Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards

Response to Comments

United States
Environmental Protection
Agency

Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards

Response to Comments

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

NOTICE

This technical report does not necessarily represent final EPA decisions or positions. It is intended to present technical analysis of issues using data that are currently available. The purpose in the release of such reports is to facilitate the exchange of technical information and to inform the public of technical developments.

EPA United States Environmental Protection Agency

EPA-420-R-22-036
December 2022

EPA's Proposed Rule and Related Materials for Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards was signed by Administrator Michael Regan on March 7, 2022. A pre-publication version of the proposal was made available on EPA's website on that date, prior to publication in the Federal Register on March 28, 2022 (87 FR 17414 et seq.).[1] The proposal indicated that the rule would be open for public comment until May 13, 2022; the comment period was subsequently extended to May 16 through a separate notice in the Federal Register (87 FR 24146, May 3, 2022).

This Response to Comments document is a compilation of public comments submitted to the public docket for this rule, Docket ID No. EPA–HQ–OAR–2019-0055, as well as EPA responses. Some aspects of our responses appear in the preamble to the final rule or other documents in this rule's docket and are incorporated by reference in this document.

This document is organized by category of comment topic. The original documents submitted by commenters, including any attachments, footnotes, tables, and figures are included in the docket.

EPA received nearly 266,250 written comments on this proposal. Of the written comments, 35 documents are mass mailer letters individually sent by, or representing through signature, 264,343 commenters. There are also an additional 1,839 documents submitted as comments to the docket for this rule, for a total of 1,874 individual posted comments. Detailed comments on various aspects of the proposed program from the mass mailers and 360 other comment documents are reproduced verbatim in this document. A list of these comments can be found in Appendix 1. Note that an individual comment or part of a comment may be reproduced in more than one section of this document if it contains observations on more than one aspect of an issue. Appendix 2 contains a list of the remaining comments submitted to the docket before the docket closed on May 16, 2022. These comments express general support for or opposition to the proposal and/or contain opinions or statements about issues but without detailed data, information, or comment relating to specific provisions of the proposal or EPA's supporting analysis. The comments listed in Appendix 2 are not reproduced verbatim in this document, as these comments did not raise issues with reasonable specificity or were outside the scope of the rulemaking. However, Appendix 2 contains a brief summary of the nature of these comments.

The public hearing transcripts are included in the docket.[2] Appendix 3 contains a list of the testifiers and a brief summary of the nature of their testimony. The public testimony that is more specific in nature and not subsequently included in written comments submitted by the testifier or the testifier's organization is included verbatim in this document.

Late comments received during the period after the comment period closed, from May 17, 2022, through October 4, 2022, were considered to the extent practicable in developing the final rule. These late comments are set out in Section 34.

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[1] EPA notified more than 110 stakeholders of the availability of the pre-publication version through an e-mail dated March 7, 2002, from Brian J. Nelson, Director, Heavy-Duty Onroad & Nonroad Center U.S. Environmental Protection Agency.

[2] See docket ID EPA-HQ-OAR-2019-0055-2867. During the 3-day public hearing (April 12, 13, and 14, 2022), 278 individuals testified. The hearing testimony transcripts publicly available are redacted versions that were edited to remove potential Personally Identifiable Information (PII).

The responses presented in this document are intended to augment the rationale and responses to comments that appear in the preamble to the final rule and to address comments not discussed in the preamble to the final rule. To the extent there is any confusion or apparent inconsistency between this Response to Comments document and the preamble, the preamble itself remains the definitive statement of the rationale for the final rule. This document, together with the preamble to the final rule and the information contained in the Regulatory Impact Analysis, and related technical support documents, should be considered collectively as EPA's response to all of the significant comments submitted on the proposal.

Table of Contents

Table of Acronyms

Acronym	Definition
3B-MAW	3 Bin Moving Average Window
°C	Degrees Celsius
µg	Microgram
µm	Micrometers
20xx$	U.S. Dollars in calendar year 20xx
A/C	Air Conditioning
ABT	Averaging, Banking and Trading
AC	Alternating Current
ACEA	European Automobile Manufacturers Association
ACES	Advanced Collaborative Emission Study
ACF	Advanced Clean Fleet (California standards)
ACT	Advanced Clean Truck (California standards)
ADAS	Advanced Driver Assistance Systems
AECC	Association for Emission Controls by Catalyst
AECD	Auxiliary Emissions Control Device
AEO	Annual Energy Outlook
AER	All-electric range
AES	Automatic Engine Shutdown
AESS	Automatic Engine Shutdown System
AFDC	Alternative Fuels Data Center
AFTC	Alternative Fuel Tax Credit
AHS	American Housing Survey
Al	Aluminum
Al2TiO5	Aluminum Titanate
AMOC	Atlantic Meridional Overturning Circulation
AMT	Automated Manual Transmission
ANL	Argonne National Laboratory
ANPR(M)	Advanced Notice of Proposed Rulemaking
APA	Administrative Procedures Act
API	American Petroleum Institute
APU	Auxiliary Power Unit
AQ	Air Quality
AQCD	Air Quality Criteria Document
AQMD	Air Quality Management District
AR4	Fourth Assessment Report
ARB	California Air Resources Board
ARB HHDDT	California Air Resources Board Heavy Heavy-Duty Diesel Test
ASC	Ammonia Slip Catalyst
ASL	Aggressive Shift Logic
ASM	Annual Survey of Manufacturers
ASTM	ASTM International, formerly American Society for Testing and Materials
AT	Automatic Transmissions
AT	Advanced Technology
ATA	American Trucking Association
ATIS	Automated Tire Inflation System
ATRI	Alliance for Transportation Research Institute
ATS	Aftertreatment System
ATSDR	Agency for Toxic Substances and Disease Registry

Acronym	Definition
ATUS	American Time Use Survey
ATVM	Advanced Technology Vehicle Manufacturing
Avg	Average
B100	1 methyl-ester biodiesel fuel
B20	0.2 biodiesel blended with 0.8 petroleum distilate diesel fuel
BECCS	Bioenergy with Carbon Capture and Storage
BenMAP	Benefits Mapping and Analysis Program
BETP	Bleed Emissions Test Procedure
BEV	Battery Electric Vehicle
bhp	Brake Horsepower
bhp-hr	Brake Horsepower Hour
BLS	Bureau of Labor Statistics
BMEP	Brake Mean Effective Pressure
BSFC	Brake Specific Fuel Consumption
BSG	Belt-driven starter-generator
BTS	Bureau of Transportation Statistics
BTU	British Thermal Unit
C	Carbon
C	Centigrade
Ca	Calcium
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CaaS	Charge-as-a-Service
CaCO3	Calcium Carbonate
CAD/CAE	Computer Aided Design And Engineering
CAE	Computer Aided Engineering
CAFE	Corporate Average Fuel Economy
CAMx	Comprehensive Air Quality Model with Extensions
CAN	Controller Area Network
CARB	California Air Resources Board
CASAC	Clean Air Science Advisory Committee
CaSO4	Calcium Sulfate
CATF	Clean Air Task Force
CBI	Confidential Business Information
CCP	Coupled Cam Phasing
CCSCR	Close-Coupled Selective Catalytic Reduction
CCSP	Climate Change Science Program
CCV	Close Crankcase Ventilation
CD	Charge Depleting
CDA	Cylinder Deactivation
CDC	Centers for Disease Control
CDPF	Catalyzed Diesel Particulate Filter
CE-CERT	Center for Environmental Research and Technology
CEQ	Council on Environmental Quality
CF	Conformity Factor
CFD	Computational Fluid Dynamics
CFR	Code of Federal Regulations
CH4	Methane
CHEAPR	Connecticut Hydrogen and Electric Automobile Rebate Program
CI	Compression-ignition
CI	Carbon Intensity
CILCC	Combined International Local and Commuter Cycle

Acronym	Definition
CIPM	International Committee for Weights and Measures (Bureau International des Poids et Mesures)
CITT	Chemical Industry Institute of Toxicology
CM	Compliance margin
CMAQ	Community Multiscale Air Quality
CMAQ	Congestion Mitigation and Air Quality Improvement program (DoT)
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO2	Carbon Dioxide
CO2eq	CO2 Equivalent
COFC	Container-on-Flatcar
COI	Cost of Illness
COPD	Chronic Obstructive Pulmonary Disease
CoV	Coefficient of Variation
CPI	Consumer Price Index
CPO	Compressor pressure outlet
CPS	Cam Profile Switching
CPSI	Cells per Square Inch
C-R	Concentration-Response
CRC	Coordinating Research Council
CRGNSA	Columbia River Gorge National Scenic Area
CRR	Rolling Resistance Coefficient
CS	Climate Sensitivity
CS	Charge Sustaining
CSA	Combined Statistical Area
CSB	Clean School Bus Program
CSI	Cambridge Systematics Inc.
CSS	Coastal Sage Scrub
CSV	Comma-separated Values
CTP	Clean Trucks Plan
CTTP	Cold Temperature Test Procedure
Cu	Copper
CuO	Copper(II) oxide or cupric oxide
CV	Commercial Vehicle
CVD	Cardiovascular Disease
CVT	Continuously-Variable Transmission
CW	Curb Weight
CY	Calendar year
D/UAF	Downward and Upward Adjustment Factor
DAAAC	Diesel Aftertreatment Accelerated Aging Cycle
DARAP	Diesel Aftertreatment Rapid Aging Protocol
DCP	Dual Cam Phasing
DCT	Dual Clutch Transmission
DDE	Durability demonstration engine
DE	Diesel Exhaust
DEAC	Cylinder Deactivation
DEER	Diesel Engine-Efficiency and Emissions Research
DEF	Diesel Exhaust Fluid
DER	Distributed Energy Resources
DERA	Diesel Emission Reduction Act
deSOx	Removal of sulfur oxide compounds
DF	Deterioration Factor
DHHS	U.S. Department of Health and Human Services

Acronym	Definition
Diesel HAD	Diesel Health Assessment Document
DMC	Direct Manufacturing Costs
DNR	Department of Natural Resources (State-Level)
DO	Dissolved Oxygen
DOC	Diesel Oxidation Catalyst
DOD	Department of Defense
DOE	Department of Energy
DOHC	Dual Overhead Camshaft Engines
DoIP	Diagnostic over IP (???)
DOT	Department of Transportation
DPF	Diesel Particulate Filter
DPM	Diesel Particulate Matter
DQS	DEF Quality Sensor
DR	Discount Rate
DRIA	Draft Regulatory Impact Analysis
DTE	Distance to Empty
DVVL	Discrete Variable Valve Lift
EAS	Exhaust Aftertreatment System
EC	European Commission
EC	Elemental Carbon
EC	Economic Census
ECM	Electronic Control Module or Engine Control Module
ECU	Engine Control Unit
ED	Emergency Department
EERA	Energy and Environmental Research Associates
EEVO	Early exhaust valve actuation
EFR	Engine Friction Reduction
EGR	Exhaust Gas Recirculation
EGU	Electrical Generating Unit
EHC	Electrically heated catalyst
EHPS	Electrohydraulic Power Steering
EIA	Energy Information Administration (part of the U.S. Department of Energy)
EIS	Environmental Impact Statement
EISA	Energy Independence and Security Act
EIVC	Early Intake Valve Closing
EIWR	Emission Warranty Information Reporting
EJ	Environmental Justice
EMCT	Emission Measurement and Testing Committee
EMFAC	California EMission FACtors emission inventory model
EMS-HAP	Emissions Modeling System for Hazardous Air Pollution
EO	Executive Order
EPA	Environmental Protection Agency
EPCA	Energy Policy and Conservation Act
EPMA	electron probe microanalysis
EPS	Electric Power Steering
ePTO	Electric Power Take-Off System
ERC	Emision-Related Component
ERG	Eastern Research Group
ERM	Employment Requirements Matrix
ESA	Endangered Species Act
ESC	Electronic Stability Control
ETC	Electronic Throttle Control

Acronym	Definition
ETW	Estimated Test Weight
EU	European Union
EV	Electric Vehicle
EVCS	Electric Vehicle Charging Station
EVSE	Electric Vehicle Supply Equipment
F	Frequency
FAME	Fatty Acid Methyl Ester
FCAB	Federal Consortium for Advanced Batteries
FCEV	Fuel Cell Electric Vehicle
FCV	Fuel Cell Voltage
Fe	Iron
FEL	Family Emission Limit
FET	Federal Excise Tax
FEV1	Functional Expiratory Volume
FHWA	Federal Highway Administration
FIA	Forest Inventory and Analysis
FMCSA	Federal Motor Carrier Safety Administration
FOH	Fuel Operated Heater
FR	Federal Register
FRM	Final Rulemaking
FTC	Federal Trade Commission
FTE	Full Time Equivalent
FTP	Federal Test Procedure
FUL	Full Useful Life
FVC	Forced Vital Capacity
g	Gram
g/s	Gram-per-second
g/ton-mile	Grams emitted to move one ton (2000 pounds) of freight over one mile
gal	Gallon
gal/1000 ton-mile	Gallons of fuel used to move one ton of payload (2,000 pounds) over 1000 miles
GCAM	Global Change Assessment Model
GCW	Gross Combined Weight
GCWR	Rated Gross-combined Weight (vehicle + trailer)
GDI	Gasoline Direct Injection
GDP	Gross Domestic Product
GEM	Greenhouse gas Emissions Model
GEOS	Goddard Earth Observing System
GHG	Greenhouse Gas
GIFT	Geospatial Intermodal Freight Transportation
GPF	Gasoline Particulate Filter
GREET	Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation
GSA	General Services Administration
GSF1	Generic Speed Form one
GST	Generic Scan Tools
GUI	Graphical User Interface
GVWR	Gross Vehicle Weight Rating
GW	Gigawatt
GWC	Gasoline Working Capacity
GWP	Global Warming Potential
H2	Hydrogen
H2 ICE	Hydrogen Internal Combustion Engine
H2O	Water

Acronym	Definition
HABs	Harmful Algal Blooms
HAD	Diesel Health Assessment Document
HAP	Hazardous Air Pollutant
HALT	Highly Accelerated Life Testing
HC	Hydrocarbon
HD	Heavy-Duty
HDDE FTP	Heavy-Duty Diesel Engine Federal Test Procedure
HDDT	Heavy-Duty Diesel Truck
HDE	Heavy-Duty Engine
HDEV	Heavy-duty electric vehicle
HDGV	Heavy-Duty Gasoline Vehicle (GVWR <14,000 lb)
HDIUT	Heavy-Duty In-Use Testing
HDO	Heavy-Duty Otti-cycle
HDOE FTP	Heavy-Duty Otto-Cycle Engine Federal Test Procedure
HDOH	Heavy-Duty On Highway
HDT	Heavy-Duty Truck
HDUDDS	Heavy Duty Urban Dynamometer Driving Cycle
HDV	Heavy-Duty Vehicle
HEG	High Efficiency Gearbox
HEI	Health Effects Institute
HES	Health Effects Subcommittee
HEV	Hybrid Electric Vehicle
HFC	Hydrofluorocarbon
HFET	Highway Fuel Economy Dynamometer Procedure
HGTS	Hot Gas Test Stand
HHD	Heavy Heavy-Duty
HHDD	Heavy-Heavy-Duty Diesel
HHDDT	Highway Heavy-Duty Diesel Transient
HHDE	Highway Heavy-Duty Engine
HHDGV	Heavy-Heavy-Duty Gasoline Vehicle (>14,000 lb. GVWR)
HIF	Health Impact Function
HIL	Hardware-in-the-Loop
HNCO	Iso-cyanic Acid
hp	Horsepower
HrlCE	Hydrogen-Fueled Internal Combustion Engine
hrs	Hours
HRV	Heart Rate Variability
HSC	High Speed Cruise Duty Cycle
HTA	Hydrothermally aged
HTUF	Hybrid Truck User Forum
HVAC	Heating, Ventilation and Air Cooling
HWFE	Highway Fuel Economy Drive Cycle
hz	Hertz
I/M	Inspection and Maintenance
IARC	International Agency for Research on Cancer
IATC	Improved Automatic Transmission Control
IC	Indirect Costs
IC	Internal Combustion
ICCT	International Council on Clean Transport
ICD	International Classification of Diseases
ICE	Internal Combustion Engine
ICEV	Internal Combustion Engine Vehicle

Acronym	Definition
ICF	ICF International
ICI	Industrial, Commercial, Institutional
ICM	Indirect Cost Multiplier
ICP	Intake Cam Phasing
ICP-MS	Inductively coupled plasma mass spectrometry
ICR	Information Collection Request
ICV	Internal Combustion Vehicle
IIJA	Infrastructure Investment and Jobs Act
IMAC	Improved Mobile Air Conditioning
IMC	Indirect Manufacturing Costs
IMPROVE	Interagency Monitoring of Protected Visual Environments
IPCC	Intergovernmental Panel on Climate Change
IRA	Inflation Reduction Act
IRAF	infrequent regeneration adjustment factor
IRFA	Initial Regulatory Flexibility Analysis
IRIS	Integrated Risk Information System
ISA	Integrated Science Assessment
ISC	In-Service Conformity
IUL	Interim Useful Life
IUMPR	In-Use Monitor Performance Ratio
IUT	In-Use Testing
JAMA	Journal of the American Medical Association
k	Thousand
K	Potassium
kg	Kilogram
KI	kinetic intensity
km	Kilometer
km/h	Kilometers per Hour
kW	Kilowatt
L	Liter
LA92	Inventory development dynamometer driving schedule
lb	Pound
LBM	Liquified Biomethane
LCA	Life Cycle Analysis
LD	Light-Duty
LDT	Light-Duty Truck
LDV	Light-Duty Vehicle
LED	Low Emission Diesel
LHD	Light Heavy-Duty
LHDD	Light Heavy Duty Diesel
LHDGV	Light-Heavy-Duty Gasoline Vehicle
LIVC	Late Intake Valve Closing
LLC	Low Load Cycle
LLNL	Lawrence Livermore National Laboratory’s
LNG	Liquified Natural Gas
LO-SCR	Light-Off SCR (also Close-coupled SCR)
LPG	Liquified Petroleum Gas
LRR	Lower Rolling Resistance
LSC	Low Speed Cruise Duty Cycle
LT	Light Trucks
LTCCS	Large Truck Crash Causation Study
LTL	Less Than Truckload

Acronym	Definition
LUB	Low Friction Lubes
LUC	Land Use Change
m2	Square Meters
m3	Cubic Meters
MAGICC	Model for the Assessment of Greenhouse-gas Induced Climate Change
MANE-VU	Mid-Atlantic Northeast Visibility Union
MAW	Moving-Average-Windows
MCF	Mixed Conifer Forest
MCS	Megawatt Charging System
MCT	Multicycle Test
MD	Medium-Duty
MDPV	Medium-Duty Passenger Vehicle
MDV	Medium-Duty Vehicle
MECA	Manufacturers of Emissions Control Association
mg	Milligram
Mg	Magnesium
μg/m3	Micrograms per cubic meter
Mg(OH)2	Magnesium Hydroxide
mg/hp-hr	Milligrams per horsepower-hour
MHD	Medium Heavy-Duty
MHDD	Medium Heavy Duty Diesel
MHDE	Medium Heavy-Duty Engine
MHDV	Medium Heavy-Duty Vehicle (??? Evergreen Action comment)
MHEV	Mild Hybrid
mi	mile
MIL	Malfunction indicator light
min	Minute
MM	Million
MMBD	Million Barrels per Day
MMT	Million Metric Tons
Mn	Manganese
MoU	Memorandum of Understanding
MOVES	MOtor Vehicle Emissions Simulator
MP-AES	Microwave Plasma Atomic Emission Spectroscopy
mpg	Miles per Gallon
mpge	Miles per Gallon Equivalent
mph	Miles per Hour
MPO	Metropolitan Planning Organization
MRL	Minimal Risk Level
MSA	Metropolitan Statistical Area
MSAT	Mobile Source Air Toxic
MST	Manufacturer self-testing
MT	Manual Transmission
MT	Metric Tons
MTS	Maximum Test Speed
MW	Megawatt
MY	Model Year
N2	Molecular Nitrogen
N2O	Nitrous Oxide
Na	Sodium
NA	Nonattainment Area
NA	Not Applicable

Acronym	Definition
NAAQS	National Ambient Air Quality Standards
NACFE	North American Council for Clean Freight Efficiency
NAFA	National Association of Fleet Administrators
NAICS	North American Industry Classification System
NAS	National Academy of Sciences
NASTC	National Association of Small Trucking Companies
NATA	National Air Toxic Assessment
NCAR	National Center for Atmospheric Research
NCI	National Cancer Institute
NCLAN	National Crop Loss Assessment Network
NDUV	Nondispersive Ultraviolet
NEC	Net Energy Change Tolerance
NEI	National Emissions Inventory
NEMS	National Energy Modeling System
NEPA	National Environmental Policy Act
NESCAUM	Northeastern States for Coordinated Air Use Management
NESCCAF	Northeast States Center for a Clean Air Future
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NH3	Ammonia
NHS	National Highway System
NHTSA	National Highway Traffic Safety Administration
NIEHS	National Institute of Environmental Health Services
NiMH	Nickel Metal-Hydride
NIOSH	National Institute of Occupational Safety and Health
NIST	National Institute for Standards and Technology
Nm	Newton-meters
NMHC	Nonmethane Hydrocarbons
NMMAPS	National Morbidity, Mortality, and Air Pollution Study
NO	Nitric Oxide
NO2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NOX	Oxides of Nitrogen
NPRM	Notice of Proposed Rulemaking
NPV	Net Present Value
NRC	National Research Council
NRC-CAN	National Research Council of Canada
NREL	National Renewable Energy Laboratory
NTDE	New Technology Diesel Engine
NTE	Not-to-exceed
NTEA	National Truck and Equipment Association
NTP	National Toxicology Program
NVH	Noise Vibration and Harshness
NZEV	Near-Zero Emission Vehicle
O&M	Operating and maintenance
O3	Ozone
OAQPS	Office of Air Quality Planning and Standards
OBD	Onboard diagnostics
OBDEL	On-Board Diagnostic Emissions Limit
OBM	On Board Monitoring
OC	Organic Carbon
OE	Original Equipment
OEHHA	Office of Environmental Health Hazard Assessment

Acronym	Definition
OEM	Original Equipment Manufacturer
OHV	Overhead Valve
OMB	Office of Management and Budget
OOIDA	Owner-Operator Independent Drivers Association
OOS	Out of State
OP	Opposed-Piston
OPEC	Organization of Petroleum Exporting Countries
ORD	EPA's Office of Research and Development
ORNL	Oak Ridge National Laboratory
ORVR	Onboard refueling vapor recovery
OSAR	On Board Sensor Monitoring and Reporting Consortium
OSHA	Occupational Health and Safety Administration
OTA	Over-the-Air
OTAQ	Office of Transportation and Air Quality
OTC	Ozone Transport Commission
OTR	Ozone Transport Region
P	Phosphorus
Pa	Pascal
PA	Policy Assessment
PAH	Polycyclic Aromatic Hydrocarbons
PBHPH	Per brake horsepower-hour
PCM	Powertrain Control Module
PCV	Positive Crankcase Ventilation
PEF	Peak Expiratory Flow
PEMFC	Proton-Exchange Membrane Fuel Cell
PEMS	Portable Emissions Monitoring System
PEV	Plug-in Electric Vehicle
PFI	Port Fuel Injection
PGM	Platinum Group Metal
PGM	Photochemical Grid Modeling
PHEV	Plug-in Hybrid Electric Vehicles
PLT	Production-line testing
PM	Particulate Matter
PM10	Coarse Particulate Matter (diameter of 10 µm or less)
PM2.5	Fine Particulate Matter (diameter of 2.5 µm or less)
POC	People of Color
POM	Polycyclic Organic Matter
POTW	Public Owned Treatment Works
Ppb	Parts per Billion
Ppm	Parts per Million
Psi	Pounds per Square Inch
PTO	Power Take Off
PVE	Production Engine/Vehicle Evaluation Testing
PZEV	Partial Zero Emission Vehicle
R&D	Research and Development
RBM	Resisting Bending Moment
RD	Renewable Diesel
REAL	Real Emissions Assessment Logging
REL	Reference Exposure Level
RESS	Rechargeable Energy Storage System
REV Midwest	Regional Electric Vehicle Midwest Coalition
RFA	Regulatory Flexibility Act

Acronym	Definition
RfC	Reference Concentration
RFIP	Renewable Fuels Infrastructure Program
RFS	Renewable Fuel Standard
RFSP	Renewable Fuel Standard Program
RFS2	Renewable Fuel Standard 2
RIA	Regulatory Impact Analysis
RMC	Ramped Modal Cycle
RMC-SET	Ramped Modal Cycle Supplementary Emissions Test
RNG	Renewable natural gas
RPE	Retail Price Equivalent
RPM	Revolutions per Minute
RSC	Ricardo Strategic Consulting
RSWT	Reduced-Scale Wind Tunnel
RTS	Return-to-Service
S	Second
S	Sulfur
SAB	Science Advisory Board
SAB-HES	Science Advisory Board - Health Effects Subcommittee
SAE	SAE International, formerly Society of Automotive Engineers
SAFE	Safer Affordable Fuel-Efficient
SAIPE	Small Area Income and Poverty Estimates
SAR	Second Assessment Report
SAV	Submerged Aquatic Vegetation
SBA	Small Business Administration
SBREFA	Small Business Regulatory Enforcement Fairness Act
SC-GHG	Social Cost of Greenhouse Gases
SCC	Social Cost of Carbon
SCR	Selective Catalyst Reduction
SCRF	SCR-on-DPF
SEA	Selective enforcement audit
SER	Small Entity Representation
SET	Supplemental Emission Test
SGDI	Stoichiometric Gasoline Direct Injection
SHED	Sealed Housing Evaporative Determination
SHEV	Strong Hybrid Vehicles
SI	Spark-Ignition
SiC	Silicon Carbide
SIDI	Spark Ignition Direct Injection
SIP	State Implementation Plan
SIR	Service Information Requirements (CARB)
SMAD	Supplementary Monitor Activity Data
sMCT	Short Multi-Cycle Test
sMCAT+	Short Multi-Cycle Test Plus Steady State
SO2	Sulfur Dioxide
SOA	Secondary Organic Aerosol
SOC	State of Charge
SOFC	Solid Oxide Fuel Cells
SoH	State of Health (battery or fuel cell)
SOHC	Single Overhead Cam
SOP	Start of Production
SOx	Sulfur Oxides; Oxides of Sulfur
SPR	Strategic Petroleum Reserve

Acronym	Definition
SRT	Standard repair time
SSZ-13	A Chabazite-type Aluminosilicate ABC-6 Zeolite
Stage 3 RW	Stage 3 rework
STB	Surface Transportation Board
Std.	Standard
STP	Scaled Tractive Power
SUV	Sport Utility Vehicle
SVOC	Semi-Volatile Organic Compound
SwRI	Southwest Research Institute
TaaS	Transportation-as-a-Service
TAR	Technical Assessment Report
TC	Total Costs
TCO	Total Cost of Ownership
TCp	Total Cost package
TDS	Turbocharging And Downsizing
TEU	Twenty-Foot Equivalent Units
THC	Total Hydrocarbon
TIAX	TIAX LLC
TL	Truckload
TMC	Technology & Maintenance Council
TOFC	Trailer-on-Flatcar
Ton-mile	One ton (2000 pounds) of payload over one mile
TOU	Time of Use
TP	Tailpipe
Tpd	Tons per day
TRAP	Traffic Related Air Pollution
TRBDS	Turbocharging and Downsizing
TROPOMI	Tropospheric Monitoring Instrument
TRU	Trailer Refrigeration Unit
TSD	Technical Support Document
TSS	Thermal Storage
TTW	Tank-to-Wheel
TW	Test Weight
TWC	Three-Way Catalyst
U.S.	United States
U/DAF	Upward and Downward Adjustment Factor
UBE	Useable battery energy
UCT	Urban Creep and Transient Duty Cycle
UDDS	Urban Dynamometer Driving Schedule
UF	Utility Factor
UFP	Ultra Fine Particles
UL	Useful Life
ULEDE	Ultra-Low Emissions Diesel Engines
ULSD	Ultra-low sulfur diesel
URE	Unit Risk Estimate
USDA	United States Department of Agriculture
USGCRP	United States Global Change Research Program
USPS	United States Postal Service
UTSA	Uniform Trade Secrets Act
UV	Ultraviolet
UV-b	Ultraviolet-b
V2G	Vehicle-to-Grid

Acronym	Definition
VA	Variable Allowance
VGT	Variable-geometry Turbine
VIN	Vehicle Identification Number
VIO	Vehicles in Operation
VIUS	Vehicle Inventory Use Survey
VMT	Vehicle Miles Traveled
VNT	Variable nozzle turbine
VOC	Volatile Organic Compound
VSL	Vehicle Speed Limiter
VSL	Value of Statistical Life
VTEC-E	Variable Valve Timing & Lift Electronic Control-Economy
VTG	Variable turbine geometry
VTRIS	Vehicle Travel Information System
VVA	Variable Valve Actuation
VVL	Variable Valve Lift
VVT	Variable Valve Timing
WACAP	Western Airborne Contaminants Assessment Project
WHD	Wage and Hour Division (Department of Labor)
WHO	World Health Organization
WHR	Waste Heat Recovery
WHTC	World Harmonized Transient Cycle
WHVC	World Harmonized Vehicle Cycle
WMO	World Meteorological Organization
WRF	Weather Research Forecasting
WTP	Willingness-to-Pay
WTVC	World Wide Transient Vehicle Cycle
WTW	Well to Wheels
WVU	West Virginia University
zCSF	Zone-Coated Soot Filter
ZE	Zero Emission
ZEP	Zero Emission Powertrain
ZET	Zero Emission Truck
ZETI	Zero-Emission Technology Inventory (CALSTART)
ZEV	Zero emission vehicle
ZMER	Zero-Mile Emission Rate
Zn	Zinc
ZSM-5	Zeolite Socony Mobil-5, an Aluminosilicate Pentasil Zeolite within the family of zeolites

1 Overall Reactions to EPA's Proposal

EPA categorized the content of detailed written comments received on this rule by topic area and assembled them for response in the various sections of this Response to Comment document. In addition to detailed comments on specific aspects of the proposed rule, many commenters also provided general statements that indicate their support for the proposal as written, support for the proposal while also stating that the proposal doesn't go far enough or general opposition to the proposal. Because these statements are general in nature, they were not assigned to specific sections of the document. Instead, these statements are summarized here; full excerpts are provided in Appendix 4 for completeness.

1.1 General support for the proposal as written

<u>EPA Summary and Response</u>

<u>Summary</u>:

Many individuals and organizations who commented on the proposal included general statements that supported or strongly supported the proposed action. While these commenters did not always express a preference over any of the options, many stated the need to further reduce internal combustion engine emissions while pursuing ZEV options. A few commenters noted that this may be EPA's last rulemaking setting requirements for internal combustion engines, so it is important to get it right. Several commenters generally supported specific aspects of the proposal without going into detail: the NOx limits, the GHG reduction program and improvements in PM emission levels. Some of these commenters also said that EPA should align the NOx regulations with CARB's Omnibus rule to drive a more stringent national standard. Finally, several commenters noted that the technologies to achieve the standards must be feasible and achievable over the full useful life of the engine.

<u>Response</u>:

EPA acknowledges the comments expressing general support for EPA's rulemaking. Some of these statements of general support also included additional non-specific comments that disagreed with or suggested changes in specific aspects of the proposed program; we address those comments in other sections of this Response to Comments document or in the preamble to this rule. Also, as explained in the preamble of the final rule, we are not taking final action in this rule on the GHG components of the proposal; comments on the GHG components of the proposal are contained in Section 28.

1.2 General support for the proposal while also stating that the proposal doesn't go far enough

EPA Summary and Response

Summary:

Most of the comments received, including the vast majority of mass mailer comments, generally call on EPA to do more to reduce emissions from trucks and truck engines, especially by speeding up the transition to electric vehicles. These commenters requested action that would lead to cleaner emissions from internal combustion-powered vehicles and challenged EPA to be more ambitious, more aggressive, or increase the stringency of the standards to strengthen the rule. These commenters also requested EPA to implement a program for faster and more complete implementation of zero emission vehicles. While not always providing data or detailed information, many commenters requested full ZEV sales by 2035, and a few requested EPA adopt a goal of 100% ZEV by 2050. There was also some support for fuel cell vehicles. Of the comments that generally mentioned costs, many noted that electric vehicles are becoming cost effective.

Response:

EPA acknowledges the comments that recommend EPA adopt more stringent NOx and GHG standards for heavy-duty engines and trucks. As explained elsewhere in this document as well as in the preamble and RIA for this rule, the criteria pollutant heavy-duty engine standards EPA is adopting will have a significant impact on improving air quality across the country and EPA's assessment of the relevant statutory factors in CAA section 202(a)(3)(A) justify the final emission standards (see the EPA response in section 1.3 of this document). Responses to comments that provided more detailed information and data are included in the other sections of this document. Also, as explained in the preamble of the final rule, we are not taking final action in this rule on the GHG components of the proposal; comments on the GHG components of the proposal are contained in Section 28.

1.3 General opposition to the proposal

EPA Summary and Response

Summary:

Some commenters expressed general opposition to the proposed revisions to the GHG Phase 2 program. Some comments also expressed general opposition to the proposed criteria pollutant portion of the rule due to concerns about impacts of the new standards, useful life, and warranty requirements on truck prices, transportation costs, jobs, and serviceability of hardware. Several of those who commented provided more detailed comments that are included in other sections of this document; others provided only general statements of concern.

Response:

EPA acknowledges these comments expressing general opposition to the proposed rule. As explained in the preamble of the final rule, we are not taking final action in this rule on the GHG components of the proposal; comments on the GHG components of the proposal are contained in Section 28. Preamble Section II presents the need for this final rule, which is the need for additional emissions control from heavy-duty engines and vehicles, with additional information included in RIA Chapter 4 and section 2 of this document. Preamble Sections I.D and XIII describe our statutory authority for taking this final action.

Our technical analyses that form the basis of this final rule are presented in Sections III, V, VI, VII, VIII, and X of the preamble to this rule, with additional information included in RIA Chapters 3, 5, 6, 7, 8, and 10. In setting the final emission standards, EPA appropriately assessed the statutory factors specified in CAA section 202(a)(3)(A), including giving appropriate consideration to the cost associated with the application of technology EPA determined will be available for the model year the final standards apply (i.e., cost of compliance for the manufacturer associated with the application of such technology). EPA's assessment of the relevant statutory factors in CAA section 202(a)(3)(A) justify the final emission standards. We also evaluated additional factors, including factors to comply with E.O. 12866; our assessment of these factors lends further support to the final rule. Preamble Section IV describes the basis for the final useful life and warranty periods, with comments relating to useful life and warranty in sections 3.8 and 4.0 of this document, respectively. Our analysis also shows that to the extent the final rule impacts heavy-duty vehicle sales, we expect the impacts to be small and short in duration; further, our estimates suggest a slight increase in employment in 2027 due to the final rule (see preamble Section X and RIA Chapter 10 for a description of our economic analyses). These issues are also discussed in response to more detailed comments provided by some individuals and organizations in the separate sections of this document.

2 Need for additional air quality control

2.1 Human and environmental health impacts of criteria and toxic air pollutants

Comments by Organizations

Organization: *Ali P.*

We need environment-related regulations now more than ever. Pollution is a rampant problem, and the climate crisis is only worsening, both of which are harmful to humans and the world's ecosystems. Traditional heavy-duty vehicles contribute to the formation of ozone and expel particulate matter and greenhouse gases into the atmosphere, worsening both of these issues. This proposed rule would be a step forward in reducing our global environmental impact. [EPA-HQ-OAR-2019-1032]

There is very little regulation regarding the formation of ozone in the troposphere. It has the greatest negative impact on children, teenagers, the elderly, and people with preexisting respiratory conditions. While these groups may be the most vulnerable, ozone can be detrimental to anyone's health, as it is linked to premature death and a myriad of respiratory issues, including trouble breathing, asthma, and an increased likelihood of developing a respiratory infection

(American Lung Association, 2020). Ground level ozone's dangerous and widespread nature alone warrants an increase in its regulation, but there are additional societal and environmental effects that further make ozone's regulation an urgent matter. For example, ozone significantly damages plant tissue and reduces plant productivity. This both negatively impacts wildlife that (either directly or indirectly) relies on these plants, and it can cause a decrease in crop yields (California Air Resources Board, 2020). These combined effects of ozone can thus result in a loss of biodiversity, a loss of money, and a loss of available food, all of which could be better prevented with the regulation of ozone through policies such as this proposed rule. [EPA-HQ-OAR-2019-1032]

Particulate matter (PM) released into the atmosphere also impacts people's health. PM can affect anybody, but some people experience worse effects than others. The effects of PM can range from mild eye irritation to the worsening of preexisting respiratory issues to an increased risk of lung cancer or heart attacks. The smaller the particles, the deeper they can enter the lungs, and the worse their potential damage on the respiratory system. The smallest particles can even enter the bloodstream (Centers for Disease Control and Prevention, 2019). PM is arguably the most directly harmful pollutant to humans. All particle sizes are dangerous, and their variability in size, chemical composition, and origin means the number of possible effects they can have on humans is innumerable. It also means they can have varying drastic effects on the environment if, for example, they get deposited into the soil or get dissolved into bodies of water such as lakes and ponds. PM of certain chemical makeups can cause changes in abiotic factors (such as altering the acidity of the soil or of a body of water), disrupting the ecosystems that rely on these factors (United States Environmental Protection Agency, 2021). For the sake of the public's health and the environment's health, a reduction of PM in our atmosphere is necessary. [EPA-HQ-OAR-2019-1032]

The transportation sector is responsible for over a quarter of U.S. greenhouse gas emissions, which is more than any other sector, because the vast majority of transportation methods rely on the burning of fossil fuels for power (United States Environmental Protection Agency, 2022). Heavy-duty vehicles are obviously included in this statistic, so reducing the extent of their greenhouse gas emissions is a necessary step in slowing climate change, a global crisis that has been largely ignored for too long. Immediate and effective action is crucial to becoming carbon neutral, a goal most countries have pledged to accomplish, within the next several decades. Government regulations that focus on reducing greenhouse gas emissions and promoting the health of the environment are a necessity. Implementing this proposed rule, and others like it, is the least we can do in the face of our worsening climate. [EPA-HQ-OAR-2019-1032]

Organization: *American Farm Bureau Federation (Farm Bureau)*

Since 1990, economy-wide NOx emissions from highway vehicles have declined by 75%, even as overall vehicle miles traveled have increased by nearly 50%. Continued improvements in advanced-technology diesel engines are a key driver of this success, and one of many reasons U.S. air quality is among the best in the world. [EPA-HQ-OAR-2019-0055-1163-A1, p.1]

Organization: *Anne Mellinger-Birdson*

Heavy duty vehicle engines are primarily diesel, and create fine (PM2.5) and ultrafine particles, carbondioxide (CO_2), volatile organic compounds and air toxics (VOCs), nitrogen oxides (NOx), and heavy metal air pollution. Even if the diesel exhaust is filtered to reduce particles and heavy metals such as arsenic or mercury, it does not eliminate these pollutants and all the gases are still released. In addition, VOCs and NOx are substrates for ozone formation which also causes health damage. Below, I comment on the health damage caused by all the pollutants made by heavy duty vehicle engines. [EPA-HQ-OAR-2019-0055-1244]

In addition, many vulnerable populations including children, the elderly, and communities of color are both more exposed to air pollution, and more at risk of health problems caused by air pollution. [EPA-HQ-OAR-2019-0055-1244]

1. Particles and ultrafine particles contribute major health damage in the U.S., causing heart disease, lung disease, cancer, strokes, dementia, low birth weight, premature birth, damaged lung growth in children(https://doi.org/10.1056/NEJMoa1414123), and excess deaths (https://doi.org/10.1056/NEJMoa1702747).In the U.S., PM2.5 from fossil fuels cause 13.1% of all deaths(https://doi.org/10.1016/j.envres.2021.110754), and diesel heavy duty engines are a significant percent of the PM2.5. Particulate pollution is also linked to obesity, diabetes, mental health problems, autism, and cognitive difficulties in people of all ages, from childhood to the elderly. [EPA-HQ-OAR-2019-0055-1244]

2. VOCs can cause headaches, cancer, immune system problems and are linked to other health conditions. [EPA-HQ-OAR-2019-0055-1244]

3. Nitrogen oxides cause lung disease, trigger asthma attacks, contribute to heart disease, and damage children's lung growth (https://doi.org/10.1056/NEJMoa1414123). Children who grow up with higher NOx exposure are more likely to develop asthma (https://doi.org/10.1016/S2542-5196(21)00255-2). [EPA-HQ-OAR-2019-0055-1244]

5. Heavy metals such as arsenic and mercury are carcinogenic, and cause numerous other health problems including kidney damage. [EPA-HQ-OAR-2019-0055-1244]

6. Ozone causes asthma attacks, is as bad for progression of emphysema as 29 pack-years of cigarettes(https://doi.org/10.1001/jama.2019.10255). Ozone likely contributes to children developing asthma, and contributes to heart disease in adults. Ozone causes excess deaths in Medicare recipients, this effect is more pronounced in black people (https://doi.org/10.1056/NEJMoa1702747). [EPA-HQ-OAR-2019-0055-1244; see also Section 23]

7. Air pollution (PM, NOx, and ozone) is strongly linked to increased risk of pneumonia, and to lower respiratory tract viral infections such as respiratory syncytial virus, influenza, and Covid(https://doi.org/10.1289/EHP9726). [EPA-HQ-OAR-2019-0055-1244]

8. Demetillo and colleagues found that diesel traffic is the dominant source of NO_2 disparities(https://doi.org/10.1029/2021GL094333). Lane and colleagues found that historical

redlining maps from the 1930s still cause current day disparities in PM2.5 and NOx, with the placement of highways as one of the main contributing factors (https://doi.org/10.1021/acs.estlett.1c01012). Houston and colleagues found that Black and Asian-American/Pacific Island people were more exposed to diesel truck traffic near the Port of Los Angeles (https://doi.org/10.2105/AJPH.2012.301120). [EPA-HQ-OAR-2019-0055-1244; see also Section 23]

Because air pollution from trucks and other heavy duty vehicles is so damaging to health, and especially to vulnerable populations such as children, the elderly, pregnant women, and communities of color, because of the structural inequities in our built environment placing more highways, ports, and railyards in communities of color, and because climate change is the biggest health threat we face, I support this rule. I encourage EPA to make it much stronger to fully protect the health of the most vulnerable populations. [EPA-HQ-OAR-2019-0055-1244; see also Section 23]

Organization: *American Lung Association et al.*

Cleaning up the trucking sector is a public health and health equity priority, and we urge US EPA to establish strict new standards by the end of 2022 that push the rapid cleanup of smog-forming emissions from trucks, ensure real-world pollution reductions and spur the transition to zero-emission trucking. [EPA-HQ-OAR-2019-0055-1271-A1, p.1]

Over forty percent of all Americans live in communities impacted by unhealthy levels of ozone and/or particle pollution, according to the American Lung Association's State of the Air 2022 report.1 The trucking sector is a major source of smog- and particle-forming oxides of nitrogen emissions (NOx) that threaten health across the United States and add to localized health burdens and disparities. Poor air quality is associated with a wide range of negative health outcomes, including asthma attacks, heart attacks and stroke, low birthweight, premature birth, developmental harms, lung cancer and premature death. As US EPA notes, there are significant disparities in exposures to harmful trucking pollution, and those most impacted are 'more likely to be people of color and have lower incomes.'2 [EPA-HQ-OAR-2019-0055-1271-A1, p.1]

> 1 American Lung Association. State of the Air 2022. April 2022. www.lung.org/sota
>
> 2 United States Environmental Protection Agency. Transportation and Environmental Justice. Regulatory Rulemaking Announcement. March 2022. https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10144Y3.pdf

Organization: *California Association of Sanitation Agencies (CASA)*

Last, but not least, delaying emission reductions via an electrification-only approach will negatively impact disadvantaged environmental justice (EJ) communities and trigger nonattainment penalties upon stationary sources, when mobile and federal sources are the primary cause of ozone nonattainment. [EPA-HQ-OAR-2019-0055-1301-A1, p.2]

Organization: *CALSTART*

Air pollution is the leading environmental health risk-factor worldwide and in the US and is associated with millions of premature deaths worldwide and hundreds of thousands in the US annually (Landrigan, 2018; WHO, n.d.; Thakrar, 2020). Emissions of nitrogen oxides (NOx) from vehicles and other sources are a major source of air pollution. On-road heavy-duty vehicles contribute 42 percent of NOx emissions from on-road sources in the US (EPA, 2017). While harmful to breathe on its own, NOx reacts with other chemicals to form ozone and particulate matter. In 2018, 2019 and 2020, more than 137 million people lived in US counties that received an “F” grade for either ozone or particle pollution, including 31 million children and 21 million people aged 65 or older, who face an increased risk of harm from breathing ozone or particle pollution (American Lung Association, 2022; American Lung Association, 2022a). [EPA-HQ-OAR-2019-0055-1313-A1, p.3]

Organization: *ChargePoint, Inc. (ChargePoint)*

HDVs alone are the single largest contributor to US emissions of NOx, volatile organic compounds (VOCs), and carbon dioxide (CO2). Long term exposure of NOx “can cause long term lung damage in people who live close to truck traffic.”4 ChargePoint is ready to support swift deployment of zero emission MHDVs in public and private fleets in the near future through deployment with the necessary charging infrastructure thus and proving substantial air quality benefits to roadside communities. [EPA-HQ-OAR-2019-0055-1294-A1, p. 1]

> 3 Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis, March 2022, https://www.nrel.gov/docs/fy22osti/82081.pdf
>
> 4 “EPA Proposal to Clean Up Truck Emissions Would Prevent Asthma Attacks, Reduce Smog and Soot and Save Lives” https://www.lung.org/media/press-releases/epa-proposal-to-clean-up-truck-emissions-would

Organization: *Chesapeake Bay Foundation, Inc. (CBF)*

EPA last updated the nitrogen oxides ('NOx') standards for heavy-duty vehicles in 2001.1 Since that time, a growing body of evidence has confirmed our understanding of the significant human health and environmental harm caused by air pollution from this sector. [EPA-HQ-OAR-2019-0055-1295-A1, p.1]

> 1 Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements, 66 Fed. Reg. 5002 (Jan. 18, 2001).

As part of its mission, CBF is dedicated to saving the Bay—and keeping it saved—as defined by reaching a 70 on CBF’s Health Index, which uses ecological indicators to measure pollution, habitat, and fisheries.18 One indicator for pollution is nitrogen, a primary pollutant causing the excess algal blooms that block sunlight for underwater grasses and use up life-sustaining oxygen when they decompose, leading to the Bay’s dead zones.19 Since 2010, CBF has been dedicated to the success of the Chesapeake Bay Total Maximum Daily Load ('Bay TMDL'), a federal-state partnership designed to reduce the nitrogen, phosphorus, and sediment pollution contributing to dead zones in the Bay.20 The Bay TMDL sets a deadline of 2025, at which point 'all pollution control measures needed to fully restore the Bay and its tidal rivers are in place.'21 [EPA-HQ-OAR-2019-0055-1295-A1, pp.5-6]

18 CBF, 2018 State of the Bay Report, https://www.cbf.org/about-the-bay/state-of-the-bay-report/.

19 CBF, About the Indicators, https://www.cbf.org/about-the-bay/state-of-the-bay-report/sotb-about-the-indicators.html#nitrogen-phosphorus; see also, 85 Fed. Reg. at 3310/1 ('Environmental impacts of concern are associated with [NOx, ozone, and PM2.5] and include light extinction, decreased tree growth, foliar injury, and acidification and eutrophication of aquatic and terrestrial systems.').

20 See U.S. EPA, Chesapeake Bay Total Maximum Daily load for Nitrogen, Phosphorus, and Sediment (Dec. 2010) ('Chesapeake Bay TMDL'), available at https://www.epa.gov/chesapeake-bay-tmdl/chesapeake-bay-tmdl-document.

21 Chesapeake Bay TMDL at ES-1.

Atmospheric deposition of nitrogen, often in the form of NOx, from both mobile sources and stationary sources makes up about one-third—more than 85 million pounds—of the Bay's total yearly nitrogen load.22 The Chesapeake Bay airshed is almost nine times larger than the watershed,23 and this airborne nitrogen pollution travels from as far west as Indiana and Kentucky, and as far north as Quebec, Canada. These NOx emissions drift into the Bay watershed and fall out of the air either dry or as precipitation.24 [EPA-HQ-OAR-2019-0055-1295-A1, p.6]

22 CBF, Air Pollution, https://www.cbf.org/issues/air-pollution/; see also Chesapeake Bay TMDL, Section 4.6.2, Atmospheric Deposition, pp. 4-33 (Dec. 2010), https://www.epa.gov/sites/production/files/2014-12/documents/cbay_final_tmdl_section_4_final_0.pdf.

23 Chesapeake Bay TMDL, Appendix L, at L-4, https://www.epa.gov/sites/production/files/2015-02/documents/appendix_l_atmos_n_deposition_allocations_final.pdf.

24 Chesapeake Bay TMDL at Section 4.6.2, p. 4-33.

Fossil-fuel-powered cars and trucks are one of the principal sources of NOx pollution in the Bay region.25 Indeed, when EPA conducted air modeling for the Bay TMDL, it modeled a 2030 scenario in which 'emissions projections assume[d] continued stringent controls are in place, such as…Heavy Duty Diesel vehicle fleet fully replaced with newer heavy-duty vehicle (sic) that comply with new standards.'26 Motor vehicles emit NOx close to the ground, depositing nitrogen on plants and soils within tens of meters of the highway.27 Additional nitrogen falls on impervious surfaces, such as roads and parking lots, where much of it is washed into waterways and, ultimately, the Bay.28 A portion of motor vehicle NOx remains airborne, where it either combines with sunlight to form ozone, or remains as nitrogen in one or more forms. Many of these NOx compounds then make their way into the Bay and its tributaries. [EPA-HQ-OAR-2019-0055-1295-A1, p.6]

25 Chesapeake Bay TMDL at Section 4.6.2, p. 4-33.

26 Chesapeake Bay TMDL at Appendix L-15.

27 Redling, K., E. Elliott, D. Bain, and J. Sherwell, Highway contributions to reactive nitrogen deposition: tracing the fate of vehicular NO using stable isotopes and plant biomonitors, Biogeochemistry 116:261-274, 2013.

28 See Chesapeake Bay TMDL, at Appendix L-23.

Clean Air Act programs that reduce airborne nitrogen are a key component of protecting waterways from excess nitrogen pollution.29 Reducing nitrogen inputs to the Bay airshed and watershed is a critical part of achieving and maintaining water quality goals in the Chesapeake Bay. [EPA-HQ-OAR-2019-0055-1295-A1, p.7]

29 See Keith N. Eshleman, Robert D. Sabo, Declining nitrate-N yields in the Upper Potomac River Basin: What is really driving progress under the Chesapeake Bay restoration?, Atmospheric Environment, Vol. 146, pp. 280-289 (Dec. 2016), https://doi.org/10.1016/j.atmosenv.2016.07.004; see also, Linker, Lewis C., Robin Dennis, Gary W. Shenk, Richard A. Batiuk, Jeffrey Grimm, and Ping Wang, 2013. Computing Atmospheric Nutrient Loads to the Chesapeake Bay Watershed and Tidal Waters, Journal of the American Water Res. Ass'n (JAWRA) 1-17. DOI: 10.1111/jawr.12112, available at https://www.chesapeakebay.net/documents/Atmo_Dep__CB_TMDL_10-13.pdf.

Organization: *City Council District 8, Pittsburgh, PA, Erika Strassburger*

As a Member of Pittsburgh City Council, I hear from constituents on a weekly basis about the poor air quality in our region that threatens public health, especially for the most vulnerable populations, and prevents true enjoyment of our city. [EPA-HQ-OAR-2019-0055-2233, p.1]

Organization: *Clean Air Board of Central Pennsylvania*

Trucks and buses remain a dominant source of nitrogen oxide (NOx) pollution in many communities, threatening the health of millions of people. Heavy-duty trucks and buses drive American commerce and connect people across the country. Creating cleaner trucks is an economic opportunity to support jobs and make more efficient vehicles while reducing harmful pollution. Heavy-duty trucks and buses continue to contribute significantly to air pollution at the local, regional, and national level, often disproportionally affecting communities of color and low-income populations. [EPA-HQ-OAR-2019-0055-1305-A1, p.1]

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

In the sections below, Commenters detail the outsized contribution of HDVs to dangerous air pollution, public health burdens, environmental injustices, and climate change. The scale of these problems, in combination with the Agency's statutory mandates, demands a swift and protective regulatory response from EPA in this rulemaking. [EPA-HQ-OAR-2019-0055-1302-A1, p.11]

EPA must fulfill its mandate to curb emissions from HDVs, which lead to air pollution that causes significant negative health impacts. As EPA notes, 'Heavy-duty (HD) engines operating across the U.S. emit NOx and other pollutants that contribute to ambient levels of ozone, PM, and NOx. These pollutants are linked to premature death, respiratory illness (including childhood asthma), cardiovascular problems, and other adverse health impacts. Data show that heavy-duty engines are important contributors to concentrations of ozone and PM2.5 and their resulting threat to public health.'1 In particular, NOx emissions increase levels of ozone, because ground-level ozone forms when there are high concentrations of ambient NOx and VOCs and when solar radiation is high.2 NOx emissions (along with other gaseous precursors such as VOCs and SOX) also impact particulate matter by forming secondary particles through atmospheric chemical reactions.3 Reductions in NOx emitted from HDVs would therefore result in reduced ambient levels of ozone and PM and improved health and environmental outcomes. See 87 Fed. Reg. at 17,417.4 [EPA-HQ-OAR-2019-0055-1302-A1, pp.11-12]

1 See Margaret Zawacki et al., Mobile Source Contributions to Ambient Ozone and Particulate Matter in 2025, 188 Atmospheric Environment 129–41 (2018), https://doi.org/10.1016/j.atmosenv.2018.04.057. See also Kenneth Davidson et al., The Recent and Future Health Burden of the U.S. Mobile Sector Apportioned by Source, Environmental Research Letters (2020), https://doi.org/10.1088/1748-9326/ab83a8.

2 See EPA, Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards—Draft Regulatory Impact Analysis 171 (Mar. 2022), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10144K0.pdf.

3 See id. at 174.

4 See also id. at Chapter 4: Health and Environmental Impacts.

HDVs are particularly notable contributors to particulate matter (PM) and criteria air pollutants. For example, the California Air Resources Board (CARB) found that HDVs are responsible for more than 70% of NOx emissions from on-road mobile sources.5 In addition, the International Council on Clean Transportation (ICCT) found that for urban driving, the NOx emissions from one line-haul truck are equivalent to the emissions from 100 cars for each mile driven.6 Nationally, HDVs are the largest contributor to mobile-source emissions of NOx, making up about 32% of NOx emissions from on- and off-road mobile sources.7 [EPA-HQ-OAR-2019-0055-1302-A1, p.12]

5 See CARB, CARB Staff Current Assessment of the Technical Feasibility of Lower NOx Standards and Associated Test Procedures for 2022 and Subsequent Model Year 1 (2019), https://www.arb.ca.gov/msprog/hdlownox/white_paper_04182019a.pdf.

6 See Huzeifa Badshah et al., Current State of NOx Emissions from In-Use Heavy-Duty Diesel Vehicles in the United States, ICCT (Nov. 2019), https://theicct.org/publication/current-state-of-nox-emissions-from-in-use-heavy-duty-diesel-vehicles-in-the-united-states/.

7 See EPA, EPA Announces the 'Clean Trucks Plan' 2 (2021), https://www.epa.gov/system/files/documents/2021-08/420f21057.pdf. Data is from MOVES3 for onroad and nonroad sectors and 2017 National Emissions Inventory (NEI) for all other mobile sectors.

Air pollution has become so significant that the public-health burdens attributable to air pollution are ‘now estimated to be on a par with other major global health risks such as unhealthy diet and tobacco smoking, and air pollution is now recognized as the single biggest environmental threat to human health.’8 Researchers at the University of Chicago studied the impact of air pollution on life expectancy, and found that ‘the deadly effects of PM2.5 on the heart, lungs, and other systems have a more devastating impact on life expectancy than communicable diseases like tuberculosis, behavioral killers like cigarette smoking, and even war.’9 [EPA-HQ-OAR-2019-0055-1302-A1, pp.12-13]

8 See Ken Lee & Michael Greenstone, Air Quality Life Index Annual Update, Energy Policy Institute at the University of Chicago (2021), https://aqli.epic.uchicago.edu/wp-content/uploads/2021/08/AQLI_2021-Report.EnglishGlobal.pdf.

9 See World Health Organization (WHO), WHO Global Air Quality Guidelines (2021), https://apps.who.int/iris/bitstream/handle/10665/345329/9789240034228-eng.pdf.

Particulate pollution from HDVs can cause severe health impacts even with only short-term exposures. There is consistent evidence showing the relationship between short-term exposure to PM and mortality, particularly cardiovascular and respiratory mortality. Short- and long-term exposure to PM2.5 can cause harmful health impacts such as heart attacks, strokes, worsened asthma, and early death.10 In addition, short-term PM exposure has been linked to increases in infant mortality, hospital admissions for cardiovascular disease, hospital admissions and emergency visits for chronic obstructive pulmonary disease, and severity of asthma attacks and hospitalization for asthma in children. Year-round exposure to PM is associated with elevated risks of early death, primarily from cardiovascular and respiratory problems such as heart disease, stroke, influenza, and pneumonia.11 [EPA-HQ-OAR-2019-0055-1302-A1, p.13]

10 See EPA, Integrated Science Assessment (ISA) for Particulate Matter (Dec. 2019), https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=347534.

11 See American Lung Association, State of the Air 2022 at 21–22 (2022), https://www.lung.org/research/sota.

Not surprisingly, air pollution from HDVs often occurs along highways and in industrial or urban hubs. A new Clean Air Task Force (CATF) map and data visualization tool, Deaths by Dirty Diesel,12 highlights the price that communities pay in negative health impacts from diesel engines (including trucks and other diesel-fueled equipment). Deaths by Dirty Diesel makes data on health impacts from diesel pollution easily accessible to community members on a state, county, and metro area basis. [EPA-HQ-OAR-2019-0055-1302-A1, p.13]

12 See CATF, Deaths by Dirty Diesel Map, https://www.catf.us/deathsbydiesel/. See also CATF, Deaths by Dirty Diesel Map: Health Impacts Methodology, https://cdn.catf.us/wp-content/uploads/2022/01/06091832/deaths-dirty-diesel-methodology.pdf.

The Deaths by Dirty Diesel tool illustrates the various impacts of PM,13 with a focus on the negative impacts from fine particulate matter, or PM2.5. The colors on the map depict diesel engines' contribution to PM2.5 air pollution in various geographic areas. The tool also contains data on the adverse health, social, and economic impacts attributable to emissions from diesel engines, including deaths, heart attacks, acute bronchitis, respiratory symptoms, asthma, emergency room visits, cancer risk, monetized health losses, and lost work and activity days.14 The tool shows the clear linkage between high levels of diesel-related air pollution and threats to public health and welfare. For example, while risk is not spread evenly across any state, the data show that California, New Jersey, and New York have the highest cancer risk from diesel pollution, and Wyoming, Montana, and Oregon have the lowest. The tool is intended to help visualize the vast impact of diesel pollution on communities and to make that information accessible to the general public. [EPA-HQ-OAR-2019-0055-1302-A1, p.14]

13 See CARB, Inhalable Particulate Matter and Health (PM2.5 and PM10), https://ww2.arb.ca.gov/resources/inhalable-particulate-matter-and-health.

14 CATF, Deaths by Dirty Diesel Map: Health Impacts Methodology, https://cdn.catf.us/wp-content/uploads/2022/01/06091832/deaths-dirty-diesel-methodology.pdf.

Not coincidentally, the negative impacts of diesel pollution are often clustered along the country's busiest interstate highways. California offers the starkest example: residents of Los Angeles cope with the country's worst diesel pollution, at 0.726 ug/m3, but the map shows that a driver heading north from Los Angeles on Interstate 5 would continue to encounter dangerously high diesel particulate matter levels in California's Central Valley (Fresno County, CA: 0.451 ug/m3), in the Bay Area (San Mateo County, CA: 0.465 ug/m3), and even at the north end of I-5 in the Puget Sound region (Kitsap County, WA: 0.221 ug/m3).15 Many of these counties, including Los Angeles and Fresno Counties in California, are in non-attainment status for their PM2.5 air quality.16 [EPA-HQ-OAR-2019-0055-1302-A1, p.14]

15 See CATF, Diesel pollution is a deadly problem in the United States (Jan. 2022), https://www.catf.us/2022/01/diesel-pollution-deadly-problem-united-states/.

16 See EPA, Current Nonattainment Counties for All Criteria Pollutants (2022), https://www3.epa.gov/airquality/greenbook/ancl.html.

According to the American Lung Association (ALA) State of the Air 2022 report, fourteen counties received failing grades on all three of the air quality indicators that ALA reviewed: daily particulate matter pollution, annual particulate matter pollution, and ozone pollution.17 Seven of those are California counties bisected by I-5, three are other California counties that sit just to the east of I-5, and another three are California counties bisected by other interstate highways (I-8, I-10, I-15, and I-40). The last is in Arizona, southeast of Phoenix and at the convergence of three highways (I-8, I-10, and I-19).18 EPA must take action to reduce the dangerous levels of pollution found across the country in this rulemaking. [EPA-HQ-OAR-2019-0055-1302-A1, p.14]

17 See ALA, State of the Air 2022 at 19.

18 See Department of Transportation, Federal Highway Administration, National Highway Freight Network Map, https://ops.fhwa.dot.gov/freight/infrastructure/nfn/maps/nhfn_map.htm (last modified Mar. 5, 2020).

These findings show the critical need for EPA to minimize the harmful emissions from the HDV sector. Doing so will not only improve a significant public-health and environmental issue but will also decrease air pollution and improve well-being in overburdened communities. [EPA-HQ-OAR-2019-0055-1302-A1, p.16]

NOx emissions from the heavy-duty sector also harm plants, wildlife, and visibility within national parks and wilderness areas, including those that have been designated as ‘Class I’ under the Clean Air Act and receive special air quality and visibility protections. 49 As EPA has noted in the past, ‘[e]nvironmental impacts of concern are associated with these pollutants and include light extinction, decreased tree growth, foliar injury, and acidification and eutrophication of aquatic and terrestrial systems.’ 85 Fed. Reg. 3,306, 3,310 (Jan. 21, 2020). These impacts are especially damaging in areas already suffering from a range of climate change impacts, such as the Rocky Mountains, Sierra Nevada Mountains, Appalachian Mountains, and Southwestern Desert ecosystems. For example, ozone phytotoxicity can lead to foliar injury and reduce the photosynthetic capacity of plants and trees, including Jeffrey and Ponderosa pines and other high-elevation coniferous species.50 Moreover, many of the tree species weakened by ozone and other air pollutants linked to NOx emissions are already facing climate change-driven stressors, such as drought, high temperatures, and native bark beetle attacks.51 As a result, NOx and GHG pollution from the heavy-duty sector directly contributes to the ongoing tree mortality and mega-wildfire crisis that has devastated the Western United States in recent years. Additionally, nitrogen deposition from NOx pollution causes widespread deleterious impacts across land and water ecosystems, including from both direct exposure (e.g., nitrogen enrichment) and biological effects (e.g., decreases in biodiversity, fish declines). See 87 Fed. Reg. at 17,454–56. Examples of nitrogen deposition impacts include expansion of algae blooms in high altitude lakes within Sequoia and Kings Canyon National Parks52 and the spread of invasive, fire-prone grasses in Joshua Tree National Park.53 These harms affect the public welfare in countless ways, damaging the ability of ecosystems to clean the air and water and to provide the basic natural resources humans rely on for food, shelter, and material goods. See generally Draft Regulatory Impact Analysis (DRIA) Chs. 4.2, 4.3. EPA must take action to mitigate these harms in this rulemaking. [EPA-HQ-OAR-2019-0055-1302-A1, pp.19-20]

49 See National Park Service, Air, Class I, https://www.nps.gov/subjects/air/class1.htm.

50 Ricardo Cisneros et. al., Ozone, nitric acid, and ammonia air pollution is unhealthy for people and ecosystems in southern Sierra Nevada, California, 158 Envtl. Pollution 3261 (2010). See also 87 Fed. Reg. at 17,455.

51 Ricardo Cisneros et. al., Ozone, nitric acid, and ammonia air pollution is unhealthy for people and ecosystems in southern Sierra Nevada, California, 158 Envtl. Pollution 3261 (2010).

52 National Park Service, Sequoia and Kings Canyon Park Air Quality, https://www.nps.gov/seki/learn/nature/airqualitymon.htm.

53 National Park Service, Park Air Profiles - Joshua Tree National Park, https://home.nps.gov/articles/airprofiles-jotr.htm.

Organization: *ClearFlame Engine Technologies (ClearFlame)*

By eliminating the diesel fuel from the diesel engine, ClearFlame engines will eliminate the emissions of diesel particulate matter (PM) and NOx that increase asthma emergencies and threaten health in disadvantaged communities that live with disproportionate levels of diesel pollution, while also reducing GHG emissions in the near-term from these engines. [EPA-HQ-OAR-2019-0055-1261-A1, p. 2]

Organization: *Connecticut Department of Energy and Environmental Protection (CTDEEP)*

The transportation sector is responsible for 67 percent of NOx emissions in Connecticut, a key component of ground level ozone (smog). Exposure to poor air quality exacerbates acute and chronic respiratory problems such as asthma, Chronic Obstructive Pulmonary Disease, and other lung diseases. Furthermore, the immediate health impacts of mobile source related air pollution (both direct and indirect) are felt in areas within and along transportation corridors that have borne a disproportionate impact from this pollution for decades. A recent national report, Asthma Capitals 20215, ranked New Haven (#5) and Hartford (#17) among the 100 largest U.S. cities where it is most challenging to live with asthma. Both cities sit at the intersection of major U.S. highways. CTDEEP recently conducted an analysis of on-road HD vehicle emissions and found that, in 2020, on-road HD emissions accounted for 36% of on-road NOx emissions, but emissions from HD vehicles are projected to increase to 57% of total on-road NOx emissions by

2045 without the adoption of new emissions standards.6 [EPA-HQ-OAR-2019-0055-1306-A1, p.2]

5 AAFA 2021 Asthma Capitals Report May 2021

6 MHD_Whitepaper_030822.pdf (ct.gov) p. 11

Organization: *Consumer Reports (CR)*

CR commends EPA for updating long overdue emission standards for heavy-duty vehicles. Heavy-duty vehicles transport consumer goods all across the country, delivering goods to warehouses and directly to homes. The growth of e-commerce and the promise of fast delivery times will likely increase consumer reliance on heavy-duty vehicles. The U.S. Energy Information Administration estimates a 55% growth in total medium- and heavy-duty vehicle miles traveled between 2019 and 2050.6 A recent investigative article by CR highlights the impacts of expanding e-commerce on communities living near warehouses. These impacts include increased traffic and pollution coming from heavy-duty vehicles delivering goods to the warehouses.7 The expansion of the heavy-duty industry to meet consumers' needs should not come at the expense of communities living near trucking routes, nor at the expense of the health of consumers making purchases. [EPA-HQ-OAR-2019-0055-1285-A1, p.2]

6 NREL, Decarbonizing Medium- and Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis, (March 2022). Available at: https://www.nrel.gov/docs/fy22osti/82081.pdf

7 Kaveh Waddell, When Amazon Moves In These Communities Pay the Price, Consumer Reports (December 9, 2021). Available at: https://www.consumerreports.org/corporate-accountability/when-amazon-expands-these-communities-pay-the-pricea2554249208/

As the EPA states, heavy-duty engines will continue to be one of the largest 'contributors to mobile source NOx emissions nationwide in the future.'8 While making up only 5% of on-road vehicles, and 10% of vehicle miles traveled, EPA estimates that NOx emissions from heavy-duty vehicles will represent 32% of the mobile source NOx emissions in calendar year 2045, and that heavy-duty engines would represent 89% of the on-road NOx inventory in calendar year 2045.'9 NOx are precursors to fine particulate matter (PM2.5) and ground-level ozone. [EPA-HQ-OAR-2019-0055-1285-A1, pp.2-3]

8 Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards. 87 Fed. Reg. 1741, 17418 (March 28, 2022). Available at: https://www.govinfo.gov/content/pkg/FR-2022-03-28/pdf/2022-04934.pdf.

9 Id.; Bureau of Transportation Statistics, U.S. Vehicle Miles, Available at: https://www.bts.gov/content/us-vehicle-miles

Long-term exposure to ozone and PM2.5 increases the risk of premature death from respiratory and cardiovascular diseases. Exposure to PM2.5 is also linked with increased incidences of childhood asthma.10 These health impacts more significantly affect the estimated 72 million people living within 200 meters of a truck freight route. Communities living near these routes are disproportionately people of color and those with lower incomes.11 A recent study conducted by the Union of Concerned Scientists showed that Asian-American, Black, and Latinx communities face, respectively, 34%, 24%, and 23% higher exposures to diesel pollution compared to their white counterparts.12 Stringent NOx emission standards are vital to reducing these adverse health impacts and to addressing historic environmental inequities. [EPA-HQ-OAR-2019-0055-1285-A1, p.3]

> 10 American Lung Association, Health Impact of Air Pollution, (2022. Available at: https://www.lung.org/research/sota/health-risks.
>
> 11 87 F.R. 17414, 17418.
>
> 12 Union of Concerned Scientists, Inequitable Exposure to Air Pollution from Vehicles in California, (January 28, 2019). Available at: https://www.ucsusa.org/resources/inequitable-exposure-air-pollution-vehicles-california-2019.

Organization: *Delaware Department of Natural Resources and Environmental Control (DNREC)*

On-Road HD vehicles are one of the largest sources of nitrogen oxide (NOx) emissions in Delaware, emitting nearly 3,945 tons/year (16%) of all NOx pollution. NOx contributes to smog and secondary particulate matter (PM), which, along with primary PM emissions, are associated with increased risk of premature deaths, hospitalization, and emergency room (ER) visits. Numerous respiratory and cardiovascular diseases are linked to these pollutants such as asthma, decreased lung function, heart attacks, and lung cancer. [EPA-HQ-OAR-2019-0055-1200-A1, p.2]

All combustion engines produce NOx and although technology has advanced in recent years, more must be done to reduce NOx emissions from mobile sources. Cutting NOx and PM emissions from the trucking industry is vital for improving public health and meeting National Ambient Air Quality Standards. [EPA-HQ-OAR-2019-0055-1200-A1, p.2]

Organization: *District of Columbia Department of Energy and the Environment (DOEE)*

The District continues to have high annual ozone. The fourth highest values above the 70 ppb 2015 8-hour Ozone National Ambient Air Quality Standard (NAAQS), except in 2020 when vehicle congestion in the Washington, DC, area was exceptionally reduced due to the Covid-19 health emergency. Oxides of Nitrogen (NOx) emissions from highway trucks are major contributors to unhealthy levels of ground-level ozone and fine particulate matter. In fact, modeling conducted by the Ozone Transport Commission (OTC) found that onroad diesel vehicles were projected to be the second largest contributor to ozone in the District, behind only onroad gasoline vehicles.1 This is detailed below in Table 1. These vehicles were modeled to contribute to 16% of anthropogenic ozone on both exceedance days and throughout ozone season in the District, which is a higher percentage than the District contributes to itself (12% on average and 10% on exceedance days). [EPA-HQ-OAR-2019-0055-1299-A1, pp. 1 - 2]

1. Ozone Transport Commission. 2011-Based Modeling Platform Support Document October 18, 2018

Urban residents in the District are exposed to higher levels of health-damaging PM2.5 and air toxic pollutants which concentrate at “hot-spots” near high-density traffic arteries. Freight transportation relies on trucks, trains, and ships operating within communities in the Northeast and Mid-Atlantic to move goods. This activity generates significant amounts of localized air pollution in communities and for frontline workers already overburdened by diesel exhaust pollution. Local emissions contribute to an ongoing health crisis in these communities. Reducing NOx from heavy-duty truck engines is of the utmost importance due to its role in local and regional ground-level ozone formation, as well as its contributions to PM2.5, and winter-time visibility impairment at Class 1 areas. There are substantial year-round benefits of implementing measures to reduce heavy-duty vehicle NOx emissions. [EPA-HQ-OAR-2019-0055-1299-A1, p. 2]

An OTC analysis, shown in Figure 1, projects that on-road diesel vehicles, including heavy-duty vehicles (HDVs), will be the third largest NOx emissions source in the Ozone Transport Region (OTR) in 2023. Emissions from highway trucks are estimated to comprise 20 percent of the OTR’s total NOx emissions. [EPA-HQ-OAR-2019-0055-1299-A1, p. 2]

2. Tan, et al., “On-Board Sensor-Based NOx Emissions from Heavy-Duty Diesel Vehicles,” Environmental Science and Technology, 53: 5504-5511 (2019).

To estimate the impact of on-road diesel the OTC modeled the contribution, in parts per billion (ppb), of on-road diesel to 8-hour maximum ozone concentrations at monitors in the District.34 Table 1, below, lists the percent contribution to total ozone from on-road diesel vehicles in the District. On-road diesel emissions are projected to contribute about 6 ppb to total ozone and the projected contribution makes up nearly 15 percent of controllable ozone contributions on these days. Also, at all monitors, on-road diesel vehicles are consistently projected to be the second largest anthropogenic contributing sector to ozone, typically only behind area/nonpoint, on-road gasoline vehicles, and in some cases, electric generating units. [EPA-HQ-OAR-2019-0055-1299-A1, p. 3]

3. Ozone Transport Commission “Technical Support Document for the 2011 Ozone Transport Commission/Mid-Atlantic Northeastern Visibility Union Modeling Platform - 2nd Revision,” December 2018.

4. The modeling evaluated the 8-hour maximum ozone on the 4th highest day, which is the metric EPA uses to evaluate compliance with the ozone NAAQS.

A national standard is necessary for a small jurisdiction such as the District because very few private heavy-duty vehicles are registered in the District. In fact, of the heavy-duty vehicles registered in the District, only about 50 vehicles are held privately, despite the thousands of heavy-duty vehicles that pass through our borders. This does not consider the numerous heavy-duty vehicles that circumnavigate the Washington Beltway which never cross the District border yet impact our air quality. Our residents require NOx reductions from diesel vehicles in order to breathe healthy air, and the only effective approach is a national solution. [EPA-HQ-OAR-2019-0055-1299-A1, p. 3]

Although as a whole the District boasts impressive health profiles, life expectancies, and quality of life indicators, many historically overburdened communities in the District do not reflect the trends found in other parts of the city. While traffic and air pollution are problems throughout the city, evidence points to motor vehicle air pollution being concentrated along the interstates and highways that serve as major commuter and goods movement routes, with the heaviest traffic channeled through Southeastern DC (Wards 6, 7, and 8). The communities in Wards 6, 7, and 8 have higher-than-average rates of asthma, which is correlated with higher NOx emissions. If the EPA does not act on the specific issues highlighted above, DOEE fears communities will not see cleaner air, and thus, will continue to suffer adverse health effects. [EPA-HQ-OAR-2019-0055-1299-A1, p. 7]

Organization: *Elders Climate Action*

ECA requests this action to –

3) to end the inequitable and unlawful disparate impact on BIPOC and low income frontline communities who are most exposed to emissions from HDVs in violation of Title VI of the Civil Rights Act and thereby suffer "disproportionately high and adverse human health or environmental effects on minority populations and low-income populations" in violation of EO 12,898. [EPA-HQ-OAR-2019-0055-1218-A1, p. 1]

Diesel trucks and buses are also major sources of other deadly air pollutants. Medium and heavy-duty diesel engines emit more than 60% percent of the deadly particle pollution from vehicles. Particle pollution cuts short tens of thousands of US lives per year and contributes to the heavy burden of asthma on our nation's children. Diesels are the primary source of particles in communities near heavily-trafficked highways where 65 million Americans are exposed to harmful concentrations. [EPA-HQ-OAR-2019-0055-1218-A1, p. 3]

Vehicle pollution inequitably harms Black and Latinex communities that are much more likely compared to whites to reside near heavy truck traffic on highways, and at truck terminals, ports and distribution centers. [EPA-HQ-OAR-2019-0055-1218-A1]

NOx from diesels combines with heat and sunlight in the atmosphere to form ground level ozone, or smog, a lung irritant and asthma trigger. Heavy duty vehicle emissions are a major contributor to urban smog in the 230 urban counties where pollution concentrations violate national air quality standards. [EPA-HQ-OAR-2019-0055-1218-A1, p. 3]

Without effective action to achieve the emission reductions needed for attainment, many at risk groups will suffer harm. EPA's review of the NAAQS for ozone and particulate matter have identified groups especially at risk from vehicle pollution, including-- Babies and children, whose bodies are rapidly developing, Pregnant women who risk increased premature birth and low weight births when exposed to vehicle pollution. Children who develop asthma. Children and adults with asthma who suffer asthma attacks. People with existing respiratory diseases including COPD, COVID-related breathing limitations, long-COVID, and people with active COVID or respiratory infections. People with lung cancer or other chronic diseases including other cancers. People with or at risk for cardiovascular disease. Elders (over age 65) who risk premature death with exposure to air pollution. [EPA-HQ-OAR-2019-0055-1218-A1, p. 4]

The proposed rule fails to achieve the public health benefits that will flow from requiring trucks and buses to emit zero particles, zero NOx and toxic pollutants that cause urban smog, childhood asthma, respiratory and cardiovascular diseases, and premature deaths. Equally objectionable is the failure of EPA to even consider zero emission standards for short-haul HDVs, and to evaluate the climate and public health benefits that would follow from the actions needed for attainment in the worst affected nonattainment areas. [EPA-HQ-OAR-2019-0055-1218-A1, p. 4]

Fire smoke and unprecedented hot temperatures are having a significant impact on human health as an example of the regional impact of heat waves, drought and wildfires. [EPA-HQ-OAR-2019-0055-1218-A1, p. 23]

The heat dome that raised temperatures above 110 F for three days in the Pacific NW in June 2021 caused over 200 heat-related deaths in Oregon and Washington. [EPA-HQ-OAR-2019-0055-1218-A1, p. 23]

Recent research demonstrates that emissions from wildfire are the largest source of fine particle pollution in large regions of the U.S. and contributed to thousands of premature deaths. Wildfire in the western U.S. now accounts for half of all fine particle pollution in some areas of the West, doubling the exposure to PM2.528 from non-fire sources including motor vehicles, power plants and industrial operations.29 [EPA-HQ-OAR-2019-0055-1218-A1, p. 23]

28. PM2.5 are particles smaller than 2.5 micrometers in diameter.

29. Burke, M. et al.,

The changing risk and burden of wildfire in the United States | PNAS (Jan 11, 2021). A warming climate is responsible for roughly half of the increase in burned area in the United States (4), and future climate change could lead to up to an additional doubling of wildfire-related particulate emissions in fireprone areas (36) or a many-fold increase in burned area (37, 38). Costs from these increases include both the downstream economic and health costs of smoke exposure, as well as the cost of suppression activities, direct loss of life and property, and other adaptive measure (e.g., power shutoffs) that have widespread economic consequences.30 [EPA-HQ-OAR-2019-0055-1218-A1, p. 23]

30. Id.

Using satellite measurements of smoke plumes integrated with ground level monitored PM2.5 (fine particle) concentration data, Burke et al. estimate that between 7,000 and 14,500 deaths per year (depending on the dose/response curve used to estimate mortality from observed exposures) are attributable to fire smoke in the contiguous U.S. [EPA-HQ-OAR-2019-0055-1218-A1, p. 24]

Mortality and other health impacts such as asthma attacks and exacerbating COPD will be experienced most severely by communities already burdened by the adverse health effects of daily exposure to fine particle pollution emitted from tailpipes, power plants and industrial sources. Exposure to fire smoke in the American West during the 2020 fire season was universal. No communities were spared. But fire smoke at least doubled the annual exposure routinely suffered by BIPOC and low income communities living near major highways and industrial sources. [EPA-HQ-OAR-2019-0055-1218-A1]

In Oregon, mortality attributed to fire includes many hundreds more deaths than the lives lost directly to fires. Statewide smoke pollution during the 2020 fires threatened lives and wellbeing with extreme hazard concentrations of particles known to cause pre-mature death and cancer, exacerbate asthma, COPD and other respiratory conditions, and cardio-vascular diseases. [EPA-HQ-OAR-2019-0055-1218-A1, p. 24]

The Oregon Health Authority (OHA) reports that "[t]he most severe recent air quality events in Oregon are due to wildfire smoke…"31 OHA cited a study finding that fire smoke in 2012 "caused hundreds of premature deaths, nearly 2,000 emergency room visits and more than $2 billion in health costs."32 OHA points to the longer fire season as increasing the harm from exposure to smoke. "Fire seasons in Oregon are roughly 100 days longer than they were in the 1970s. Longer seasons mean more smoke in Oregon communities."33 The greater density of smoke and longer duration of smoke exposure in 2020 likely at least doubled the mortality caused by smoke exposure compared to 2012. [EPA-HQ-OAR-2019-0055-1218-A1, p. 24]

31. Oregon Climate and Health Report, 40 (Oregon Health Authority, 2020).

32. Id., 33.

33. Id.,

In addition, low income families without air conditioning are much less able to escape smoke pollution by closing doors and windows during the summer heat to keep themselves safe. Workers cannot avoid exposure to smoke pollution if required to work outdoors. [EPA-HQ-OAR-2019-0055-1218-A1, p. 24]

Beyond the economic and environmental damage, social disruption, and harm to health that will result from a longer fire season and expanded fire zones, more deadly air quality will likely make parts of the American West uninhabitable during the fire season for the most vulnerable populations such as the elderly, children and those with existing respiratory and cardiovascular conditions. [EPA-HQ-OAR-2019-0055-1218-A1, p. 24]

These recent data and other sources published since 2009, including the data discussed at length in the Administrator's 2009 Endangerment Finding, 74 Fed. Reg. 66,496 (December 15, 2009), confirm the finding that EPA made 12 years ago: "The Administrator finds that the elevated atmospheric concentrations of the well-mixed greenhouse gases may reasonably be anticipated to endanger the public health and welfare of current and future generations." Id., at 66,523. [EPA-HQ-OAR-2019-0055-1218-A1, pp. 24 - 25]

Organization: *Environmental Defense Fund (EDF) (1265 and 2855)*

EDF conducted an analysis examining the climate, air pollution, health and monetized impacts that would result from electrifying 40 percent of new Class 4-8 single unit trucks, 40 percent of new Class 8 short haul (day cab) tractors, and 80 percent of all transit and school buses, in the 2027-2029 timeframe.70 [EPA-HQ-OAR-2019-0055-1265-A1, p.15]

> 70 EDF. 2022. The Opportunity for Near-Term Electrification of Medium- and Heavy-Duty Vehicles

We have attached this analysis to our comments and summarize the key results here. As stated above, numerous recent studies confirm that eliminating tailpipe emissions from these segments is both technically feasible and cost-saving.71 EDF analysis shows that advancing ZEVs at this rate would:

- Avoid 85 million metric tons of greenhouse gas (GHG) emissions every year by 2040 and more than 1.6 billion tons of GHG emissions through 2050, eliminating 46 percent of emissions from those segments by 2050.
- Significantly reduce ozone forming nitrogen oxide (NOx) pollution by nearly 45,000 tons annually in 2040 and 840,000 -2.2 million tons through 2050 – pollution that disproportionately impacts people of color and lower income neighborhoods.
- Prevent as many as 7,500 - 9,600 premature deaths through 2050.
- Provide our nation with up to $34 billion in economic benefits annually in 2040 with a cumulative savings of $650-680 billion by 2050. [EPA-HQ-OAR-2019-0055-1265-A1, p.15]

> 71 See eg. Vishnu Nair, Sawyer Stone, Gary Rogers, Sajit Pillai. 2022. Medium and Heavy-Duty Electrification Costs for MY 2027- 2030, Roush Industries for Environmental Defense Fund. http://blogs.edf.org/climate411/files/2022/02/EDF-MDHD-Electrification-v1.6_20220209.pdf; Muratori, Matteo et al. 'Decarbonizing Medium- and Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis.' NREL Transforming Energy. March 2022. https://www.nrel.gov/docs/fy22osti/82081.pdf.

While these segments present the most cost-effective near-term opportunity for reductions, it will be equally important for other segments, including long-haul tractors, to transition to electrification as soon as possible because of their significantly high emissions, high vehicle miles traveled and lower fuel economy. The dramatic economic and health savings shown above are the result of just a portion of the medium- and heavy-duty fleet starting to electrify over the next 7 years. The impact of 100 percent new ZEV sales across all vehicle segments would push these benefits into the trillions of dollars. (See Attachment A for the full White Paper and a more extensive justification for the near-term electrification of the truck and bus segments modeled) [EPA-HQ-OAR-2019-0055-1265-A1, p.16]

Organization: *Evangelical Environmental Network (EEN)*

We support new standards for control of air pollution from heavy-duty trucks. The transportation sector emitted pollution is a major sort of air pollution-related death and disease, and recently became the #1 source of global warming pollution in the United States. Heavy-duty trucks are a leading source of lung-damaging air pollutants—including smog-forming NOx pollution and particle pollution (soot). It's estimated that in 2020, that nationwide trucks consumed 55.3 billion gallons of fuel and emitted 561 million metric tons of greenhouse gases, 1.5 million metric tons of nitrogen oxides (NOx) and 38,000 metric tons of particulate matter (soot) (PM). The largest single source of these pollutants are heavy duty trucks (57% of vehicle generated soot comes from trucks.) [EPA-HQ-OAR-2019-0055-0993-A1, p.1]

PM2.5 alone results in at least 200,000ii deaths annually in the United States from nine (9) separate causes including: cardiovascular disease, cerebrovascular disease, chronic kidney disease, chronic obstructive pulmonary disease, dementia, type 2 diabetes, hypertension, lung cancer, and pneumonia.iii Over 15,000 preterm births are linked to PM2.5 with 1/3 of early births resulting in deaths.iv [EPA-HQ-OAR-2019-0055-0993-A1, p.2]

> ii J. Lelievelda, K. Klingmüllera , A. Pozzera , R. T. Burnettc , A. Hainesd , and V. Ramanathan, Effects of fossil fuel and total anthropogenic emission removal on public health and climate, Proceedings of the National Academy of Sciences Apr 2019, 116 (15) 7192-7197; DOI: 10.1073/pnas.1819989116
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> iii Benjamin Bowe, MPH1,2; Yan Xie, MPH1,2,3; Yan Yan, MD, PhD1,4; et al., Burden of Cause-Specific Mortality Associated With PM2.5 Air Pollution in the United States, JAMA Netw Open. 2019;2(11): e1915834. doi:10.1001/jamanetworkopen.2019.15834
>
> iv Leonardo Trasande, Patrick Malecha, and Teresa M. Attina, Particulate Matter Exposure and Preterm Birth: Estimates of U.S. Attributable Burden and Economic Costs, ENVIRONMENTAL HEALTH PERSPECTIVES, http://dx.doi.org/10.1289/ehp.1510810, March 2016

Ozone-forming nitrogen oxides harm the health of both children and adults – this includes asthma,1 other respiratory illnesses like COPD, and brain inflammation leading to cognitive decline. [EPA-HQ-OAR-2019-0055-1134-A1, p.1]

> 1 Rasmussen S.G., et al., "Association Between Unconventional Natural Gas Development in the Marcellus Shale and Asthma Exacerbations," JAMA Internal Medicine, 2016, 176(9), 1334–1343, https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/2534153 Willis, M. D., et al., "Unconventional natural gas development and pediatric asthma hospitalizations

in Pennsylvania, Environmental Research, 166, 402-408, October 2018, https://www.ncbi.nlm.nih.gov/pubmed/29936288

Pregnant people and babies are especially vulnerable. As evangelicals, we have a special care for children – both born and unborn. Medical research shows that ozone exposure increases the likelihood of reproductive and developmental harm, including reduced fertility, preterm birth, stillbirth and low birth weight. [EPA-HQ-OAR-2019-0055-1134-A1, p.1]

Being recently pregnant, these harms hit me at a personal level. [EPA-HQ-OAR-2019-0055-1134-A1, p.1]

Medical research shows that exposure to diesel fumes like emitted from heavy duty vehicles can contribute to ADHD. [EPA-HQ-OAR-2019-0055-1134-A1, p.1]

Like every parent, I want my children to reach their full God-given potential and the truth is heavy duty vehicle pollution robs children of this. But safeguarding our children from heavy duty truck pollution is beyond the control of one person, one parent. We need the strongest standards possible to defend the health and lives of our children. [EPA-HQ-OAR-2019-0055-1134-A1, pp.1-2]

Organization: *Evergreen Action*

The transportation sector accounts for the largest share of greenhouse gas emissions in the nation, and Medium and Heavy Duty Vehicles (MHDVs) represent nearly a third of those emissions. In addition to producing greenhouse gas emissions, heavy duty vehicles are also responsible for significant soot and smog pollution. The particulate matter in soot is responsible for a range of lung and heart diseases which increases hospitalization rates and keeps people from school and work. The NOx pollution that contributes to smog formation harms millions of Americans every year by causing decreased lung function and exacerbating respiratory diseases. These health impacts most severely impact low income communities and communities of color that tend to be surrounded by and displaced by transportation routes. [EPA-HQ-OAR-2019-0055-1289-A1, p.1]

Organization: *Florida Council of Churches*

Our Sovereign God formed humanity from the dust of Earth and breathed into our nostrils the breath of life, and humanity became a living breathing creature. We all share this breath of life. In the age of the pandemic, we've masked up to limit the spread of the moisture in our breathing. But there is no break, no stop sign, no point of exchange where my breath ends and your breath begins. We breathe the same air. We are made of the same breath. Scripture says it's the breath of God. Indeed, we share this breath of the divine with all living creatures and the inanimate structures on Earth. Let us think of Earth and its biosphere as a breathing creature itself, inhaling and exhaling. Ancient rabbis say that in pronouncing the Hebrew name for God replicates this inhaling and exhaling. Breath is life. [EPA-HQ-OAR-2019-0055-1006, p.1]

Florida is home now to nearly 22 million people and is growing by 1000 new residents a day. Almost half of Floridians live in the ten counties with the highest density of population and thus traffic congestion. Density can be determined in various ways. If one excludes land area with zero population, the ten most dense counties are respectively Broward, Pinellas, Miami-Dade, Palm Beach, Orange, Seminole, Hillsborough, Duval, Sarasota, and Lee. These counties also have significant, historic populations of African descent and Latine populations who live in urban neighborhoods ringed by inner-city interstates and expressways. It has been well-documented by scholars how the road systems were intentionally designed in conjunction with redlining to box these people in. They bear the brunt of exhaust pollution in Florida. Asthma is common across the state in these hemmed in communities and life-expectancy is lower. [EPA-HQ-OAR-2019-0055-1006, p.1]

The Parramore district in Orlando has one of the highest ozone readings in the nation. It is completely hemmed in by elevated interstate highways. The City of St Petersburgh established a community garden at the Enoch Davis Center in the southcentral neighborhood but had to put it in raised beds. The ground around the center was too toxic for a garden – the toxicity was the accumulation of exhaust pollution over the decades. We must address both NOx and heavy metal pollution in these urban settings. The road runoffs create accumulated toxicities. One of our future food supplies is urban agriculture, and the soil is crying for renewal – as the New Testament says, even the stones are shouting and creation is longing for the liberation of humanity. [EPA-HQ-OAR-2019-0055-1006, pp.1-2]

Organization: *International Council on Clean Transportation (ICCT)*

Current EPA 2010 standards are inadequate to protect public health from HDV NOx emissions. Diesel vehicles are the largest contributor to health impacts from transportation-related air pollution in the U.S., responsible for more than 9 thousand premature deaths in 2015. ICCT research has shown that excess NOx emissions from diesel HDVs produce health impacts an order of magnitude greater than diesel passenger cars. Diesel HDVs are one of the top contributors to racial, ethnic, and socioeconomic disparities in PM2.5 and NO2 exposure. Previous ICCT research has shown that achieving a 90% NOx reduction for model year 2027 and later diesel engines could avoid more than $1 trillion in air pollution-related health damages cumulatively from 2027–2050. [EPA-HQ-OAR-2019-0055-1211-A1, p. 3]

RECOMMENDATION: We strongly encourage EPA to finalize stringent NOx engine standards by the end of this year. [EPA-HQ-OAR-2019-0055-1211-A1, p. 3]

On-road vehicles remain the largest source of NOx emissions in the United States,3 and the majority of these emissions are from HDVs—especially those with diesel engines.4 Current EPA 2010 standards for heavyduty vehicles have not been updated since 2010, whereas EPA's Tier 3 emissions standards will continue to reduce criteria pollutant emissions from new light- and medium-duty passenger vehicles through model year 2025.5 [EPA-HQ-OAR-2019-0055-1211-A1, p. 7]

3. EPA, “Air Pollutant Emissions Trends Data.” https://www.epa.gov/air-emissions-inventories/air-pollutantemissions-trends-data

4. https://theicct.github.io/roadmap-doc/

5. https://www.transportpolicy.net/standard/us-light-duty-emissions/ and https://www.transportpolicy.net/standard/us-heavy-duty-emissions/

EPA 2010 standards are inadequate to protect public health from HDV NOx emissions. Diesel vehicles are the largest contributor to health impacts from transportation-related air pollution in the U.S., responsible for more than 9 thousand premature deaths in 2015.6 ICCT research has shown that excess NOx emissions from diesel HDVs produce health impacts an order of magnitude greater than diesel passenger cars in the U.S.7 ICCT research also shows that a disproportionate amount of NOx emissions from heavy-duty vehicles is emitted during urban driving. Vehicle operation at speeds of less than 25 mph results in NOx emissions of more than five times the certification limit for the average HDV certified to EPA 2010 standards.8 Diesel HDVs are one of the top contributors to racial, ethnic, and socioeconomic disparities in PM2.5 and NO2 exposure in the U.S.9 [EPA-HQ-OAR-2019-0055-1211-A1, p. 7]

6. Anenberg et al., "The Global Burden of Transportation Tailpipe Emissions on Air Pollution-Related Mortality in 2010 and 2015."

7. Anenberg et al., "Impacts and Mitigation of Excess Diesel-Related NOx Emissions in 11 Major Vehicle Markets."

8. Badshah, H., Posada, F., and Muncrief, R. (2019). Current state of NOx emissions from in-use heavy-duty diesel vehicles in the United States." Washington, DC: International Council on Clean Transportation. https://theicct.org/wpcontent/uploads/2021/06/NOx_Emissions_In_Use_HDV_US_2019 1125.pdf

9. Tessum et al., "PM 2.5 Polluters Disproportionately and Systemically Affect People of Color in the United States"; Kerr, Goldberg, and Anenberg, "COVID-19 Pandemic Reveals Persistent Disparities in Nitrogen Dioxide Pollution."

EPA's Option 1 will benefit communities in all states; adopting requirements similar to the scenario represented by Federal omnibus + Alternative 3 would further increase benefits by approximately 15% across U.S. states. [EPA-HQ-OAR-2019-0055-1211-A1]

The most populous states, such as California and Texas have among the highest potential health benefits in absolute terms from heavy-duty vehicle emission regulations. Yet multiple states are projected to experience outsized benefits compared to their population, such as Pennsylvania and Delaware, as well as Midwest and Southern states, including Indiana, Arkansas, Ohio, Missouri, North Carolina, and Georgia. [EPA-HQ-OAR-2019-0055-1211-A1]

Organization: *International Union, United Automobile, Aerospace and Agricultural Implement Workers of America (UAW)*

Across the country, many of our members live in communities facing air quality issues and the concurrent health risks. [EPA-HQ-OAR-2019-0055-1138-A1, p.2]

Organization: *Lion Electric Co. USA Inc. (Lion)*

It is critical that we as a country recognize the impact that internal combustion engine (ICE) vehicles have in causing air pollution in our communities. For this reason, Lion applauds the EPA for considering updated and more stringent guidelines to curb the air quality and health-related issues associated with the on-road heavy-duty vehicle sector as it stands. [EPA-HQ-OAR-2019-0055-1151-A2, p. 1]

As the EPA noted in the rulemaking document, the health risks associated with the air pollutants from ICE vehicles are steep and costly both financially and measured in terms of human lives. Therefore, it is imperative that aggressive steps be taken to reduce this harm immediately. [EPA-HQ-OAR-2019-0055-1151-A2, p. 3]

Organization: *Maine Department of Environmental Protection (Department)*

Ozone can cause chronic obstructive pulmonary disease (COPD), and long-term exposure may result in permanent lung damage, such as abnormal lung development in children. There is also consistent evidence that short-term exposure to ozone increases risk of death from respiratory causes.1 [EPA-HQ-OAR-2019-0055-1288-A1, p.1]

> 1 U.S. EPA, "Health Effects of Ozone Pollution," https://www.epa.gov/ground-level-ozone-pollution/health-effects-ozone-pollution, last updated July 30, 2019 (accessed February 7, 2020).

NOx emissions are the major drivers of surface ozone concentrations at the regional scale in the eastern United States, and significant contributors to fine particle pollution and regional haze. Maine, because of its geographic location at the downwind terminus of the northeast corridor, is especially impacted by transported emissions from states and regions to our south.[EPA-HQ-OAR-2019-0055-1288-A1, p.2]

The primary ozone and precursor transport route is over the Gulf of Maine and along the Maine coastline. Historically, during ozone events in Maine, peak ozone levels are monitored first along the southern Maine coast, then they are monitored later in the day at downwind locations as the air mass moves along the coastline to the Northeast. As an example, Figure 1 shows the coastal track of a high-ozone air mass which occurred during the June 12, 2017, ozone event, with peak ozone levels monitored at the summit of Cadillac Mountain four (4) hours after the peak ozone level was recorded at the Kennebunkport monitoring site and seven (7) hours after the peak ozone level was recorded at a Connecticut monitoring site just outside of New York City. Figure 2 shows surface wind streams during the afternoon of June 12, 2017, where the sea breeze transport pattern matches the historical transport pattern for ozone events along the Maine coast. [EPA-HQ-OAR-2019-0055-1288-A1, p.2]

Although Maine is currently attaining all National Ambient Air Quality Standards (NAAQS)3, reducing heavy-duty vehicle NOx emissions is still important for urban and rural residents that are often exposed to higher levels of health-damaging PM2.5 and air toxic pollutants concentrated at "hot-spots" near higher-density traffic arteries. Freight transportation relies on trucks, trains, and ships operating within communities in the Northeast and mid-Atlantic to move goods. This activity generates a significant amount of localized air pollution in communities and for frontline workers already overburdened by diesel exhaust pollution. [EPA-HQ-OAR-2019-0055-1288-A1, p.3]

> 3 Maine's Limited Maintenance Plans for the Portland and Midcoast region were approved on 10/14/20202 (85 FR 64969).

Because of its role in secondary particulate formation, reducing heavy-duty vehicle NOx emissions can help improve visibility in Federal Class I areas. There are seven Class I Federal areas in the region that comprises the Mid-Atlantic Northeast Visibility Union (MANE-VU)4, with these Class I areas historically facing some of the worst visibility in the nation. Monitor analyses of the Interagency Monitoring of Protected Visual Environment (IMPROVE) network shows the increasing importance of nitrate formation on visibility impairment, especially in the winter months.5 Because of this, the MANE-VU states through the MANE-VU Regional Planning Organization process requested that EPA implement a program to reduce NOx emissions from HDVs.6 [EPA-HQ-OAR-2019-0055-1288-A1, p.3]

> 4 Maine has three Class I areas: Acadia National Park, Moosehorn Wilderness Area, and Roosevelt Campobello International Park.
>
> 5 Mid-Atlantic/Northeast Visibility Union. "Mid-Atlantic/Northeast U.S. Visibility Data 2004-2017 (2nd RH SIP Metrics)," December 18, 2018.
>
> 6 Mid-Atlantic/Northeast Visibility Union. "Statement of the MANE-VU States Concerning a Course of Action by the Environmental Protection Agency and Federal Land Managers toward Assuring Reasonable Progress for the Second Regional Haze Implementation Period (2018-2028)," August 25, 2017.

To address the region's persistent air quality problems, reducing NOx from heavy-duty truck engines is of the utmost importance due to its role in local and regional ground-level ozone formation, as well as its contributions to PM2.5, and visibility impairment at Class 1 areas. The year-round benefits of measures to reduce heavy-duty vehicle NOx emissions are substantial. [EPA-HQ-OAR-2019-0055-1288-A1, p.4]

Organization: *Mass Comment Campaign sponsored by American Lung Association (248)*

Pollution from diesel-powered trucks and buses puts the health of anyone who spends time outdoors at risk, but especially people living in communities near highways, ports, bus depots and other transportation hubs. Nitrogen oxide (NOx) emissions can cause lung damage on their own and also form ground-level ozone and particle pollution. Ozone and particle pollution can lead to asthma attacks, cardiovascular and lung disease, strokes and even premature death. [EPA-HQ-OAR-2019-0055-1609-A1, p.1]

In its 2022 “Zeroing in on Healthy Air” report, the American Lung Association found that a nationwide transition to zero-emission light, medium and heavy-duty vehicles, powered by non-combustion electricity, would save 110,000 lives and secure $1.2 trillion in public health benefits nationwide from 2020-2050. [EPA-HQ-OAR-2019-0055-1609-A1,p.1]

Organization: *Mass Comment Campaign sponsored by Climate Action Campaign (22,659)*

- Smog and soot air pollution caused by trucks and buses are among the greatest threats to public health for the more than 45 million people in the U.S. living within 300 feet of a major roadway or transportation facility. [EPA-HQ-OAR-2019-0055-1193, p.1]

Organization: *Mass Comment Campaign sponsored by Evangelical Environmental Network (EEN) (67,755)*

Pollution from transportation is a major cause of air-pollution-related death and disease, and recently transportation became the top source of global warming pollution in the United States. Heavy-Duty Trucks, like tractor-trailers, are a leading source of lung-damaging air pollutants—including smog-forming NOx pollution and particle pollution (soot). In 2020, trucks emitted an estimated 561 million metric tons of greenhouse gases, 1.5 million metric tons of nitrogen oxides (NOx) and 38,000 metric tons of particulate matter (soot) (PM), filling the air we breathe with life-threatening air pollution. The largest single source of these pollutants is heavy duty trucks. [EPA-HQ-OAR-2019-0055-1610-A1, p.1]

As pro-life Christians, we want the air that we breathe to be safe for our children. However, soot (PM2.5) from burning fossil fuels cut short the lives of 350 million Americans each year and contributes to at least 15,000 premature births of which 1/3 of those babies die. Heavy duty trucks, like tractor-trailers, emit soot and other pollutants that put God’s creation and our families - especially pregnant mothers and the unborn - in harm's way. Unborn children close to major roads are at higher risk of birth defects, and children attending school near these highways have higher rates of cancer and asthma. [EPA-HQ-OAR-2019-0055-1610-A1,pp.1-2]

That's why over 67, 755 pro-life Christians are calling on the EPA to ensure stronger standards that will cut pollution from Heavy-Duty Trucks by 2027 and move us to zero emission by 2035. Our kids deserve clean air and the right to an abundant live. [EPA-HQ-OAR-2019-0055-1610-A1, p.2]

Organization: *Mass Comment Campaign sponsored by Moms Clean Air Force and Arizona Climate Action Coalition (198)*

Trucks are also major sources of other deadly air pollution. Medium and heavy duty trucks account for more than 60% percent of the deadly particle pollution that comes from vehicles.

Particle pollution cuts short tens of thousands of US lives per year and contributes to the heavy burden of asthma on our nation's children. [EPA-HQ-OAR-2019-0055-1192-A1, pp.1-2]

Organization: *Mass Comment Campaign sponsored by Neighbors for Clean Air and Elders Climate Action (43)*

Diesel trucks and buses are also major sources of other deadly air pollutants. Medium and heavy-duty diesel engines emit more than 60% percent of the deadly particle pollution from vehicles. Diesel engines emit deadly particle pollution. NOx combines with heat and sunlight in the atmosphere to form ground level ozone, or smog, a lung irritant and asthma trigger. Particle pollution cuts short tens of thousands of US lives per year and contributes to the heavy burden of asthma on our nation's children. [EPA-HQ-OAR-2019-0055-1619-A1, p.2]

Heavy duty vehicles are major contributors to air pollution in the Portland metro area and on the I-5 and I-84 corridors. [EPA-HQ-OAR-2019-0055-1619-A1, p.2]

The Oregon Health Authority says that many groups are especially at risk from vehicle pollution, including--
Babies and children whose bodies are rapidly developing,
Pregnant women who risk premature births and low weight babies when exposed to vehicle pollution.
Children are at higher risk of developing asthma.
Children and adults with asthma suffer more frequent asthma attacks requiring urgent or emergency care.
People with existing respiratory diseases including COPD, COVID-related breathing limitations, long-COVID, and people with active COVID or other respiratory infections suffer more severe outcomes.
Non-smokers are more at risk for lung cancer or other chronic diseases including other cancers.
People with or at risk for cardiovascular disease.
Elders (over age 65) suffer higher risk of premature death with exposure to vehicle pollution. [EPA-HQ-OAR-2019-0055-1619-A1, p.2]

Organization: *Mass Comment Campaign sponsored by PennEnvironment (50)*

Smog pollution from trucks is also a threat to public health, causing childhood asthma, cancer and even premature death. To protect our health and fight climate change, EPA must strengthen the proposed heavy duty truck rule. [EPA-HQ-OAR-2019-0055-1616-A1, p.1]

Organization: *Mass Comment Campaign sponsored by Public Citizen (168)*

Diesel pollution kills. Nearly 10,000 people in the United States die each year from exposure to diesel emissions from the transportation sector, and hundreds of thousands of others face heart attacks, asthma, and respiratory conditions that damage their wellbeing and quality of life. The EPA's proposed rulemaking on diesel emissions is much needed. I appreciate the EPA for proposing these new standards to better protect the climate and the health of people. [EPA-HQ-OAR-2019-0055-1597-A2, p.1]

Organization: *Mass Comment Campaign sponsored by The Outreach Team (95)*

Smog and soot air pollution from trucks and buses are among the greatest public health threats for millions of people, which is why the EPA must create the strongest possible limits on heavy duty vehicle pollution. I support strong truck pollution regulations. [EPA-HQ-OAR-2019-0055-1618, p.1]

Organization: *Mass Comment Campaign sponsoring organization unknown - 1 (2,443)*

Every year semi-trucks, busses, and other heavy-duty vehicles emit millions of tons of nitrogen oxides (NOx) and other greenhouse gas pollutants driving climate change. [EPA-HQ-OAR-2019-0055-1594-A1, p.1]

NOx air pollution from heavy-duty vehicles contributes to ozone and fine particulate pollution, which are unsafe to breathe, especially for the young and elderly and anyone exercising outdoors. [EPA-HQ-OAR-2019-0055-1594-A1, p.1]

In our national parks it harms plants, trees, insects and other animals and it reduces the ability of visitors to see and appreciate the views of our treasured park landscapes. [EPA-HQ-OAR-2019-0055-1594-A1,p.1]

Organization: *Metropolitan Washington Air Quality Committee (MWAQC) et al.*

Poor air quality affects the residents living and working in metropolitan Washington. Some communities in metropolitan Washington face higher rates of illnesses such as asthma than the national average, and these illnesses are aggravated by these pollutants. As such, reductions in NOx emissions will provide health benefits from both reduced ozone and PM2.5 pollution. [EPA-HQ-OAR-2019-0055-0996-A1, p. 2]

Organization: *Moving Forward Network (MFN)*

It is well understood that diesel exhaust is “carcinogenic to humans,” as determined by the World Health Organization, and leads to tens of thousands of premature deaths each year.16 Diesel exhaust contains smog precursors, fine particulate matter—which can be inhaled and lodged in the lungs, and more than 40 known cancer-causing compounds.17 Exposure to pollution from diesel-powered vehicles has also been linked to low birth rate, premature birth, lower IQ, diabetes, stroke, congestive heart failure, heart disease, obesity, asthma, and allergies.18 [EPA-HQ-OAR-2019-0055-1277-A1, p. 8]

> 16. https://www.catf.us/2022/01/diesel-pollution-deadly-problem-united-states/, https://phys.org/news/2019-02-pollution-deathslinked- diesel.html; “Diesel Engine Exhaust Carcinogenic.” International Agency for Research on Cancer, World Health Organization, 12 June 2012, www.iarc.fr/en/media-centre/pr/2012/pdfs/pr213_E.pdf; see also Kristina W. Whitworth, Elaine Symanski, and Ann L. Coker, Childhood Lymphohematopoietic Cancer Incidence and Hazardous Air Pollutants in Southeast

Texas, 1995-2004, Envtl. Health Perspectives, Vol. 116 No. 11 (Nov. 2008), 1576-1580 (describing cancer risk linked to air pollutants).

17. Cal. Air Res. Bd., "Summary: Diesel Particulate Matter Health Impacts," (last visited May 4, 2022), https://ww2.arb.ca.gov/resources/summary-diesel-particulate-matter-health-impacts.

18. Wilhelm, Michelle, et al. "Traffic-Related Air Toxics and Term Low Birth Weight in Los Angeles County, California." Environmental Health Perspectives, vol. 120, no. 1, Aug. 2011, doi:10.3897/bdj.4.e7720.figure2f [exposure linked to low birth weight]; Christopher S. Malley, Johan C.I. Kuylenstierna, Harry W. Vallack, Daven K. Henze, Hannah Blencowe, Mike R. Ashmore. Preterm birth associated with maternal fine particulate matter exposure: A global, regional and national assessment. Environment International, 2017 [exposure linked to premature birth]; Perera, Frederica, et al. "Prenatal Airborne Polycyclic Aromatic Hydrocarbon Exposure and Child IQ at Age 5 Years." Pediatrics, vol. 124, no. 2, Aug. 2009, pp. 195–203, doi:10.1542/peds.2008-3506 [exposure linked to lower IQ]; ZJ, Andersen, et al. "Diabetes incidence and long-term exposure to air pollution: a cohort study." Diabetes Care, vol. 35, no. 1, Jan. 2012, pp. 92-98, doi: 10.2337/dc11-1155 [exposure linked to diabetes]; T., To et al. "Chronic disease prevalence in women and air pollution--A 30-year longitudinal cohort study." Environmental International, vol. 80, July 2015, pp. 26-32, doi: 10.1016/j.envint.2015.03.017 [exposure linked to diabetes, stroke, congestive heart failure, and heart disease in women]; Dong, Guang-Hui, et al. "Ambient Air Pollution and the Prevalence of Obesity in Chinese Children: The Seven Northeastern Cities Study." Obesity, vol. 22, pp. 795-800, doi: doi:10.1002/oby.20198 [exposure linked to obesity in children]; Finkelman, Fred. "Diesel exhaust particle exposure during pregnancy promotes development of asthma and atopy." The Journal of Allergy and Clinical Immunology, vol. 134, issue 1, pp. 73-74, doi: 10.1016/j.jaci.2014.04.002 [exposure linked to development of asthma and atopy].

On top of this, these same communities suffer from a handful of additional harms from the freight sector: the paved areas and large, low buildings dominating freight facilities contribute to urban heat island effects, stormwater issues and other environmental impacts. Other industrial sources are often clustered near freight facilities, which means that communities impacted by diesel trucks are also impacted by other sources of air and water pollution, and toxic releases. These communities also face racism and other forms of discrimination that increase their vulnerability to environmental threats. In fact, freight-impacted communities are even more vulnerable to the impacts of air and other pollution because of socio-demographic stressors—including racial segregation, high rates of poverty, lack of access to affordable foods, and lack of access to healthcare—compared to communities that do not face these stressors.25 [EPA-HQ-OAR-2019-0055-1277-A1, p. 9 - 10]

25. Environmental Justice Health Alliance for Chemical Policy Reform, Coming Clean, and Campaign for Healthier Solutions, Life at the Fenceline: Understanding Cumulative Health Hazards in Environmental Justice Communities (Sept. 2018), available at https://new.comingcleaninc.org/assets/media/documents/Life%20at%20the%20Fenceline

%20-%20English%20-%20Public.pdf; Rachel Morello-Frosch et al., “Understanding the Cumulative Impacts of Inequalities in Environmental Health: Implications for Policy,” Health Affairs 30, no. 5 (2011): 879-998.

Organization: *National Association of Clean Air Agencies (NACAA)*

Many of these areas are over-burdened communities whose citizens are exposed to a disproportionate share of harmful environmental conditions. The excessive emissions from HD trucks are a primary cause, contributing substantial emissions of NOx – the key pollutant contributing to the formation of ozone and PM2.5 – and are linked with a large number of adverse impacts on the respiratory system, as well as other ill effects associated with exposure to elevated levels of ozone and PM, including premature death. [EPA-HQ-OAR-2019-0055-1232-A1, p. 2.]

Organization: *National Association of Small Trucking Companies (NASTC)*

We appreciate the goals of the proposed rule. NASTC and our members share the aims of reduced pollution and of cleaner air. Further, we understand the health and environmental concerns cited in the proposed rule (though we do have concerns about the underlying assumptions). We also understand that heavy-duty vehicles emit a sizable amount of nitrogen oxide (NOx) and greenhouse gases (GHG) while doing their jobs. [EPA-HQ-OAR-2019-0055-1130-A1, p. 1]

Organization: *National Coalition for Advanced Transportation (NCAT)*

The transportation sector is also responsible for a significant share of criteria pollutant emissions, including over 55% of the nitrogen oxides (NOx) total emissions inventory in the U.S.,15 17.9 million tons per year of carbon monoxide, 133,000 tons per year of fine particulate matter (PM) PM2.5, 287,000 tons per year of PM10, and 1.8 million tons per year of volatile organic compounds (VOCs).16 These emissions have significant effects on communities around the country. [EPA-HQ-OAR-2019-0055-1290-A1, p. 5]

15. U.S. EPA, Smog, Soot, and Other Air Pollution from Transportation, https://www.epa.gov/transportation-air-pollution-and-climate-change/smog-soot-and-local-air-pollution (last updated Nov. 20, 2020).

16. NHTSA, The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Year 2021 – 2026 Passenger Cars and Light Trucks Final Environmental Impact Statement (Mar. 2020) at 4-1–4-2, available at https://www.nhtsa.gov/sites/nhtsa.gov/files/documents/safe_vehicles_rule_feis.pdf.

Electric and other zero emission vehicles are a critically important, cost-effective strategy to reduce such air pollution, particularly in areas with severe air quality problems. All-electric vehicles produce zero direct emissions since these vehicles lack a tailpipe and thus have zero tailpipe emissions of GHGs or other pollutants. As a result, use of these vehicles in place of internal combustion engine vehicles can significantly improve air quality in urban areas. On average across the United States, annual life cycle emissions per vehicle are substantially lower for all electric vehicles as compared to gasoline vehicles. The emissions reductions are even greater in geographic areas that use relatively low-polluting energy sources for electricity generation.20 The share of electricity generated from renewable energy resources (e.g., wind, solar, geothermal, hydroelectric, and biomass) has dramatically increased in recent years to about 20% of total U.S. electricity generation in 2020.21 And the U.S. Energy Information Administration (EIA) predicts that this trend of significant increases in generation from renewable resources will continue.22 As the sources of electricity generation become cleaner, GHG and criteria pollutant emissions related to use of electric vehicles will further decline. Electric vehicles also emit less heat and produce less noise.23 Researchers from Harvard studied emissions from electric vehicles and conventional vehicles in large metropolitan statistical areas and concluded that in each area, air pollution mortality was significantly less from electric vehicles.24 Others have found that, regardless of the electric vehicle adoption scenario they considered, ozone and PM2.5 concentrations declined with the adoption of electric vehicles.25 [EPA-HQ-OAR-2019-0055-1290-A1, pp. 5-6]

20. U.S. DOE Alternative Fuels Data Center, Emissions from Hybrid and Plug-In Electric Vehicles, https://afdc.energy.gov/vehicles/electric_emissions.html (last visited July 5, 2021) (see comparison of electricity sources and annual vehicle emissions, on a national average and state-by-state basis).

21. U.S. EIA, Electricity in the United States, https://www.eia.gov/energyexplained/electricity/electricityin-the-us.php (last updated Mar. 18, 2021) (figure showing U.S. electricity generation by major energy sources, 1950-2020)

22. U.S. EIA, Annual Energy Outlook 2021 (Feb. 2021) at 16, available at https://www.eia.gov/outlooks/aeo/pdf/AEO_Narrative_2021.pdf.

23. Vishant Kothari & Ryan Sclar, World Resources Institute, '4 Reasons to Prioritize Electric Vehicles After COVID-19,' https://www.wri.org/insights/4-reasons-prioritize-electric-vehicles-after-covid-19 (Oct. 14, 2020).

24. Ernani F. Choma, et al., 'Assessing the Health Impacts of Electric Vehicles Through Air Pollution in the United States,' 144 Environment International 106015 (2020), available at https://www.sciencedirect.com/science/article/pii/S016041202031970X#b0105.

25. D.R. Peters, et al., 'Public Health and Climate Benefits and Trade-Offs of U.S. Vehicle Electrification,' 4 GeoHealth (2020), available at https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2020GH000275; see also Uarporn Nopmongcol, et al., 'Air Quality Impacts of Electrifying Vehicles and Equipment Across the United States,' 51 Environmental Science and Technology 2830 (2017), https://pubs.acs.org/doi/abs/10.1021/acs.est.6b04868.

Organization: *National Parks Conservation Association (NPCA)*

It is unquestionable that heavy-duty vehicles and engines impact the health of individuals who breathe in dirty air and the environment at large. As stated in the proposed rule, 'Heavy-duty (HD) engines operating across the U.S. emit NOx and other pollutants that contribute to ambient levels of ozone, PM, and NOx. These pollutants are linked to premature death, respiratory illness (including childhood asthma), cardiovascular problems, and other adverse health impacts. Data show that heavy-duty engines are significant contributors to concentrations of ozone and PM2.5 and their resulting threat to public health.'6 [EPA-HQ-OAR-2019-0055-1314-A1, p.2]

6 87 Fed. Reg. at 17,417.

As it relates to parks, this air pollution harms the health and wellbeing of visitors and employees within national parks and residents of the gateway communities surrounding national parks. NOx pollution also directly impacts numerous unique park ecosystems harming plants and wildlife. As EPA has noted in the past, 'Environmental impacts of concern are associated with these pollutants and include light extinction, decreased tree growth, foliar injury, and acidification and eutrophication of aquatic and terrestrial systems.'7 These impacts are especially relevant in areas already suffering from a range of climate change impacts, such as the Rocky Mountains, Sierra Nevada Mountains, Appalachian Mountains, and Southwestern Desert ecosystems. For example, ozone phytotoxicity can lead to foliar injury and reduce the photosynthetic capacity of plants and trees, including Jeffery and Ponderosa pines and other high elevation coniferous species.8 Moreover, many of the tree species weakened by ozone and other air pollutants linked to NOx emissions are already facing climate change driven stressors associated with manmade GHG emissions, such as drought, high temperatures, and native bark beetle attacks.9 Because of this, NOx and GHG pollution from heavy-duty trucks can be directly linked and the ongoing tree mortality and mega-wildfire crisis that has devastated the Western United States in recent years. Additionally, nitrogen deposition from NOx pollution causes widespread deleterious impacts across land and water ecosystems and includes both direct exposure (e.g. nitrogen enrichment) and biological effects (e.g. decreases in biodiversity; fish declines;). Examples of nitrogen deposition impacts include expansion of algae blooms in high altitude lakes within Sequoia and Kings Canyon National Parks and the spread of invasive, fire prone, grasses in Joshua Tree National Park.10 These harms affect the public welfare in countless ways, damaging the ability of ecosystems to clean our air and water and to provide us with the basic natural resources we rely on for food, shelter, and material goods. [EPA-HQ-OAR-2019-0055-1314-A1, pp.2-3]

7 85 Fed. Reg. at 3310

8 Ricardo Cisneros, et. al., Ozone, nitric acid, and ammonia air pollution is unhealthy for people and ecosystems in southern Sierra Nevada, California, Environmental Pollution 158, 3261 (2010).

9 Id.

10 See generally, NPS, Sequoia and Kings Canyon Park Air Quality. Available at https://www.nps.gov/seki/learn/nature/airqualitymon.htm. See also, NPS, Park Air

Profiles - Joshua Tree National Park. Available at https://home.nps.gov/articles/airprofiles-jotr.htm.

Heavy-Duty Vehicle NOx pollution also contributes to haze pollution that decreases visibility in our national parks and other Class 1 areas covered by the CAA's Regional Haze Program. Haze consists of pollutants emitted from these vehicles, engines, and other sources that causes and contributes to regional haze in the national parks resulting in views that can be distorted and impaired.11 Virtually every park in the United States is affected by haze pollution, and for 89 percent of parks, visibility impairment is either a moderate or significant concern.12 As a result of haze pollution, visitors of the national parks miss out on many miles-worth of views of the grand landscapes this country has to offer. On average, 50 miles of scenery is missed by visitors to national parks due to impaired visibility caused by regional haze, and in some parks, as many as 90 miles of scenery and landscape is lost in sight due to regional haze.13 Although air quality has improved over time, these benefits are not felt by all parks equally. In fact, 33 national parks are as polluted as this nation's 20 largest cities.14. With numerous states in the middle of their second-round regional haze planning periods additional reductions in NOx pollution from HD vehicles could go a long way towards helping achieve natural levels of visibility in national parks and other Class 1 areas as is set forth as a goal under the Clean Air Act. . [EPA-HQ-OAR-2019-0055-1314-A1, p.3]

11 NPCA, Air and Climate Report: Polluted Parks, NPCA.org (2019), https://www.npca.org/reports/air-climate-report.

12 Id.

13 Id.

14 Id.

Organization: *National Religious Partnership for the Environment*

For communities living near freeways, trucking corridors, and freight hubs, pollution from medium- and heavy-duty trucks and buses can be deadly. Discriminatory land use and transportation policies have resulted in the burden of diesel pollution exposure to be borne more heavily by communities of color. This exposure to diesel pollution has led to long-term respiratory and cardiovascular health issues. [EPA-HQ-OAR-2019-0055-1221-A1, p.1]

Organization: *National Tribal Air Association (NTAA)*

Tribes continue to suffer from unhealthy exposures to ozone, fine particulate matter (PM2.5) and hazardous air pollutants emitted from heavy-duty vehicles. [EPA-HQ-OAR-2019-0055-1382-A2, p.2]

Organization: *New York Farm Bureau (NYFB)*

Since 1990, economy-wide NOx emissions from highway vehicles have declined by 75%, even as overall vehicle miles traveled have increased by nearly 50%. Continued improvements in advanced-technology diesel engines are a key driver of this success, and one of many reasons U.S. air quality is among the best in the world. [EPA-HQ-OAR-2019-0055-1268-A1, p. 1]

Organization: *Northeast States for Coordinated Air Use Management (NESCAUM)*

The NESCAUM region includes the New York City (NYC) Combined Statistical Area (CSA) with over 20 million people living across portions of Connecticut, New Jersey, New York, and Pennsylvania. It is the largest CSA by population in the United States. While air pollution levels have dropped over the years across much of the United States, the NYC metropolitan area and surrounding regions continue to persistently exceed federal health-based air quality standards for ground-level ozone.[EPA-HQ-OAR-2019-0055-1249-A1, p. 2.]

The chronically persistent high ozone concentrations compromise the health and welfare of the citizens living in the NYC CSA and elsewhere in the NESCAUM region. Epidemiological studies provide strong evidence that ozone is associated with respiratory effects, including increased asthma attacks, as well as increased hospital admissions and emergency department visits for people suffering from respiratory diseases. Ozone can cause chronic obstructive pulmonary disease (COPD), and long-term exposure may result in permanent lung damage, such as abnormal lung development in children. There is also consistent evidence that short-term exposure to ozone increases risk of death from respiratory causes.5 Furthermore, more recent studies show that ozone concentrations below the current National Ambient Air Quality Standards (NAAQS) contribute to the risk of premature death in sensitive populations, such as the elderly.6 [EPA-HQ-OAR-2019-0055-1249-A1, pp. 2-3]

> 5. U.S. EPA, "Health Effects of Ozone Pollution," https://www.epa.gov/ground-level-ozone-pollution/health-effects-ozone-pollution, last updated May 5, 2021 (accessed May 12, 2022).
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> 6. Di, Q., et al., "Air pollution and mortality in the Medicare population," New England Journal of Medicine 376: 2513-2522 (2017). DOI: 10.1056/NEJMoa1702747; Di, Q., et al. "Association of short-term exposure to air pollution with mortality in older adults," JAMA 318: 2446-2456 (2017). DOI: 10.1001/jama.2017.17923.

While ozone is largely a summertime issue in the Northeast, NOx emissions are a year-round problem. During colder seasons, NOx emissions play a role in producing secondary PM2.5 through the formation nitrates. PM2.5 exposure is associated with a variety of health effects, including reduced lung function, irregular heartbeat, asthma attacks, heart attacks, and premature death in people with heart or lung disease.7 Low-income communities and communities of color are often located near trucking corridors, ports, fleet garages, warehouses, and other trucking hubs. These communities are often affected by disproportionate amounts of diesel exhaust emissions and worsened health burdens due to poor air quality in US cities.8,9 Health and economic impacts include increase in asthma and other respiratory illnesses, especially in children and older adults, leading to additional trips to doctors and emergency rooms, missed days of school and work, and thousands of premature deaths each year. [EPA-HQ-OAR-2019-0055-1249-A1, p. 3.]

> 7. U.S. EPA, "Health and Environmental Effects of Particulate Matter (PM)," https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm, last updated May 26, 2021 (accessed May 12, 2022).
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> 8. Demetillo, M.A.G.; Harkins, C.; McDonald, B.C.; Chodrow, P.S.; Sun, K.; Pusede, S. E., "Space-Based Observational Constraints on NO2 Air Pollution Inequality From Diesel Traffic in Major US Cities," Geophys. Res. Lett. 48: e2021GL094333 (2021). DOI: 10.1029/2021GL094333. Available at https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2021GL094333 (accessed May 12, 2022).

The public health and environmental impacts of NOx are summarized in Table 1. [EPA-HQ-OAR-2019-0055-1249-A1, p. 3]

Organization: *Our Children's Trust*

EPA continues here a long-standing practice of discounting the lives of children and unborn future generations when it analyzes and considers the formulation of proposed regulations to carry out its delegated authority to protect the air and human health and welfare. That charge, to protect air quality in order to protect human health and welfare, is a charge not to merely protect one living generation of adults' air quality, but to protect babies, children, and 'our Posterity'—for the U.S. Constitution is clear that all sovereign authority vested in our federal government, and here as delegated to EPA, cannot be used to destroy the nation and thereby its sovereignty, precluding children of today and tomorrow from inheriting the air and water and land in sound condition and having the ability to govern themselves to also protect the lifegiving air and all generations to come. [EPA-HQ-OAR-2019-0055-1317-A1, p.2]

The RIA and proposed rule analysis repeatedly reference how children are a most vulnerable class of citizens and their physical health is threatened by the pollutants being allowed by this proposed rule. However, EPA has not analyzed the extreme mental health harms to children from both the physical harms they experience from this pollution, but also from the climate anxiety they carry due to the institutional betrayal of agencies like EPA and also the acute and chronic trauma they experience from living with climate crisis. There is a mental health crisis among our young, which EPA in other contexts has acknowledged. It should be included here as well and in every analysis you conduct, particularly when so many of the physical harms you assess and monetize are respiratory in nature for children, and where the inability to breathe on bad ozone days or when fires are ripping through your community are destabilizing the mental health of so many of our children. [EPA-HQ-OAR-2019-0055-1317-A1, p.4]

Under the 5th Amendment to the U.S. Constitution, the government is restrained from engaging in conduct that infringes upon fundamental rights to life, liberty, and property, and equal protection of the law, all of which includes a climate system that sustains human life and liberty.

Under the Public Trust Doctrine, embedded in our Constitution and other founding documents, and in the very sovereignty of our Nation, U.S. residents (both present and future, i.e., Posterity) have a right to access and use crucial natural resources, like air and water. The U.S. government, and its executive agencies, have fiduciary duties as trustees to manage, protect, and prevent substantial impairment to our country's vital natural resources which the government holds in trust for present and future generations.19 [EPA-HQ-OAR-2019-0055-1317-A1, p.6]

19 Juliana v. United States, 217 F. Supp. 3d 1224, 1254 (D. Or. 2016).

Organization: *Ozone Transport Commission (OTC) and Mid-Atlantic/Northeast Visibility Union (MANE-VU)*

NOx emissions are the major drivers of surface ozone concentrations at the regional scale in the eastern United States. Epidemiological studies provide strong evidence that ozone is associated with respiratory effects, including increased asthma attacks, as well as increased hospital admissions and emergency room visits for people suffering from respiratory diseases. High ozone concentrations can compromise the health and welfare of people living in the Ozone Transport Region (OTR). People of color and those with lower household incomes are often impacted by disproportionate amounts of diesel exhaust emissions and worsened health burdens due to poor air quality in US cities.1 Ozone can cause chronic obstructive pulmonary disease (COPD), and long-term exposure may result in permanent lung damage, such as abnormal lung development in children. There is also consistent evidence that short-term exposure to ozone increases the risk of death from respiratory causes.2 Furthermore, recent studies show that ozone concentrations below the current National Ambient Air Quality Standards (NAAQS) continue to contribute to the risk of premature death in sensitive populations, such as the elderly.3 [EPA-HQ-OAR-2019-0055-1250-A1, p.2]

1 Demetillo, M.A.G.; Harkins, C.; McDonald, B.C.; Chodrow, P.S.; Sun, K.; Pusede, S. E., 'Space-Based Observational Constraints on NO2 Air Pollution Inequality From Diesel Traffic in Major US Cities,' Geophys. Res. Lett. 48: e2021GL094333 (2021). DOI: 10.1029/2021GL094333. Available at https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2021GL094333.

2 U.S. EPA, 'Health Effects of Ozone Pollution,' https://www.epa.gov/ground-level-ozone-pollution/health-effects-ozone-pollution, last updated May 5, 2021. Accessed May 12, 2022.

3 Di, Q., et al. 'Air pollution and mortality in the Medicare population.' New England Journal of Medicine 376.26 (2017): 2513-2522. DOI: 10.1056/NEJMoa1702747; Di, Q., et al. 'Association of short-term exposure to air pollution with mortality in older adults.' JAMA 318.24 (2017): 2446-2456. DOI: 10.1001/jama.2017.17923.

While ozone is largely a summertime issue in the OTR, NOx emissions are a year-round problem, due to its role in producing secondary PM2.5 in the colder seasons. PM2.5 exposure is associated with a variety of health effects, including reduced lung function, irregular heartbeat, asthma attacks, heart attacks, and premature death in people with heart or lung disease.6 The public health and environmental impacts of NOx are summarized in Table 1. [EPA-HQ-OAR-2019-0055-1250-A1, p.3]

> 6 U.S. EPA, 'Health and Environmental Effects of Particulate Matter (PM),' https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm, last updated May 26, 2021. Accessed May 12, 2022.

Organization: *Retail Industry Leaders Association (RILA)*

EPA's proposed changes to its pollutant emissions standards for heavy-duty engines are a logical update that will benefit employees and customers of the nation's retailers through improved air quality.[EPA-HQ-OAR-2019-0055-1189-A2, p.2]

Organization: *Saahil Pasha*

According to the American Lung Association, approximately 3 out of every 8 people in the United States lives in a county where a grade of “F” has been assigned for the ozone pollution (American Lung Association, 2021). This means that these counties received an extremely poor rating for the ground level ozone. In 2018, 2019, and 2020, more than 122.3 million people lived in counties that received a rating of “F” (American Lung Association, 2021). According to the Environmental Protection Agency (EPA), ground level ozone forms when nitrogen oxides (NOx) and volatile organic compounds undergo a chemical reaction in the presence of sunlight and heat ("Ground-level ozone basics," 2021). Ground level ozone in high concentrations is extremely detrimental to health. Adults and children with asthma, older adults, people who work outdoors, and people that spend time outdoors are at a significant risk for lung and airway related illness ("Health effects of ozone pollution," 2021). [EPA-HQ-OAR-2019-0055-1206]

The DFW metroplex ranks 17th on the American Lung Association's list of most polluted cities in the country, due in part to both fine particulate matter (PM2.5) and ozone (American Lung Association, 2021). DFW failed to meet federally mandated air quality levels in 2019 (IQAir.com, 2021). Pollutants emitted by cars, power plants, and chemical plants react with sunlight, resulting in elevated surface ozone levels (EPA, 2021). The DFW metroplex has significant numbers of daily commuters traveling to work by private vehicle and plenty of hot, sunny days, providing the perfect environment for ozone pollution to develop. [EPA-HQ-OAR-2019-0055-1206]

Air pollution, and the resulting poor air quality leads to increased morbidity and mortality from respiratory disorders, cardiovascular diseases, cancers, and body systems dysfunctions (Manisalidis et al., 2020). Ozone and particulate matter (PM) are the most prominent air toxins, and the harmful effects are primarily related to lung function. Tissue damage associated with inhalation, affects the conducting airways (upper respiratory tract, bronchi, bronchioles) as well as the alveoli of the lungs, where air/blood oxygen exchange occurs (Steinberg, 1990). Even minute quantities of ozone negatively affect forced expiratory lung volume in healthy young people (Brown, 2008). Asthmatics and sufferers of chronic obstructive lung disease are especially affected by surface ozone. EPA regulations concerning maximum tolerable ozone levels continue to be debated, but really no amount of surface air ozone is good for humans (Levitan, 2018). [EPA-HQ-OAR-2019-0055-1206]

Air pollution directly impacts all residents of the North Texas area and is a significant public health concern. Air quality is an important consideration for all who enjoy outdoor activities, and especially those who have chronic health conditions. According to Air North Texas, 10 counties in the area fall under "non-attainment" for ozone pollution, which means that local air quality is worse than National Ambient Air Quality Standards established by amendments to the Clean Air Act of 1970 (Air North Texas, 2022). In addition, poor air quality disproportionately affects those who belong to minority groups. Black, Latinx, and low- socioeconomic populations are more likely to reside near trucking and freight routes where most of the air pollution is produced (Demetillo, 2021). These communities are excessively exposed to poor air quality, resulting in a near fifteen-year difference in life expectancy (Chaudhary, 2021). In addition, those with pre-existing conditions such as asthma, lung diseases, and heart disease have increased risk of being negatively impacted by air pollution (NSW Government, 2013). [EPA-HQ-OAR-2019-0055-1206]

Air pollution has an impact on the incidence of chronic disease and is considered a risk factor. The proposed EPA rule and improved health outcome projections will reduce the burden of chronic disease. Further, reducing the burden of chronic disease on healthcare resources can contribute towards reducing healthcare costs (Chapel et al., 2017). [EPA-HQ-OAR-2019-0055-1206]

Organization: *Sage Lincoln*

I applaud the EPA’s efforts to reduce pollution from heavy-duty trucks: truck emissions of NOx, PM, CO, and ozone are linked to premature death, respiratory illness, cardiovascular problems, and other health impacts. I support the EPA adopting the most stringent air pollution standards for three reasons:

I. Heavy-duty trucks are a leading source of harmful air pollutants.
II. Vehicle pollution is most concentrated on and near roadways, exposing bicyclists to unsafe levels of pollutants.
III. Decreasing truck emissions and ensuring safe, healthy bicycling can disproportionately benefit low-income individuals. [EPA-HQ-OAR-2019-0055-1073]

I. Heavy-duty trucks are a leading source of harmful air pollutants.

As the EPA acknowledges in its proposed comment, emissions from the transportation sector are a major source of air pollution and can lead to harmful health effects including premature death, respiratory illnesses, and cardiovascular problems. The medium- and heavy-duty vehicle and engine sector is the largest contributor to mobile source emissions of NOx, which reacts in the atmosphere to form smog and particulate matter.1 The health impacts of these pollutants are well documented. For example, PM2.5 alone results in 200,000 deaths per year in the United States.2

1 Heavy-Duty Vehicles, Air Pollution, and Climate Change, CONGRESSIONAL RES. SERVICE (Feb. 11, 2022), https://crsreports.congress.gov/product/pdf/IF/IF12043.

2 Benjamin Bowe et al., Burden of Cause-Specific Mortality Associated With PM2.5 Air Pollution in the United States, JAMA NETWORK OPEN (Nov. 20, 2019).

Currently, over 137 million people in the United States live in regions with unhealthy levels of ozone or particulate pollution.3 Many of these people live in cities: urban areas experience higher levels of truck-related air pollution than most of the country.4 Although diesel vehicles represent just 5 percent of traffic in cities, they emit up to half of urban NOx pollution.5 Furthermore, communities near truck routes exposed to the highest levels of pollution are disproportionately low-income and minority, and face a higher health burden from these pollutants.

3 2022 State of the Air, AMERICAN LUNG ASSOC. (2022), https://www.lung.org/research/sota/key-findings.

4 Heather Strosnider et. al, Rural and Urban Differences in Air Quality, CENTER FOR DISEASE CONTROL AND PREVENTION (June 23, 2017).

5 Kristoffer Tigue, Diesel Emissions in Major US Cities Disproportionately Harm Communities of Color, INSIDE CLIMATE NEWS (Oct. 27, 2021).

More stringent heavy-duty truck emission standards will save lives and help protect the health of the millions of Americans who live in urban areas and near truck routes. [EPA-HQ-OAR-2019-0055-1073]

II. Bicyclists Are Exposed to Dangerous Levels of Air Pollution from Exhaust.

While pollution from vehicles causes regional air quality issues, concentrations of these toxic pollutants are higher closest to traffic, particularly on and adjacent to roads.6 Individuals on or near roads, such as bicyclists, are therefore exposed to extremely high concentrations of pollution.

6 Near Roadway Air Pollution and Health: Frequently Asked Questions, EPA (Aug. 2014).

Bike lanes adjacent to traffic feature very poor air quality: bicyclists are essentially breathing in direct exhaust from vehicles before it has a chance to disperse.7 Studies have shown that this close proximity to traffic exposes bicyclists to pollution levels that greatly exceeds threshold values established as dangerous to human health.8 Just a few feet can make a huge difference for pollution concentration—bicyclists in bike lanes are exposed to 50 percent more NOx and black carbon than on bike paths adjacent to busy streets.9

7 Piers MacNaughton et. al, Impact of Bicycle Route Type on Exposure to Traffic-Related Air Pollution, 490 SCI. TOTAL ENVIRON. 37 (Aug. 15, 2014).

8 Juan F. Franco et al., Air Pollution alongside Bike-Paths in Bogota-Colombia, FRONT ENVIRON. SCI. (Nov. 25, 2016).

9 Piers MacNaughton et. al, Impact of Bicycle Route Type on Exposure to Traffic-Related Air Pollution, 490 SCI. TOTAL ENVIRON. 37 (Aug. 15, 2014).

During exercise, bikers have higher ventilation rates, exposing them to more pollution. Cyclists can breathe nine times more air while biking than resting, increasing exposure to toxic air pollution ninefold.10 This combination of proximity to traffic and higher breathing rate leads to extremely high pollution exposure. Studies are mixed on whether the harm of pollution exposure during cycling outweighs the benefit of cycling: at least some studies have found that the risk of cardiovascular disease from exposure to particulate pollution while exercising outweighed the health benefits of that exercise.11 Either way, even short-term exposure to pollutants while biking increases blood pressure,12 deaths, and cardiovascular- and respiratory-related hospitalizations.13

10 Richard Schiffman, On Your BIke, Watch Out for the Air, N.Y. TIMES (July 6, 2017).

11 Seong Rae Kim, Association of the combined effects of air pollution and changes in physical activity with cardiovascular disease in young adults, 42 EUROPEAN HEALTH J.2487 (July 1, 2021).

12 James Ramsay, Just How Healthy is Biking in New York City? Help Us Find Out, Gothamist (June 18, 2019).

13 Burden of disease from environmental noise - Quantification of healthy life years lost in Europe, WORLD HEALTH ORG. (2011).

Our understanding of the health impacts of cycling adjacent to traffic is still evolving and ongoing studies are attempting to precisely determine the health impacts of breathing pollution while biking.14 However, it is clear that reductions in truck emissions will reduce the extremely high pollution exposure of bicyclists. [EPA-HQ-OAR-2019-0055-1073]

14 Natalie Migliore, Something in the Air: Biking Could be Hazardous To Your…, WFUV (Sept. 10, 2018).

III. Safe, Healthy Bicycling Disproportionately Benefits Philadelphians and Low-Income Individuals.

The Philadelphia metro area is the 17th most polluted in the country for fine particulate pollution and the 21st most polluted for ozone.15 Philadelphia is also the poorest big city in America: 20 percent of Philadelphia families live in poverty,16 and 43 percent are unable to meet their basic needs.17 Philadelphia residents pay a higher percentage of income on transit fares than commuters in most cities, making public transit potentially cost-prohibitive.18 However, Philadelphia has higher per capita bicycle commuting rates than any of the ten largest cities in the U.S.19

15 2022 State of the Air, AMERICAN LUNG ASSOC. (2022), https://www.lung.org/research/sota/key-findings.

16 Philadelphia County, U.S. CENSUS QUICKFACTS (July 1, 2021), https://www.census.gov/quickfacts/fact/table/US/PST045221.

17 DIANA M. PEARCE, OVERLOOKED & UNDERCOUNTED 2019 BRIEF: STRUGGLING TO MAKE ENDS MEET IN PENNSYLVANIA 5 (Oct. 2019), https://pathwayspa.org/wp-content/uploads/2020/01/PA2019_OverlookedUndercounted_Web.pdf.

18 The Cost of Commuting for Philadelphians, PEW TRUSTS (July 24, 2019), https://www.pewtrusts.org/en/research- and-analysis/reports/2019/07/24/the-cost-of-commuting-for-philadelphians.

19 Biking to Get Around, BICYCLE COALITION OF GREATER PHILADELPHIA, https://bicyclecoalition.org/resources/commuting/ (accessed May 4, 2022).

Bicycle commuting, where feasible, is an affordable method of transportation: low-income Americans commute by bike more than any other income brackets.20 Furthermore, people of color currently account for the fastest cyclist growth rate.21 Therefore, ensuring bicyclists can travel safely and healthily is an issue of equity. Additionally, as cities nationwide encourage bicycling for its climate, health, and traffic benefits, the EPA should ensure that bicyclists are not forced to breath unsafe levels of pollutants from vehicle exhaust.

20 Brian McKenzie, Modes Less Traveled—Bicycling and Walking to Work in the United States, U.S. CENSUS BUREAU (May 8, 2014), https://www.census.gov/library/publications/2014/acs/acs-25.html.

21 THE NEW MAJORITY: PEDALING TOWARDS EQUITY, BIKE LEAGUE 3 (May 2013), https://bikeleague.org/sites/default/files/equity_report.pdf.

The health effects of truck emissions are serious and well documented. Millions of Americans are exposed to unsafe levels of air pollutants each year because of our current lax standards, and communities near truck routes, urban areas, and bicyclists are disproportionately burdened. For these reasons, I urge the EPA to choose the most stringent standards possible for truck emissions and to improve emissions standards for all other vehicles. [EPA-HQ-OAR-2019-0055-1073]

Organization: *South Coast Air Quality Management District*

A strong low-NOx standard further supports the agency's mission to protect public health. The EPA's own Regulatory Impact Analysis (RIA) reaffirms much of our understanding of the health effects associated with exposure to ozone. Exposure to ambient concentrations of ozone is associated with numerous adverse health impacts including respiratory, metabolic and cardiovascular effects as a result of both short- and long-term exposure.21 The RIA also infers a causal relationship between asthma exacerbation and other respiratory effects and short term NOx exposure.22 It is also worth noting that heavy-duty emissions contribute to ambient levels of air toxics which can expose the affected population to an elevated cancer risk.23 This is significant because in addition to contributing to the formation of PM2.5 and ozone, many VOCs, including benzene, are also considered air toxics.24 [EPA-HQ-OAR-2019-0055-1201-A1, pp.6-7]

21 RIA at pg. 172; see also 2016 AQMP, Appendix 1, pgs. I-5 – I-18.

22 Id. at pg. 178.

23 Id. at pg. 182.

24 2016 AQMP at pg. 9-9.

Organization: *Southern Environmental Law Center (SELC)*

Medium- and heavy-duty vehicles generate an outsized share of harmful tailpipe pollution. Though comprising less than 10 percent of all vehicles on the road, trucks are responsible for over 60 percent of all tailpipe NOx and particulate matter (PM) emissions.4 EPA estimates these vehicles will account for 89 percent of on-road NOx emissions, and 32 percent of all mobile source NOx emissions, by calendar year 2045.5 These vehicles also contribute to ambient ozone and carbon monoxide (CO) levels. All of these pollutants are linked to serious health impacts, such as premature death, respiratory illness, and cardiovascular issues, and all have health-based National Ambient Air Quality Standards (NAAQS) developed by EPA.6 One report estimates that NOx and PM emissions from medium- and heavy-duty vehicles nationwide are 'responsible for up to 4,550 premature deaths, 4,290 hospital visits, and 2.7 million incidents of exacerbated respiratory conditions and lost or restricted workdays annually,' resulting in over $53 billion in monetized public health impacts annually.7 [EPA-HQ-OAR-2019-0055-1247-A1, p.2]

4 Per EPA MOVES model emissions inventory. See e.g., U.S. ENV’T PROT. AGENCY, MOVES and Other Mobile Source Emissions Models, https://www.epa.gov/moves (last updated July 2, 2021).

5 Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, 87 Fed. Reg. at 17418.

6 Id. at 17441. See also, AM. LUNG ASS’N, State of the Air (2021), https://www.lung.org/getmedia/17c6cb6c- 8a38-42a7-a3b0-6744011da370/sota-2021.pdf. For example, an estimated 750 premature deaths related to on-road vehicle emissions occurred in Virginia in 2016. Transp., Equity, Climate & Health Project, Preliminary Results Slides, https://cdn1.sph.harvard.edu/wp-content/uploads/sites/2343/2020/10/TRECHPrelimResultsSlides.pdf (last visited Apr. 13, 2022)

7 Dana Lowell & Jane Culkin, M.J. BRADLEY & ASSOCS., Medium- & Heavy-Duty Vehicles: Market Structure, Environmental Impact, and EV Readiness 13 (July 2021), https://www.mjbradley.com/sites/default/files/EDFMHDVEVFeasibilityReport22jul21.pdf.

Many major metropolitan areas in the U.S., including many in the South like Washington, D.C., Atlanta, and Birmingham, already suffer from elevated concentrations of ozone, NOx, and PM.8 Medium- and heavy-duty vehicle traffic (measured in vehicle miles traveled) is expected to grow by 29 percent through 2050, with higher projected regional growth rates in the Southeast.9 As noted in the Federal Register notice, '72 million people live within 200 meters of a truck freight route,' making exposure to medium- and heavy-duty vehicle tailpipe pollution a serious public health issue nationwide.10 [EPA-HQ-OAR-2019-0055-1247-A1, p.2]

8 See ENV’T AM., U.S. PIRG & FRONTIER GRP., Trouble in the Air: Millions of Americans Breathed Polluted Air in 2018 (Winter 2020), https://uspirg.org/sites/pirg/files/reports/EnvironmentAmerica_TroubleintheAir_scrn.pdf.

9 Dana Lowell & Jane Culkin, supra note 7 at 13.

10 Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, 87 Fed. Reg. at 17418.

Exposure to this type of pollution is also an environmental justice issue; '[r]elative to the rest of the population, people of color and those with lower incomes are more likely to live near truck routes.'11 This is in part due to zoning practices and land use decisions, including in the South, that have consistently sited highways and commercial and industrial facilities that often rely on frequent truck deliveries in communities of color and low-income communities.12 [EPA-HQ-OAR-2019-0055-1247-A1, pp.2-3]

11 Id.

12 See e.g., Kaveh Waddell, When Amazon Expands, These Communities Pay the Price, CONSUMER REPS. (Dec. 9, 2021), https://www.consumerreports.org/corporate-accountability/when-amazon-expands-these-communities-paythe-price-a2554249208/; INST. FOR TRANSP. & DEV. POL’Y, Highways and Zoning: Tools of Racist Policy (Mar. 10, 2021), https://www.itdp.org/2021/03/10/highways-and-zoning-tools-of-racist-policy/; Ashish Valentine, ‘The Wrong Complexion for Protection.’ How Race Shaped America’s Roadways and Cities, NAT’L PUB. RADIO (July 5, 2020), https://www.npr.org/2020/07/05/887386869/how-transportation-racism-shaped-america; Johnny Miller, Roads to Nowhere: How Infrastructure Build on American Inequality, THE GUARDIAN (Feb. 21, 2018), https://www.theguardian.com/cities/2018/feb/21/roads-nowhere-infrastructure-american-inequality.

Organization: *States of California, et al. (The States)*

Heavy-duty truck engines are a significant source of air pollutants that contribute to ambient concentrations of ozone, inhalable particulate matter (PM2.5), and air toxics.6 Exposure to ozone and PM2.5 has serious health effects and is associated with increased risk of premature deaths, emergency room visits, and hospital stays.7 A range of adverse respiratory effects are linked to these pollutants such as asthma, respiratory inflammation, and decreased lung function and growth.8 [EPA-HQ-OAR-2019-0055-1255-A1, p. 4]

6. 87 Fed. Reg. at 17,444.

7. Id. at 17,444-51.

8. Id.

In particular, PM2.5 poses the greatest health risk among air pollutants as the fine particles can lodge deep into the lungs and possibly enter into the bloodstream, causing irregular heartbeat, heart attacks, as well as increased risk of lung cancer.9 Recent evidence also suggests a causal relationship between PM2.5 exposure and a host of other negative health impacts, including male and female reproductive and developmental effects from long-term exposure (i.e., fertility, pregnancy, and birth outcomes), metabolic effects from long-term and short-term exposure, and nervous system effects from short-term exposure.10 Heavy-duty engine emissions also contribute to ambient levels of air toxics, such as benzene, formaldehyde, acetaldehyde, and naphthalene, that are known or suspected to cause cancer and other serious health effects.11 [EPA-HQ-OAR-2019-0055-1255-A1, p. 4]

9. EPA Notice of Proposed Rulemaking on the Control of Air Pollution from Airplanes and Airplane Engines: Particulate Matter Standards and Test Procedures, 87 Fed. Reg. 6324, 6331 (Feb. 3, 2022).

10. Id.

11. Draft RIA at § 4.1.6.

Organization: *Sustainable Solar Systems*

Diesel pollution from heavy duty trucks and buses is a massive public health threat. Even without considering climate change, the air pollution caused by heavy duty trucks is a environmental justice issue that causes more health issues in frontline and marginalized communities. Diesel pollution worsens asthma and is particularly dangerous to children’s developing lungs. Here in Philadelphia, 21% of children have asthma, which is more than double the national rate. Indoor and outdoor air pollution are major contributors to the high prevalence of asthma in Philadelphia. The air pollution doesn't only affect childrens' health. It increases costs for LMI families, increases absentee rates in school and days missed from work for their parents. It affects childrens ability to learn in school, affecting lifetime income levels for those children. [EPA-HQ-OAR-2019-0055-2737, p.1]

Organization: *Taxpayers Protection Alliance (TPA)*

As pointed out by other commenters such as the Lake Michigan Air Directors Consortium, pollution from diesel vehicles is a significant contributor to ground level ozone.1 In turn, ground level ozone can have an array of adverse effects including respiratory distress and damage to vegetation.2 Emissions pose a particular threat to underserved communities and can exacerbate health and wealth inequalities. Yet, heavy-handed regulations are a crude way to handle this dire threat. As the EPA rightly notes, the highway vehicles targeted play a critical economic role, including, ‘support[ing] local and regional construction, refuse collection, and delivery work to long-haul tractor-trailers that move freight cross-country.’3 [EPA-HQ-OAR-2019-0055-1102-A1, p.1]

> 1 Lake Michigan Air Directors Consortium, ‘Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine Standards Docket No. EPA-HQ-OAR-2019-0055’ (Apr. 25, 2022).
>
> 2 See, for example: Zhang, Junfeng Jim, Yongjie Wei, and Zhangfu Fang, ‘Ozone pollution: a major health hazard worldwide,’ Frontiers in Immunology (2019): 2518.
>
> 3 U.S. Environmental Protection Agency, ‘Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards,’ Proposed Rule (Mar. 28, 2022).

Organization: *Tesla, Inc. (Tesla)*

Tesla fundamentally agrees with the agency that: Emissions from heavy-duty vehicles contribute to poor air quality and health across the country, especially in overburdened and underserved communities. Without further reductions, heavy duty vehicles will continue to be one of the largest contributors to mobile source emissions of NOx, which react in the atmosphere to form ozone and particulate matter.32 [EPA-HQ-OAR-2019-0055-1219-A1, p.5]

> 32 EPA, Heavy-Duty 2027 and Beyond: Clean Trucks Proposed Rulemaking (March 2022) at 2.

While comprising less than 10 percent of all vehicles on the road, medium- and heavy-duty trucks account for more than 60 percent of tailpipe NOx and particulate matter (PM) emissions from the on-road fleet; these emissions contribute to poor air quality in many urban areas, including areas with vulnerable populations.33 [EPA-HQ-OAR-2019-0055-1219-A1, p.5]

> 33 See generally, MJ Bradley, Medium- & Heavy-Duty Vehicles: Market Structure, Environmental Impact, and EV Readiness (Aug. 11, 2022) at 4; See also, Union of Concerned Scientists, Ready for Work Now Is the Time for Heavy-Duty Electric Vehicles (Dec. 11, 2019) at 2 (While heavy-duty vehicles make up only 10 percent of all vehicles on roads in the United States, they contribute 45 percent of the transportation sector’s nitrogen oxide pollution, 57 percent of its fine particulate matter pollution, and 28 percent of its global warming emissions).

Indeed, the public health, climate, and economic benefit from much more stringent NOx and GHG emission standards than the EPA proposes cannot be understated. Air pollution is estimated to cause over 200,000 premature deaths in the U.S. each year; with more than half are caused by transportation emissions.34 Recent findings indicate that the U.S. health care costs of air pollution and climate change exceed $800 billion per year.35 Air pollution impacts with pollutants like PM2.5 that are associated with the medium- and heavy-duty sector not only cause premature mortality, cardiovascular disease and respiratory disease but also can affect neurological disorders.36 Other studies suggest that exacerbation of air pollution and heat exposure related to climate change may be significantly associated with risk to pregnancy outcomes in the U.S.37 [EPA-HQ-OAR-2019-0055-1219-A1, p.6]

34 Atmospheric Environment, Air pollution and early deaths in the United States. Part I: Quantifying the impact of major sectors in 2005 (Nov. 2013); See also, PNAS, Fine-scale damage estimates of particulate matter air pollution reveal opportunities for location-specific mitigation of emissions (April 8, 2019) (Over 100,000 premature death just from PM 2.5).

35 Medical Society Consortium, The Costs of Inaction: The Economic Burden of Fossil Fuels and Climate Change on Health in the United States (May 20, 2021).

36 The Lancet, Long-term effects of PM2·5 on neurological disorders in the American Medicare population: a longitudinal cohort study (Oct. 19, 2020).

37 Bekkar, et al. JAMA Open Network, Association of Air Pollution and Heat Exposure with Preterm Birth, Low Birth Weight, and Stillbirth in the USA Systematic Review (June 18, 2020).

These negative effects of air pollution disproportionately harm the most vulnerable populations, including children, the elderly, and residents in low-income and disadvantaged communities.38 Indeed, two-thirds of Americans who live near high-volume roads are people of color and the median household income in these places is roughly 20% below the national average.39 Emissions from heavy-duty diesel trucks are roughly the equivalent to those of 20 to 55 light-duty vehicles on the road. Repeatedly, peer reviewed, government and inter-governmental studies point toward electrification as key to addressing criteria air pollutants, improving air quality, and lower the risk of respiratory illness.40 [EPA-HQ-OAR-2019-0055-1219-A1, p.6]

38 UN Environmental Programme, Young and old, air pollution affects the most vulnerable (Oct. 16, 2018).

39 Union of Concerned Scientists, Delivering Opportunity: How Electric Buses and Trucks Can Create Jobs and Improve Public Health in California,'(Oct. 11,2016), at 10.

40 See e.g., International Panel on Climate Change (IPCC), AR 6 Climate Change 2022: Impacts, Adaptation and Vulnerability (Feb. 28, 2022) at 7-120; USGCRP, National Climate Assessment 4, Volume II, Chapter 29 at Box 29.2 (In transportation, for example, switching away from petroleum to potentially lower GHG fuels, such as

electricity and hydrogen, is projected to reduce local air pollution. In California, drastic GHG emissions reductions have been estimated to substantially improve air quality and reduce local particulate matter emissions associated with freight transport that disproportionately impact disadvantaged communities').

By removing diesel from the heavy-duty equation altogether, BEVs represent a superior solution relative to other approaches that seek to reduce emissions by increasing the efficiency of diesel trucks or via post combustion treatment. As one recent analysis recognized, fully addressing harmful air pollution from trucks used in urban and community areas by 2035 and eliminating pollution from all new trucks and buses by 2040, can provide tremendous public health and welfare benefits, including preventing 57,000 premature deaths by 2050, reducing NOx emission by more than 10M tons, eliminating almost 200,000 tons of PM by 2050, and avoiding 4.7B tons of GHG emissions.41 [EPA-HQ-OAR-2019-0055-1219-A1, p.6]

41 EDF, Clean Trucks, Clean Air, American Jobs (Mar. 4, 2021) at 1.

Indeed, the American Lung Association (ALA) recently estimated that wide-spread transportation electrification across the United States translates into $72 billion in avoided health effects. Electrification would save approximately 6,300 lives per year and avoid more than 93,000 asthma attacks, and 416,000 lost workdays annually due to significant reductions in transportation-related pollution.42 Other studies have found dramatic localized air quality and public health benefits will result for electrifying the heavy-duty fleet.43 [EPA-HQ-OAR-2019-0055-1219-A1, pp.6-7]

42 American Lung Association, The Road to Clean Air Benefits of a Nationwide Transition to Electric Vehicles (March 31, 2022) at 5-6. See also, ZETA, Medium- and Heavy Duty Electrification: Weighing the Opportunities and Barriers to Zero Emission Fleets (Jan. 26, 2022) at 8-9.

43 See, Texas A&M, Tailpipe Emission Benefits of Medium- and Heavy-Duty Truck Electrification in Houston, TX (Apr 14, 2021) (Finding that by electrifying 40% of the predominantly diesel-fueled MHDVs in the eight-county area, Texans could avoid 21 tons per day of NOx — over a quarter of the 80 tons per day emitted by greater Houston’s on-road traffic. This could be achieved by electrifying a little over 60,000 MHDVs, about 1% of all the vehicles in greater Houston. By comparison, it would take 3.8 million light duty vehicles to achieve the same amount of NOx reductions. Electrification of MHDVs is the quickest way to take the biggest bite out of greater Houston’s NOx emissions.)

Organization: *Valeria Trujilo Aguilar*

EPA Should Support and Advance with Lower NOx Emission Standards for New HDV Engines Proposed in Option 2 of the Cleaner Trucks Initiative

As a private citizen residing in Denver, Colorado which ranks #7 among the most polluted cities in the U.S. by ozone concentration and receiving a grade of F in both ozone and particle pollution graded by the American Lung Association “State of the Air” Report2 methodology which uses quality-assured data from the EPA in accordance with current National Ambient Air Quality Standards for O3 and PM2.5. IQAir3 estimates that air quality in Denver is slightly declining from 2017-2020 at 7.4 ug/m3, 8 ug/m3, 8.2 ug/m3 and 8.7 ug/m3 respectively. Ozone pollution represents Denver's main air quality challenge with motor vehicle emissions been the single largest contributor4. Pollutants from HDV pose health risks at all stages of life accounting for significant risk of premature births and premature deaths due to the adverse effects on nearly every organ system in the body5. [EPA-HQ-OAR-2019-0055-1223]

2 American Lung Association, "Colorado: Denver", State of the Air, Research & Reports, Report Cards, States and Counties, accessed May 15, 2022, https://www.lung.org/research/sota/city-rankings/states/colorado/denver.

3 IQAir, "Air Quality in Denver", Modified May 15 at 18:00, accessed May 15, 2022, https://www.iqair.com/us/usa/colorado/denver.

4 IQAir, "Air Quality in Denver", Modified May 15 at 18:00, accessed May 15, 2022, https://www.iqair.com/us/usa/colorado/denver.

5 Sara Chandler, Joel Espino, and Jimmy O'Dea, "Delivering Opportunity: How Electric Buses and Trucks Can Create Jobs and Improve Public Health in California", Union of Concerned Scientists, The Greenlining Institute, October 2016, Updated May 2017, accessed May 15, 2022, https://www.ucsusa.org/sites/default/files/attach/2016/10/UCS-Electric-Buses-Report.pdf.

The EPA6 recognizes that climate change and ozone pollution are highly intertwine. Ozone is formed through photochemical interactions between nitrogen oxide compounds (NOx) and volatile organic compounds (VOCs)7. Scientists suggest that there is a strong correlation between higher ozone levels and higher daylight temperatures8. Ozone levels do not always increase with higher temperatures when VOCs to NOx ratios are low, suggesting that regulating the sources of VOCs and NOx have the potential to alter the harmful health effects of ozone levels even in the presence of higher temperatures; an inedible threat of GHG contributing to climate change9. The EPA cites automobiles, trucks, and buses as significant contributing sources of VOCs and NOx emissions10. Thus, advocating for the maximum NOx stringency standards for new heavy-duty vehicles has the potential to minimize the harmful effects of ozone pollution by decreasing the sources that contribute to its formation which continue to disproportionally affect susceptive groups in ozone polluted cities like Denver. Mapping for Environmental Justice published a map for the State of Colorado in 2020 that shows communities of color breathe nearly twice as much diesel pollution than white communities11. [EPA-HQ-OAR-2019-0055-1223]

6 EPA, "Basic Information about NO2", accessed May 15, 2022, https://www.epa.gov/no2-pollution/basic-information-about-no2#What%20is%20NO2.

7 Jeannie Allen, "Tango in the Atmosphere: Ozone and Climate Change", NASA Earth Observatory, February 2004, accessed May 15, 2022, https://www.giss.nasa.gov/research/features/200402_tango/.

8 Jeannie Allen, “Tango in the Atmosphere: Ozone and Climate Change”, NASA Earth Observatory, February 2004, accessed May 15, 2022, https://www.giss.nasa.gov/research/features/200402_tango/.

9 9 Jeannie Allen, “Tango in the Atmosphere: Ozone and Climate Change”, NASA Earth Observatory, February 2004, accessed May 15, 2022, https://www.giss.nasa.gov/research/features/200402_tango/.

10 EPA, “Sources of Hydrocarbon and NOx Emissions in New England”, accessed May 15, 2022, https://www3.epa.gov/region1/airquality/piechart.html.

11 Mapping for Environmental Justice, “Colorado”, The Green Initiative Fund, Earth Island Institute, University of California Berkeley, accessed May 15, 2022, https://mappingforej.berkeley.edu/colorado/

The EPA states that NOx exposures aggravate respiratory diseases such as asthma which leads to more respiratory symptoms requiring hospitalizations and emergency room visits and susceptible groups such as children and the elderly are at higher risk of developing respiratory infections among other respiratory complications12. Consistent with the Clean Air Act section 202(a)(3)(A), the reduction of NOx emissions in new mobile sources such as in HDV, the EPA will continue to fulfill its purpose to protect human health and welfare. [EPA-HQ-OAR-2019-0055-1223]

12 EPA, “Basic Information about NO2”, accessed May 15, 2022, https://www.epa.gov/no2-pollution/basic-information-about-no2#What%20is%20NO2.

Organization: *WE ACT for Environmental Justice*

The medium- and heavy-duty truck sector is the second largest contributor of climate change causing greenhouse gas emissions in the transportation sector and the largest source of harmful smog and soot-forming nitrogen oxides (NOx) in the United States.1 It is well known that NOx and particulate matter emitted from diesel and gasolene trucks and buses create poor air quality and severe health impacts.2 An analysis of EPA data revealed that by 2023, diesel emissions can cause nearly 9,000 premature deaths, 3,800 heart attacks, 173,067 cases of respiratory symptoms, and more than 2,963 asthma-related visits to the emergency room.3 [EPA-HQ-OAR-2019-0055-1347-A1, p.1]

1 https://www.epa.gov/system/files/documents/2022-04/hd-2027-stds-nprm-overview-2022-04.pdf

2 https://erj.ersjournals.com/content/17/4/733

3 https://www.catf.us/deathsbydiesel

Organization: *William F. Limpert*

The American people want and deserve clean air.

A recent study by Harvard University and the Universities of Birmingham and Leicester in the United Kingdom found that the fossil fuel industry causes 8,000,000 premature deaths worldwide each year, including 350,000 in the United States. In that regard it is possible that EPA's very concerning estimates of increased health costs, premature deaths, hospital emissions, asthma and allergic rhinitis symptoms, and lost days from school and work resulting from failure to act may actually underestimate the benefits these rules would bring to us, and especially to those of us with limited income. We have known for a long time that the true cost of using fossil fuels is much higher than what we are paying at this time. That true cost may very well fall to our children, grandchildren, and all those who follow us, even if they never use fossil fuels. [EPA-HQ-OAR-2019-0055-1190]

I would like to comment on the benefits of better visibility that these rules would bring to us. Good atmospheric visibility provides clearer vision, more natural colors, increased productivity, and better emotional health. My wife and I formerly owned a home and property in Bath County, in western Virginia. This is a sparsely populated area with little traffic or industrial activity. The air quality there was by far the best that we have experienced in our lifetimes. We could see fine detail far into the distance. The night sky was filled with stars. Colors were greatly enhanced by the good visibility. We were always emotionally uplifted when we were there, and I think other local residents were as well. Despite very large political differences and life experiences we all got along very well. Despite being physically separated we all felt a sense of community and togetherness. If someone had a problem, others came to help. In most cases when cars passed on the road both parties waved. Days spent there were the happiest days of our lives. I really think that the great visibility from little fossil fuel use in that area contributed heavily to all of these benefits. These benefits will convey to all of us with better outdoor visibility under the proposed rules. [EPA-HQ-OAR-2019-0055-1190]

Organization: *World Resources Institute (WRI)*

In addition to these ambient conditions, also of concern are the on-board emissions from the diesel school buses that represent more than 90 percent of the 480,000 school buses on the road today, transporting over 20 million students daily and driving 3.3 billion miles annually. Children are particularly susceptible to the negative health effects of diesel exhaust from school buses, a known carcinogen linked to reduced lung development and increased risk for asthma and pneumonia in children, among other risks. In addition, there is evidence that reducing diesel exhaust exposure can improve not only students' respiratory health, but also their academic outcomes. [EPA-HQ-OAR-2019-0055-1298-A1, p.2]

Electric school buses, which produce zero tailpipe emissions, are the healthiest solution for all students, bus drivers, and the communities they travel through. Because students from low-income communities are more likely to ride a school bus - 60% of students from low-income families ride the bus to school, compared to 45% of students from families with higher incomes - a more stringent rule will advance the transition to an electric school bus fleet and simultaneously help address this transportation inequity. [EPA-HQ-OAR-2019-0055-1298-A1, p.2]

EPA studies confirm that medium- and heavy-duty vehicles also generate 23 percent of the transportation sector's greenhouse gas emissions (GHG), contributing to the severity of climate change impacts, including heat waves, drought, sea level rise, extreme climate and weather events, coastal flooding, and wildfires. Some populations may be especially vulnerable to these and other climate change impacts, including low-income communities, people with disabilities, people of color, and Indigenous populations. Furthermore, studies (such as the recent 'Zeroing in on Healthy Air' from the American Lung Association) show that regulations and policies designed to reduce GHG emissions, such as through accelerating electric transportation, will have the added benefit of reducing other forms of pollution, such as air toxics and particular matter, that impact public health and disproportionately impact overburdened communities. [EPA-HQ-OAR-2019-0055-1298-A1, p.2]

Organization: *Yellowstone Integrated Architecture and Construction*

Dangerous nitrogen oxides and other pollution that heavy duty vehicles like trucks and buses spew into our air hurt communities of color and low wealth communities first and worst, but affect all of us, especially our children. [EPA-HQ-OAR-2019-0055-2816, p.1]

Diesel pollution from heavy duty trucks and buses is a massive public health threat. Diesel pollution worsens asthma and is particularly dangerous to children's developing lungs. [EPA-HQ-OAR-2019-0055-2816, p.1]

EPA Summary and Response

Summary:

Commenters agreed that emissions from heavy-duty trucks are a significant contributor to air pollution, including concentrations of ozone and $PM_{2.5}$, which are negatively impacting human and environmental health across the nation. Commenters noted that NOx emissions are higher in urban driving. Commenters requested a national standard for heavy-duty trucks both as soon as possible and as stringent as possible.

Many commenters noted that they need this rule to protect the health of children and future generations, and that emissions from trucks impact children's health in many ways, including asthma incidence. Commenters also mentioned other sensitive populations, e.g., pregnant women, older adults, and those with existing diseases, that are at risk from pollution by vehicles. Commenters noted that health and environmental impacts of criteria and toxic pollutants are made worse by the ongoing impacts of climate change (pollution from heavy duty trucks can have a larger impact on populations already affected by climate change).

Multiple commenters stated that visibility in Class I and other areas is negatively impacted by NOx emissions, especially in the wintertime, and that these standards will be beneficial throughout the year. A commenter emphasized that good atmospheric visibility provides clearer vision, more natural colors, increased productivity, and better emotional health. Another environmental effect noted by commenters is deposition. They stated that deposition of nitrogen and other pollutants is a problem and mobile source emissions are a significant contributor to deposition. They stated that this is demonstrated in the air quality modeling done for the Chesapeake Bay TMDL. They also stated that cleaning up air can help waterways too.

Numerous commenters mentioned that EJ communities are experiencing disproportionate health effects and being impacted by emissions of criteria and toxic pollutants from heavy duty trucks.

One commenter specifically noted that bicyclists are exposed to dangerous levels of air pollution from exhaust and that reductions in truck emissions will reduce the extremely high pollution exposure of bicyclists. They also noted that bicycle commuting, where feasible, is an affordable method of transportation: low-income Americans commute by bike more than any other income brackets and people of color currently account for the fastest cyclist growth rate. Therefore, ensuring bicyclists can travel safely and healthily is an issue of equity. Additionally, as cities nationwide encourage bicycling for its climate, health, and traffic benefits, the EPA should ensure that bicyclists are not forced to breathe unsafe levels of pollutants from vehicle exhaust.

One commenter provides an analysis of the air quality and human health benefits of electrifying 40 percent of new Class 4-8 single unit trucks, 40 percent of new Class 8 short haul (day cab) tractors, and 80 percent of all transit and school buses, in the 2027-2029 timeframe; the commenter's results show meaningful reductions in GHGs and NOx emissions through 2050, which would lead to improvements in health effects and environmental effects.

Multiple commenters mentioned or referenced the American Lung Association's State of the Air report. The State of the Air report highlights the number of Americans who continue to live in places with failing grades for unhealthy levels of particle pollution or ozone.

Response:

Section II of the preamble describes the health and environmental effects caused by emissions of NOx and other criteria and toxic pollutants from heavy-duty trucks. EPA agrees that emissions from heavy-duty trucks contribute to concentrations of ozone, NO_2, and $PM_{2.5}$, which are all associated with impacting human health. Heavy-duty trucks and buses continue to contribute significantly to air pollution at the local, regional, and national level, often disproportionally affecting communities of color and low-income populations and this final rule will achieve significant improvements in air quality, including for those disproportionately affected. EPA also agrees that protecting children's health is a high priority; we added text in preamble Section II.B describing why children can have increased vulnerability and susceptibility for adverse health effects from air pollution exposures.

Emissions from heavy-duty trucks also impact environmental health through contributing to deposition impacts and visibility decrements, as well as contributing to ozone that harms vegetation.

We are finalizing new standards for diesel engines over a new low-load duty cycle to capture operation at lower speeds and loads that would represent urban driving (see preamble section III for more information). Our responses to comments on stringency of the criteria pollutant standards can be found in Section 3. Our responses to additional, more general comments in support of the proposed rule, advocating a more stringent approach, or in opposition to the rule, can be found in Sections 1.1, 1.2., and 1.3. Finally, our responses to comments about the EJ need for this rule can be found in Section 23.

2.1.1 Emissions from Heavy-Duty Trucks are underestimated

Comments by Organizations

Organization: *District of Columbia Department of Energy and the Environment (DOEE)*

Moreover, the modeled NOx contribution from HDVs shown in Figure 2 is potentially underestimated because EPA has not yet incorporated high emitting heavy-duty trucks, such as glider vehicles and HDVs with tampered emission control systems into their mobile source emissions models. In-use testing data suggests that real-world NOx emissions are higher than modeled estimates, underscoring the need to achieve substantial NOx emission reductions from the heavy-duty diesel truck sector.2 [EPA-HQ-OAR-2019-0055-1299-A1, pp. 2 - 3]

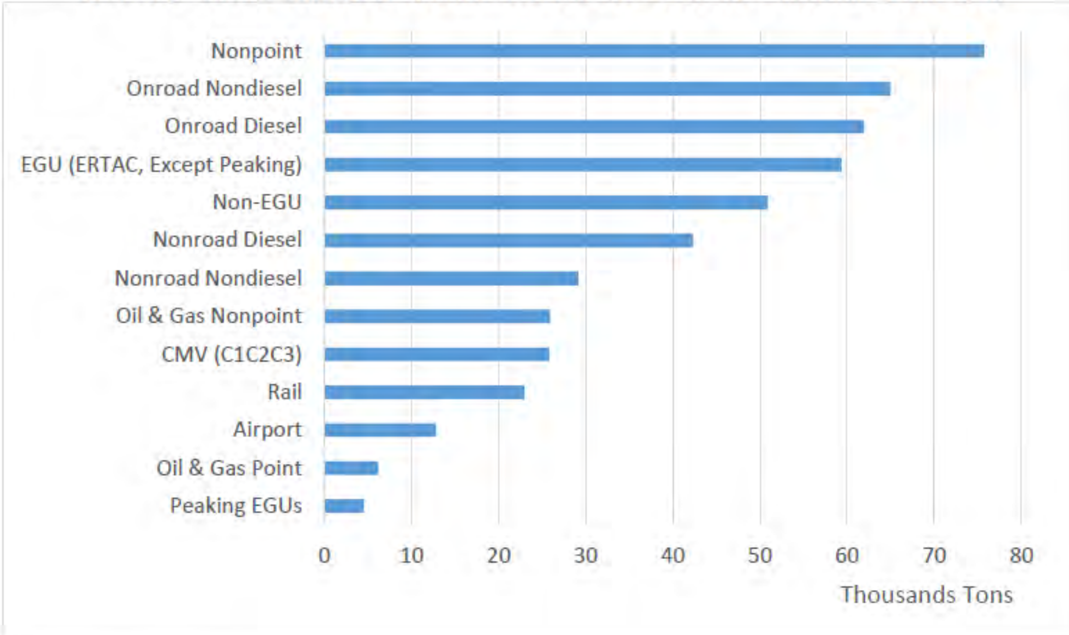
> 2. Tan, et al., "On-Board Sensor-Based NOx Emissions from Heavy-Duty Diesel Vehicles," Environmental Science and Technology, 53: 5504-5511 (2019).

Organization: *Maine Department of Environmental Protection (Department)*

Regionally, heavy-duty vehicles are the third largest source of NOx emissions as illustrated in Figure 3. Moreover, the modeled NOx contribution from HDVs shown in Figure 3 is potentially underestimated, because the mobile source model used in developing the inventory does not account for high emitting heavy-duty trucks, such as glider vehicles and HDVs with tampered emission control systems. [EPA-HQ-OAR-2019-0055-1288-A1, p.4]

> 9 Tan, Y., et al., 'On-Board Sensor-Based NOx Emissions from Heavy-Duty Diesel Vehicles,' Environmental Science and Technology, 53: 5504-5511 (2019). DOI: 10.1021/acs.est.8b07048.

Figure 3
Modeled Ozone Season NO_x Emissions in the OTR for Calendar Year 2023



Source: OTC

Organization: *Northeast States for Coordinated Air Use Management (NESCAUM)*

The modeled NOx contribution from HDVs shown in Figure 4 is potentially underestimated because the mobile source model used in developing the inventory does not account for high emitting heavy-duty trucks, such as glider vehicles and HDVs with tampered emission control systems. In-use testing data suggest that real-world NOx emissions are higher than modeled estimates, underscoring the need to achieve substantial NOx reductions from the heavy-duty diesel truck sector.16 [EPA-HQ-OAR-2019-0055-1249-A1, p. 7]

16. Tan, Y., et al., “On-Board Sensor-Based NOx Emissions from Heavy-Duty Diesel Vehicles.” Environ. Sci. Technol., 53: 5504-5511 (2019). DOI: 10.1021/acs.est.8b07048.

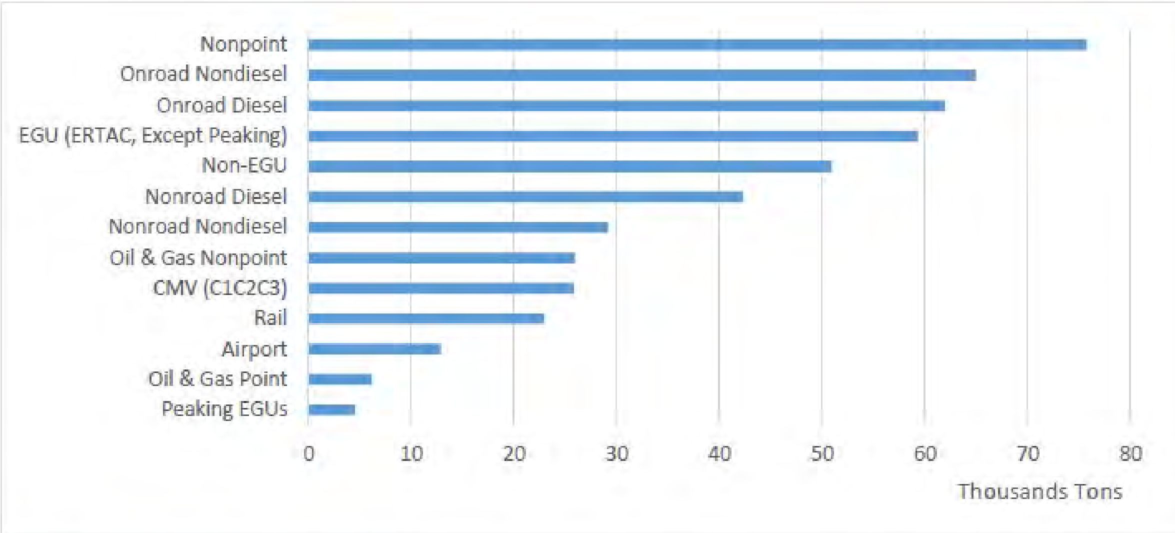


Figure 4: Modeled NOx Emissions in the Northeast (calendar year 2023).

EPA Summary and Response

Summary:

Commenters noted that modeled NOx emissions from heavy-duty trucks in the figures included as part of the comments are potentially underestimated because the modeling done to generate the NOx inventory did not account for glider kits and tampered vehicles. Commenters stated that this could mean that heavy-duty trucks are an even larger contributor of NOx emissions, compared to what's shown in the figures.

Response:

Thank you to the commenters for providing this information to support taking action on heavy-duty engines and vehicles. EPA agrees that the earlier versions of MOVES, such as the one used to generate the NOx inventory in the referenced OTC figure, did not fully account for the high-emitting heavy-duty vehicles. However, as described in Chapter 5.2.2 of the draft RIA, EPA used an updated version of MOVES (MOVES_CTI_NPRM) that accounts for glider vehicles in the analysis done for the proposal. EPA also is aware of intentional tampering of emission control systems that could increase the emissions of NOx from heavy-duty trucks. Although we account in our model for some level of tampering and mal-maintenance, such as NOx aftertreatment malfunction, we recognize the need to update the tampering and mal-maintenance effects in MOVES, particularly to incorporate recent data surveying intentional tampering in heavy-duty trucks; we are continuously working to update our inventory and inventory modeling tools.

2.1.2 Health impacts of NO_2

Comments by Organizations

Organization: *Various Academic Researchers*

Strengthening HDV NOx emissions standards is necessary to protect children's health

NOx emissions are precursors to PM2.5 and ozone, which contribute tens of thousands of premature deaths each year in the U.S. Heavy-duty trucks and buses are responsible for a substantial share of PM2.5- and ozone-attributable premature deaths. Traffic-related air pollution is responsible for an estimated 22,000 premature deaths in the U.S. each year, about 19% of all PM2.5- and ozone-attributable deaths in the U.S.1 On-road diesel vehicles contribute an estimated 43% of these traffic-related air pollution deaths. The vast majority of diesel vehicles in the U.S. are the heavy-duty vehicles that would be affected by the proposed emissions standards. [EPA-HQ-OAR-2019-0055-1220-A1, p. 1]

> 1. Anenberg, S. C.; Miller, J.; Henze, D. K.; Minjares, R.; Achakulwisut, P. The Global Burden of Transportation Tailpipe Emissions on Air Pollution-Related Mortality in 2010 and 2015. Environ. Res. Lett. 2019, 14 (9), 094012. https://doi.org/10.1088/1748-9326/ab35fc.

NOx emissions also produce NO2, which is associated with respiratory effects, and in particular the development of new cases of asthma amongst children. The 2016 EPA Integrated Science Assessment for NO2 concluded that "There is likely to be a causal relationship between long-term NO2 exposure and respiratory effects based on the evidence for development of asthma (Section 6.2.9, Table 6-5). The conclusion is strengthened from the 2008 ISA (Table ES-1) because where previous epidemiologic findings were inconsistent, recent studies consistently observe NO2-related increases in asthma development in children who are followed over time and are supported by previous experimental studies." An American Thoracic Society workshop report published in 2019 also "found that long-term exposure to air pollution, especially metrics of traffic-related air pollution such as nitrogen dioxide and black carbon, is associated with onset of childhood asthma." In 2017, a large meta-analysis of epidemiological studies found a relative risk of 1.26 (95% confidence interval, 1.10-1.37) for each 10 ppb increase in NO2.2 [EPA-HQ-OAR-2019-0055-1220-A1, p. 1]

> 2. Khreis, H.; Kelly, C.; Tate, J.; Parslow, R.; Lucas, K.; Nieuwenhuijsen, M. Exposure to Traffic-Related Air Pollution and Risk of Development of Childhood Asthma: A Systematic Review and Meta-Analysis. Environment International 2017, 100, 1–31. https://doi.org/10.1016/j.envint.2016.11.012.

Given the large burden of NO2 concentrations on children's respiratory health throughout the U.S. and the important contribution of HDV NOx emissions to those concentrations, strengthening NOx emissions limits for HDVs is necessary to protect children's health. [EPA-HQ-OAR-2019-0055-1220-A1, p. 2]

EPA Summary and Response

Section II of the preamble describes the health and environmental effects caused by emissions of NOx and other criteria and toxic pollutants from heavy duty trucks. EPA agrees that reducing NOx and other emissions from heavy-duty trucks protects children's health.

2.2 National Ambient Air Quality Standards (NAAQS)

Comments by Organizations

Organization: *California Air Pollution Control Officers Association (CAPCOA)*

As U.S. EPA is aware, California faces some of the nation's most significant air quality challenges. The state's largest facilities which include power plants and refineries, as well as our significant manufacturing industries are subject to the most stringent emissions standards nationally if not worldwide. As a result, NOx emissions have been reduced by approximately 90% through decades of implementation of strong stationary source control measures. However, much of the state remains in non-attainment of federal ambient air quality standards. [EPA-HQ-OAR-2019-0055-1253-A1,p.1]

For example, nearly 90% of California's 40 million residents live in areas that do not meet the 2015 federal ozone standards. These issues are especially acute in disadvantaged communities where residents often face additional challenges including exposure to air toxics from the transportation sector and are more vulnerable to the impacts of climate change including significantly increased risk from wildfires and wildfire smoke. [EPA-HQ-OAR-2019-0055-1253-A1, p.2]

The reason for this continued non-attainment is primarily due to emissions from the transportation sector which continues to be heavily reliant on the combustion of fossil fuels. Mobile sources are the largest contributor of criteria pollutant, toxic, and anthropogenic greenhouse gas emissions throughout the state. CARB data shows that mobile sources account for 70-80% of overall NOx emissions. To meet federal and state clean air standards and protect public health, this pollution must be cut by up to 80% by the mid-2030s. While air districts do not have authority to regulate mobile sources, we have worked diligently to implement incentive programs like the Moyer program which since its inception in 1998 has enabled the voluntary replacement, scrappage, or repower of over 68,000 engines resulting in reduction of more than 198,000 tons of NOx and Reactive Organic Gases, and reduction of over 7,300 tons of particulate matter. Additionally, CARB's Heavy-Duty Omnibus Regulation which was adopted in 2020 is expected to reduce NOx by 24 tons per day in 2031. [EPA-HQ-OAR-2019-0055-1253-A1, p.2]

Despite these significant efforts by air districts and CARB, federal action to reduce emissions is critical if we are to attain the National Ambient Air Quality Standards. For example, data shows that in the South Coast air basin, considering only emissions from ships, locomotives, and aircraft which are under federal authority, the region needs an additional 46 tons per day of NOx reductions by 2023 to attain standards in a timely manner. When also considering the emissions from on-road heavy-duty trucks that are subject to federal authority, the region needs a total of 67 – 69 tons per day of NOx reductions from federal sources. Extrapolating this example to the rest of California, it is clear that without significant progress in reducing mobile source emissions, especially at the federal level, it will be extremely difficult if not impossible to meet our air quality mandates. Absent strong federal action, extreme nonattainment areas such as the South Coast and San Joaquin Valley air basins face Clean Air Act penalties and sanctions due to mobile source emissions under federal jurisdiction. Such air districts will be forced to implement additional stationary source regulations that are much less cost-effective than federal mobile source measures and in regions that already impose the most stringent regulations in the nation. To this end, CAPCOA strongly encourage U.S. EPA to promulgate technology forcing regulations in the mobile sector that are directly and solely under U.S. EPA authority that yield as much emissions reductions as possible as quickly as possible. The health of our residents depends on it. [EPA-HQ-OAR-2019-0055-1253-A1, p.2]

Organization: *California Association of Sanitation Agencies (CASA)*

Even if all stationary sources had zero emissions, some air basins (including the South Coast Air Basin) wouldn’t be in attainment with national ambient air quality standards for ozone. Failure to comply with federal standards could result in the loss of billions of dollars in federal highway funds and a permit moratorium (as stated by the South Coast Air Quality Management District (SCAQMD)). For example, the Clean Air Act (CAA) requires the South Coast Air Basin, which is in extreme nonattainment for ozone, to come into compliance by 2023. If this deadline is not achieved, CAA Sections 179 and 185 allow the USEPA to impose the following sanctions: withhold federal highway funding and increase offsetting requirements and impose an annual penalty on major stationary sources. Some public wastewater agencies have estimated the potential penalty to exceed $1,000,000 per year. Thus, these Proposed Standards are essential to air basins for limiting ozone production prior to federal attainment deadlines, while also providing the necessary options of heavy-duty vehicles for critical operations as described in this comment letter. [EPA-HQ-OAR-2019-0055-1301-A1, p.1]

Organization: *Capital Area Council of Governments (CAPCOG) and Central Texas Clean Air Coalition (CAV)*

As of 2020, the region’s design value for ozone (O3) is at 93% of the federal limit and 80% of the annual fine particulate matter (PM2.5) limit for the National Ambient Air Quality Standards (NAAQS). While the CAC will continue to do its part to reduce emissions through voluntary programs within our region, as EPA’s proposed rule indicates, heavy-duty engines will continue to be one of the largest contributors to mobile source nitrogen oxides (NOx) emissions. [EPA-HQ-OAR-2019-0055-1274-A1, p.1]

Air quality modeling shows that NOx emissions are responsible for about 99% of the local, state, and national contribution to high O3 levels within the region. In 2028, heavy-duty vehicles will account for just 7% of the region’s weekday vehicle miles traveled (VMT) but 46% of the region’s on-road NOx emissions. [EPA-HQ-OAR-2019-0055-1274-A1, p.1]

Organization: *Clean Energy Ventures et al.*

We believe that EPA's Clean Trucks Plan, of which this Proposal is a critical component, is critical to helping states attain and maintain the National Ambient Air Quality Standard for Ozone, to providing improved health to residents of disadvantaged communities that continue to be burdened by disproportionate levels of diesel pollution, and to ensuring that the heavy-duty engine and vehicle sector will play its part in helping our nation meet our critical climate goals. [EPA-HQ-OAR-2019-0055-2339-A2, pp.1-2]

Organization: *ClearFlame Engine Technologies (ClearFlame), Remora, and SixWheel*

More than 127 million Americans live in areas that either have not attained the 8-hour National Ambient Air Quality Standard. These Americans need the emissions reductions on the fastest time frame possible. [EPA-HQ-OAR-2019-0055-1329-A2, p. 2]

Organization: *Coalition for Clean Air*

These emissions prevent most of the state from meeting national ambient air quality standards set to protect public health, with the South Coast having the worst smog – and the San Joaquin Valley the worst particulate matter -- in the entire country. That means nearly all Californians encounter unhealthful air quality days. That results in lost days at school, emergency room visits and hospitalizations, and lost days at work, not to mention human suffering. One 2008 study that remains relevant conservatively estimated that pollution in the San Joaquin Valley and the Los Angeles air basins results in a cost of about $28 billion annually. [EPA-HQ-OAR-2019-0055-1139-A1, p.1]

Organization: *Colorado Energy Office, et al.*

Environmental impacts from the transportation sector—and the resulting health and economic consequences—are a major concern. Greenhouse gas emissions from vehicles are the top source of emissions in Colorado and a significant portion of the population lives in an area of the state that is soon to be classified as a severe ozone nonattainment area by the US Environmental Protection Agency. Transportation is one of the two largest sources of ozone precursors along with oil and gas production, largely due to NOx emissions from medium and heavy duty vehicles, and reducing transportation emissions is a critical strategy to meet federal health-based air quality standards. [EPA-HQ-OAR-2019-0055-1297-A1, p.1]

Organization: *Connecticut Department of Energy and Environmental Protection (CTDEEP)*

For almost 50 years, Connecticut's citizens have suffered the public health and economic impacts from ozone nonattainment. This past year, Connecticut experienced twenty-one days with unhealthy ozone levels, and on April 13, 2022, EPA published a public notice2 proposing to reclassify Fairfield, New Haven, and Middlesex Counties as 'severe' nonattainment with respect to the 2008 national ambient air quality standard or NAAQS for ground level ozone. The importance of NOx emissions reductions to addressing ozone nonattainment is well documented and reaffirmed by EPA in 20163 in its response to Connecticut and several other states and jurisdictions reaffirming the urgent need to reduce NOx emissions that ‘significantly contribute to ozone and fine particulate problems’ noting that the parties pointed to the ‘significant contribution of heavy-duty vehicles to NOx in their areas.’ 4 [EPA-HQ-OAR-2019-0055-1306-A1, pp.1-2]

2 see, 87 Fed. Reg. 21825

3 U.S. EPA, ‘Memorandum in Response to Petition for Rulemaking to Adopt Ultra-Low NOx Standards for On-Highway Heavy-Duty Trucks and Engines,’ December 20, 2016. Available at https://www.epa.gov/sites/production/files/2016-12/documents/nox-memorandum-nox-petition-response-2016-12-20.pdf (accessed April 25, 2022).

4 81 Fed. Reg. 73478 (Oct. 25, 2016), at 73523.

Past ozone control strategies for NOx have centered around Point Source Electrical Generating Units (EGUs). EGU based strategies have been effective in reducing the long-range pollutant transport into Connecticut. However, mobile source NOx emissions dominate ozone production. Figure 1 is a graphic of contribution modeling done by the Ozone Transport Commission (OTC) which depicts sector contributions to Connecticut’s Westport monitor. On-road diesel emissions, contributing 11% of NOx emissions, constitute a major share of ozone production at this critical nonattainment monitor. States’ modeling efforts continue to yield important information about the role of widespread NOx emissions in contributing to ozone nonattainment in Connecticut. [EPA-HQ-OAR-2019-0055-1306-A1, p.2]

Figure 2 is a high-resolution gridded NOx inventory (1km). This inventory was mapped for southwest Connecticut and New York City (without EGU point sources) to show where emissions are concentrated. At this resolution, the NOx emissions along the major highways are evident. As the Westport monitor evidences, the impact of on-road mobile emissions continues to climb and account for a large percentage of the ozone produced in our state. Connecticut urges EPA to act swiftly to significantly reduce NOx emissions from HD trucks as part of this proposal. [EPA-HQ-OAR-2019-0055-1306-A1, p.3]

Actual nitrogen dioxide emissions (NO2) concentrations can also be assessed through satellite technology which has evolved to a point where NO2 can be resolved on an urban scale. The Tropospheric Monitoring Instrument (TROPOMI) satellite map in Figure 3 shows averaged monitored NO2 concentrations for the summer of 2021. Concentrated areas of NO2 emissions in urban centers occur just upwind of nearby ozone non-attainment areas. Air pollution from the transportation sector is not just a state environmental or transportation issue; it is a national issue that requires EPA to implement a federal program to achieve deep NOx reductions from HD trucks. The transportation sector in general, and the HD sector in particular, involves the shipping of freight across state lines. Effectively addressing this sector at the federal level is imperative to putting Connecticut, and many other jurisdictions across the country,7 on the path to achieving health based NAAQs and to protecting our most vulnerable communities. [EPA-HQ-OAR-2019-0055-1306-A1, p.3]

7 See NACAA_Comments-EPA_HD_Truck_NPRM-051622lh.pdf (4cleanair.org) p. 4-8

Figure 2 States have limited authority to address transportation-related emissions, nonetheless we have been active partners with EPA in reducing transportation related air pollution. In Connecticut, we continue to implement a ‘whole of government approach’ to finding innovative state air quality and transportation solutions to improve air quality, reduce climate pollution, protect public health and enhance economic competitiveness. Connecticut has been a leader in the electrification of the transportation sector, joining the seven state Zero Emission Vehicle MOU in 2013 and through the creation of clean car incentive programs like the California Low Emission and Zero Emission Programs. Connecticut is also one of fifteen states that has adopted these standards because they are more protective of public health and the environment than the federal standards. Since 2015, Connecticut has also implemented the Connecticut Hydrogen and Electric Automobile Program Rebate (CHEAPR), a first of its kind rebate program that incentivizes the purchase of electric vehicles at the point of sale. Connecticut is also a signatory the Multi-State Medium and Heavy Duty Zero-Emission Vehicle Memorandum of Understanding to advance the rapid and equitable electrification of trucks and buses. In addition, recently passed legislation, Public Act 22-25 which authorizes several programs for medium and heavy-duty vehicles and adopts aggressive procurement targets too incorporate zero-emission vehicles and transit buses into our state fleet. [EPA-HQ-OAR-2019-0055-1306-A1, p.4]

Organization: *Delaware Department of Natural Resources and Environmental Control (DNREC)*

All combustion engines produce NOx and although technology has advanced in recent years, more must be done to reduce NOx emissions from mobile sources. Cutting NOx and PM emissions from the trucking industry is vital for improving public health and meeting National Ambient Air Quality Standards. [EPA-HQ-OAR-2019-0055-1200-A1, p.2]

Delaware’s process for attaining and maintaining the NAAQS is complex, costly, and time consuming, but without more protective vehicle emission standards, Delaware will not meet air quality goals. [EPA-HQ-OAR-2019-0055-1200-A1, p.3]

Organization: *District of Columbia Department of Energy and the Environment (DOEE)*

The District has set ambitious goals for NOx emission reductions from heavy-duty vehicles through our Clean Energy Omnibus Amendment Act of 2018 (D.C. Law 22-257), which mandates that 100 percent of public buses be zero-emission by 2045. Additionally, the District has signed on to the Multi-State Medium and Heavy-Duty Zero Emission Vehicle Memorandum of Understanding (MHD ZEV MOU), committing to a phase out fossil fuel-burning medium- and heavy-duty truck and bus sales by 2050. However, both of these programs function in a longer time horizon and the District needs NOx reductions from the medium and heavy-duty vehicle sector sooner in order to attain and maintain the ozone NAAQS. [EPA-HQ-OAR-2019-0055-1299-A1, p. 3]

Organization: *Elders Climate Action*

ECA, its chapters and members have a stake in this decision both because 1) we are the elders of families whose health and well-being are personally affected by exposure to the hazardous air pollution conditions existing in 230 urban counties where the NAAQS for ozone and/or PM2.5 are violated. [EPA-HQ-OAR-2019-0055-1218-A1, p. 1]

ECA requests this action to – 2) optimize the emission reductions needed from HD on-road vehicles to ensure attainment of the ozone and PM2.5 NAAQS within the deadlines established by the CAA rather than delaying attainment until 2045 for some areas, and not attaining at all in New York City, Houston, South Coast and San Joaquin Valley; and [EPA-HQ-OAR-2019-0055-1218-A1, p. 1]

The need for national zero emission standards is greatest in the urban areas that EPA has designated “extreme” (South Coast AQMD) and “severe” (San Joaquin Valley AQMD), or recently bumped-up to “serious” for ozone. NOx emissions from HDVs are a primary contributor to their numerous elevated violations of the ozone NAAQS. These areas are not able to achieve sufficient emissions reductions to attain the NAAQS without significant reductions from HDVs. We submit modeling to show the potential emission reduction benefits of the action we request in South Coast and San Joaquin Valley where the attainment deadlines are 2035 and 2031, respectively. [EPA-HQ-OAR-2019-0055-1218-A1, pp. 3 - 4]

This statutory standard applies to emissions of four listed criteria pollutants, and subsection 202(l)(2) establishes a similar statutory directive for control of “hazardous air pollutants from motor vehicles” (including benzene and formaldehyde listed by law, 1,3 butadiene and other pollutants identified by EPA as “mobile source air toxics”). [EPA-HQ-OAR-2019-0055-1218-A1, p. 6]

These statutory mandates do not directly apply to GHG pollutants. However, they do apply to nitrogen oxides (NOx) which are governed by a NAAQS for NO2, by the NAAQS for ozone which requires the control of nitrogen oxides as precursors to the formation of ozone in the atmosphere, 1 and the NAAQS for PM2.5 which governs NOx emissions as a precursor to the formation of nitrates measured as a fine particle (PM2.5). EPA explains that this proposed HDV rule is intended to control NOx emitted from HDVs for the purpose, among others, of achieving reductions needed for attainment of both the ozone and PM2.5 NAAQS. [EPA-HQ-OAR-2019-0055-1218-A1, p. 6]

1. 40 CFR Part 50, section 50.9, 50.10.

The failure to attain the ozone NAAQS in 230 urban counties where 135 million Americans reside is a perpetual air pollution pandemic that has burdened millions of children with a lifetime of asthma and shortened millions of American lives over the last 50 years. This public health crises will continue to make our cities unhealthy places to raise our children and for elders to reside for decades to come. [EPA-HQ-OAR-2019-0055-1218-A1, p. 6]

In most nonattainment areas, the nitrogen oxides and reactive organic compounds emitted from internal combustion engines (ICEs) are the primary cause of ozone formation and a significant contributor to PM2.5 nonattainment. Replacing ICEs as quickly as possible is the solution to urban smog and soot pollution that impairs the health and quality for life for millions of urban Americans. [EPA-HQ-OAR-2019-0055-1218-A1, p. 7]

This statutory "greatest degree of emission reduction" mandate also applies to all species of PM10 and PM2.5 emitted from HDVs as particles or aerosols because both inhalable (PM10) and respirable (PM2.5) particles are governed by NAAQS issued to protect public health,2 and are included within the scope of the directive in section 202(a)(3)(A) to issue standards for "particulate matter." HDV emissions that are measured as particulate matter (PM) include metals in carbon fuels, and both particle and aerosol carbon species that are the products of incomplete carbon (C) combustion such as elemental C, black C, benzene, PAHs, aldehydes and CO2 which is the product of complete C combustion. EPA acknowledges that diesel engines emit PM that contributes to nonattainment for PM2.5 and causes significant health risks. [EPA-HQ-OAR-2019-0055-1218-A1, p. 7]

2. 40 CFR Part 50, sections 50.6, 50.7, 50.13.

The rule package identifies both ozone and PM2.5 as pollutants of concern that are the reason for proposing standards for NOx. The TSD includes a modeling analysis of the NOx reductions and the PM emission reduction benefits that will be achieved by the proposed standards for NOx, but EPA does not include any analysis of the NOx or PM emission reductions that could be achieved by adopting zero emission standards for classes or categories of HDVs. [EPA-HQ-OAR-2019-0055-1218-A1, p. 7]

The modeling analysis is performed for 2027 and 2045. 2027 is an attainment deadline year for recently bumped-up "serious" ozone nonattainment areas (NAs), but 2045 has no relation to a statutory attainment deadline. The deadlines for the San Joaquin Valley "severe" ozone nonattainment is 2031 and the deadline for South Coast AQMD is 2037. The modeling results reported in the TSD demonstrate that most NAs will attain the ozone standard by 2045, but not South Coast, San Joaquin Valley, New York City or Harris County TX. Clearly the reductions required by the proposed rule are not adequate to attain the NAAQS in these NAs by the statutory deadlines applicable to each NA. [EPA-HQ-OAR-2019-0055-1218-A1, p. 7]

Additional reductions are also needed for some PM2.5 NAs to attain by the statutory deadlines. [EPA-HQ-OAR-2019-0055-1218-A1, p. 7]

These modeling results demonstrate the need to evaluate alternative regulatory options that include standards sufficient to achieve the emission reductions needed for attainment by the applicable statutory deadlines. Zero emission standards based on the availability of zero emission power trains should be evaluated as a regulatory option for timely attainment of the NAAQS. [EPA-HQ-OAR-2019-0055-1218-A1, p. 7]

The degree of control needed for both NOx and PM2.5 emitted from HDVs should be demonstrated by modeling the impact that HDV standards will have on attainment of the

NAAQS for two reasons: 1) the statutory purpose of protecting public health, and 2) the structure of section 202 of the Act which establishes different criteria for standards for HDVs versus standards for light duty vehicles. [EPA-HQ-OAR-2019-0055-1218-A1, p. 8]

The standard setting authority granted to EPA by section 202 must be viewed in light of the statutory framework which declares the purpose of the Act is "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." 42 U.S.C. §7401(b)(1). Under the structure of the Act, the NAAQS promulgated pursuant to section 109 provide the relevant benchmarks for determining whether the primary purpose of the Act, i.e., protecting public health, is being implemented. [EPA-HQ-OAR-2019-0055-1218-A1, p. 8.]

Here EPA has investigated the impact that the proposed standards will have on attainment and found that 1) controlling emissions from HDVs are necessary for attainment in many ozone NAs because the reductions required by the proposed rules will contribute to attainment in some NAs, but 2) that the reductions are not enough to demonstrate attainment in the worst polluted air pollution control regions.3 [EPA-HQ-OAR-2019-0055-1218-A1, p. 8.]

> 3. The modeling analysis results reported in the Technical Support Document are useful for drawing these inferences, but the modeling is not adequate to determine the emission reductions needed for timely attainment by the statutory deadlines for each NA. Regional modeling for NAs that are not expected to attain before the statutory deadline should be performed, in collaboration with regional air quality planning agencies, to obtain more precise data regarding the emission reductions needed for attainment.

This statutory mandate to achieve "the greatest degree of emission reduction achievable…"for heavy duty vehicles does not apply to standards for light duty vehicles (LDVs). Section 202(i) specifically authorizes EPA to forego more stringent standards for LDVs if they are not needed for attainment, but that provision does not apply to HDVs. For HDVs, the duty to set standards that reflect "the greatest degree of emission reduction achievable…" is continuing, and is not limited by the need for reductions to attain NAAQS. These differences imply 1) that standards for both HDVs and LDVs must continue to be strengthened as necessary to support the states in developing implementation plans that can attain the NAAQS; and 2) that for HDVs the progressive emission reductions that become available from more advanced technology must continue to be reflected in more stringent standards. [EPA-HQ-OAR-2019-0055-1218-A1, p. 9.]

To estimate the emission reduction benefits of the regulatory approach that we ask EPA to adopt, we have performed modeling using the EMFAC model to quantify the emission reductions that would be achieved in the South Coast and San Joaquin Valley (SJV) Air Quality Management Districts (AQMD)s. [EPA-HQ-OAR-2019-0055-1218-A1, p. 13]

CARB has developed estimates of the NOx reductions needed for attainment in South Coast and SJV AQMDs. CARB has identified emissions from federally regulated transportation source sectors as the primary cause of nonattainment after the implementation of stationary and area source measures included in the draft ozone SIP. These source sectors include out-of-state (OOS) trucks traveling into and through California, commercial shipping and aircraft operations in CA. [EPA-HQ-OAR-2019-0055-1218-A1, p. 13]

In these comments we fault EPA for not identifying the degree of emission needed to help states achieve the emission reductions needed for ozone and PM2.5 attainment. To address that objection, we have prepared modeling analyses of two scenarios to estimate the contribution to attainment in the two most polluted ozone NAs in the U.S. where 20 million Americans are at risk from exposure to frequent (more than 100 days per year) daily violations of the ozone NAAQS, that include the most extreme daily peak concentrations measured in the U.S. [EPA-HQ-OAR-2019-0055-1218-A1, p. 13]

Organization: *Energy Innovation, LLC*

The NOx standards for HDTs should be sufficiently stringent to reduce harmful air pollution and improve public health in the near-term. The most adversely impacted communities cannot wait another decade before realizing the benefits of cleaner trucks. [EPA-HQ-OAR-2019-0055-1310-A1, p.6]

In the 20 years since EPA issued the last major rule to address NOx from HD engines, areas in the U.S. have continued to struggle with meeting National Ambient Air Quality Standards (NAAQS), with some regions increasing criteria pollutant emissions and being reclassified to 'serious' nonattainment.xxxviii [EPA-HQ-OAR-2019-0055-1310-A1, p.6]

xxxviii EPA Proposed Rule, 17418.

We know that air pollution from transportation disproportionately impacts people of color, who are three times more likely than white people to live in the most polluted counties in the U.S.xxxix [EPA-HQ-OAR-2019-0055-1310-A1, pp.6-7]

xxxix American Lung Association, Fact Sheet: Medium and Heavy Duty Vehicles, https://www.lung.org/getmedia/bb0d60ba-eff2-4084-907b-916839ae985d/medium-and-heavy-duty-vehicles-fact-sheet.pdf.

Organization: *Great Rivers Environmental Law Center and Dutchtown South Community Corporation (DSCC)*

These disturbing health trends are exacerbated by the fact that the St. Louis metropolitan area has been designated as an ozone nonattainment area since 1992, with the exception of the year 2003, when the 1-hour ozone NAAQS were revoked.12 Further, EPA recently notified the Missouri Department of Natural Resources ('MDNR') that because of continued exceedances of the ozone standard, the area would likely be reclassified to higher nonattainment designation with more stringent ozone compliance requirements.13 [EPA-HQ-OAR-2019-0055-1323-A1, p.3]

12 U.S. EPA, Missouri Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants, data current as of April 30, 2022, located at https://www3.epa.gov/airquality/greenbook/anayo_mo.html.

13 Reclassification of Areas Classified as Marginal for the 2015 Ozone National Ambient Air Quality Standards, 87 Fed. Reg. 21842, 21845 Table 1 (April 13, 2022).

It is also meaningful that very little NAAQS air monitoring measuring transportation-related pollutants is taking place in the St. Louis metro area, especially in or near the minority and other disadvantaged populations that bear the disparate impacts of this pollution. Within the entire City of St. Louis, there is only one ozone monitor, two NOx and CO monitors, and four PM monitors.20 Expanding to the entire St. Louis ozone nonattainment region, only five more ozone monitors are added to the picture.21 However, none of these additional ozone monitors are located in the areas with the highest minority populations.22 This lack of meaningful monitoring makes it very difficult for impacted communities to understand the nature of the ozone problem affecting their health. [EPA-HQ-OAR-2019-0055-1323-A1, p.5]

20 MDNR, Air Facilities & Air Quality Monitoring Sites, located at https://modnr.maps.arcgis.com/apps/webappviewer/index.html?id=d5ce71196074 4f74abe421312915d075.

21 Id.

22 Id.

EPA should also include in the rule additional requirements for increased air monitoring for pollutants of concern near transportation corridors in overburdened communities so as to document whether these existing and proposed regulatory approaches are working. As EPA has admitted, current NAAQS monitoring is woefully inadequate to document the regional distribution of transportation pollutants, so increased monitoring is essential to determining the adequacy and efficiency of EPA’s final regulations.24 [EPA-HQ-OAR-2019-0055-1323-A1, p.6]

24 U.S. EPA, Control of Air Pollution from New Motor Vehicles: Heavy Duty Engine and Vehicle Standards, Draft Regulatory Impact Analysis at p.177 (March 2022).

Organization: *Jessica Stevens*

I am writing in support of the Environmental Protection Agency in the proposed regulation to reduce air pollution from highway heavy duty vehicles and engines. Greenhouse gasses, ozone, and other particulate matter are primary contributors in our current climate crisis, so any recommendation to reduce these is urged. In addition, these have direct consequences in public health and environmental justice, which was put under consideration in constructing this report. I will outline why this regulation is essential in taking steps against climate change and why it is important in our quality of life, as well as providing some recommendations and other items to take under consideration. [EPA-HQ-OAR-2019-0055-1028]

Transportation is currently the greatest source of greenhouse gasses in the United States. In 2020, it accounted for 27% of the emissions produced, mostly coming from petroleum based fuel for trucks, cars, planes, etc. (Sources of Greenhouse Gas Emissions). Over half of the emissions in this industry come from cars, light, medium, and heavy duty trucks, while the other half result from other forms of transportation like planes, ships, and trains. The National Institute of Environmental Health Services (NIEHS) outlines the air pollution produced by the transportation sector and the potential health impacts this has. The NIEHS states that Traffic Related Air Pollution (TRAP) includes ground level ozone, carbon, hydrocarbons, and particulate matter (Air Pollution and Your Health). This can result in various forms of respiratory disease, like asthma or chronic obstructive pulmonary disease. Additionally, air pollution increases the risk for cardiovascular disease and certain cancers, particularly breast and lung cancer. The NIEHS also found that nine out of 10 people living in urban areas worldwide were found to be affected by air pollution (Air Pollution and Your Health). This report specifically mentions that lower income families and people of color possess higher risk for air pollution by being more likely to be located near truck routes. This is a public health and environmental justice problem that needs to be addressed. [EPA-HQ-OAR-2019-0055-1028]

Organization: *Maine Department of Environmental Protection (Department)*

Furthermore, recent studies show that ozone concentrations below the current National Ambient Air Quality Standards (NAAQS) continue to contribute to the risk of premature death in sensitive populations, such as the elderly.2 NOx emissions from trucks likewise impede the States' ability to attain and maintain federal air quality standards for particulate matter. [EPA-HQ-OAR-2019-0055-1288-A1,p.1]

> 2 Di, Q., et al. "Air pollution and mortality in the Medicare population." New England Journal of Medicine 376.26 (2017): 2513-2522. DOI: 10.1056/NEJMoa1702747; Di, Q., et al. "Association of short-term exposure to air pollution with mortality in older adults." JAMA 318.24 (2017): 2446-2456. DOI: 10.1001/jama.2017.17923.

Organization: *Metropolitan Washington Air Quality Committee (MWAQC) et al.*

We agree that the proposed rule has the potential to achieve significant Nitrogen Oxide (NOx) emissions reductions and will likely result in substantial public health and welfare benefits. The region is currently designated as being in non-attainment of federal National Ambient Air Quality Standards (NAAQS) for ozone. NOx is a precursor pollutant of ground-level ozone. As such, reductions in NOx emissions will help the region to attain the federal NAAQS for ozone. In addition, NOx is a precursor to secondary particulate matter, such as particulate matter measuring 2.5 micrometers in diameter and smaller (PM2.5). Exposure to PM2.5, along with ground-level ozone, is associated with premature death, increased hospitalizations, and emergency room visits due to exacerbation of chronic heart and lung diseases and other serious health impacts. [EPA-HQ-OAR-2019-0055-0996-A1, p. 1]

The National Capital region has implemented several emissions control measures in all emissions sectors, including transportation, over the years to improve its air quality and comply with NAAQS for a variety of criteria pollutants. The region also relies heavily on federal emissions control programs for a significant amount of its emissions reductions. While significant progress has been made in the Washington region to reduce emissions of criteria pollutants and GHG emissions, addressing sources of low-level NOx, including from on-road vehicles, is critical to continuing to deliver cleaner air for the residents of the region. The role of the federal government's leadership in delivering effective regulatory limits on emissions from motor vehicles is a critical component of our ability to meet our adopted and mandated environmental objectives. As such, MWAQC, TPB, and CEEPC believe the continued updates to emission standards to reduce pollutants are appropriate and necessary. [EPA-HQ-OAR-2019-0055-0996-A1, p. 2]

Organization: *Mid-America Regional Council (MARC) Air Quality Forum*

While significant reductions in NOx from industrial and electric generation sources have been achieved—helping to maintain ozone attainment in the Kansas City region—ongoing federal leadership is needed to achieve more significant emissions reductions from on-road sources. The importance of the role of the federal government in delivering effective regulatory limits on emissions from motor vehicles cannot be understated. These limits challenge manufacturers to integrate tried and tested control technology for curtailing emissions into their projects which would otherwise be adopted at a slower pace. It is a critical component to maintaining the current and future attainment for ozone and meeting GHG targets in the transportation sector in the Kansas City region. [EPA-HQ-OAR-2019-0055-1131-A1, p. 2]

Organization*: Midwest Ozone Group (MOG)*

MOG is pleased to see EPA undertake this initiative under Section 202(a)(1) of the Act. While states also have an obligation to address emissions from mobile sources as part of their nonattainment SIP planning, EPA has additional authority that is critical to the objectives of the Clean Air Act. [EPA-HQ-OAR-2019-0055-1272-A1, p.2]

It is essential that EPA's mobile source regulatory program that will impact state implementation plan development be balanced for upwind and downwind states. MOG cautions EPA to ensure the implementation of this proposed rule regulating emissions from heavy duty trucks will include direction to states relative to implementation that will target alignment encouraging all states to manage mobile emissions from heavy duty trucks in a collaborative manner. The Clean Air Act provides for the authority to regulate mobile sources within the state implementation plan strategies supporting the NAAQS as specifically noted by EPA in its proposed FIP for the 2015 ozone NAAQS.3 The Wisconsin v. EPA D.C. Circuit opinion concluded that EPA exceeded its statutory authority under the Good Neighbor Provision 'by issuing a Rule that does not call for upwind States to eliminate their substantial contributions to downwind nonattainment in concert with the attainment deadlines.' 938 F.3d 303, 318 (D.C. Cir. 2019). The Wisconsin remand directed EPA to address the downwind state 'deadline' in such a manner as to 'harmonize' the deadlines of upwind and downwind states and to apply 'parallel timeframes.' Id. at 312, 314. The D.C. Circuit repeatedly has explained the CAA directive to 'harmonize' and manage the relationship described as parallel between the Good Neighbor obligations for upwind states and statutory attainment deadlines for downwind areas. That relationship is one of ‘par,’ using the Court’s term, meaning to be judged on a common level with the other.4 With this proposed rule is opportunity to implement mobile source emissions reductions that will impact ambient air quality for upwind and downwind states. [EPA-HQ-OAR-2019-0055-1272-A1, pp.2-3]

> 3 87 Fed. Reg. 2077, ftn. 142. 'The EPA recognizes that mechanisms exist under title I of the CAA that allow for the regulation of the use and operation of mobile sources to reduce ozone-precursor emissions.'
>
> 4 Definition of Par, MERRIAM-WEBSTER, https://www.meriam-webster.com/dictionary/par (last visited Mar. 24, 2022).

Organization: *Moving Forward Network (MFN)*

Often, freight operations are located in communities that have poor air quality and fail to achieve federal clean air standards. As many as 40 percent of U.S. ports and many other freight facilities are in areas that are not meeting the National Ambient Air Quality Standards for ozone and PM, and freight operations have been identified as major contributors to nonattainment issues.24 [EPA-HQ-OAR-2019-0055-1277-A1, p. 9]

> 24. Clean Air Act Advisory Committee. “Ports Initiative Workgroup Report: Recommendations for the U.S. EPA.” US EPA, September 2016. https://www.epa.gov/sites/default/files/2016-09/documents/ports_workgroup_report_for_epa_9_15_16.pdf; see, e.g., South Coast Air Quality Mgmt. Dist., Proposed Rule 2304 Indirect Source Rule for Commercial Marine Ports Working Group Meeting #1, Powerpoint (Feb. 25, 2022), at p. 2, available at https://www.aqmd.gov/docs/default-source/planning/fbmsm-docs/pr-2304-wgm-no-1_2022-02-25.pdf?sfvrsn=8 (describing the ports of LA and Long Beach as the “single largest fixed source of air pollution in the South Coast Air Basin”).

Organization: *National Association of Clean Air Agencies (NACAA)*

There is a looming crisis facing many state and local clean air agencies. Currently, more than one-third of the U.S. population lives in an area that does not meet the health- and welfare-based National Ambient Air Quality Standards (NAAQS) for ozone, particulate matter (PM) or both. [EPA-HQ-OAR-2019-0055-1232-A1, p. 2.]

While state and local air agencies have made great strides in reducing emissions from stationary sources, for the most part they lack the authority to regulate mobile sources and never do they have the authority to regulate mobile sources upwind of or across their borders. The regulation of mobile sources is an authority that lies almost entirely within the purview of the federal government. Unfortunately, emission standards for this heavy-duty “federal source” have not kept pace with standards for the light-duty motor vehicle sector or stationary sources, and fall far short of what is needed to meet clean air and public health protection goals. As large swaths of the country slip deeper into nonattainment, or teeter on the cusp of it, many state and local air agencies are left with few avenues to achieve the emission reductions they sorely need. Areas that miss their attainment deadlines face the threat of "bump-up" to a more demanding classification of nonattainment – if they are not already classified as Extreme – and statutorily required economic sanctions if they fail to meet their attainment deadlines. On April 13, 2022, EPA proposed to bump up 30 areas in nonattainment of the 20082 and 20153 ozone NAAQS, meaning the citizens of these areas continue to suffer the detrimental impacts of unhealthful air. [EPA-HQ-OAR-2019-0055-1232-A1, p. 2]

2. https://www.govinfo.gov/content/pkg/FR-2022-04-13/pdf/2022-07509.pdf

3. https://www.govinfo.gov/content/pkg/FR-2022-04-13/pdf/2022-07513.pdf

Further, EPA is now in the process of reconsidering the existing PM and ozone NAAQS, adopted in 2012 and 2015, respectively, and reaffirmed in December 2020. With respect to PM, the agency's science advisors on the Clean Air Science Advisory Committee (CASAC) are recommending that EPA revise the standards to make them more protective of public health. In a letter transmitted to Administrator Michael S. Regan on March 18, 2022,4 responding to the EPA staff Draft Policy Assessment (PA) for PM, the science advisors wrote that "all CASAC members agree that the current level of the annual [PM2.5] standard [of 12 micrograms per cubic meter (µg/c3)] is not sufficiently protective of public health and should be lowered" and that a majority of CASAC members finds "that the available evidence calls into question the adequacy of the current 24-hour standard [of 35 µg/m3]" and "conditional on retaining the current form, the majority of CASAC members favor lowering the 24-hour standard." NACAA also notes that in the Draft PA EPA staff report that the risk assessment for PM2.5 revealed that Black populations experience significantly higher mortality risk when compared to other racial groups, even at the recommended lower standard.5 [EPA-HQ-OAR-2019-0055-1232-A1, pp. 2 - 3.]

4. https://www.4cleanair.org/wp-content/uploads/PM-NAAQS-CASAC-Responses-to-EPA-PM-Draft-PA-031822.pdf (see pp. 2-3)

5. https://www.epa.gov/system/files/documents/2021-12/draft-policy-assessment-for-the-reconsideration-of-the-pm-naaqs_october-2021_ed3.pdf (see pp. 3-149 – 3-150)

On April 28, 2022,6 EPA staff released for review and comment the Draft PA for ozone, in which the staff put forth their conclusion that the current evidence and information do not call into question the adequacy of the protection provided by the current standard and, instead, continue to provide support for the current standard and consideration of retaining that standard without revision. CASAC members, who have not yet weighed in, were to meet in June to conduct their peer review of the Draft PA. However, on May 13, 2022, CASAC Chair Dr. Lianne Sheppard issued a memorandum7 in which she announced that she had paused review of the Draft PA so the Committee can 1) discuss EPA's charge question about the CASAC Ozone Panel's views on "EPA's evaluation of newer studies and its conclusion that they do not materially change the findings of the 2020 ISA [Integrated Science Assessment] or warrant reopening of the air quality criteria," 2) consider several Panel members' concerns regarding some of the causal determinations made in the 2020 ISA and 3) decide if the Panel would like to have further discussion of the science prior to reviewing the draft PA. [EPA-HQ-OAR-2019-0055-1232-A1, p. 3]

6. https://www.epa.gov/system/files/documents/2022-04/o3_reconsideration_draft_pa-v_final-compressedfinal.pdf

7. https://www.4cleanair.org/wp-content/uploads/CASAC-Ozone-Panel-Chair-Memo-05-13-22.pdf

Regardless of whether either or both standards are strengthened, the fact is that many areas across the country are in need of NOx reductions just to meet the current standards and provide clean air to their citizens. [EPA-HQ-OAR-2019-0055-1232-A1, p. 3]

Our nation is in need of a strong, sustainable transportation strategy with top priority placed on new federal programs to continue to reduce emissions from the mobile source sector. As this strategy is developed, the need for meaningful reductions in criteria pollutant emissions, especially NOx and PM, cannot be overlooked. Regarding attainment and maintenance of the ozone NAAQS, most areas of the country are "NOx-limited," meaning that reducing NOx emissions is the key to success. In addition, research shows that in some areas of the country, such as much of the East Coast, NOx reductions are now "supercharged," meaning that one-pound of reduction in NOx emissions equals more than one pound of ozone reduction. Failure to adequately address transportation-related NOx sources will have a direct and consequential impact on state and local air agencies' abilities to fulfill their statutory obligations to attain and maintain federal air quality standards by mandated deadlines and achieve their environmental justice goals. [EPA-HQ-OAR-2019-0055-1232-A1, p. 3]

Now is the time for decisive federal action that will result in deep NOx reductions from HD trucks. Cleaning up this sector is imperative to putting our nation on a path to attaining and maintaining the health-based NAAQS and protecting our nation's most vulnerable communities. EPA must take full advantage of this opportunity to adopt a maximally stringent, technology-forcing federal rule that will take effect beginning with MY 2027 and achieve the full measure of potential emission reductions. Through a variety of actions, states are demonstrating strong leadership with respect to addressing HD truck NOx emissions, including by exercising their authority under section 177 of the CAA and through non-regulatory efforts such as collaborative Memoranda of Understanding (MOU). It is incumbent upon EPA to do its part. If EPA does not incorporate NACAA's recommendations into the final rule and does not finalize the rule this year, in time for it to take effect with MY 2027, many areas will be forced to adopt severe limits on stationary sources, for which they have authority to control, at ever-increasing costs, if reductions from such sources are even available. [EPA-HQ-OAR-2019-0055-1232-A1, pp. 3 - 4]

Americans in every part of the country urgently need improvements in NOx emissions from onroad HD vehicles; the following examples are just a few indications of this nationwide need. [EPA-HQ-OAR-2019-0055-1232-A1, p 4]

In Wisconsin, EPA action to significantly reduce NOx emissions from highway heavy-duty vehicles is critical for the state to meet its Clean Air Act (CAA) attainment obligations relative to ozone. Wisconsin's Lake Michigan shoreline experiences complex, persistent ozone issues due to a combination of emissions, meteorology and geography, as well as from transported ozone precursors originating from out of state. As a result, Wisconsin has multiple areas that remain in nonattainment of the 2015 ozone standard. Reductions in regional NOx emissions are necessary to resolve these nonattainment areas. The onroad mobile sector is the largest contributor of NOx emissions in Wisconsin. According to the 2017 National Emissions Inventory, the onroad mobile sector accounts for 38 percent of the NOx inventory in Wisconsin, with nearly half of those emissions coming from heavy-duty vehicles. Recent ozone modeling done by the Lake Michigan Air Directors Consortium indicates onroad diesel vehicles, the vast majority of which are heavy-duty vehicles, contribute up to 8 parts per billion (ppb) or 11 percent of ozone at Wisconsin's lakeshore nonattainment monitors. A comprehensive federal rule to address nationwide NOx emissions from this sector cannot be delayed any further. [EPA-HQ-OAR-2019-0055-1232-A1, p. 4]

New Jersey and its multi-state nonattainment areas need NOx reductions from HD trucks for attainment and/or maintenance reasons associated with both the 2008 and 2015 ozone NAAQS. Although the state is currently in attainment of the PM2.5 NAAQS, the NOx reductions would help the state attain any future revised PM2.5 NAAQS by reducing levels of PM2.5 precursors. In addition, New Jersey needs NOx reductions to meet its regional haze goals; given the timing of this rule – to be finalized this year – the related NOx reductions will contribute toward achievement of those goals. New Jersey is also home to several ports that are surrounded by environmental justice communities impacted by the emissions from heavy truck traffic. Mobile sources (onroad and nonroad) make up greater than 75 percent of New Jersey's annual and summer day inventory for NOx. Due to state preemption, New Jersey is limited in its capacity to address the largest sources of ozone-producing pollutants and relies on federal measures like the HD truck rule to attain. In New Jersey, electric generating units (EGU) are less than 5 percent of the inventory and non-EGU stationary sources are 14 percent. The cost per ton associated with further reductions from these source sectors would be high. [EPA-HQ-OAR-2019-0055-1232-A1, p. 4]

Over the years, Oregon has had difficulty reducing emissions from the medium- and heavy-duty mobile source sectors because of limited tools at the state level. Oregon relies on California and its federal counterparts at EPA to develop and maintain the most advanced new vehicle emission standards possible to complement bold action at the state level. In 2019, Oregon adopted the second strongest diesel regulations in the nation and will begin phasing out older model medium- and heavy-duty diesel-powered trucks in the Portland Metro Region next year. But state action alone will not be enough. The decades-long downward trend in ambient ozone concentrations has leveled off. Despite Oregon's status as a "section 177 state" and its adoption of several California rules, it remains likely that the state will see increases in ozone concentrations due to ongoing climate warming and increased interstate transportation. Further, if the ozone NAAQS is revised downward, Oregon will be at greater risk of losing its attainment status in several communities. [EPA-HQ-OAR-2019-0055-1232-A1, pp. 4 - 5]

The Puget Sound Clean Air Agency (PSCAA) in Seattle, WA seeks a technology-forcing standard to reduce NOx emission from HD trucks due to several ozone-related concerns. Reducing NOx would help reduce exposure in the near-road communities, which are disproportionately affected by air pollution, and also assist in addressing ozone-impacted areas. Finally, the PSCAA's former PM2.5 nonattainment area includes one of the largest container ports on the West Coast and strong growth in both population and goods movement are anticipated along the West Coast's main north-south interstate and the in the region served by PSCAA. Reducing PM and NOx from heavy-duty vehicles through controls that do not lose their effectiveness over time or during some duty cycles will be vital to the health of near-roadway and near-port communities and to maintaining the area's attainment status. For all these reasons, technology-forcing regulations and substantial warranties to ensure that compliant emission rates are sustained over more of the useful life of the truck and over the full set of duty cycles will provide significant benefit to the Seattle area. [EPA-HQ-OAR-2019-0055-1232-A1, p. 5]

Historically, the Louisville Metropolitan Statistical Area (MSA) has been challenged with meeting the ozone NAAQS.8 The area was designated as Marginal nonattainment for the 2015 ozone NAAQS and has recently been proposed by EPA to be bumped up to Moderate nonattainment since the area failed to meet the standard by the Marginal nonattainment deadline of August 2021. In the meantime, the MSA currently meets the standard (with a 2021 design value of 69 ppb) and a Request for Redesignation is being prepared for submittal to EPA. Even so, EPA's proposed rule provides an important opportunity to address HD truck emissions now and protect public health by reducing emissions of ozone precursors, particulate matter and toxic air pollutants. HD truck emissions are a significant contributor of ozone precursors, NOx and volatile organic compounds (VOC). The impact of this vehicle sector was apparent recently with respect to meeting transportation conformity Motor Vehicle Emission Budgets; variations in HD truck speeds were found to be critical in staying under the 2020 NOx budget (established in 2007). As with most medium- and large-size cities in the U.S., the HD trucks in the mobile emissions category are a critical source over which the Louisville Metro Air Pollution Control District (APCD) has little control, so meaningful federal controls are very important to APCD's attainment planning for ozone and subsequent maintenance of the standard. Onroad heavy-duty diesel vehicles represent the third largest overall NOx emissions sector in the area (after EGUs and onroad non-diesel light-duty vehicles).9 In addition, should EPA revise the PM NAAQS, as EPA staff and CASAC have recommended to the Administrator, reductions in NOx emissions from HD trucks will be equally important for Louisville's attainment planning for that standard. Although APCD has instituted a voluntary cooperative program, the Air Quality Action Partners Program,10 for businesses to reduce emissions, including mobile source emissions, HD trucks continue to be an ongoing concern, especially from an environmental justice standpoint. Further, a stringent HD truck rule will further reduce risk from emissions of toxic air pollutants not addressed by APCD's Strategic Toxic Air Reduction (STAR) Program. This is especially important since HD truck traffic travels through many fenceline communities and adds to the cumulative exposures of those who live nearby. The strictest version of this rule will benefit Louisville in many ways. [EPA-HQ-OAR-2019-0055-1232-A1, pp. 5 - 6]

8. https://www.4cleanair.org/wp-content/uploads/Lville-Ozone-History.jpg

9. https://www.4cleanair.org/wp-content/uploads/Lville-HD-Diesel.jpg

10. https://louisvilleky.gov/government/air-pollution-control-district/air-quality-action-partners-program

Although Maryland has made significant progress over the past 30 years in improving air quality for its citizens, there is still much work needed to reduce NOx emissions and meet air quality and public health goals. Maryland has implemented aggressive NOx reduction measures such as adopting the California light-duty vehicle emission program and pursuing strong reduction measures on stationary sources via the state's Healthy Air Act. Despite these efforts, the majority of Maryland's population resides in areas designated nonattainment for the 70-ppb 2015 ozone NAAQS, and on April 13, 2022, significant portions of Maryland were proposed to be bumped up in nonattainment status. In Maryland, and the Northeast region, medium- and heavy-duty trucks are the second leading contributor of NOx emissions. To attain the federal ozone standards, emission reductions from HD trucks are needed. [EPA-HQ-OAR-2019-0055-1232-A1, p. 6]

The Yakima Regional Clean Air Agency was designated as nonattainment for PM10 and is now in its second 10-year maintenance plan. The area is now in jeopardy of becoming nonattainment for PM2.5. If EPA revises the PM2.5 NAAQS to 30 or 32 micrograms per cubic meter (μ/m3) the area will most likely be designated as nonattainment. Hence, Yakima needs reductions in NOx – a PM2.5 precursor – from HD trucks along area highway corridors to reduce its PM levels. [EPA-HQ-OAR-2019-0055-1232-A1, p. 6]

The Denver Metro/North Front Range needs reductions in emissions from heavy-duty truck traffic to aid in attainment and address environmental justice concerns. Recent source apportionment modeling for 2023 demonstrates that NOx emissions are driving ozone formation at monitors throughout the region11 and that medium- and heavy-duty truck traffic is a significant contributor to ozone formation.12 [EPA-HQ-OAR-2019-0055-1232-A1, p. 6]

11. https://raqc.egnyte.com/dl/mQUvLxQUWs/Dashboard_mda8_v_2021.03.05_(1).xlsx

12. https://raqc.egnyte.com/dl/VHRCCkBuru/Dashboard_LocalAPCA_mda8_v2021.03.17_(1).xlsx

Reductions in HD truck NOx emission would be a proactive measure for the Kansas City metropolitan area. While the county and Greater Kansas City metro area would obviously benefit from cleaner heavy-duty trucks, Johnson County, KS does not have data that indicate the need for NOx reductions specifically from HD trucks. That being said, the last photochemical modelling, a fairly dated data set, showed the Johnson County metro area to be a mix of VOC- and NOx-limited areas. The Kansas City metro area is in the early stages of developing a local-scale neighborhood monitoring effort, perhaps a network, that may reveal need for these reductions at a neighborhood scale. It is anticipated this monitoring will aid in confirming those suspected EJ communities in the greater metro area and within Johnson County that the regional scale monitoring does not capture. The recent trends in increased industrial warehousing across the Kansas City metro area is anticipated to increase truck traffic and bring it closer to residential neighborhoods, including environmental justice communities. Unfortunately, the area does not have targeted data to show the potential impact of this clearly beneficial program for cleaner heavy-duty trucks. However, the anticipated reductions from the proposed HD truck rule would be preventative and help keep the Kansas City metro area from needing to explore future NOx reduction strategies. Although the situation is not as dire as in other parts of the country, cleaner heavy-duty trucks would certainly help in improving and maintaining our air quality to be more protective of our residents' health. [EPA-HQ-OAR-2019-0055-1232-A1, pp. 6 - 7]

The District of Columbia continues to have annual ozone fourth highest values above the 70-ppb 2015 ozone NAAQS, except in 2020 when vehicle congestion in the Washington, DC, area was significantly reduced due to the COVID-19 health emergency. NOx emissions from highway trucks are major contributors to unhealthy levels of ground-level ozone and fine PM. In fact, modeling conducted by the Ozone Transport Commission13 found that onroad diesel vehicles are the second largest contributor to ozone in the District, behind only onroad gasoline vehicles. Onroad diesels were modeled to contribute 16 percent of anthropogenic ozone on exceedance days and throughout the ozone season in the District, which is a higher percentage than all of the District contributes to itself (12 percent on average and 10 percent on exceedance days). NOx reductions from diesel vehicles are necessary in order for residents of the District to breathe healthy air. [EPA-HQ-OAR-2019-0055-1232-A1, p. 7]

13. https://otcair.org/upload/Documents/Reports/OTC%20MANE-VU%202011%20Based%20Modeling%20Platform%20Support%20Document%20October%202018%20-%20Final.pdf

Many key environmental justice communities in Washington are located near high-traffic roadways well used by heavy-duty trucks. One such community is Seattle's Chinatown-International District, which sits next to the interchange of two major interstates (I-5 and I-90). This community is home to Seattle's near-road NOx monitoring site, which records the highest NOx concentrations in the region. Monitoring results demonstrate that ambient concentrations of NO and NO2 are highly correlated with peak traffic patterns on these interstates. As a key precursor to ozone formation, NOx also impacts air quality in communities with elevated ozone concentrations such as Washington's Tri-Cities. Previous research indicates that onroad vehicles are the dominant source of NOx in this community, which experiences some of Washington's highest ozone concentrations in the summer months. [EPA-HQ-OAR-2019-0055-1232-A1, p. 7]

For almost 50 years, Connecticut's citizens have suffered the public health and economic impacts of ozone nonattainment. This past year, Connecticut experienced 21 days with unhealthy ozone levels, and on April 13, 2022, EPA proposed to reclassify Fairfield, New Haven and Middlesex Counties as Severe nonattainment with respect to the 2008 ozone NAAQS. The importance of reducing NOx emissions to address ozone nonattainment is critical for Connecticut. A recent national report, Asthma Capitals 2021,14 ranked New Haven (#5) and Hartford (#17) among the 100 largest U.S. cities where it is most challenging to live with asthma. The Connecticut Department of Energy and Environmental Protection recently issued an assessment of onroad medium- and heavy-duty vehicle emissions,15 which included the finding that in 2020 onroad HD vehicles accounted for 36 percent of total onroad NOx emissions but are projected to increase to 57 percent of total onroad NOx emissions by 2045 without the adoption of new emission standards. Connecticut urgently needs stringent, technology-forcing federal emission standards for HD trucks now. [EPA-HQ-OAR-2019-0055-1232-A1, p. 7]

14. https://www.aafa.org/media/3040/aafa-2021-asthma-capitals-report.pdf

15. https://portal.ct.gov/-/media/DEEP/air/mobile/MHD/MHD_Whitepaper_030822.pdf

California's population closely overlaps its air quality challenges driven in large part by transportation emissions that often differentially affect the state's most vulnerable communities. Redoubled efforts to address the air quality needs of every California resident have seen focused Community Air Protection programs targeting the stationary and mobile sources impacting these communities. The communities adjacent to railyards, ports, warehouses and freight corridors experience heavy truck traffic characterized by idling, driving slowly and frequent stops – conditions under which today's HD trucks do not control NOx emissions effectively. California has spent $8 billion to date on technology advancement and early market development of cleaner and zero emission vehicles (ZEVs). New vehicles sold in California are being brought under stringent near-term tailpipe and zero emission requirements while fleet rules like the Truck and Bus regulation are driving accelerated turnover of the oldest remaining trucks by the end of this year. Despite these aggressive and sustained efforts to achieve emission reductions, a similar amount of heavy-duty truck emissions in California comes from trucks initially sold under federal jurisdiction. The necessity of dealing with "both halves" of heavy-duty truck emissions (under California's jurisdiction and under federal jurisdiction) is paramount as outlined in California's EPA-approved State Implementation Plans and underlying the state Mobile Source Strategy and local Air Quality Management Plans. It is crucial that EPA's federal HD truck standards drastically cut truck emissions, including during low load conditions, to reduce adverse health impacts and improve air quality throughout the state, especially in those areas that are already disproportionately impacted by truck emissions. [EPA-HQ-OAR-2019-0055-1232-A1, p. 8]

In 2016, state and local air agencies from around the country joined together to petition EPA to adopt "ultra-low NOx" emission standards for highway heavy-duty trucks and engines. Petitioners, who based their case on their need for the related NOx reductions, included the South Coast (CA) Air Quality Management District; Pima County (AZ) Department of Environmental Quality; Bay Area (CA) Air Quality Management District; Connecticut Department of Energy and Environmental Protection; Delaware Department of Natural Resources and Environmental Control, Division of Air Quality; Washoe County (NV) Health District, Air Quality Management; New Hampshire Department of Environmental Services; New York City (NY) Department of Environmental Protection; Akron (OH) Regional Air Quality Management District; Washington State Department of Ecology; Puget Sound (WA) Clean Air Agency; Rhode Island Department of Environmental Management; Massachusetts Department of Environmental Protection; Vermont Department of Environmental Conservation; New York State Department of Environmental Conservation; and Sacramento (CA) Metropolitan Air Quality Management District. [EPA-HQ-OAR-2019-0055-1232-A1, p. 8]

Organization: *National Coalition for Advanced Transportation (NCAT)*

In 2020, approximately 97 million people nationwide lived in counties with pollution levels above the primary National Ambient Air Quality Standards (NAAQS).17 [EPA-HQ-OAR-2019-0055-1290-A1, p. 5]

> 17. U.S. EPA, Air Quality - National Summary, https://www.epa.gov/air-trends/air-quality-nationalsummary (last updated May 26, 2021).

Organization: *National Parks Conservation Association (NPCA)*

Heavy-duty vehicles are a key contributor to ozone and PM National Ambient Air Quality Standards (NAAQS) nonattainment in air basins across the country. This is of particular concern in states like California, where NOx pollution from HD vehicles is an outsized source of ozone and PM2.5 in regions such as the San Joaquin Valley and South Coast Air Basins. When it comes to meeting the CAA's NAAQS, The San Joaquin Valley is now in extreme nonattainment with the 1997, 2008, and 2015 ozone standards, serious nonattainment with the 1997 annual and 24-hour and 2006 24-hour PM2.5 standards, and moderate nonattainment with the 2012 annual PM2.5 standard. The San Joaquin Valley is also home to the environmental justice communities of Fresno, Visalia, and Bakersfield, which are ranked by American Lung Association (ALA) as being three of the most polluted cities in the country for ozone, annual PM2.5, and short-term PM2.5 pollution.26 In terms of the economic impact, one study found that '[i]n the San Joaquin Valley overall, the cost of air pollution is more than $1,600 per person per year, which translates into a total of nearly $6 billion in savings if federal ozone and PM2.5 standards were met.'27 [EPA-HQ-OAR-2019-0055-1314-A1, pp.4-5]

> 26 ALA, 2019 State of the Air Report: Most Polluted Cities. Available at, https://www.lung.org/our-initiatives/healthy-air/sota/city-rankings/most-polluted-cities.html.
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> 27 Jane V. Hall, et. al., The Benefits of Meeting Federal Clean Air Standards in the South Coast and San Joaquin Valley Air Basins 2008), at 5. Available at http://publichealth.lacounty.gov/mch/AsthmaCoalition/docs/BenefitsofMeetingCleanAirStandards_11_06_08.pdf.

When viewed alongside other heavily impacted areas, like West Oakland or communities in the South Coast Air Basin, the total impact to vulnerable populations in the state is enormous, both from an economic and public health standpoint. Attaining statewide standards for PM and ozone just in California would annually prevent 9,000 premature deaths—more than the total number of deaths from second-hand smoke and motor vehicle crashes combined—and avoid the annual $2.3 billion price tag in the State's economy associated with hospitalizations and treatment related to air pollution.28 The uneven distribution of health, social, and livelihood costs of the freight sector is one of California's deepest forms of environmental injustice, where freight hubs and corridors disproportionately poison the State's low-income communities and communities of color.29 In West Oakland, where CARB attributes 71% air pollution risk to truck traffic,30 residents have life expectancies as much as 24 years shorter than their neighbors in the Oakland

Hills.31 This story will sound familiar to communities in Wilmington, Roseville, Shafter, Fresno, Commerce, North Richmond, rural Riverside, and many other predominantly low-income communities and communities of color that live near freight hubs and truck corridors.32 [EPA-HQ-OAR-2019-0055-1314-A1, p.5]

28 CARB, Quantification of the Health Impacts and Economic Valuation of Air Pollution from Ports and Goods Movement in California, (Mar. 21, 2006) https://www.arb.ca.gov/planning/gmerp/plan/appendix_a.pdf

29 See, e.g. Pacific Institute, Paying with Our Health: The Real Cost of Freight Transport in California, (Nov. 2006). Available at https://pacinst.org/wp-content/uploads/2013/02/paying-with-our-health-full-report.pdf.

30 CARB, Diesel Particulate Matter Health Risk Assessment for the West Oakland Community, (Dec. 2008) at 3. Available at https://www.arb.ca.gov/ch/communities/ra/westoakland/documents/westoaklandreport.pdf.

31 Virgina Commonwealth University, Neighborhood-Level Determinants of Life Expectancy in Oakland, CA, (Sept. 2012) at 20. Available at https://societyhealth.vcu.edu/media/society-health/pdf/PMReport_Alameda.pdf.

32 Pacific Institute, Paying with Our Health: The Real Cost of Freight Transport in California, (Nov. 2006). https://pacinst.org/wp-content/uploads/2013/02/paying-with-our-health-full-report.pdf.

EPA must quickly move forward with this rule and strengthen it to ensure California can fulfill its various NAAQS commitments already included in various state ozone and PM2.5 SIPs. For instance, California has approved a combined San Joaquin Valley SIP for the 1997, 2006, and 2012 PM2.5 standards that relies on an expected 7 tons per day (tpd) of NOx reductions through a California specific low-NOx engine standard and 8 tpd of NOx reductions through a federal low-NOx engine standard.33 [EPA-HQ-OAR-2019-0055-1314-A1, p.5]

33 CARB, San Joaquin Valley Supplement to the Revised 2016 State Strategy for the State Implementation Plan. See table 3, at 7. (plan awaiting EPA approval). Available at https://ww3.arb.ca.gov/planning/sip/sjvpm25/2018plan/20180828_sjv_supplement_sip_strategy.pdf.

Similarly, the South Coast Air Quality Management District's (SCAQMD) SIP for attainment with the 2008 8-hour ozone standard, 2006 24-hr PM2.5 standard, and the 2012 annual PM2.5 standard (approved by EPA last year), lays out an expected 5 tpd of NOx reductions through a California low-NOx engine standard and an expected 7 tpd through a federal low-NOx engine standard.34 Because heavy-duty NOx makes up such a large amount of the expected tpd emission reductions seen in state plans like these, it's clear that EPA cannot afford to waiver on moving forward with strong standards without also jeopardizing future clean air goals for millions of California's. [EPA-HQ-OAR-2019-0055-1314-A1, p.6]

> 34 South Coast Air Quality Management District, Final 2016 Air Quality Management Plan. See table 4.5, at 4-35. Available at http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2016-air-quality-management-plan/final-2016-aqmp/final2016aqmp.pdf.

Organization: *North Central Texas Council of Governments (NCTCOG)*

Several counties within the Dallas-Fort Worth Metropolitan Planning Area are currently in nonattainment for the pollutant ozone under both the 2008 and 2015 8-hour ozone standards. NCTCOG supports efforts for clean air that will develop an aggressive program which takes into consideration the capabilities of Original Equipment Manufacturers (OEMs) while at the same time not disrupting commerce given the current state and future uncertainty of the economy. NCTCOG is currently implementing several programs to reduce emissions in North Texas, and these comments are informed by this experience. [EPA-HQ-OAR-2019-0055-1254-A2, p.1]

Transportation Conformity is a planning requirement carried out by a regional Metropolitan Planning Organization (MPO) to ensure long-range transportation plans are consistent with air quality goals established to bring a region into compliance with National Ambient Air Quality Standards (NAAQS). Due to increases in truck population and urban congestion, emission inventories are beginning to show increases over time. Addressing engine standards now can aid in maintaining the reduction trend of future year emission inventories which will allow for successful USDOT conformity determinations. The chart below shows this emerging future year situation. [EPA-HQ-OAR-2019-0055-1254-A2, p.4]

Organization: *Northeast States for Coordinated Air Use Management (NESCAUM)*

NESCAUM strongly supports EPA's development of new engine and vehicle emission standards and test procedures that will reduce emissions of oxides of nitrogen (NOx) from heavy-duty vehicles. NOx emissions are a primary precursor to the formation of ground-level ozone and secondary fine particulate matter (PM2.5), and contribute to acid deposition, eutrophication, and visibility impairment in the NESCAUM region. [EPA-HQ-OAR-2019-0055-1249-A1, p. 1]

In 2016, many of the NESCAUM member state agencies and the New York City Department of Environmental Protection joined with the South Coast Air Quality Management District (SCAQMD) and other agencies in petitioning EPA to undertake a rulemaking to revise the on-road heavy-duty engine exhaust emission standards for NOx from 0.2 g/bhp-hr to 0.02 g/bhp-hr.1 Also in 2016, NESCAUM requested that the Secretary of Energy incorporate research into advanced NOx reduction technologies in the Department of Energy (DOE) SuperTruck Program, given the substantial contribution heavy-duty trucks make to NOx pollution in the region.2 [EPA-HQ-OAR-2019-0055-1249-A1, pp. 1 - 2]

1. South Coast Air Quality Management District, et al. "Petition to EPA for Rulemaking to Adopt Ultra-Low NOx Exhaust Emission Standards for On-Road Heavy-Duty Trucks and Engines," June 3, 2016. Available at https://www.epa.gov/sites/production/files/2016-09/documents/petition_to_epa_ultra_low_nox_hd_trucks_and_engines.pdf. (accessed May, 12, 2022).

2. NESCAUM letter to Dr. E. Moniz, Secretary, U.S. Department of Energy, re: SuperTruck II Initiative, May 18, 2016. Available at http://www.nescaum.org/documents/nescaum-doe-supertruckii-nox-tech-lttr-20160518.pdf/.

EPA's response to the 2016 petition clearly acknowledges the importance of NOx reductions to the Northeast and other states.3 In addition, EPA's Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles—Phase 2 final regulation also detailed the importance of NOx reductions to the Northeast, stating that: EPA received compelling letters and comments from [NACAA, NESCAUM, OTC, and SCAQMD], explaining the critical and urgent need to reduce NOx emissions that significantly contribute to ozone and fine particulate air quality problems in their represented areas. The comments describe the challenges many areas face in meeting both the 2008 and recently strengthened 2015 ozone NAAQS. These organizations point to the significant contribution of heavy-duty vehicles to NOx emissions in their areas.4 [EPA-HQ-OAR-2019-0055-1249-A1, p. 2]

3. U.S. EPA, "Memorandum in Response to Petition for Rulemaking to Adopt Ultra-Low NOx Standards for On-Highway Heavy-Duty Trucks and Engines," December 20, 2016. Available at https://www.epa.gov/sites/production/files/2016-12/documents/nox-memorandum-nox-petition-response-2016-12-20.pdf (accessed April 25, 2022).

4. 81 Fed. Reg. 73478 (October 25, 2016), at 73523.

While it is now six years since EPA received the petition, NESCAUM welcomes this proposal to improve the emissions performance of on-road heavy-duty engines and vehicles. Below we describe the Northeast's need for EPA to promulgate a final rule that maximizes the pollution reductions achievable from these pollution sources. [EPA-HQ-OAR-2019-0055-1249-A1, p. 2]

The NESCAUM region includes the New York City (NYC) Combined Statistical Area (CSA) with over 20 million people living across portions of Connecticut, New Jersey, New York, and Pennsylvania. It is the largest CSA by population in the United States. While air pollution levels have dropped over the years across much of the United States, the NYC metropolitan area and surrounding regions continue to persistently exceed federal health-based air quality standards for ground-level ozone.[EPA-HQ-OAR-2019-0055-1249-A1, p. 2.]

For several decades, ozone concentrations in the Northeast trended downward due to the adoption of measures that reduce emissions of ozone precursors. In recent years, however, air quality monitoring data have shown a flattening trend. Figure 1 plots the number of days in

Connecticut where maximum 8-hour ozone was measured above the 2008 and 2015 ozone NAAQS for each year from 1976 to 2021. After significant improvements in the earlier years, the number of ozone exceedance days in Connecticut have remained level or have slightly increased since 2011. Similar patterns have been recorded in other parts of the Northeast Corridor. [EPA-HQ-OAR-2019-0055-1249-A1, pp. 3 - 4]

In addition to the stalling trend in ozone improvements, the New York-Northern New Jersey-Long Island ozone nonattainment area saw an unusually high peak 1-hour ozone average of 143 ppb in July 2018, a level not seen in the NYC region in more than 10 years. This ozone nonattainment area was classified as a serious nonattainment area for the 2008 ozone NAAQS, but failed to meet its attainment deadline of July 20, 2021. As a result, on April 13, 2022, EPA proposed reclassifying it from serious to severe nonattainment status. The NYC metro area will need additional pollution reductions to meet the 2015 NAAQS.10 [EPA-HQ-OAR-2019-0055-1249-A1, p. 4]

10. 87 Fed. Reg. 21825 (April 13, 2022).

Also on April 13, 2022, EPA proposed reclassifying the Greater Connecticut nonattainment area from marginal nonattainment for the 2015 ozone NAAQS to moderate. EPA also proposed to reclassify a number of other areas in the Northeast Corridor from marginal to moderate nonattainment status for the 2015 ozone NAAQS, including the nonattainment areas of Baltimore, MD; Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE; and Washington, DC-MD-VA.11 These areas failed to attain the 2015 ozone NAAQS by August 3, 2021, as required for marginal classifications, and similarly to the NYC reclassification for the 2008 ozone NAAQS, these areas will need additional pollution reductions, particularly from NOx emission sources, in order to meet the 2015 ozone NAAQS. [EPA-HQ-OAR-2019-0055-1249-A1, pp. 4 - 5.]

11. 87 Fed. Reg. 21842 (April 13, 2022).

Figure 1 also includes an extensive list of requirements that have been adopted by Connecticut and other states in the NESCAUM region to reduce emissions of ozone precursors from stationary sources, area sources, fuels, mobile sources, and consumer products. Imposing further control requirements on many of these source categories can be more costly than controlling heavy-duty engine emissions and create disproportionate economic burdens for those sources. For example, estimates of the costs for additional NOx controls on industrial, commercial, and institutional boilers that are 100 million British Thermal Units per hour in size range from $2,700 to $21,000 per ton of NOx reduced as compared to a cost range of $1,000 to $5,000 per ton of NOx reduced from heavy-duty vehicles (HDVs).12,13 [EPA-HQ-OAR-2019-0055-1249-A1, p. 5]

12. OTC/Lake Michigan Air Directors Consortium (LADCO), “Evaluation of Control Options for Industrial, Commercial and Institutional (ICI) Boilers,” May 2010.

13. Manufacturers of Emission Controls Association, “Technology Feasibility for Heavy-Duty Diesel Trucks in Achieving 90% Lower NOx Standards in 2027,” February, 2020. Available at https://www.meca.org/wp-content/uploads/resources/MECA_2027_Low_NOx_White_Paper_FINAL.pdf (accessed May 12, 2022).

In 2018, NESCAUM launched the Long Island Sound Tropospheric Ozone Study (LISTOS) to investigate the evolving nature of ozone formation and transport in the NYC region and downwind. LISTOS involves a large group of researchers from state and federal agencies and academia that bring a diverse set of resources, expertise, and instrumentation skills. LISTOS has provided detailed imagery and data on ozone and its precursors in the Northeast. To illustrate the relative scale of NOx emissions during the LISTOS effort, Figure 2 readily shows enhanced nitrogen dioxide (NO2) concentrations (NO2 is a major component of NOx) observed by satellite along the Northeast Corridor during the 2018 ozone season, with the highest weekday (Mon-Fri) NO2 concentrations in the New York City area. Much of this NO2 is associated with transportation sources, and these mobile source sectors are projected to continue to be significant contributors to ozone in future years.14 [EPA-HQ-OAR-2019-0055-1249-A1, p. 5]

14. Zawacki, M., et al., “Mobile source contributions to ambient ozone and particulate matter in 2025.” Atmos. Envt. 188: 129-141 (2018).

Figure 3 shows satellite imagery of NO2 emissions in the Northeast and Mid-Atlantic on a single day in February during the 2019 winter. In addition to region-wide stagnation on this particular day, the strength of the NO2 signal also reflects the longer NO2 lifetime in winter. NO2 levels are abundant and dominant along transportation corridors and in large cities across the region, again indicating a strong mobile source NOx contribution. [EPA-HQ-OAR-2019-0055-1249-A1, p. 5]

The NO2 levels shown in Figure 3 align with the road major arteries where goods are being transported by truck from the ports of New York, Baltimore, and Philadelphia. Note also how clearly defined the area of red is along Interstate 91 in central Connecticut and Massachusetts. [EPA-HQ-OAR-2019-0055-1249-A1, p. 7]

To address the region’s persistent air quality problems, reducing NOx emissions from heavy-duty vehicles is of the utmost importance due to its role in local and regional ground-level ozone formation, as well as its contributions to PM2.5 (especially in the winter). As shown in Figure 4, on-road diesel vehicles, including HDVs, are the third largest NOx emissions source in the Northeast.15 [EPA-HQ-OAR-2019-0055-1249-A1, p. 7]

15. National Emissions Inventory Collaborative, “2016v1 Emissions Modeling Platform,” 2019. Retrieved from http://views.cira.colostate.edu/wiki/wiki/10202.

Absent adoption of stringent new engine NOx standards, emissions from HDVs will increase in the future as truck ton miles travelled is projected to increase by approximately 30 percent over the next 25 years (Figure 5). This growth in activity, if not counteracted by increased stringency of new engine and vehicle emissions standards, will result in significantly increased HDV emissions. We also note that highway trucks often travel long distances and can be registered in states far from where they operate. Therefore, a strong national program is needed to reduce highway truck emissions and maximize public health benefits in the Northeast and nationally. [EPA-HQ-OAR-2019-0055-1249-A1, pp. 7 - 8]

Due to the importance of heavy-duty vehicles to the overall NOx inventory, states in the Northeast have for decades measured, quantified, modeled, and published information on heavy-duty vehicle emissions in the region and articulated the need for further heavy-truck NOx reductions. Independently, and collaboratively with EPA and industry, states have conducted in-use emissions testing and data logging, implemented early heavy-truck periodic and roadside inspection and maintenance programs, and piloted technologies to reduce emissions from HDVs. In 2020, NESCAUM coordinated the signing of the Multi-state Medium- and Heavy-Duty Zero Emission Vehicle (MHD ZEV) Memorandum of Understanding (MOU) through the Multi-state ZEV Task Force.18 Pursuant to the MHD ZEV MOU, 17 states, the District of Columbia, and the Canadian province of Quebec are working collaboratively to accelerate electrification of MHD trucks and buses to eliminate harmful emissions from these vehicles. Their collective goal is to ensure that 100 percent of all new truck and bus sales are ZEVs by no later than 2050, with an interim target of at least 30 percent by 2030. To provide a framework for meeting these goals, the participating jurisdictions, working through the Multi-State ZEV Task Force facilitated by NESCAUM, have developed a draft MHD ZEV Action Plan. [EPA-HQ-OAR-2019-0055-1249-A1, p. 8]

> 18. Multi-state Medium- and Heavy-Duty Zero Emission Vehicle Memorandum of Understanding (announced July 14, 2020, most recent state signing on March 29, 2022). Available at https://www.nescaum.org/documents/mhdv-zev-mou-20220329.pdf.

Organization: *Ozone Transport Commission (OTC) and Mid-Atlantic/Northeast Visibility Union (MANE-VU)*

Millions of OTR residents live in areas that violate the ozone NAAQS. Many areas of the OTR are designated as in nonattainment with the 2015 8-hour average ozone NAAQS of 70 parts per billion (ppb) (Figure 1). These nonattainment areas are struggling to achieve the 2015 ozone NAAQS, and on April 13, 2022, EPA proposed reclassifying a number of them from 'marginal' to 'moderate' nonattainment status for the 2015 ozone NAAQS, including Baltimore, MD; Greater Connecticut; Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE; and Washington, DC-MD-VA.4 These areas failed to attain the 2015 ozone NAAQS by August 3, 2021, as required for 'marginal' classifications, and will need additional pollution reductions, particularly for NOx, in order to meet the 2015 ozone NAAQS. [EPA-HQ-OAR-2019-0055-1250-A1, p.2]

> 4 87 Fed. Reg. 21842 (April 13, 2022).

The OTR also includes the New York City (NYC) Combined Statistical Area (CSA). With over 20 million people, it is the largest CSA by population in the United States. It not only violates the 2015 ozone NAAQS, but also the less stringent 2008 8-hour ozone NAAQS of 75 ppb. On April 13, 2022, EPA proposed to reclassify the New York City/Long Island-Northern New Jersey-

Southwest Connecticut area from ‘serious’ to ‘severe’ nonattainment because it failed to meet its ‘serious’ attainment deadline of July 20, 2021.5 This large metropolitan area will need additional pollution reductions to achieve both the 2008 and 2015 ozone NAAQS levels. [EPA-HQ-OAR-2019-0055-1250-A1, p.2]

5 87 Fed. Reg. 21825 (April 13, 2022).

The Clean Air Act requires ozone NAAQS attainment as ‘expeditiously as practicable,’ and EPA’s proposed Options 1 and 2 do not meet this requirement. The introduction of effective and available heavy-duty engine and vehicle pollution reduction technologies will assist jurisdictions in the OTR in reaching attainment of the ozone standards. This is the most ‘expeditiously as practicable’ path called for by the Clean Air Act and anything less than this will not be acceptable. [EPA-HQ-OAR-2019-0055-1250-A1, p.13]

Parts of the OTR continue to experience persistently high ozone levels affecting tens of millions of people. While air pollution levels have dropped over the years across much of the United States, the portions of the OTR listed in Table 2 continue to persistently exceed both past and recently revised federal health-based air quality standards for ground-level ozone. [EPA-HQ-OAR-2019-0055-1250-A1, p.4]

Organization: *Pennsylvania Chamber of Business and Industry*

The PA Chamber recognizes substantial NOx reductions may be achievable through cost-effective controls on the heavy-duty mobile source sectors, which according to EPA data is responsible for approximately 17% of nationwide NOx emissions. EPA and the Pennsylvania Department of Environmental Protection have noted the significant reductions in both direct emissions of NOx (an ozone precursor) and recorded ambient air quality readings of ozone across the state that have occurred over the past two decades. This is the product of technological innovation and efficiency measures being deployed by industry in conjunction with a predictable regulatory environment from state and federal regulators. Despite this progress, as major point sources of criteria emissions, Pennsylvania’s industrial and manufacturing facilities remain under substantial regulatory pressure. While almost the entirety of the state is in compliance with the 2015 ozone standard, a few counties remain in non-attainment. These counties are situated in close proximity to major interstate corridors. Given that mobile sources are responsible for approximately half of NOx emissions in Pennsylvania, according to EPA estimates, and that EPA has not updated heavy truck NOx standards in nearly two decades, it is certainly timely to move forward with a collaborative process to address achievable reductions. We believe a workable, cost-effective heavy-trucking rule can facilitate attainment for the few regions of the state that are above federal ozone NAAAQS goals. As a result, the operating environment for all of Pennsylvania’s industries can be improved, coinciding with an improvement in air quality. [EPA-HQ-OAR-2019-0055-1319-A1, p.2]

Organization: *San Joaquin Valley Air Pollution Control District (District)*

Despite achieving significant emissions reductions through decades of implementing the most stringent stationary and mobile regulatory control program in the nation, significant additional reductions in nitrogen oxide (NOx) emissions are needed to attain the latest health-based National Ambient Air Quality Standards (NAAQS) for ozone and PM2.5. [EPA-HQ-OAR-2019-0055-1291-A1, p.1]

NOx is the main precursor pollutant contributing to the formation of both ozone and secondary PM2.5 in the Valley. The District has jurisdiction over stationary and area sources, which now make up less than 15% of the total NOx emissions inventory. In contrast, over 85% of the Valley's NOx emissions come from mobile sources under federal jurisdiction, with heavy-duty trucks being the single largest NOx emissions source. While the District will continue to review all existing stationary source categories and regulations for additional emission reduction opportunities, attaining the federal standards is not possible without significant reductions in emissions from mobile source categories. Failure to meet the federal Clean Air Act NAAQS requirements would lead to devastating public health and economic consequences for the San Joaquin Valley. [EPA-HQ-OAR-2019-0055-1291-A1, p.2]

Federal action to reduce emissions is critical if we are to attain the NAAQS. It is clear that without significant progress in reducing mobile source emissions, especially at the federal level, it will be extremely difficult if not impossible to meet our air quality mandates. Absent strong federal action, extreme nonattainment areas such as the San Joaquin Valley face Clean Air Act penalties and sanctions due to mobile source emissions under federal jurisdiction. [EPA-HQ-OAR-2019-0055-1291-A1, p.2]

Organization: *South Coast Air Quality Management District*

The South Coast AQMD is the agency responsible for improving air quality in the South Coast Air Basin (Basin), a region in Southern California with 17 million residents that EPA has designated extreme nonattainment for ozone pollution. As a result of the Basin's historical and ongoing air quality challenges, EPA rulemaking to secure further reductions of emissions from heavy-duty truck engines is a matter of exceptional urgency for the District. In 2016, the District, allied with multiple other local air quality planning agencies, petitioned EPA for rulemaking to adopt ultra-low NOx standards for heavy-duty trucks and engines.1 [EPA-HQ-OAR-2019-0055-1201-A1, p.1]

> 1 South Coast AQMD, 2016 Petition for Rulemaking, available at https://www.epa.gov/sites/default/files/2016-09/documents/petition_to_epa_ultra_low_nox_hd_trucks_and_engines.pdf.

The South Coast Air AQMD is the regional agency responsible for control of air pollution from non-vehicular sources in the South Coast Air Basin (Basin).4 Specifically, the South Coast AQMD has jurisdiction over an area of approximately 10,743 square miles, consisting of the Basin, and the Riverside County portions of the Salton Sea Air Basin and Mojave Desert Air Basin. The Basin, which encompasses all of Orange County in addition to the non-desert portions of Los Angeles, Riverside, and San Bernardino Counties, is home to over 17 million people and approximately 11 million motor vehicles.5 The Basin has also experienced rapid growth over the course of the past century. The population of the region is expected to see continued growth through 2023 and beyond.6 The meteorology, topography, and climate of the

Southern California region combine to create a concentration of high air pollution potential in the Basin.7 Additionally, the four counties of the Basin comprise one of the largest and fastest-growing local economies in the United States, with rapid growth in the shipping, trade, service, and logistics sectors. [EPA-HQ-OAR-2019-0055-1201-A1, p.2]

4 See Cal. Health & Safety Code Sections 40410 & 40412.

5 South Coast AQMD, Multiple Air Toxics Exposure Study V, Final Report (August 2021), available at http://www.aqmd.gov/docs/default-source/planning/mates-v/mates-v-final-report-9-24-21.pdf?sfvrsn=6, pg. 1-2.

6 South Coast AQMD, 2016 Air Quality Management Plan, available at http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2016-air-quality-management-plan/final-2016-aqmp/final2016aqmp.pdf?sfvrsn=15, pg. 1-5, Figure 1-3.

7 See e.g. South Coast AQMD, Overview of 2022 Air Quality Management Plan (2022 AQMP Overview) (March 4, 2022), available at http://www.aqmd.gov/docs/default-source/Agendas/Governing-Board/2022/2022-Mar4-020.pdf?sfvrsn=6, Slide 3 (Ozone Trends in the South Coast Air Basin).

The combined impact of air quality control programs at the local, state, and federal levels have provided significant reductions in emissions of harmful pollutants over time. As a consequence of regulations and efforts enacted to date, ozone planning inventory emissions are projected to be 379 tons per day (tpd) of VOC and 255 tpd of NOx by 2023.8 By 2031, emissions are projected to be further reduced to approximately 362 tpd of VOC and 214 tpd of NOx.9 Total NOx emissions in the Basin will have been reduced by nearly 51% between 2012 and 2023 due to state and local efforts alone. However, reaching attainment in 2023 without corresponding reductions from federal sources would require total elimination of nearly all AQMD and CARB regulated sources. This is neither reasonable nor feasible. It is simply not possible for State and local reductions to attain National Ambient Air Quality Standards (NAAQS) for ozone without reductions from federal sources. The Basin is in extreme nonattainment for the 8-Hour Ozone (2015) NAAQS.10 [EPA-HQ-OAR-2019-0055-1201-A1, pp. 4-5]

8 Id. at Slides 5-6 (Key Pollutants for Ozone Attainment & NOx Emissions and Reduction Goals).

9 Id.

10 EPA, 8-Hour Ozone (2015) Nonattainment Areas, available at https://www3.epa.gov/airquality/greenbook/jnc.html.

For the 1997 ozone standard alone, the Basin needs a total of 67-69 tpd of NOx reductions from federally-regulated sources by 2023 in order to meet its attainment goals on time. In fact, it is projected that the Basin will need a 45% reduction in NOx emissions beyond existing regulations by 2023, a 55% reduction by 2031. Emissions must be reduced to a carrying capacity of 141 tpd by 2023.11 As a result, the Basin must reduce expected 2023 emissions by 128 tpd. The region also needs approximately 54 tpd of NOx reductions from federally-regulated sources by 2037 to attain the 2015 standard. Overall, emissions must be reduced by 72% beyond the 220 tpd baseline NOx emissions in 2037 to achieve the 62.8 tpd carrying capacity.12 [EPA-HQ-OAR-2019-0055-1201-A1, p.5]

11 South Coast AQMD, Final Contingency Measure Plan (2019), available at https://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2016-air-quality-management-plan/1997-ozone-contingency-measure-plan/1997-8-hour-ozone-draft-contingency-measure-plan---100819.pdf?sfvrsn=10, pg 17.

12 2022 AQMP Overview at Slides 5 & 6 (Key Pollutants for Ozone Attainment & NOx Emissions and Reduction Goals).

Per California's EMission FACtors (EMFAC) 2021 emissions inventory model, nearly two million heavy duty vehicles operate in California each year. These include long-haul trucks, transit buses, and drayage trucks, which are a significant source of NOx emissions. In California alone, these sources account for 31% of all statewide NOx emissions.13 Existing mobile source programs are expected to reduce NOx emissions by over 50% in the Basin by the 2031.14 Still, on-road heavy-duty vehicles will remain one of the largest contributors to the state's NOx emissions inventory as well as a sizeable portion of the Basin's emissions inventory.15 As noted in the EPA's Notice of Proposed Rulemaking (NPRM), heavy-duty engines are expected to represent 32% of mobile source NOx emissions in Calendar Year (CY) 2045 and 89% of the on-road NOx inventory in CY 2045.16 [EPA-HQ-OAR-2019-0055-1201-A1, p.5]

13 CARB, Omnibus Regulation, Initial Statement of Reasons for Rulemaking (ISOR) (2020), available at https://ww2.arb.ca.gov/sites/default/files/barcu/board/rulemaking/hdomnibuslownox/fsor.pdf, pg. ES-2, Figure ES-1.

14 Id.

15 Id. at ES-2; see also 2022 AQMP Overview at Slide 8 (NOx Reductions Needed for Attainment).

16 87 Fed. Reg. at 17418.

California is not alone in its need for more stringent regulation of NOx emissions. For instance, during public testimony on the NPRM, the Northeast States for Coordinated Air Use Management indicated that a significant portion of its region, which covers New England, New York, and New Jersey, 'struggles to comply' with the 2008 8-hour ozone standard.17 The National Association of Clean Air Agencies also testified that over a third of the nation's population lives in areas of the country designated non-attainment for the ozone NAAQS, while 'many others live in areas just on the cusp of non-attainment.'18 Testimony from Maryland's Department of the Environment indicated that although the state has taken aggressive measures to meet its air quality goals, including adoption of California's Light-Duty Vehicle Emission Program, a majority of the population continues to reside in areas designated as non-attainment for the 2015 ozone standard, with a significant additional portion of the state set to be bumped up to non-attainment status this year.19 Echoing similar sentiments, the Oregon Department of Environmental Quality noted that in spite of adoption of several more stringent California rules, increases in ozone concentrations are likely, with Oregon at risk of losing its attainment status in several communities.20 Numerous other examples exist but the sentiment remains the same – a strong nationwide low-NOx standard is essential. [EPA-HQ-OAR-2019-0055-1201-A1, pp.5-6]

17 EPA, Proposed Rule and Related Materials for Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, Virtual Hearing Transcript (Day 3 Testimony), (April 14, 2022), available at https://www.epa.gov/system/files/documents/2022-04/hd-2027-stds-public-hearing-transcript-2022-04-14-day3.pdf, pg. 74, lines 3-7.

18 Day 1 Testimony, (April 12, 2022), available at https://www.epa.gov/system/files/documents/2022-04/hd-2027-stds-public-hearing-transcript-2022-04-12-day1.pdf, pg. 35, lines 3-7.

19 Day 2 Testimony (April 13, 2022), available at https://www.epa.gov/system/files/documents/2022-04/hd-2027-stds-public-hearing-transcript-2022-04-13-day2.pdf, pg. 16, line 22 - pg. 17, lines 1-11.

20 Id. at pg. 196, lines 15-22.

Organization: *States of California, et al. (The States)*

As stated, heavy-duty engines are a significant source of inhalable particulate matter PM2.5 and NOx emissions in the country. The CAA requires EPA to set and regularly review and revise federal health-based ambient air quality standards for "criteria pollutants," including PM2.5, NOx, and ground-level ozone.28 These National Ambient Air Quality Standards (NAAQS) aim to provide States with achievable goals to protect the health of their residents from air pollution resulting from emissions of criteria air pollutants and precursors. The NAAQS for ozone, established in 2015 and retained in 2020, is an 8-hour standard with a level of 70 parts per billion, although EPA recently announced that it may reconsider the previous administration's decision to retain the ozone NAAQS.29 EPA is also implementing the previous 8-hour ozone standard, set in 2008 at a level of 75 parts per billion. For PM2.5, there are two NAAQS that were set in 1997, revised in 2006 and 2012, and retained in 202030: an annual standard (12.0 micrograms per cubic meter) and a 24-hour standard (35 micrograms per cubic meter). [EPA-HQ-OAR-2019-0055-1255-A1, pp. 9 - 10]

28. 42 U.S.C. §§ 7408-7409.

29. See EPA, "EPA to Reconsider Previous Administration's Decision to Retain 2015 Ozone Standards," available at https://www.epa.gov/ground-level-ozone-pollution/epa-reconsider-previous-administrations-decision-retain-2015-ozone.

30. On June 10, 2021, EPA announced that it will reconsider the previous administration's decision to retain the PM NAAQS. See Press Release, EPA, EPA to Reexamine Health Standards for Harmful Soot that Previous Administration Left Unchanged (June 10, 2021), available at https://www.epa.gov/newsreleases/epa-reexamine-health-standards-harmful-soot-previous-administration-left-unchanged.

Depending on whether the air quality in an area meets the NAAQS for a particular pollutant, EPA designates the area as being in "attainment" or "nonattainment." EPA further classifies areas that are in nonattainment according to the severity of their air pollution problem, and areas with more severe pollution levels are given more time to meet the standard while being subject to more stringent control requirements under State Implementation Plans. [EPA-HQ-OAR-2019-0055-1255-A1, p. 10]

As of May 31, 2021, there were 34 ozone nonattainment areas for the 2008 ozone NAAQS and 50 ozone nonattainment areas for the 2015 ozone NAAQS, which amounts to 122 million people living in ozone nonattainment areas.31 Sixteen of the 8-hour ozone nonattainment areas are located in California and the only two extreme nonattainment areas in the nation are located in the South Coast Air Basin and San Joaquin Valley of California.32 Indeed, for the South Coast Air Basin to meet the federal ozone standards, overall NOx emissions need to be reduced by 70 percent from today's levels by 2023, and approximately 80 percent by 2031.33 The Greater Connecticut and New York-Northern New Jersey-Long Island ozone nonattainment areas failed to meet the deadline for moderate nonattainment of the 2008 ozone NAAQS and were re-designated to serious nonattainment status for that NAAQS. These areas must now meet the attainment date of 2021 for the 2008 standard. Many areas of the country are also currently in nonattainment for the PM2.5 NAAQS standards, and as of May 31, 2021, more than 32 million people live in PM2.5 nonattainment areas.34 [EPA-HQ-OAR-2019-0055-1255-A1, p. 10]

31. Draft RIA at § 6.1.1.

32. 2016 State Strategy for the State Implementation Plan for Federal Ozone and PM2.5 Standards (Cal. SIP Strategy), available at https://ww2.arb.ca.gov/resources/documents/2016-state-strategy-state-implementation-plan-federal-ozone-and-pm25-standards.

33. CARB, Staff Report, Initial Statement of Reasons – Public Hearing to Consider the Proposed Heavy-Duty Engine and Vehicle Omnibus Regulation and Associated Amendments, at II-2 (June 23, 2020), EPA-HQ-OAR-2019-0055-0632 ("Omnibus ISOR").

34. Draft RIA at § 6.1.1.

Given the extraordinary challenges that California and many States are facing to attain and maintain ozone and PM2.5 NAAQS, substantial emission reductions beyond those currently being achieved by state regulatory programs are critically necessary. Reducing emissions from heavy-duty vehicles will help States attain and maintain NAAQS for these pollutants.

According to California's EMission FACtors (EMFAC) 2017 emissions inventory model, almost a million heavy-duty vehicles operate on California roads each year and contribute 31 percent of all statewide NOx emissions.35 In the South Coast Air Basin, heavy-duty vehicles are responsible for 32 percent of mobile source NOx emissions.36 In New York, medium and heavy-duty vehicles are responsible for 52 percent of the NOx and 45 percent of the PM2.5 emitted by on-road vehicles. Further, regulating only heavy-duty engines certified for use in California and other States is not sufficient because heavy-duty vehicles play an important role in the transport of goods for interstate commerce and frequently cross state borders.37 Therefore, the Proposed Rule would assist States with attaining and maintaining the NAAQS, and ease the burden on nonattainment areas that already have stringent state and local regulations.38 [EPA-HQ-OAR-2019-0055-1255-A1, pp. 10 - 11]

35. Omnibus ISOR at ES-1.

36. CARB, Measures for Reducing Emissions from On-Road Heavy-Duty Vehicles (June 3, 2021) available at http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2022-air-quality-management-plan/heavy-duty-trucks-presentations-06-03-21.pdf?sfvrsn=8 (last accessed May 16, 2022).

37. See Omnibus ISOR at ES-17.

38. See Draft RIA at § 6.1.2

The emission reductions achieved by Option 1 are also critical for States seeking to attain and maintain the NAAQS for ozone and PM2.5. For example, given California's extraordinary challenges in attaining both the ozone and PM2.5 NAAQS, its state implementation plan is designed with stringent emissions reductions across all sources. But even with the expected emission reductions from California's mobile source programs, on-road heavy-duty vehicles are projected to remain one of the largest contributors to the state's NOx emissions inventory.64 And operators in many States, including in California, purchase used heavy-duty vehicles that have been certified to meet federal, not state, standards. Indeed, federally certified heavy-duty vehicles account for over half of the total miles traveled by heavy-duty vehicles in California.65 For the heaviest vehicles (Class 8 vehicles over 33,000 pounds GVWR), over 60 percent of vehicle miles traveled in California are by federally certified heavy-duty vehicles.66 Thus, the adoption of Option 1 is critical to provide the maximum emission reductions necessary for California and other States to attain and maintain the NAAQs for ozone and PM2.5. [EPA-HQ-OAR-2019-0055-1255-A1, p. 15]

64. Omnibus ISOR at ES-2.

65. Omnibus ISOR at ES-17.

66. Id.

Organization: *Western States Air Resources Council (WESTAR)*

Mobile emissions represent approximately 65% of the current NOx inventory in the 13 contiguous WESTAR states. For clarification, mobile sources include on-road, non-road, rail, and commercial marine. Comparatively, oil and gas sources contribute 11.7% and electrical generating units contribute 9.1%. For additional perspective, percentage contributions from all source sectors are shown in Figure 1. The Western states projected that the mobile source NOx emissions will still comprise 44.5% of the western inventory in 2028. Most of the reductions in this sector will come from the Tier 3 Motor Vehicle Emission and Fuel Standards program established in 20142. However, the Tier 3 program is projected to be fully implemented by 2025 and it is important to continue reducing mobile source emissions to reduce particulate matter and ozone concentrations in the west. Additional mobile source emissions reductions will be necessary for western states to continue to improve visibility in Class I areas as well. Of the 156 Mandatory Class I Federal areas, 118 (75 percent) are in the West. Western states have made considerable progress in controlling stationary source emissions. Mobile source emission reductions must be accomplished at a similar pace. Reductions in emissions that can be controlled are particularly important as catastrophic wildfire smoke impacts western states with increasing severity and frequency. A recent study by the National Center for Atmospheric Research shows that the increase in wildfires has begun to reverse the last ten years of clean air gains and is changing the annual pattern of air quality in North America.3 [EPA-HQ-OAR-2019-0055-1230-A1,pp.1-3]

> 2 WRAP Technical Support System (TSS); The Western Regional Air Partnership (WRAP) and the Cooperative Institute for Research in the Atmosphere (CIRA), 19 Apr 2022, http://views.cira.colostate.edu/tssv2
>
> 3 Buchholz, R.R., Park, M., Worden, H.M. et al. New seasonal pattern of pollution emerges from changing North American wildfires. Nature Communications 13, 2043 (2022). https://doi.org/10.1038/s41467-022-29623-8

One of EPA's stated goals with this proposed rule is to help states comply with the ozone NAAQS and improve visibility as part of the Regional Haze program. The proposal states that "The proposed Option 1 standards would significantly decrease ozone concentrations across the country, with a population- weighted average decrease of over 2 ppb in 2045.4 " In terms of emissions reductions, EPA estimates that Option 1 would reduce NOx emissions from heavy-duty vehicles in 2040 by more than 50 percent and by 60 percent in 2045. Most nonattainment areas for the 2008 and 2015 ozone NAAQS are required to attain the standard within the next six years (2028). While the proposed emission reductions are welcome, they will be too late to impact current ozone nonattainment areas and won't prevent the short-term transport of pollution throughout the western states. For this reason, we encourage EPA to find ways to foster quicker adoption of heavy-duty engine controls and technology within the industry through incentives and the proposed early adoption credits. [EPA-HQ-OAR-2019-0055-1230-A1,pp.3-4]

> [4] Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, 87 Fed Reg. 17427 (March 28, 2022)

Organization: *Wisconsin Department of Natural Resources (WDNR)*

This proposed rule would provide critical relief to Wisconsin's ozone nonattainment areas by reducing NOx emissions from heavy-duty trucks by up to 90%. [EPA-HQ-OAR-2019-0055-1162-A1, p. 1]

Wisconsin's Lake Michigan shoreline experiences complex, persistent ozone issues due to a combination of emissions, meteorology, and geography. As a result, Wisconsin's lakeshore has historically struggled to attain federal ozone standards, and the state currently has multiple areas in nonattainment of the 2015 ozone standard. Ensuring Wisconsin can attain current and future ozone National Ambient Air Quality Standards (NAAQS) requires a long-term, multi-sector strategy that reduces region-wide NOx and VOC emissions. Since Wisconsin does not have the authority to regulate emissions from on-road sources, the state relies upon federal action to reduce NOx and VOC emissions from this sector. It is therefore crucial that EPA exercise its authority to develop and implement the most stringent, technically feasible NOx standards for all mobile sources, including heavyduty vehicles. [EPA-HQ-OAR-2019-0055-1162-A1, p. 1]

The on-road mobile sector is the largest contributor of NOx emissions in Wisconsin, with the 2017 National Emissions Inventory reporting that the on-road mobile sector accounted for 38% of the NOx inventory in Wisconsin; this percentage is typical of other states in the region.1 Heavy-duty diesel vehicles constitute nearly half of the emissions from that sector, a sector only the federal government is able to regulate. Additionally, recent ozone modeling done by the Lake Michigan Air Directors Consortium indicates on-road diesel vehicles, most of which are heavy-duty vehicles, contribute up to 8 parts per billion or 11% of ozone at Wisconsin's lakeshore nonattainment monitors. EPA's air quality modeling done to support this proposal shows Sheboygan County would remain in nonattainment through at least 2045 without this rule, 30 years after the standard was promulgated. [EPA-HQ-OAR-2019-0055-1162-A1, pp. 1 - 2]

1. 2017 National Emissions Inventory

Wisconsin's ozone nonattainment areas are located downwind of major population centers, including transportation and freight hubs that are a significant source of heavy-duty vehicle emissions, the vast majority of which originate outside of Wisconsin. Based on EPA's recent transport modeling, Wisconsin contributes only 8- 16 percent of the ozone in its own nonattainment areas while other states directly contribute between 42-48 percent of the ozone to these areas. A comprehensive federal rule to address heavy-duty NOx emissions is therefore needed to reduce upwind state emissions from this sector and help Wisconsin meet its attainment obligations. [EPA-HQ-OAR-2019-0055-1162-A1, p. 2]

EPA Summary and Response

Summary:

Commenters stated that the emissions reductions from this rule are needed to reduce ozone concentrations and attain and maintain the ozone NAAQS. Commenters indicated that NOx emissions are driving their ozone concentrations and that heavy-duty trucks are significant contributors to the NOx emissions and ozone concentrations in their areas, including heavy-duty traffic associated with freight movement and ports. Commenters mentioned that satellite data is helping illustrate the onroad NOx emissions which contribute to ozone and PM concentrations. Commenters also described the contribution to their ozone from NOx emissions from heavy-duty trucks from upwind states, and a commenter from California pointed out that most of the trucks on roads in the state are registered in other states, so this rule is important to their attainment plans. Several states and other organizations noted that other cost-effective state and local regulatory options for reducing emissions of NOx have been exhausted and remaining options are less cost-effective than federal heavy duty vehicle standards. Some commenters also noted that additional NOx emission reductions will help them demonstrate transportation conformity.

Several commenters highlighted that their area is in the process of having their ozone classification bumped up, meaning that they are not able to meet the ozone NAAQS by their attainment deadline. Commenters specifically noted that EPA proposed to bump up 30 areas that were not attaining the 2008 and 2015 ozone NAAQS in April 2022. Commenters said that reductions in NOx emissions from heavy-duty vehicles will help those areas as well as other areas struggling to maintain the ozone NAAQS. A commenter noted that EPA was required to use modeling to help put into place more stringent standards so that areas would actually attain the NAAQS as expeditiously as possible. Another commenter felt that EPA should optimize the emission reductions needed from HD on-road vehicles to ensure attainment of the ozone and $PM_{2.5}$ NAAQS within the deadlines established by the CAA.

One commenter mentioned that much of the country has NOx-limited chemistry, which means that reductions of NOx are needed to reduce ozone, and that in some East Coast areas reducing one pound of NOx leads to reductions of greater than one pound of ozone. Another commenter highlighted that even ozone concentrations below the level of the standard contribute to risk of premature death in sensitive populations.

Numerous commenters mentioned that EJ communities are located in nonattainment areas or areas at risk of becoming nonattainment areas. A commenter noted that NAAQS monitors are often not cited to protect EJ communities and that makes it difficult to understand their risk and suggested that EPA should include in the rule additional requirements for increased air monitoring for pollutants of concern near transportation corridors in overburdened communities to document whether these existing and proposed regulatory approaches are working.

A commenter also stated that EPA is currently reconsidering the ozone NAAQS, and that regardless of whether the standard is strengthened, many areas across the country need NOx reductions just to meet the current standards and provide clean air to their citizens. Commenters also noted that NOx reductions are important for decreasing PM concentrations and meeting the PM NAAQS as well. One commenter mentioned that EPA is currently reconsidering the PM NAAQS as well and CASAC has recommended making the standards more protective. A few commenters provided satellite data showing NO_2 concentrations along highways and illustrating how NO2 emissions have a longer lifetime in winter and can contribute to PM and visibility concerns in the winter. Commenters pointed out that reducing emissions of NOx can help reduce ozone concentrations in the summertime and $PM_{2.5}$ concentrations in the wintertime as well as helping improve visibility. Commenters concerned with meeting the ozone and $PM_{2.5}$ NAAQS asked for the most stringent and timely rule possible. A commenter noted that the rule is needed for ozone attainment but that there is also need for flexibilities. A commenter also stated that zero emission standards are needed to help all areas of the country attain the NAAQS and that EPA should analyze more stringent alternatives.

Response:

EPA agrees that reductions in NOx are generally necessary to attain and maintain the ozone and $PM_{2.5}$ NAAQS across the country and that NOx reductions will help with other CAA responsibilities like the regional haze rule and transportation conformity. EPA also agrees that monitoring is important to helping EPA and the general public understand the quality of the air they are breathing and its potential impacts on their health. The comments requesting additional monitoring are outside the context of this specific rule, which is more narrowly focused on setting emission standards under CAA section 202. The monitoring objectives, requirements, and network design criteria for Ozone, PM, NO_2, and CO are specified in 40 CFR part 58 appendix D. Monitoring objectives include providing data to the general public in a timely manner, supporting compliance with the NAAQS, and providing data for research purposes. The monitoring requirements include monitoring sites that serve a variety of needs and are often higher than EPA's minimum requirements provide. In addition to the existing regulatory network, EPA is improving ambient air quality monitoring for communities with American Rescue Plan funds (see https://www.epa.gov/arp/enhanced-air-quality-monitoring-funding-under-arp).

This final rule will reduce emissions from heavy-duty engines that contribute to ambient levels of ozone, PM, NO_X, and CO, which are all pollutants for which EPA has established health-based NAAQS, and we agree that there is a significant need for the emissions reductions, air quality improvements, and health benefits provided by this final rule. As documented in our RIA for this final rule (Chapters 5 and 6) and described in the Preamble (Sections VI and VII), the HD2027 program will significantly reduce heavy duty truck emissions, leading to significant air quality improvements and helping state and local areas attain and maintain the existing health-based air quality standards in a cost-effective and timely way.[3]

In setting heavy-duty highway engine emission standards for NO_X, PM, HC, and CO, Clean Air Act section 202(a)(3)(A) requires EPA to set standards that ''reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology.'' EPA's authority to set such standards must be based on appropriate consideration of these specified factors, and EPA has fully analyzed and explained the basis for the final standards under this authority, as discussed further in the Preamble (Sections I and III). We recognize and acknowledge the concerns raised by several commenters related to attaining and/or maintaining the NAAQS. As discussed in this section and preamble Section VII, we

[3] In response to the commenter requesting that EPA include in this final action direction to states that would encourage collaborative management of mobile emissions from heavy duty trucks, we note that such direction is outside the scope of this final rule; however, as discussed in this section and preamble Section VII, we expect the air quality improvements of this rulemaking to be widespread across the country.

expect this final rule to result in widespread reductions in ozone and PM, which will assist many areas across the country with NAAQS attainment or maintenance. However, the amount of reductions necessary for each area to attain the NAAQS is not a factor used to determine the stringency of heavy-duty engine emissions standards.

States with ozone and $PM_{2.5}$ nonattainment areas are required to take action to bring those areas into attainment. Since this rule will reduce emissions of NOx from trucks across the country, this rule will help states and municipal areas in their efforts to attain the ozone and $PM_{2.5}$ NAAQS "as expeditiously as practicable" and may relieve areas with already stringent local regulations from some of the burden associated with adopting additional local controls. The final rule could also assist counties with ambient concentrations near the level of the ozone and $PM_{2.5}$ NAAQS who are working to ensure long-term attainment or maintenance of the ozone and $PM_{2.5}$ NAAQS. The air quality modeling done for the proposed rule illustrates the impact on projected concentrations of ozone and $PM_{2.5}$. Our air quality modeling indicates this action will meaningfully decrease ozone concentrations in many areas of the country. Furthermore, numerous state air quality agencies and organizations representing geographic groups of these state agencies have affirmed in their comments that air quality improvements from this rule will be a critical part of areas' strategies to attain and maintain the NAAQS. Our analysis of the air quality impacts of the proposed standards clearly shows these improvements. While we agree that understanding the impact of the rule on future attainment is important, due to time and resource constraints, we focused our air quality modeling on a future year with substantial fleet turnover (2045) rather than on years with specific attainment deadlines.

Responses to comments about the EJ need for this rule are in Section 23.EPA is not taking final action at this time as part of this final rule on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. For the comments received on this portion of the proposal, see Section 28 of this document.

2.3 Human and environmental health impacts of greenhouse gases (GHGs) and climate change

Comments by Organizations

Organization: *350Marin*

The IPCC's 2022 report warns that irreversible climate impacts are happening now. [EPA-HQ-OAR-2019-0055-2474, p.1]

We in California are feeling the effects of Climate Change for five years already. Eight of the largest wild fires in state history have occurred since 2017. Additionally, we are dealing with increased drought and longer fire seasons. We are in a Climate Emergency. [EPA-HQ-OAR-2019-0055-2474, p.1]

To stop global heating and stabilize the climate, Greenhouse gas emissions have to be cut drastically. [EPA-HQ-OAR-2019-0055-2474, p.1]

Here in California transportation is the largest instate source of such emissions. Nationwide transportation makes up 29% of the carbon footprint, with heavy-duty vehicles emitting nearly one-third. Reducing vehicle GHG emissions is key. New trucks covered by these new EPA standards will be on the road long beyond 2050; they should be zero emission starting as soon as possible. [EPA-HQ-OAR-2019-0055-2474, p.1]

Organization: *Agricultural Retailers Association (ARA) (1241 and 1421)*

In addition, American biofuels like ethanol reduce greenhouse gas (GHG) emissions by 46 percent compared to regular gasoline and are key to achieving any climate goals.2 [EPA-HQ-OAR-2019-0055-1251-A1, p. 3]

> 2. https://growth energy. org/2022/04/12/growth-energy-thanks-biden-for-delivering-lower-cost-fuel-options-for-families/

Organization: *American Soybean Association (ASA)*

Biomass-based diesel offers lower emissions solutions in the transportation sector and as the Administration seeks to move toward an electric vehicle-focused approach to lowering greenhouse gas emissions, biomass-based diesel can offer greenhouse gas emissions reductions of at least 50% compared to petroleum diesel in aging vehicles that still require liquid fuel and in heavy-duty vehicles that are more difficult to electrify. [EPA-HQ-OAR-2019-0055-1309-A1, p.2]

As the federal government seeks to address climate change both today and long-term, biomass based diesel will remain an important tool in the toolbox in both existing diesel engines and new ultra-low carbon liquid fuel engine technologies. Carbon emissions continue to accumulate, and increased utilization of biomass-based diesel and other biofuels can help mitigate increasing emissions occurring at present. The Intergovernmental Panel on Climate Change notes in its sixth assessment report that using existing low carbon technologies is a crucial component to avoiding catastrophic temperature increases, stating that 'biodiesel and renewable diesel fuels…could offer important near-term reductions' for a number of technologies, including buses, rail, and long-haul trucking.2 [EPA-HQ-OAR-2019-0055-1309-A1, p.2]

> 2 Jaramillo, P., S. Kahn Ribeiro, P. Newman, S. Dhar, O.E. Diemuodeke, T. Kajino, D.S. Lee, S.B. Nugroho, X. Ou, A. Hammer Strømman, J. Whitehead, 2022: Transport. In IPCC, 2022: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_FinalDraft_Chapter10.pdf

Organization: *Anne Mellinger-Birdsong*

4. CO2 is one of the main greenhouse gases causing climate change. Numerous health agencies and medical institutions have declared that climate change is a public health emergency (https://doi.org/10.1056/NEJMe2113200). The World Health Organization states that “Climate

change is the single biggest health threat facing humanity.” (https://www.who.int/news/item/11-10-2021-who-s-10-calls-for-climate-action-to-assure-sustained-recovery-from-covid-19) [EPA-HQ-OAR-2019-0055-1244]

Organization: *CALSTART*

The climate crisis is also at a critical stage. Reports from the Intergovernmental Panel on Climate Change (IPCC) document the urgency to reduce global warming emissions. In the IPCC’s recently released Sixth Assessment Report, global greenhouse gas (GHG) emissions peak between 2020 and 2025 in pathways that limit warming to 1.5°C with a 50 percent probability and no or limited overshoot (IPCC, 2022). Global warming emissions must be reduced by 43 percent from 2019 levels by 2030 to limit warming to 1.5°C with a 50 percent probability (IPCC, 2021). Aligned with this emission target is the commitment by the United States to reduce national net GHG emissions by 50-52 percent compared to 2005 levels by 2030.2 If emissions are not reduced to these levels by 2030, it will be even more difficult to limit warming later this century (IPCC, 2018). [EPA-HQ-OAR-2019-0055-1313-A1, p.2]

> 2 50 percent below 2005 levels (7,435 MMT CO2e) of US emissions corresponds to roughly the same level of reductions as 43 percent below 2019 levels (6,571 MMT CO2e) (UNFCCC, 2021; EPA, 2022).

The global decline in emissions must occur despite emissions continuing to grow globally over the last decade (IPCC, 2022a). While we are behind the pace needed to stabilize global temperatures at safe levels, we can still limit warming to 1.5°C through actions in the next couple of years (IPCC, 2021). If global carbon dioxide emissions continue at current rates, the remaining carbon budget for limiting warming to 1.5°C will likely be exhausted before 2030 (IPCC, n.d.). About 410±30 Gt of CO2 were emitted between 2010 and 2019. This is about the same size as the remaining carbon budget for keeping global warming to 1.5°C with a 67 percent probability (about 400 Gt CO2 from 2020 onwards or a 500 Gt CO2 budget with a 50 percent probability of limiting warming to 1.5°C) (IPCC, 2021). [EPA-HQ-OAR-2019-0055-1313-A1, pp.2-3]

Organization: *ChargePoint, Inc. (ChargePoint)*

With 21% of all transportation sector GHG emissions traced to MHDVs (including buses),3 continuing to target the lowering of MHDV emissions through thoughtful regulatory action will aid tremendously in improving air quality nationwide, especially in roadside communities. [EPA-HQ-OAR-2019-0055-1294-A1, p. 1]

> 3 Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis, March 2022, https://www.nrel.gov/docs/fy22osti/82081.pdf

Organization: *Chesapeake Bay Foundation, Inc. (CBF)*

In addition, the devastating effects of climate change have solidified the need to drastically reduce greenhouse gas emissions (GHGs). [EPA-HQ-OAR-2019-0055-1295-A1, p.1]

The increasingly dramatic impacts from climate change have begun and will continue to add stress to the Bay.36 In November 2018, Volume II of the Fourth National Climate Assessment found 'that climate change is affecting the natural environment, agriculture, energy production and use, land and water resources, transportation, and human health and welfare across the U.S. and its territories.'37 The Bay region has already experienced several of these impacts, including increased temperatures and sea level rise.38 Like excess nitrogen, warm waters contribute to dead zones due to their decreased capacity to hold dissolved oxygen. Rising sea levels have submerged islands and coastline, including CBF property. Some scientists predict that the Bay region could see as much as a three- to four-foot sea level rise this century.39 The 2014 Chesapeake Bay Agreement sets a goal to improve climate resiliency in the Bay, and EPA is charged with ensuring states make progress toward achieving and maintaining this goal.40 [EPA-HQ-OAR-2019-0055-1295-A1, p.9]

> 37 New Federal Climate Assessment for U.S. Released, NOAA (Nov. 23, 2018), https://www.noaa.gov/news/new-federal-climate-assessment-for-us-released.
>
> 38 Climate Change, Chesapeake Bay Foundation, https://www.cbf.org/issues/climate-change/.
>
> 39 Id.
>
> 40 2014 Chesapeake Bay Agreement at 14.

Climate change will also make it more difficult to reduce nitrogen loads to the Bay as rainfall becomes increasingly extreme and sporadic, pouring nutrients and sediment into Bay waterways.41 In 2018, the Bay experienced record-setting rainfall, which was followed by one of the Bay’s largest dead zones in 35 years.42 The impacts from climate change threaten the Bay’s recovery and future, and will require even greater pollution reduction efforts to maintain the progress made through the Bay TMDL. [EPA-HQ-OAR-2019-0055-1295-A1, p.9]

> 41 2014 National Climate Assessment, U.S. Global Change Research Program, 'Northeast' Chapter, available at https://nca2014.globalchange.gov/report/regions/northeast (describing impacts from 'increasingly intense precipitation events' and that in the Northeast 'rainfall events have increased more than in any other region of the country') (citing Groisman, P. Y., R. W. Knight, and O. G. Zolina, 2013: Recent trends in regional and global intense precipitation patterns. Climate Vulnerability, R.A. Pielke, Sr., Ed., Academic Press, 25-55).
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> 42 Scott Dance, Record Rain + Heat = Chesapeake Bay Dead Zone Among Biggest in Decades: Crabs, Fish Are Suffocating, Baltimore Sun (Aug. 29, 2020), https://www.baltimoresun.com/news/environment/bs-md-chesapeake-dead-zone-20190829-5vjzwjb3ine7rlgscndd6ucvta-story.html.

EPA must finalize a rule that accelerates the transition to a zero-emission truck fleet that will drastically reduce the sector's emissions of greenhouse gases and its contribution to the devastating impacts of climate change. [EPA-HQ-OAR-2019-0055-1295-A1, p.9]

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

Strong emissions standards are also necessary to curtail HDVs' outsized contribution to climate change. Over twelve years ago, based upon a massive scientific record, EPA found that new motor vehicles and engines contribute to the GHGs that force climate change and endanger the public health and welfare of current and future generations. 74 Fed. Reg. 66,496 (Dec. 15, 2009). The Endangerment Finding specifically included emissions from heavy-duty trucks and buses. 74 Fed. Reg. at 66,499. At the time, the transportation sector was responsible for 23% of total annual U.S. GHG emissions. Id. Since then, transportation sector emissions have only increased as a share of U.S. emissions, surpassing the electric power sector as the largest U.S. source of GHG emissions, contributing 29% of total GHG emissions in 2019 and 27.2% in 2020.29 [EPA-HQ-OAR-2019-0055-1302-A1, p.17]

> 29 EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks at ES-21 (Apr. 15, 2022), https://www.epa.gov/system/files/documents/2022-04/us-ghg-inventory-2022-main-text.pdf.

On April 29, 2022, EPA denied four petitions to reconsider the Endangerment Finding. 87 Fed. Reg. 25,412 (Apr. 29, 2022). In denying the petitions, EPA stated: The science supporting the Administrator's finding that elevated concentrations of greenhouse gases in the atmosphere may reasonably be anticipated to endanger the public health and welfare of current and future U.S. generations is robust, voluminous, and compelling, and has been strongly affirmed by recent scientific assessments of the National Academies, the US Global Change Research Program, and the Intergovernmental Panel on Climate Change.30 [EPA-HQ-OAR-2019-0055-1302-A1, p.17]

> 30 EPA, Decision Document, EPA's Denial of Petitions Relating to the Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act 1 (Apr. 1, 2022), https://www.epa.gov/system/files/documents/2022-04/decision_document.pdf; see also id. at 11–13 (documenting the continued advances in climate science that bolster the Endangerment Finding).

HDVs are the second largest domestic contributor of GHGs in the transportation sector. From 1990 to 2019, transportation GHG emissions from fossil fuel combustion increased by 20.9%.31 Medium- and heavy-duty truck GHG emissions nearly doubled between 1990 and 2019.32 This increase was driven, in part, by substantial growth in medium- and heavy-duty truck vehicle miles traveled (VMT), which increased by 107% between 1990 and 2020.33 Transportation sources also produce other climate-forcing pollutants such as CH4, N2O and HFCs.34 [EPA-HQ-OAR-2019-0055-1302-A1, p.17]

31 EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks at 3-23 (The COVID-19 pandemic led to a 13.7% decrease from 2019–2020 and is considered an outlier.). See Energy Information Agency (EIA), Annual Energy Outlook 2022 (Narrative) 11 (Mar. 2022), https://www.eia.gov/outlooks/aeo/pdf/AEO2022_Narrative.pdf (discussing the outlier nature of 2020).

32 EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks at 2-36.

33 Id. at 3-26

34 Id.

These comments incorporate and build upon the comments submitted by environmental and public health NGOs, including some signatories here, on EPA's Proposed Rule Regarding Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emission Standards.35 Those comments were a continuation of a series of comments updating the record underlying the Endangerment Finding with increasingly dire evidence of the current and future impacts of climate change and the transportation sector's outsized contribution. [EPA-HQ-OAR-2019-0055-1302-A1, pp.17-18]

35 Comments of Center for Biological Diversity et al., Regarding Proposed Rule Regarding Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emission Standards (Docket No. EPA-HQ-OAR-2021-0208) (Sept. 27, 2021).

Since the NGOs' most recent set of transportation comments were filed, the United Nations Intergovernmental Panel on Climate Change (IPCC) released several constituent pieces of the Sixth Assessment Report.36 The report warns that the world must quickly and drastically cut its dependence on fossil fuels or face climate disaster. GHGs from human activities are the most significant driver of observed climate change since the mid-20th century.37 As GHG emissions from human activities increase, they build up in the atmosphere and warm the climate, leading to increasingly destructive changes around the world—in the atmosphere, on land, and in the oceans.38 Steep and swift reductions in GHG emissions are essential to avoid the most catastrophic consequences of climate change.39 [EPA-HQ-OAR-2019-0055-1302-A1, p.18]

36 IPCC, AR6 Synthesis Report: Climate Change 2022, https://www.ipcc.ch/report/sixth-assessment-report-cycle/.

37 See generally IPCC, Climate Change 2022: Impacts, Adaptation, and Vulnerability: Summary for Policymakers (Feb. 27, 2022), https://report.ipcc.ch/ar6wg2/pdf/IPCC_AR6_WGII_SummaryForPolicymakers.pdf.

38 Id. at SPM-7–SPM-8.

39 Id. at SPM-13.

In 2019, GHG emissions from the global transport sector accounted for 23% of global energy-related CO2 emissions—with 70% of those emissions coming from road vehicles.40 Overall global transport emissions have increased 57% since 1990, growing at an average of 2% per year between 2010 and 2019, and faster than any other sector.41 Global freight transport grew 68% between 2000 and 2015.42 To have a chance at limiting global temperature increase to 1.5â„ƒ and avoid the worst impacts of climate change, current GHG emissions from the transportation sector must drop by 59% by 2050 as compared to 2020 emissions.43Analysis conducted by ICCT finds that new HD ZEV sales of 45% or higher by 2030 is necessary to avoid greater than 2â„ƒ of warming.44 Meanwhile, the IPCC predicts that without intervention, CO2 emissions from transport could grow in the range of 16% to 50% by 2050.45 The IPCC concluded that '[l]and-based, long-range, heavy-duty trucks can be decarbonised through battery-electric haulage… complemented by hydrogen[-based]…fuels in some contexts.'46 [EPA-HQ-OAR-2019-0055-1302-A1, p.18]

40 IPCC, Climate Change 2022: Mitigation of Climate Change 10-4 (Apr. 4, 2022) (Draft), https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_FinalDraft_FullReport.pdf.

41 Id. at 10-9.

42 Id. at 10-11.

43 Id. at 10-5.

44 Claire Buysse et al., Racing to Zero: The Ambition We Need for Zero-Emission Heavy-Duty Vehicles in the United States, ICCT (Apr. 8, 2022), https://theicct.org/racing-to-zero-hdv-us-apr22/.

45 IPCC, Climate Change 2022: Mitigation of Climate Change at 10-5.

46 Id.

In another report issued since the last set of NGO comments, the Office of Management and Budget (OMB) assessed the costs of climate change to the federal government, estimating that they could grow to as much as $128 billion annually due to disaster relief, flood insurance, crop insurance, healthcare expenditures, wildland fire suppression, and flood risk.47 OMB considered costs that damage physical infrastructure, social conditions, health of people and ecosystems, and economic productivity. The OMB report underscores the IPCC's stark warnings. [EPA-HQ-OAR-2019-0055-1302-A1, pp.18-19]

47 See generally OMB, Federal Budget Exposure to Climate Risk (Apr. 2022), https://www.whitehouse.gov/wp-content/uploads/2022/04/ap_21_climate_risk_fy2023.pdf.

To stave off the worst impacts of climate change, the U.S. has set a goal of reaching net zero emissions no later than 2050.48 This commitment, along with the Clean Air Act's commands, require reducing and ultimately eliminating GHG emissions from the heavy-duty truck sector as rapidly as feasible. This rulemaking is an important step in achieving that critical goal. [EPA-HQ-OAR-2019-0055-1302-A1, p.19]

> 48 The White House, FACT SHEET: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies (Apr. 22, 2021), https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/.

Organization: *Consumer Reports (CR)*

Heavy-duty vehicles are also a significant source of GHG emissions. Despite accounting for only 10% of total U.S. vehicle-miles traveled,13 medium- and heavy-duty trucks account for 23% of the total GHG emissions from transportation.14 In 2019, according to the EPA, medium and heavy-duty vehicles emitted 456.6 million metric tons of carbon dioxide (CO2) in the United States.15 Stringent GHG emission standards are needed to achieve president Biden's goal to reduce greenhouse gas emissions by 50-52% compared to 2005 levels by 2030.16 [EPA-HQ-OAR-2019-0055-1285-A1, p.3]

> 13 Bureau of Transportation Statistics, U.S. Vehicle Miles, Available at: https://www.bts.gov/content/us-vehicle-miles
>
> 14 EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2019 (EPA–430–R–21–005, published April 2021). Accessed at: https:// www.epa.gov/ghgemissions/inventory-usgreenhouse-gas-emissions-and-sinks.
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> 15 Congressional Research Service, Heavy-Duty Vehicles, Air Pollution, and Climate Change, (February 11, 2022). Available at: https://crsreports.congress.gov/product/pdf/IF/IF12043#:~:text=Further%2C%20according%20to%20EPA's%20Inventory,from%20the%20U.S.%20transportation%20sector).
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> 16 The White House, Fact Sheet: President Biden Announces Steps to Drive American Leadership Forward on Clean Cars and Trucks, (August 5, 2021). Available at: https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-president-biden-announces-steps-to-drive-american-leadership-forward-on-clean-cars-and-trucks/#:~:text=Together%2C%20today's%20announcements%20would%20put,gas%20emission%20reductions%20below%202005.

Under the CAA, the Administrator is authorized to prescribe standards applicable to the 'emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines… which in his judgment cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare.'54 The EPA has issued numerous findings showing that GHGs are reasonably anticipated to both endanger public health and to endanger public welfare.55 [EPA-HQ-OAR-2019-0055-1285-A1, p.9]

54 42 U.S.C. 7251(a)(1).

55 Endangerment and Cause or Contribute Findings for Greenhouse Gasses Under Section 202(a) of the Clean Air Act; Final Rule 74 F.R. 66495 (January 14. 2010). Available at: https://www.govinfo.gov/content/pkg/FR-2009-12-15/pdf/E9-29537.pdf.

Organization: *Edison Electric Institute (EEI)*

The mix of resources used to generate electricity in the United States has changed dramatically over the last decade and is increasingly cleaner. 2016 marked the first year that natural gas exceeded coal as the main source of electricity generation in the United States. In 2021, natural gas powered about 38 percent of the country's electricity, compared to coal-fired generation at about 22 percent.1 Renewables2 generated approximately 21 percent of total generation.3 In total, approximately 40 percent of America's electricity came from clean carbon-free resources in 2021, including nuclear energy, hydropower, solar, and wind.4 [EPA-HQ-OAR-2019-0055-1282-A1, p. 2]

1. See Energy Information Administration (EIA), Electric Power Monthly: with Data for December 2021 12 (Feb. 2022), https://www.eia.gov/electricity/monthly/current_month/february2022.pdf.

2. Renewables here are defined as wind, hydroelectric, solar, biomass, and geothermal energy.

3. See n. 3, supra.

4. See id.

Energy storage is a key asset in helping the grid integrate increasing amounts of renewables and offering resilience and reliability. Electric companies are the largest users and operators of the approximately 25 gigawatts (GW) of operational storage in the country—representing 96 percent of active energy storage projects.5 [EPA-HQ-OAR-2019-0055-1282-A1, p. 3]

5. See EEI, Harnessing the Potential of Energy Storage (June 2021), https://www.eei.org/-/media/Project/EEI/Documents/Issues-and-Policy/Energy-Storage/Harnessing_Energy_Storage_Factsheet.pdf?la=en&hash=F1AB8CC768C880975C5AD28DA798B2AAF01DA2FF.

Renewable energy deployments will continue. By 2025, EIA projects approximately 125 GW of renewables capacity will be online.6 Further, EIA projects that in the United States the share of renewables in the electricity generation mix will more than double by 2050.7 EIA projects that wind will continue to be responsible for most of the growth in renewables generation through 2024, accounting for more than two-thirds of those increases in electricity generation during that period and that solar will dominate deployments thereinafter until 2050.8 [EPA-HQ-OAR-2019-0055-1282-A1, pp. 3 - 4]

6. See EIA, Annual Energy Outlook 2022: Reference Case Projections Tables – Table 16. Renewable Energy Generating Capacity and Generation (Mar. 3, 2022), https://www.eia.gov/outlooks/aeo/data/browser/#/?id=16-AEO2022&cases=ref2022&sourcekey=0.

7. See EIA, Annual Energy Outlook 2022: With Projections To 2050 – Narrative 17 (Mar. 3, 2022), https://www.eia.gov/outlooks/aeo/pdf/AEO2022_Narrative.pdf. EIA estimates are intentionally conservative, focusing on policies currently on the books and not other potential drivers of increased renewable energy deployment, including a suite of clean energy tax credits currently being considered by Congress. These credits will drive reductions in the costs of a range of clean energy sources, increasing both deployment and emissions reductions relative to the EIA base case. See, e.g., Michael Greenstone, et al., Assessing the Costs and Benefits of Clean Electricity Tax Credits, Build Back Better Act Policy Memo, Energy Policy Institute, University of Chicago, and Rhodium Group (Feb. 9, 2022), https://rhg.com/research/assessing-the-costs-and-benefits-of-clean-electricity-tax-credits/#:~:text=Building%20on%20previous%20modeling%20conducted,a%20scenario%20without%20these%20policies.

8. See id.

These changes have profoundly decreased the sector's carbon dioxide (CO_2) emissions, the primary greenhouse gas emissions associated with electricity production. Preliminary full-year estimates are that electric power sector emissions were 36 percent below 2005 levels as of the end of 2021, as low as they were in 1984.9 These reductions will continue. Fifty EEI members have announced forward-looking carbon reduction goals, two-thirds of which include a net-zero by 2050 or earlier equivalent goal, and members are routinely increasing the ambition or speed of their goals or altogether transforming them into net-zero goals. [EPA-HQ-OAR-2019-0055-1282-A1, p. 4]

9. See EIA, Monthly Energy Review, Table 11.16—Electric Power Sector (Mar. 29, 2022), https://www.eia.gov/totalenergy/data/monthly/.

In addition, the electric industry has significantly reduced air pollutants such as mercury, hazardous air pollutants (HAPs), sulfur dioxide (SO_2), and nitrogen oxides (NO_x). As of 2021, SO_2 and NO_x emissions have declined 94 and 88 percent, respectively, since 1990.10 In addition, mercury emissions have declined by 90 percent since 2010,11 and total HAPs—

including all acid gas emissions—declined by 96 percent between 2010 to 2017.12 [EPA-HQ-OAR-2019-0055-1282-A1, p. 4]

10. See EPA, EPA Issues Power Plant Emissions Data for 2021 (Feb. 22, 2022), https://www.epa.gov/newsreleases/epa-issues-power-plant-emissions-data-2021.

11. See id.; EPA, Regulatory Impact Analysis for the Final Mercury and Air Toxics Standards 2-7 (Dec. 2011), https://www.epa.gov/sites/default/files/2015-11/documents/matsriafinal.pdf

12. See 84 Fed. Reg. 2,670, 2,689 (Feb. 7, 2019).

EEI's member companies see a clear path to continued emissions reductions over the next decade using current technologies, including nuclear power, natural gas-based generation, energy demand efficiency, energy storage, and deployment of new renewable energy—especially wind and solar—as older coal-based and less-efficient natural gas-based generating units retire. These technologies will continue to enable significant, cost-effective carbon reductions. In addition, EIA notes that coal use will continue to decline with the retirement of most of the relatively old and inefficient coal-fired electricity generating units in the United States.13 [EPA-HQ-OAR-2019-0055-1282-A1, p. 5]

13. See n. 9, supra at 18.

In the long term, reaching net-zero carbon emissions also will require the deployment of next-generation, carbon-free, 24/7, dispatchable technologies not currently available commercially. Developing a broad range of advanced clean energy technologies can help further expedite the transition of the electric power sector to one that is low- or non-emitting while keeping electricity affordable and reliable for customers. [EPA-HQ-OAR-2019-0055-1282-A1, p. 5]

Organization: *Elders Climate Action*

ECA, its chapters and members have a stake in this decision both because 2) we are the parents and grandparents of children who will be compelled to live their lives in the extreme conditions that are now occurring and will worsen as a result of the climate heating caused by the GHG pollutants emitted from combustion of carbon fuels in motor vehicles. [EPA-HQ-OAR-2019-0055-1218-A1, p. 1]

ECA requests this action to –

1) respond meaningfully to the urgency of the climate crisis that threatens to destroy the future for our children and grandchildren by turning the planet into an unsustainable Hell on Earth; [EPA-HQ-OAR-2019-0055-1218-A1, p. 1]

EPA's proposed Heavy duty vehicle (HDV) rule will allow millions of polluting diesel heavy duty vehicles to be sold in the U.S. in 2027 and beyond without requiring any manufacturer to sell a single zero emission vehicle. The proposed standards fail to implement the call from the

Intergovernmental Panel on Climate Change for immediate action to transform the transportation sector to zero CO2 emissions as soon as possible to avoid the worst impacts of the looming climate disaster. [EPA-HQ-OAR-2019-0055-1218-A1, p. 2]

The transportation sector is the leading source of climate pollution in the US, but the proposal fails to make any progress toward ending CO2 emissions from transport to avoid the worst consequences of a warming climate. Your proposal allows millions more new diesel trucks and buses in 2027-29 that will lock-in over the next 20 years 1.7 billion tons of additional CO2. [EPA-HQ-OAR-2019-0055-1218-A1, p. 2]

EPA acknowledges that the proposed rule reduces CO2 emissions by only 221,000 metric tons (MT) (0.75%) compared to the current rule (from 29.088 million MT to 28.867 million MT in 2027), allowing new HDVs sold in 2027, 2028 and 2029 to emit an estimated 86.6 million MT annually after 2029, totaling 1.78 billion metric tons of CO2 over the 20 year useful life of those HDVs. CO2 from these vehicles would be equivalent to adding 21 new large coal-fired power plants. [EPA-HQ-OAR-2019-0055-1218-A1, p. 2]

Total CO2 emissions from future vehicles will double these emissions for each additional three to four model years that these standards apply after 2029. If Congress blocks further rulemaking after 2022, or a President opposed to climate action is elected, these may be the last CO2 standards adopted for a decade. [EPA-HQ-OAR-2019-0055-1218-A1, p. 2]

CO2 from these model years will effectively prevent the US from achieving the IPCC's call for a 50% cut in CO2 by 2030, and make it difficult to achieve the zero emission economy promised by President Biden by 2050. These vehicles will remain on the road for at least 20 years, add to CO2 and prevent the U.S. from achieving the CO2 reductions identified by the Intergovernmental Panel on Climate Change (IPCC) as necessary to keep within the 1.5o C target to avoid a climate catastrophe. [EPA-HQ-OAR-2019-0055-1218-A1, p. 2]

The Nation needs strong action from EPA now to achieve sharp reductions in CO2 emissions to slow the warming. Losses from climate related events cost the Nation an estimated $145 billion in 2021. Damage is expanding rapidly year over year. Delaying major reductions from the transport sector will have devastating consequences. [EPA-HQ-OAR-2019-0055-1218-A1, p. 2]

The warmer climate has triggered a massive increase in damage from wildfire in the American West where an average of 1 million acres burned just 20 years ago, to over 15 million acres each in 2020 and 2021. Thousands of families have lost homes to fire, businesses were destroyed and communities lost schools, health care facilities, water and power supplies and other infrastructure. Smoke pollution smothered much of the West with dangerous levels of air pollution that added thousands of premature deaths across the region. The record setting heat wave in the Pacific NW last year also took hundreds of lives. Wildfire studies estimate deepening drought in the West will likely double the annual area destroyed by fire in this decade. We submit a review of the impacts of wildfire in the West and the expected impacts this decade because the social cost of carbon developed by the Interagency Working Group does not include wildfire impacts when estimating the damages associated with GHG emissions. [EPA-HQ-OAR-2019-0055-1218-A1, pp. 2 - 3]

In other regions of the U.S. more powerful hurricanes, extreme floods and massive tornadoes have caused devastation to hundreds of communities across the Gulf Coast, Mid- West and Northeast. These extreme weather events have become more powerful, more frequent and more destructive. [EPA-HQ-OAR-2019-0055-1218-A1, p. 3]

The Nation needs your help now to slow the warming to protect our families and communities. Medium and heavy-duty vehicles are a major contributor to the warming. Medium- and heavy-duty trucks emit a quarter of climate pollution from transportation despite being only 10% of vehicles on the road. You must take action now that accelerates the transition to a zero emission transport sector. [EPA-HQ-OAR-2019-0055-1218-A1, p. 3]

A zero emission standard also promotes the health protection purpose of the Act by reducing the adverse impacts on health caused by climate warming. The Administrator's 2009 Endangerment Finding4 found that GHG emissions have a significant direct adverse impact is on health as a result of fatalities caused by heat waves, and indirect effects through reductions in food production and rising concentrations of air pollutants such as ozone which forms more quickly in a warmer atmosphere. HDVs with zero emission power trains protect public health by slowing the warming caused by CO2 emitted from fossil fuel vehicles. Battery electric vehicles (BEVs) and fuel cell electric vehicles (FCVs) powered by hydrogen do not involve combustion of C fuels, and do not create or emit the pollutants that are the products of C combustion. The recently issued IPCC Impacts report5 makes clear that growing harm to public health and welfare caused by GHG pollutants cannot be avoided without reducing vehicle emissions to zero. [EPA-HQ-OAR-2019-0055-1218-A1, pp. 8 - 9]

> 4. The Administrator found that elevated concentrations of greenhouse gases in the atmosphere may reasonably be anticipated to endanger the public health and welfare of current and future U.S. generations. See 74 Fed. Reg. 66496, December 15, 2009. The Administrator recently reviewed and re-affirmed this Finding in response to Petitions to vacate the Finding. See 2204-21 decision_doc deny PET re Endgmnt Fndg.pdf. 5. Climate Change 2022: Impacts, Adaptation and Vulnerability | Climate Change 2022: Impacts, Adaptation and Vulnerability (ipcc.ch) (April 2022).

The science is clear: stabilizing the climate before it becomes too hot to support human civilization is another reason beyond attaining the ozone NAAQS in all of America's 230 nonattainment counties why GHG emissions from on-road vehicles must be reduced to zero as soon as possible. In his Climate Executive Order President Biden declared that the policy of the United States is to "put the United States on a path to achieve net-zero emissions, economywide, by no later than 2050."11 [EPA-HQ-OAR-2019-0055-1218-A1, p. 17]

> 11. Executive Order to Tackle Climate Change (January 27, 2021). Sec. 201. Policy. Even as our Nation emerges from profound public health and economic crises borne of a pandemic, we face a climate crisis that threatens our people and communities, public health and economy, and, starkly, our ability to live on planet Earth. Despite the peril that is already evident, there is promise in the solutions — opportunities to create well-paying union jobs to build a modern and sustainable

> infrastructure, deliver an equitable, clean energy future, and put the United States on a path to achieve net-zero emissions, economy-wide, by no later than 2050. We must listen to science — and act. We must strengthen our clean air and water protections. We must hold polluters accountable for their actions. We must deliver environmental justice in communities all across America. The Federal Government must drive assessment, disclosure, and mitigation of climate pollution and climate-related risks in every sector of our economy, marshaling the creativity, courage, and capital necessary to make our Nation resilient in the face of this threat. Together, we must combat the climate crisis with bold, progressive action that combines the full capacity of the Federal Government with efforts from every corner of our Nation, every level of government, and every sector of our economy. It is the policy of my Administration to organize and deploy the full capacity of its agencies to combat the climate crisis to implement a Government-wide approach that reduces climate pollution in every sector of the economy; increases resilience to the impacts of climate change; protects public health; conserves our lands, waters, and biodiversity; delivers environmental justice; and spurs well-paying union jobs and economic growth, especially through innovation, commercialization, and deployment of clean energy technologies and infrastructure. Successfully meeting these challenges will require the Federal Government to pursue such a coordinated approach from planning to implementation, coupled with substantive engagement by stakeholders, including State, local, and Tribal governments.

The President's declared policy responds to and is supported by the science which makes clear that the climate will continue to heat up so long as humanity continues to increase GHG levels in the atmosphere. The global mean temperature reached 1.2 o C above the pre-industrial baseline in 2020 12 which has produced massive damage and destruction to property and natural systems, and caused hundreds of deaths, displacement, homelessness and loss of livelihoods for tens of thousands of Americans from extreme floods, drought, wildfires, hurricanes and tornadoes. [EPA-HQ-OAR-2019-0055-1218-A1, p. 17]

> 12. World Meteorological Organization, State of the Global Climate, 6 (April 2021); available at doc_num.php (wmo.int). WMO uses the "1850–1900 baseline as an approximation of pre-industrial levels." Id.

The latest climate modeling report (AR6) from the Intergovernmental Panel on Climate Change (IPCC) now makes clear that exceeding 1.5o C before 2050 is "more likely than not" even with implementation of the most aggressive GHG reduction scenario, but that the excursion above 1.5o C can be limited to a few decades if we reduce GHG emissions by half before 2030, and achieve net zero emissions by 2050. But if we fail to meet either of those targets, it is "more likely than not" that global temperatures will reach 2.0 o C with dire consequences for humanity. [EPA-HQ-OAR-2019-0055-1218-A1, pp. 17 - 18]

To achieve net-zero emissions economy wide by 2050, zero emission technologies currently available must be deployed as soon as possible to put GHG emissions from our largest source of emissions – transportation – on the path toward zero. EPA's proposed rule merely reduces carbon fuel combustion by less than 1%. A zero emission economy cannot be achieved if vehicles continue to burn carbon fuels. Internal combustion engines (ICEs) must be replaced as quickly as possible by zero emission vehicles (ZEVs). [EPA-HQ-OAR-2019-0055-1218-A1, p. 18]

EPA's proposed HDV rule does not chart a course toward implementing either the national policy declared by President Biden or reflect the urgent need to cut GHG emissions in half by 2030 to avoid much worse future climate catastrophes. The rule preamble acknowledges that the proposed rule changes will reduce HDV CO2 emissions by only .2 MMT during MY 2027 from 29 MMT to 28.8 MMT. Over the 20 year useful life of vehicles sold in MYs 2027-29 the rule will allow millions of diesel and gasoline vehicles to be added to the Nation's highways which will emit an estimated 1.7 billion MT of CO2. These emissions will wipe out more than half of the 3.1 billion MT of CO2 reduction achieved by EPA's SAFE 2 rule for light duty vehicles. These HDV emissions are the equivalent of operating 21 new coal-fired power plants. A large fraction of these emissions could be avoided if EPA adopted the CARB zero emission standard for HDVs in the ACT rule. The rule does not achieve, or describe how it will contribute to achieving, zero emissions by 2050. [EPA-HQ-OAR-2019-0055-1218-A1, p. 18]

Harm to public health and the environmental, property and economic resources of our communities incorporated into the CAA definition of "public welfare" was anticipated and comprehensively described in the Administrator's Endangerment Finding that established the basis for regulating six GHGs under the CAA.14 All of the harms anticipated in 2009 have now been demonstrated to varying degrees, and are accelerating rapidly as the planet continues to heat up. [EPA-HQ-OAR-2019-0055-1218-A1, p. 19]

14. 74 Fed. Reg. 66,496 (December 15, 2009).

Since the Endangerment Finding, EPA's catalogue of risks have been augmented by much more comprehensive modeling of warming trends, the warming expected from a range of global emission scenarios, and a description of the emission limitations that must be implemented to avoid more catastrophic climate outcomes. [EPA-HQ-OAR-2019-0055-1218-A1, p. 19]

The IPCC's 2018 report reviews and analyzes the then-available scientific literature to provide the best information available to answer two critical questions posed by world leaders at the Paris Climate conference: 1) What are the differences between the consequences of allowing the planetary climate system to rise 1.5o C compared to 2o C above the pre-industrial background? 2) What limitations on CO2 and other GHG emissions must be achieved to avoid overshooting a 1.5o C or a 2o C rise in global temperature? [EPA-HQ-OAR-2019-0055-1218-A1, p. 20]

The IPCC's 2018 report catalogues numerous expected adverse consequences of both a 1.5o C and a 2o C rise and in global mean temperature.15 Some of the effects of greatest concern are – 1) increases in mean summer temperatures and the frequency of hot days above the 99th%ile of the baseline temperature range, and the increased duration of the summer dry season that, together, will more quickly desiccate the coastal and Cascade forests each year, increase the ignitability of forest fuels, increase the frequency and intensity of wildfires, increase the production of hazardous concentrations of fine particle pollution (smoke), and increase the adverse health consequences of public exposure to multi-day extreme hazard pollution episodes; [EPA-HQ-OAR-2019-0055-1218-A1, p. 20]

15. Global Warming of 1.5o C, Chapter 3: “Impacts of 1.5o C of global warming on natural and human systems.”

2) diminished summer stream flows that force curtailment of water for agricultural operations dependent on irrigation water, and contribute to warmer surface water temperatures that interfere with the survival of cold water fish species (e.g., salmonids) and contribute to algal blooms that produce toxic contamination of municipal and agricultural water supplies and fishery habitats; [EPA-HQ-OAR-2019-0055-1218-A1, p. 20]

3) increasing ocean acidification and ocean temperatures that together prevent reproduction and survival of some marine species, cause some native local species to abandon Oregon waters in search of cooler waters, and diminish productivity of species remaining in the local water column which in turn will reduce the catch, make commercial fishing unprofitable, and further reduce the food supply for human populations dependent on marine sources of protein and resident coastal orca populations that are now starving because of diminished food supply; [EPA-HQ-OAR-2019-0055-1218-A1, p. 20]

4) the frequency and duration of extreme precipitation events that cause flooding, erosion, displacement of human populations in flood-prone areas, the destruction of freshwater and anadromous fish spawning habitat and contamination of municipal water supplies; [EPA-HQ-OAR-2019-0055-1218-A1, p. 20]

5) warmer winter temperatures that convert winter snow precipitation events to rainfall thereby reducing the high altitude storage of water which diminishes water resources available for agriculture and municipal uses during the spring and summer, and increases the severity of drought by reducing stream flows, causing crop loss, loss of fishery habitat, and inadequate water supplies for residential and industrial users and fire fighting. [EPA-HQ-OAR-2019-0055-1218-A1, pp. 20 - 21]

6) longer wildfire seasons and expanded burn zones that increase human exposure to hazardous levels of air pollution, including multi-week exposure to levels of fine particles (smoke) known to cause pre-mature death and other adverse health outcomes among vulnerable populations, and elevated concentrations of ground level ozone harmful to public health exacerbated by warmer summer temperature regimes that govern the chemistry of ozone formation in the atmosphere.16 [EPA-HQ-OAR-2019-0055-1218-A1, p. 21]

16. “More Days With Haze: How Oregon is Adapting to the Public Health Risks of Increasing Wildfires,” p. 5 (Oregon Health Authority, 2019) available at OHA 2688 More Days with Haze (oregon.gov).

All of these effects are occurring now, and are expected to increase in severity as the climate warming accelerates. [EPA-HQ-OAR-2019-0055-1218-A1, p. 21] The IPCC found that global mean temperature was about 1.0o C above the pre-industrial baseline in 2010. By 2010, the climate regime had not yet triggered large increases in wildfire conditions compared to historical fire patterns in the American West. But as the global mean advanced from 1.1 o C to 1.2 o C, new records were being set. The World Meteorological Organization (WMO) concluded that "[i]n 2020 – one of the three warmest years on record – the global average temperature was 1.2 °C above the pre-industrial baseline."17 [EPA-HQ-OAR-2019-0055-1218-A1, p. 21]

17. World Meteorological Organization, State of the Global Climate, 6 (April 2021); available at doc_num.php (wmo.int). WMO uses the "1850–1900 baseline as an approximation of pre-industrial levels." Id.

As the global temperature approached 1.2 °C, the frequency, intensity, areal extent and duration of wildfires have increased significantly in the last five years. In 2020 burns set records across the American West. California's burn area grew to nearly 5 million acres, and the total area burned in the 11 Western states exceeded 10 million acres: 2020 Western United States wildfire season - Wikipedia. The increasing area burned by wildfire in the American West tracks the Australian experience where annual fire zones expanded rapidly in response to drought leading to a massive wildfire season burning 46 million acres (an area equal to the State of Washington) during their 2019-20 austral summer.18 [EPA-HQ-OAR-2019-0055-1218-A1, p. 21]

18. List of major bushfires in Australia - Wikipedia, see Sept. 2019-March 2020.

During the 2017 fire season, wildfire in Oregon destroyed one-half million acres for the first time in the State's history. In 2018 wildfire consumed 660,000 acres of forest. In 2020 Oregon wildfires consumed 1.2 million acres,19 forced 500,000 Oregonians to evacuate their homes ahead of the flames, incinerated 4,000 homes displacing 10,000 Oregonians, leaving many families homeless, and killed 11. The 2020 burn area doubles the 2017 burn area, and is an order of magnitude greater than the statewide average of 120,000 acres burned during the 1990-2010 period. [EPA-HQ-OAR-2019-0055-1218-A1, pp. 21 - 22]

19. https://en.wikipedia.org/wiki/2020_Oregon_wildfires (1,221,324 acres burned in 2020).

The 2018 IPCC report states that the global mean temperature is rising about 0.2o C per decade,20 twice the warming rate during the 20th Century. This accelerated warming rate suggested in 2018 that 1.5o C rise would be reached about 2035 unless large reductions in GHG emissions were achieved before 2030. New modeling performed for the 2021 IPCC report, AR6, indicates that 1.5o C above the pre-industrial baseline will be reached by 2030 if GHG emissions are held to current rates, and 2o C rise reached by 2050.21,22 WMO has since announced its estimate that the first annual 1.5o C rise in global temperature will likely occur by 2026.23 [EPA-HQ-OAR-2019-0055-1218-A1, p. 22]

20. Global Warming of 1.5o C, Chapter. 1 (Section 1.2.1.3).

21. "Analysis: When might the world exceed 1.5C and 2C of global warming? | Carbon Brief (Dec. 4, 2020).

22. Climate Change 2021: The Physical Basis (IPCC, 2021), Summary for Policy Makers, B.1.2. available at 2108-09 IPCC_AR6_WGI_SPM.pdf.

23. World Meteorological Organization, press release (May 27, 2021) available at https://public.wmo.int/en/media/press-release/new-climate-predictions-increase-likelihood-of-temporarily-reaching- 15-%C2%B0c-next-5.

Given that the frequency and ferocity of wildfire in the American West began to increase significantly after 2015 under the climate conditions associated with 1.1° C to 1.2° C rise above the 1850–1900 baseline, the march higher toward a 1.5o C rise between 2025 and 2030 can be expected to accelerate the frequency, severity and areal extent of damage caused by wildfire. [EPA-HQ-OAR-2019-0055-1218-A1]

The Oregon Climate Assessment (OCAR5.pdf | Powered by Box, January 5, 2021) anticipates that the destruction of property, disruption of daily life, large costs to the economy, pollution of the atmosphere and water supplies, impairment of human health, and damage to wildlife, the environment and habitats will worsen in coming years as the climate continues to warm more rapidly. The Assessment cites studies predicting the effects of warming on seasonal heat causing a six-fold increase in hot days (>90o F) in Oregon counties west of the Cascades during future Oregon summers (pp. 12-13), and reductions in summer precipitation (Table 2). Summers will be hotter and drier, and summer heat will start earlier and persist longer.24 The Assessment concludes that these conditions are conducive to "high-severity" wildfires: High-severity fires dominate wet, cool forests, including remnant old growth forests, in Oregon's Coast Range and western Cascade Range. High-severity wildfires in wet, cool forests typically are … facilitated by extremely dry and warm springs and summers or high winds. [EPA-HQ-OAR-2019-0055-1218-A1, p. 22]

24. Id., 3.

As these conditions become more extreme, the area incinerated by wild fires is expected to increase (pp. 48-54). A 2017 forest modeling analysis "projected a 200% increase in median annual area burned in Oregon" during the 2010-2039 period compared to 1961-2004.25 Another 2017 study looking at fires across the American West estimates a 200-400% increase in the "annual probability of very large fires."26 Going forward, the Assessment makes clear that all "empirical models … consistently project that the area burned in Oregon will increase."27 [EPA-HQ-OAR-2019-0055-1218-A1, pp. 22 - 23]

25. Climate Assessment, 53.

26. Id., 54.

27. Id., 53.

The fire zone doubled between 2017 and 2020. As predicted by forest science modeling, another doubling of the acres burned annually by 2025-30 is highly plausible as global temperature approaches 1.5° C above the pre-industrial baseline. [EPA-HQ-OAR-2019-0055-1218-A1, p. 23]

If fire zones expand to predicted levels in the Pacific NW, 25% to 40% of Oregon (15 to 25 million acres) and Washington (11 to 20 million acres) will be incinerated during this decade, economic activity will collapse and hazardous air quality will make the Northwest inhospitable to human habitation for most residents during the fire season. [EPA-HQ-OAR-2019-0055-1218-A1, p. 23]

The data and modeling estimates presented in the Oregon Climate Assessment and other sources predict a future in which the destruction of Oregon's forest resources by wildfire will continue until either 1) the cool and wet conditions that sustained Cascadia's forests during the 8,000 years before 1980 are restored, or 2) most of the standing forests are reduced to shrub or grasslands. [EPA-HQ-OAR-2019-0055-1218-A1, p. 23]

The climate will need to be stabilized as soon as possible to – o protect public health from the deadly effects of heat waves and wildfire smoke particles; o preserve the health, safety and quality of life in the American West from the devastation caused by massive uncontrollable wildfires; o preserve the health, safety and quality of life for millions of Americans living along the Gulf Coast from the devastation caused by super hurricanes, o preserve the health, safety and quality of life for hundreds of millions of Americans living in the Mid-West and Northeast from the deaths and devastation caused by massive flooding, o to protect the health, safety and quality of life for millions living in Tornado Alley from the Great Plains to the upper South; o to protect forests so that they may serve as a sink for CO2 rather than as an emission source; o preserve habitat for wildlife and a resource for forest products and other industries dependent on them, and o protect the vitality of the marine web of life from collapse as a result of acidification. [EPA-HQ-OAR-2019-0055-1218-A1, p. 25]

The IPCC provided clear guidance in its 2018 report that to stop the warming and stabilize the climate, the economy must transition to a zero carbon (CO2 and methane) emission energy system, and forests must be expanded to extract CO2 from the atmosphere. Climate stability can be achieved only by reducing GHG emissions to net-zero. [EPA-HQ-OAR-2019-0055-1218-A1, p. 25] To stabilize global temperature at any level, 'net' CO2 emissions would need to be reduced to zero. This means the amount of CO2 entering the atmosphere must equal the amount that is removed. Achieving a balance between CO2 'sources' and 'sinks' is often referred to as 'net zero' emissions or 'carbon neutrality'.34 [EPA-HQ-OAR-2019-0055-1218-A1, p. 25]

34. Global Warming of 1.5o C, Chapter 2, FAQs.

Limiting warming to 1.5°C implies reaching net zero CO2 emissions globally around 2050 and concurrent deep reductions in emissions of non-CO2 forcers, particularly methane35 (high confidence). Such mitigation pathways are characterized by energy-demand reductions, decarbonization of electricity and other fuels, electrification of energy end use, deep reductions in agricultural emissions, and some form of CDR [carbon dioxide reduction] with carbon storage on land or sequestration in geological reservoirs.36 [EPA-HQ-OAR-2019-0055-1218-A1, p. 25]

35. Methane (CH4, i.e, unburned natural gas) is 20 times more powerful than CO2 as a climate forcer.

36. Id., Exec, Summary.

Zero GHG emissions to stabilize the climate must be achieved sooner than later to minimize the losses and deaths associated with devastating warmer climate effects. Zero emissions cannot be achieved without transforming transportation which is the largest source of GHG emissions. For most transportation sources such as on-road vehicles, zero emissions can be cost-effectively achieved by electrification with batteries or fuel cells. [EPA-HQ-OAR-2019-0055-1218-A1, p. 26]

The latest IPCC modeling report (AR6, 2021) concludes based on the latest climate data and updated modeling that – Under the five illustrative [GHG emissions] scenarios, in the near term (2021-2040), the 1.5°C global warming level is very likely to be exceeded under the very high GHG emissions scenario (SSP5-8.5), likely to be exceeded under the intermediate and high GHG emissions scenarios (SSP2-4.5 and SSP3-7.0), more likely than not to be exceeded under the low GHG emissions scenario (SSP1-2.6) and more likely than not to be reached under the very low GHG emissions scenario (SSP1-1.9).37 [EPA-HQ-OAR-2019-0055-1218-A1, p. 26]

37. Climate Change 2021, Summary for Policymakers, B.1.3. (available at IPCC_AR6_WGI_SPM.pdf.)

The opportunity to stay below 1.5°C and to prevent the additional devastation that such level of warming will cause, has been frittered away by inaction and delay. At the current global mean temperature, the climate has warmed enough to endanger public health, cause devastating destruction of homes and businesses, loss of life and the disruption of natural systems by extreme floods, drought, wildfires, hurricanes and tornadoes. The harm we will experience above 1.5°C will be orders of magnitude greater. [EPA-HQ-OAR-2019-0055-1218-A1, p. 26]

But the IPCC offers the hope that "for the very low GHG emissions scenario (SSP1-1.9), it is more likely than not that global surface temperature would decline back to below 1.5°C toward the end of the 21st century, with a temporary overshoot of no more than 0.1°C above 1.5°C global warming."38 [EPA-HQ-OAR-2019-0055-1218-A1, p. 26]

38. Id.

That hope turns on cutting global CO2 emissions in half by 2030, and to net-zero by 2050 along with large reductions in non-CO2 climate forcers such as methane. EPA has not set out a regulatory path for achieving those reductions. EPA's current proposed rule will not achieve anywhere near those reductions, and fails to identify any future strategy for achieving those reductions. To fulfill the Agency's statutory mission to protect public health and welfare it must issue regulations that achieve these targets. [EPA-HQ-OAR-2019-0055-1218-A1, p. 26]

Based on these data and other available evidence, we petition the Administrator to find that – 1) climate warming already caused by GHG emissions harms the public health and is causing unacceptable adverse impacts on public welfare and the human environment, and 2) the expected increase in the severity and frequency of harms to health and the public welfare that will be caused by more extreme events that will occur as the global mean temperature advances toward and above the 1.5°C level resulting from growing GHG concentrations in the atmosphere, establish the need for a zero GHG emissions standard for HDVs pursuant to section 202(a)(1) and (3)(A) of the Clean Air Act. [EPA-HQ-OAR-2019-0055-1218-A1, p. 27.]

We petition the Administrator to make this finding as the predicate for re-opening this rulemaking for the purpose of promulgating a zero emission standard for HDVs, and a phase-in schedule that prescribes for each automaker a share of total HDV sales that must be ZEVs beginning with the 2027 MY. [EPA-HQ-OAR-2019-0055-1218-A1, pp. 27-28.]

Organization: *Energy Innovation, LLC*

The climate crisis is wreaking havoc on weather, ecosystems, agriculture, water supplies, and public health, and the timeline for reducing emissions to limit global warming to 1.5 degrees Celsius is now perilously short. The two most recent working group contributions to the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (from Working Groups II and III) make clear societal choices and actions taken this decade will determine our collective climate future.ii The transportation sector remains the largest contributor to U.S. GHG emissions, constituting 29 percent of total emissions, with 24 percent coming from heavy-duty vehicles.iii From 1990 to 2019, GHG emissions from medium- and heavy-duty trucks increased 92.9 percent, and during that time GHG emissions from buses increased 162 percent.iv [EPA-HQ-OAR-2019-0055-1310-A1, pp.1-2]

ii IPCC, 2022: Summary for Policymakers [H.-O. Pörtner, D.C. Roberts, E.S. Poloczanska, K. Mintenbeck, M. Tignor, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem (eds.)]. In: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press, https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf and IPCC, 2022: Summary for Policymakers. In: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926.001, https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_SummaryForPolicymakers.pdf.

iii EPA Proposed Rules, 17440.

iv U.S. Environmental Protection Agency, Fast Facts: U.S. Transportation Sector Greenhouse Gas Emissions, 1990-2019, December 2021, 2, https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1013NR3.pdf

Such trends are inconsistent with a climate stable future and must be reversed as quickly as possible. The EPA can and should promulgate more stringent GHG tailpipe standards that align with the U.S. Nationally Determined Contribution under the Paris Climate Agreement and achieve the emissions reductions in 2030 required for a 1.5°C trajectory. Strong tailpipe standards will also ensure compliance with Executive Order 14037, Strengthening American Leadership in Clean Cars and Trucks, aimed at making zero-emission vehicles (ZEVs), including EVs, 50 percent of all new cars sold in 2030.v They will help achieve the goals of Executive Order 14008, Tackling the Climate Crisis at Home and Abroad, as well, reducing economy-wide GHGs by 50 to 52 percent by 2030.vi [EPA-HQ-OAR-2019-0055-1310-A1, p.2]

v Executive Office of the President, Executive Order 14037 of August 5, 2021: Strengthening American Leadership in Clean Cars and Trucks, Federal Register, National Archives and Records Administration, August 10, 2021, https://www.federalregister.gov/documents/2021/08/10/2021-17121/strengthening-american-leadership-in-clean-cars-and-trucks; and White House, FACT SHEET: President Biden Announces Steps to Drive American Leadership Forward on Clean Cars and Trucks, August 5, 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-president-biden-announces-steps-to-driveamerican-leadership-forward-on-clean-cars-and-trucks/.

vi White House, Fact Sheet: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies, April 22, 2021, https://www.whitehouse.gov/briefing-room/statementsreleases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-payingunion-
jobs-and-securing-u-s-leadership-on-clean-energy-technologies/; and Executive Office of the President, Executive Order 14008 of January 27, 2021: Tackling the Climate Crisis at Home and Abroad, Federal Register, National Archives and Records Administration, February 1, 2021 https://www.federalregister.gov/documents/2021/02/01/2021-02177/tackling-the-climate-crisis-at-home-and-abroad

Organization: *Evangelical Environmental Network (EEN)*

As a climate scientist, I know we have no time to wait to act on climate change. [EPA-HQ-OAR-2019-0055-1134-A1, p.2]

The transportation sector is the biggest source of greenhouse gas emissions in the United States. Trucks and buses are responsible for 25 percent of total transportation sector greenhouse gas emissions, despite accounting for only 4 percent of vehicles on the road. [EPA-HQ-OAR-2019-0055-1134-A1, p.2]

To keep our climate as safe as possible for our children and other vulnerable people, including people of color who are disproportionately exposed, we need Strong vehicle standards to provide relief from the burden of diesel fumes and air pollution and help address climate change. [EPA-HQ-OAR-2019-0055-1134-A1, p.2]

Organization: *Jessica Stevens*

I am writing in support of the Environmental Protection Agency in the proposed regulation to reduce air pollution from highway heavy duty vehicles and engines. Greenhouse gasses, ozone, and other particulate matter are primary contributors in our current climate crisis, so any recommendation to reduce these is urged. In addition, these have direct consequences in public health and environmental justice, which was put under consideration in constructing this report. I will outline why this regulation is essential in taking steps against climate change and why it is important in our quality of life, as well as providing some recommendations and other items to take under consideration. [EPA-HQ-OAR-2019-0055-1028]

Transportation is currently the greatest source of greenhouse gasses in the United States. In 2020, it accounted for 27% of the emissions produced, mostly coming from petroleum based fuel for trucks, cars, planes, etc. (Sources of Greenhouse Gas Emissions). Over half of the emissions in this industry come from cars, light, medium, and heavy duty trucks, while the other half result from other forms of transportation like planes, ships, and trains. The National Institute of Environmental Health Services (NIEHS) outlines the air pollution produced by the transportation sector and the potential health impacts this has. The NIEHS states that Traffic Related Air Pollution (TRAP) includes ground level ozone, carbon, hydrocarbons, and particulate matter (Air Pollution and Your Health). This can result in various forms of respiratory disease, like asthma or chronic obstructive pulmonary disease. Additionally, air pollution increases the risk for cardiovascular disease and certain cancers, particularly breast and lung cancer. The NIEHS also found that nine out of 10 people living in urban areas worldwide were found to be affected by air pollution (Air Pollution and Your Health). This report specifically mentions that lower income families and people of color possess higher risk for air pollution by being more likely to be located near truck routes. This is a public health and environmental justice problem that needs to be addressed. [EPA-HQ-OAR-2019-0055-1028]

Not only are their human health impacts from emissions, but the environment, and therefore our existence as a species, suffers as well. Global warming of 1.5 degrees celsius would be extremely dangerous for the survival of our planet, but a warming of 2 degrees celsius would be even more vital to prevent. Effects of warming from greenhouse emissions include extreme weather patterns like heat waves, rising sea levels from melting ice glaciers, changes in precipitation patterns leading to floods and droughts, and in general more unpredictable and severe weather events (Human health impacts of climate change). These changes can directly or indirectly lead to illness or death. The changes in precipitation and temperature can have effects on animal and insect living patterns, affecting their own survival or behaviors. Changes in their interactions and interactions with humans can give rise to the spread or prevalence of infectious diseases. Rises in water related infections may also be a result of changes in rain patterns, increase in storms, and rising sea levels. [EPA-HQ-OAR-2019-0055-1028]

Organization: *Maine Department of Environmental Protection*

The transportation sector is also the largest source of greenhouse gas (GHG) emissions in the United States, with heavy-duty vehicles being the second-largest contributor within that sector. Reducing GHG emissions from heavy-duty vehicles is an important step in addressing the growing climate emergency that is already impacting our residents. [EPA-HQ-OAR-2019-0055-1288-A1,p.1]

Organization: *Mass Comment Campaign sponsored by American Lung Association (248)*

Trucks and buses are also a source of the greenhouse gas emissions fueling climate change. The most recent report from the Intergovernmental Panel on Climate Change made clear that the world remains incredibly vulnerable to catastrophic impacts of a warming climate. We see this in our communities. From extreme heat to flooding to wildfires, individuals' lives and livelihoods are at risk. [EPA-HQ-OAR-2019-0055-1609-A1, p.1]

Organization: *Mass Comment Campaign sponsored by Evangelical Environmental Network (EEN) (67,755)*

Pollution from transportation is a major cause of air-pollution-related death and disease, and recently transportation became the top source of global warming pollution in the United States. Heavy-Duty Trucks, like tractor-trailers, are a leading source of lung-damaging air pollutants—including smog-forming NOx pollution and particle pollution (soot). In 2020, trucks emitted an estimated 561 million metric tons of greenhouse gases, 1.5 million metric tons of nitrogen oxides (NOx) and 38,000 metric tons of particulate matter (soot) (PM), filling the air we breathe with life-threatening air pollution. The largest single source of these pollutants is heavy duty trucks. [EPA-HQ-OAR-2019-0055-1610-A1, p.1]

Organization: *Mass Comment Campaign sponsored by Moms Clean Air Force and Arizona Climate Action Coalition (198)*

The climate crisis is harming our families and our communities today and medium and heavy-duty vehicles are a major contributor to this pollution. In fact, despite making up only 10% of the total number of vehicles on the road, medium- and heavy-duty trucks contribute a quarter of the total climate pollution from the transportation sector. [EPA-HQ-OAR-2019-0055-1192-A1, p.1]

Organization: *Mass Comment Campaign sponsored by Neighbors for Clean Air and Elders Climate Action (43)*

The warmer climate has triggered a massive increase in wildfire in Oregon from an annual average of 120,000 areas burned just 20 years ago, to over 1 million acres each in 2020 and 2021. Wildfire studies reported in Oregon's Climate Assessment (2021) estimates wildfire will likely double in this decade to 2 million acres annually. Thousands of families lost homes to fire, businesses were destroyed and communities lost schools, health care facilities, water and power supplies and other infrastructure. Smoke pollution smothered the state with dangerous levels of air pollution that added hundreds of premature deaths. The record setting heat wave last year also took more than one hundred lives. [EPA-HQ-OAR-2019-0055-1619-A1,pp.1-2]

Oregon needs your help now to slow the warming to protect our families and communities. Medium and heavy-duty vehicles are a major contributor to this pollution. Despite making up only 10% of vehicles on the road, medium- and heavy-duty trucks emit a quarter of climate pollution from the transportation sector. Oregon has adopted the California rule to reduce heavy duty vehicle emissions, but Oregon's emissions are a small fraction of CO_2 emitted from vehicles nationwide. National emission reductions are needed to slow climate warming. [EPA-HQ-OAR-2019-0055-1619-A1,p.2]

Organization: *Mass Comment Campaign sponsored by The Climate Reality Project (10,820)*

Robust national standards will not only help reduce greenhouse gas emissions at a critical time, but prevent thousands of asthma cases – especially among children – hospital visits, and even deaths. [EPA-HQ-OAR-2019-0055-1083-A1, p.2]

Organization: *Mass Comment Campaign sponsoring organization unknown - 1 (2,443)*

Heavy-duty vehicles are also one of the nation's top sources of climate pollution. Nearly all of America's national parks are threatened by the symptoms of a warming climate including more frequent heat waves, drought, sea level rise, coastal flooding, and extreme wildfires. [EPA-HQ-OAR-2019-0055-1594-A1,p.1]

Organization: *Moving Forward Network (MFN)*

Add to all of this the reality that these same communities are also most at risk from the coming climate disaster. Today, global freight transport accounts for about 36 percent of overall transportation emissions, which itself accounts for one-quarter of overall CO_2 emissions, and therefore has a direct and significant impact on climate change.26 Put another way, while road transport makes up only 18 percent of total freight activity, it constitutes more than half of all freight-related CO_2 emissions. So, in addition to the clear need to address the health and air quality issues from the freight industry, there are also massive climate benefits to decarbonizing this sector. In its 2022 report "Zeroing in on Healthy Air," the American Lung Association found that a nationwide transition to zero-emission light-, medium-, and heavy-duty vehicles, powered by non-combustion electricity, would save 110,000 lives and secure $1.2 trillion in public health benefits nationwide from 2020-2050.27 These are health and economic savings that we cannot afford to waste. Yet this trend is even more worrisome than current figures indicate, since global freight traffic is accelerating substantially and emissions levels are therefore continuing to increase at an alarming rate. [EPA-HQ-OAR-2019-0055-1277-A1, p. 10]

26. IEA. "Tracking Transport 2020." IEA, 2020. https://www.iea.org/reports/tracking-transport-2020. 27

https://www.lung.org/getmedia/13248145-06f0-4e35-b79b-6dfacfd29a71/zeroing-in-on-healthy-air-report-2022.pdf

The effects of a growing climate crisis are already being felt by port-adjacent communities in deadly and dangerous ways. These effects range from deadly heat waves, to flooding, to superstorms, and hurricanes.28 Indeed, storm surge and hurricane events have significantly increased in severity and frequency in recent years. These superstorms, like Superstorm Sandy, have forced port-adjacent communities to confront new issues that are a direct result of an under-regulated freight transportation system. [EPA-HQ-OAR-2019-0055-1277-A1, p. 10]

28. https://njadapt.rutgers.edu/docman-lister/resource-pdfs/116-environmental-justice-stakeholder/file

Organization: *National Coalition for Advanced Transportation (NCAT)*

Federal vehicle standards are central to addressing climate change as well as state, regional, and local air pollution problems, which in many cases are severe. It is clear that action is needed and, in the U.S., the transportation sector generates the largest share of GHG emissions (29 percent of 2019 GHG emissions).14 [EPA-HQ-OAR-2019-0055-1290-A1, p. 4]

14. U.S. EPA, Sources of Greenhouse Gas Emissions, https://www.epa.gov/ghgemissions/sourcesgreenhouse-gas-emissions (last updated Apr. 14, 2021).

Organization: *National Parks Conservation Association (NPCA)*

National parks are incredibly vulnerable to the changing climate.15 As the temperature warms in the national parks at twice the rate of the United States as a whole, climate effects are felt across all park geographic regions and locations, from coastal areas to mountain ranges.16 Climate effects include: (1) rising sea levels; (2) increasingly intense wildfires; (3) threat and harm to wildlife habitats and lifestyles; (4) the rapid growth of disruptive, invasive species; (5) extreme weather damage; (6) drier conditions leading to difficult droughts; (7) loss of snow and ice; (8) changing landscapes and disrupted ecosystems; (9) destruction of irreplaceable park structures and artifacts; and (10) altered visitation patterns and significant losses to valuable tourism revenue.17 Due to the propensity of so much further damage being done to national parks including historic and cultural sites , climate change has been cited as a significant concern for 80 percent of the nation’s parks.18 If climate change continues at this rate and the climate effects continue to wreak havoc across the nation, wildlife and plant species’ populations will plummet, and possible additional extinctions could occur.19 However, this EPA rule can help address the climate crisis and in so doing, protect our parks’—reducing greenhouse gas emissions from heavy-duty vehicles is a massively helpful step to slowing climate change, as the transportation section is now the largest source of these emissions in the United States.20 [EPA-HQ-OAR-2019-0055-1314-A1, pp.3-4]

15 Patrick Gonzalez et al., Disproportionate Magnitude of Climate Change in United States National Parks, 13 ENVTL. RES. LETTERS 1, 6–10 (2018), https://perma.cc/99FL-CA3S.

16 Id. at 3.

17 NPCA, How the Climate Crisis Is Affecting National Parks, NPCA.org (last visited Apr. 30, 2022), https://www.npca.org/reports/climate-impacts; see also Patrick Gonzalez et al., Disproportionate Magnitude of Climate Change in United States National Parks, 13 ENVTL. RES. LETTERS 1 (2018), https://perma.cc/99FL-CA3S.

18 NPCA, Air and Climate Report: Polluted Parks, NPCA.org (2019), https://www.npca.org/reports/air-climate-report.

19 Id.

20 EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2018 at ES-25 (2020), https://perma.cc/98ZR-XNTR.

Organization: *National Religious Partnership for the Environment*

Transportation is the largest contributor to climate change in the U.S. Trucks and buses, which only account for 4 percent of vehicles on the road, produce nearly 25 percent of the transportation sector's greenhouse gases.

Organization: *National Tribal Air Association (NTAA)*

The Administration's Clean Trucks Plan, and this proposed component of that plan are exceedingly important to sovereign Tribes and the millions of Indigenous people who suffer from breathing unhealthy air. Additionally, we are all threatened by climate change. Emissions from trucks, buses, large engines, and internal combustion engines of all types are major contributors to these unacceptable conditions and well-documented threats.[EPA-HQ-OAR-2019-0055-1382-A2, p.1]

Our organization has consistently urged the U.S. EPA, Congress and States to do more to protect the health and quality of life of our members. Concurrently, Tribes are doing their part to reduce emissions including the many harmful pollutants from heavy-duty vehicles. For example, 119 Tribes and Alaska Native Villages have reduced diesel emissions through use of the VW settlement fund. Even more have participated, and continue to participate, in EPA's Diesel Emissions Reduction Act (DERA) program. [EPA-HQ-OAR-2019-0055-1382-A2, pp.1-2]

Organization: *Next Level Farmer, LLC*

There are multiple other factors affecting climate. 'Contact Info@Biochar-International.Org for credible research information'. What about forest fires? They produce toxic gasses, hazardous smoke, and airborne ash particles. What efforts are being made to stop forest fires in their tracks? Not enough I would say if 50,000 to 100,000acres are burned per fire. What about Third World Populations like China and Inda that burn wood to cook their food? This is a large percentage. However, if global efforts were made to provide a Pyrolylic Wood Burning Stove that burns wood in an oxygen-limiting environment this would have a huge impact on emissions. Plus, by burning wood or biomass through a Pyrolysis Furnace in an oxygen-limiting environment you get way more heat energy from the wood than from burning it with oxygen. What about countries in Africa that run diesel engines with limited to no pollution control devices? How is the United Nations Influencing their part in limiting pollution? What about holes in the Ozone Layer created by repeated rocket launches to put satellites in space? The heat from the rocket engines and heat from capsules re-entering the earth's atmosphere destroy the Ozone Layer. As an example NASA's launchpad is in one place and I am sure they use a simular flight pattern every time which punches holes into the earths Ozone Layer in one location. This would cause weak areas in the Ozone Layer and Sun Light would be get more and more intense on heating the ocean and affection the amount of evaporation and storm systems created at sea. Studies suggest that climate change is linked to the rise of the Industrial Revolution. The Space Race and Rocket tecnology has the same growth curve as the Industrial Revelution. Also, Tesla is planning 1,000 rocket launches to put his Global Satilite Internet Service into space. This is a 1,000 more holes in the Ozone Layer. What about the effects of the Moon on our weather? Why aren't those studies published? The Moon's Gravitational Pull effects our weather. What about the effects of Volcanos? One volcano eruption creates more ash and pollution than man does in a year. There are over 100 volcanos globally. What about the effects of large cities? Large cities put off a lot of heat. Many storm systems that come through Minnesota often go around Minneapolis and the surrounding suburbs because, of all the heat that is generated by the city. This is diverting the natural flow of weather systems. What I am saying is that it is not just one thing that is causing climate change. There are multiple factors that influence our weather. 'Contact Info@Biochar-International.Org for credible research information'. [EPA-HQ-OAR-2019-0055-2785, pp.1-2]

Organization: *Our Children's Trust*

These proposed rules will allow ‘air pollution from highway heavyduty vehicles and engines, including ozone, particulate matter, and greenhouse gases,’ (i.e., climate pollution) at levels that continue to endanger the climate system, locking in harm for the youngest generation. The RIA and Federal Register analysis of the proposed rule paint a very skewed picture of the real economic and health toll on children by continuing to unlawfully discount their lives and their health and by relying on economic analyses that by the agency’s own admission do not attempt to quantify some of the most significant economic costs and cost to lives by continuing to permit vehicles and engines to be fueled with fossil for the foreseeable future, with no plan in sight to cease this unconstitutional conduct that is quite literally destroying the quality of the air and the health of children. The science is clear—every ton of greenhouse gas emissions matters and causes more danger, more temperature rise, and more harm to children’s health and safety.2 While cast as a rule ‘to reduce air pollution,’ with no comprehensive standards for climate and air protection, this is another piecemeal authorization of ongoing unsafe levels of air pollution that are destroying our climate system. [EPA-HQ-OAR-2019-0055-1317-A1, pp.1-2]

2 IPCC, Summary for Policymakers, in Climate Change 2021: The Physical Science Basis, 28 (2021) ('Every tonne of CO_2 emissions adds to global warming.').

EPA makes no finding that the proposed regulation will protect public health and welfare and air quality, namely our climate. EPA makes no finding that these regulations are aligned with what is necessary to stabilize the climate system by preventing additional contributions of air pollution that push our climate system to further dangerous instability. These proposed regulations do not appear tied to any standard for protecting our nation's children or future generations. Instead, this rule purports to consider 'lead time, costs, and other [unidentified] factors, including market shifts to zero-emission technologies in certain segments of the heavyduty vehicle sector.' Instead of setting protective standards and leading the way to health and welfare, which are already compromised, EPA continues to follow the lead of the polluting technologies themselves. Please describe what scientific standards this proposed rule will meet in protecting air and human health and welfare. [EPA-HQ-OAR-2019-0055-1317-A1, p.2]

EPA's Actions Must Be Aligned with Restoring Earth's Energy Imbalance and Cease Infringing the Constitutional Rights of Youth. EPA has Public Trust and Constitutional Obligations to use its Authority to Protect the Atmosphere. [EPA-HQ-OAR-2019-0055-1317-A1, p.4]

Please explain how the proposed rule aligns with restoring Earth's Energy Imbalance? [EPA-HQ-OAR-2019-0055-1317-A1, p.4]

Excess accumulation of greenhouse gases in our atmosphere results in an Earth energy imbalance and thus an accumulation of heat in our climate system.7 The best available science informs that Earth's energy balance can only be restored by returning the atmospheric CO2 concentration to below 350 ppm by 2100.8 Experts have opined that it is economically and technically feasible to achieve the science-based greenhouse gas emission reduction target of close to 100% by 2050, while simultaneously enhancing sequestration capacity of sinks to drawdown historical cumulative CO2 emissions, placing the U.S. on an emissions trajectory consistent with returning atmospheric CO2 to below 350 ppm by 2100.9 [EPA-HQ-OAR-2019-0055-1317-A1, p.4]

7 Karina von Schuckmann et al., Heat Stored in the Earth System: Where Does the Energy Go?, 12 Earth Sys. Sci. Data 2013 (2020).

8 James Hansen et al., Assessing 'Dangerous Climate Change': Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature, 8 PLOS ONE e81648 (2013), https://doi.org/10.1371/journal.pone.0081648; Karina von Schuckmann et al., Heat Stored in the Earth System: Where Does the Energy Go?, 12 Earth Sys. Sci. Data 2013, 2014-15 (2020), https://doi.org/10.5194/essd-12-2013-2020.

9 See Our Children's Trust, Government Climate and Energy Policies Must Target <350 ppm Atmospheric CO2 by 2100 to Protect Children and Future

Generations (Mar. 2021); Mark Z. Jacobson et al., 100% Clean and Renewable Wind, Water, and Sunlight (WWS) All-Sector Energy Roadmaps for the 50 United States, 8 Energy & Env't Sci. 2093 (2015); Ben Haley et al., Evolved Energy Research, 350 PPM Pathways for the United States (2019), https://www.ourchildrenstrust.org/s/350-PPM-Pathways-for-the-United-States-gk6k.pdf; James H. Williams et al., Carbon-Neutral Pathways for the United States, 2 AGU Advances e2020AV000284 (2021); Ben Haley et al., Evolved Energy Research, 350 PPM Pathways for Florida (2020), https://www.ourchildrenstrust.org/s/350-PPM-Pathways-Florida-Report-pa2t.pdf; Mark Z. Jacobson, Zero Air Pollution and Zero Carbon From All Energy Without Blackouts at Low Cost in the Whole United States (2021), http://web.stanford.edu/group/efmh/jacobson/Articles/I/21-USStates-PDFs/21-WWS-USATotal.pdf.

Current increased average temperatures of 1°C and greater (now 1.2°C) are already dangerous. Basing policies and decisions that align with temperature targets of 1.5°C is exponentially more catastrophic for our children and posterity.10 The IPCC special report on Global Warming of 1.5°C (2018) stated that allowing a temperature rise of 1.5°C 'is not considered 'safe' for most nations, communities, ecosystems and sectors and poses significant risks to natural and human systems as compared to the current warming of 1°C (high confidence).'11 Medical experts have recently recognized that '[t]he science is unequivocal; a global increase of 1.5°C above the pre-industrial average and the continued loss of biodiversity risk catastrophic harm to health that will be impossible to reverse.'12 As such, 1.5°C should not be used to guide U.S. policy that is required to be based on best available science. The EPA should not be advancing policies that knowingly make the climate crisis worse, and potentially unsolvable. [EPA-HQ-OAR-2019-0055-1317-A1, p.5]

10 See IPCC, Overarching Frequently Asked Questions: FAQ 3: How will climate change affect the lives of today's children tomorrow, if no immediate action is taken? in Climate Change 2022: Impacts, Adaptation and Vulnerability (2022) ('[T]oday's children and future generations are more likely to be exposed and vulnerable to climate change and related risks such as flooding, heat stress, water scarcity, poverty, and hunger. Children are amongst those suffering the most . . . [C]hildren aged ten or younger in the year 2020 are projected to experience a nearly four-fold increase in extreme events under 1.5°C of global warming by 2100[.]')

11 M.R. Allen et al., Technical Summary, in Global Warming of 1.5°C, at 44 (2018); see also Assessing 'Dangerous Climate Change'. This was similarly noted in the IPCC, Summary for Policymakers, in Climate Change 2022: Impacts, Adaptation and Vulnerability, at 15 (2022): 'Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans (very high confidence).'

12 Lukoye Atwoli et al., Call for Emergency Action to Limit Global Temperature Increases, Restore Biodiversity, and Protect Health, The Lancet (2021) (emphasis added), https://doi.org/10.1016/S0140-6736(21)01915-2.

Climate change is causing a public health emergency that is already adversely impacting the physical and mental health of American children through, among other impacts, extreme weather events, rising temperatures and increased heat exposure, decreased air quality, altered infectious disease patterns, and food and water insecurity.13 Children are uniquely vulnerable to climate change impacts because of their developing bodies, higher exposure to air, food, and water per unit body weight, unique behavior patterns, dependence on caregivers, political powerlessness, and longevity on the planet.14 The protection of constitutional rights of children, by following the science, is of the utmost importance and must be incorporated in all relevant EPA rulemaking and policies. [EPA-HQ-OAR-2019-0055-1317-A1, p.5]

13 IPCC, Summary for Policymakers, in Climate Change 2022: Impacts, Adaptation and Vulnerability, at 11, 17 (2022). This summary found that the current level of global warming is already driving heat waves that cause human morbidity, heavy rains, flooding, extreme fires and drought, coral bleaching and demise, massive shifts in species habitats, loss of glaciers, snow and permafrost, as well as more destructive hurricanes. Id. at 11.

14 Samantha Ahdoot, Susan E. Pacheco & Council on Environmental Health, Global Climate Change and Children's Health, 136 Pediatrics e1468 (2015); Rebecca Pass Philipsborn & Kevin Chan, Climate Change and Global Child Health, 141 Pediatrics e20173774 (2018); Wim Thiery et al., Intergenerational Inequities in Exposure to Climate Extremes, 374 Science 158 (2021).

Our Children's Trust represents twenty-one youth plaintiffs, including eleven Black, Brown, and Indigenous youth, in the constitutional climate lawsuit, Juliana v. United States, in which the Administrator, in his official capacity, and EPA are defendants. This case asserts that, through the government's past and ongoing affirmative actions that cause climate change, it has violated the youngest generation's constitutional rights to life, liberty, property, and equal protection of the law, as well as failed to protect essential public trust resources. In this litigation, federal courts have affirmed 'that the federal government has long promoted fossil fuel use despite knowing that it can cause catastrophic climate change'15 and 'has long understood the risks of fossil fuel use and increasing carbon dioxide emissions'.16 The Ninth Circuit Court of Appeals found that there was evidence showing that the federal government was a substantial factor in causing the youth's constitutional injuries because '[a] significant portion of [GHG] emissions occur in this country; the United States accounted for over 25% of worldwide emissions from 1850 to 2012, and currently accounts for about 15%.'17 Without immediate effective action, our children and future generations will continue to suffer injury with long-lasting and potentially irreversible consequences.18 These judicially-recognized facts should guide EPA's policies and practices so they can identify, and alter, those policies that exacerbate American youth's existing climate change injuries. [EPA-HQ-OAR-2019-0055-1317-A1, pp.5-6]

15 Juliana v. United States, 947 F.3d 1159, 1164 (9th Cir. 2020).

16 Juliana v. United States, 947 F.3d 1159, 1166 (9th Cir. 2020).

17 Juliana v. United States, 947 F.3d 1159, 1169 (9th Cir. 2020).

18 See Assessing 'Dangerous Climate Change'; James Hansen et al., Ice Melt, Sea Level Rise and Superstorms: Evidence from Paleoclimate Data, Climate Modeling, and Modern Observations that 2°C Global Warming Could be Dangerous, 16 Atmos. Chem. & Phys. 3761 (2016); U.S. Global Change Research Program, Fourth National Climate Assessment, Vol. II (2018).

Our children and future generations are suffering injury with long-lasting and potentially irreversible consequences at present levels of heating and thus EPA must do everything in its power to facilitate greenhouse gas emissions reductions in line with best available science. Moreover, all young people seeking environmental and climate justice, especially youth from frontline and environmental justice communities that have contributed the least to emissions and have long suffered from systemic environmental racism and social and economic injustices, must not only have their voices heard, but have their rights protected. [EPA-HQ-OAR-2019-0055-1317-A1, p.6]

We seek to emphasize the need for EPA to align its rulemaking, policies, and initiatives with protecting the fundamental, constitutional rights of children. [EPA-HQ-OAR-2019-0055-1317-A1, p.6]

To learn more about how young people are being harmed, please watch the award-winning, independent feature-length documentary film now streaming on Netflix, YOUTH v GOV. These stories constitute just a small sample of what American children are experiencing due to the climate crisis the federal government continues to exacerbate by and through its national energy system. We request that the EPA incorporates the protection of children’s fundamental rights to a safe climate system, defined by the best available science, into future rulemaking, policies, and initiatives. Human laws must respect the laws of nature; our government ignores the natural laws of energy imbalance and climate destabilization at the peril of our children. We encourage you to consider additional details on our position as noted in Our Children’s Trust’s prior September 27, 2021 Comment to the EPA on the Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards - Proposed Rule (Docket No. EPA–HQ–OAR–2021–0208) attached below. [EPA-HQ-OAR-2019-0055-1317-A1, pp.6-7]

Please include all cited evidence in the administrative record. We are also happy to provide any of the cited evidence on request. All Juliana v. United States expert reports and related evidence are in the files of the Department of Justice, which represents EPA and the Administrator in the case, as its clients. Thus, you have access to all of those documents and evidence, along with the legal bases for the comments made herein. [EPA-HQ-OAR-2019-0055-1317-A1, p.7]

Organization: *Retail Industry Leaders Association (RILA)*

The threat of climate change is a critical issue that must be addressed with urgent action, which includes the implementation of effective climate change mitigation policies. Since heavy-duty transportation is a major source of GHG emissions in the United States, federal standards that reduce vehicular GHG emissions are a critical tool in the fight against climate change. It is also important for these standards to be updated to accurately track against any major shift or trends in the transportation market to ensure that these standards continue to reduce as much GHG as is technologically feasible. [EPA-HQ-OAR-2019-0055-1189-A2, p.6]

Organization: *Southern Environmental Law Center (SELC)*

Air quality can also be worsened by rising temperatures, one of the many effects of climate change. GHG emissions are a major driver of climate change, and the transportation sector is the largest source of GHG emissions in the nation.13 This is also true for most states in the South. The transportation sector is the largest source of carbon dioxide (CO2)—a significant component of GHGs14—in every state in SELC's region except for Alabama, where it is the second largest source.15 Within the transportation sector, medium- and heavy-duty vehicles are the second largest contributor of GHG emissions—behind only light-duty vehicles—accounting for about 24 percent of emissions.16 This amounts to roughly 7 percent of the nation's total GHG emissions. [EPA-HQ-OAR-2019-0055-1247-A1, p.3]

> 13 U.S. ENV'T PROT. AGENCY, Fast Facts: U.S. Transportation Sector Greenhouse Gas Emissions 1990-2019, EPA-420-F-21-076, 1 (Dec. 2021), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1013NR3.pdf.
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> 14 U.S. ENV'T PROT. AGENCY, Overview of Greenhouse Gases, https://www.epa.gov/ghgemissions/overviewgreenhouse-gases (last visited Apr. 13, 2022).
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> 15 Based on 2018 CO2 emissions. U.S. ENERGY INFO. ADMIN., State Carbon Dioxide Emission Data Tables, tbl. 4 (Mar. 2, 2021), https://www.eia.gov/environment/emissions/state/. For example, the transportation sector produces 48.6 percent of Virginia's CO2 emissions. Id.
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> 16 U.S. ENV'T PROT. AGENCY, Fast Facts: U.S. Transportation Sector Greenhouse Gas Emissions 1990-2019, EPA-420-F-21-076, 1 (Dec. 2021), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1013NR3.pdf.

The U.S. is already experiencing climate change impacts beyond worsening air quality. Sea level rise is affecting coastal communities around the country, and the South is particularly vulnerable. For example, the Hampton Roads region in Virginia has one of the highest rates of sea level rise on the East Coast, with scientists predicting a rise of 1.5 to 2 feet by 2025.17 The frequency of extreme weather events, including heavy precipitation, high tides, storm surges, and heat waves, also continue to increase.18 These weather events can lead to public emergencies and infrastructure disruptions, stressing health services and communities. There is also an economic cost to climate change. Studies have found that climate change could cost the U.S. approximately 1.2 percent of the gross domestic product for every additional degree of warming, with the South expected to experience greater impacts than other part of the country.19 [EPA-HQ-OAR-2019-0055-1247-A1, p.3]

> 17 NAT'L OCEANIC AND ATMOSPHERIC ADMIN., U.S. DEP'T OF COMMERCE, Global and Regional Sea Level Rise Scenarios for the United States (2017), https://bit.ly/2EUv033.
>
> 18 Tom Steinfeld & Chris Coil, GEORGETOWN CLIMATE CTR., and Hans-Peter Plag, OLD DOMINION UNIV., Understanding Virginia's Vulnerability to Climate Change, https://www.georgetownclimate.org/files/report/understanding-virginias-vulnerability-to-climate-change.pdf (last visited Apr. 13, 2022).
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> 19 Robinson Meyer, The American South Will Bear the Worst of Climate Change's Costs, THE ATLANTIC (June 29, 2017), https://www.theatlantic.com/science/archive/2017/06/global-warming-american-south/532200/.

Organization: *States of California, et al. (The States)*

The transportation sector is also the largest source of greenhouse gas (GHG) emissions in the United States, with heavy-duty vehicles being the second-largest contributor within that sector. Reducing GHG emissions from heavy-duty vehicles is thus an essential element of addressing the growing climate emergency that is already impacting our residents. For instance, during the summer of 2021, multiple deadly heatwaves with record-breaking high temperatures ravaged the western United States while hurricanes of historic force swept across the southern and eastern United States, resulting in mass power outages and producing record-breaking rainfall and fatal flash floods. Scientists project climate change-related impacts like these to worsen, and climate harms will disproportionately impact historically marginalized communities underscoring the urgent need for reductions in GHG emissions from this sector. [EPA-HQ-OAR-2019-0055-1255-A1, p. 2]

Organization: *Tesla, Inc. (Tesla)*

In addition to medium- and heavy-duty vehicles being one of the largest sources of other pollutants that negatively impact public health, including PM and NOx, they are also major emitters of climate-warming greenhouse gases (GHGs). As EPA acknowledges: Transportation is the largest source of GHG emissions in the United States, making up 29 percent of all emissions. Within the transportation sector, heavy-duty vehicles are the second largest contributor, at 23 percent. Reducing GHG emissions is a critical step in reducing the probability of impacts from climate change, including heat waves, drought, sea level rise, extreme climate and weather events, coastal flooding, and wildfires.44 [EPA-HQ-OAR-2019-0055-1219-A1, p.7]

44 EPA, Heavy-Duty 2027 and Beyond: Clean Trucks Proposed Rulemaking (March 2022) at 3.

As EPA has already determined, vehicle GHG emissions endanger public health and welfare.45 Since the issuance of the Endangerment Finding continued peer-reviewed scientific analysis has further elucidated the level of GHG emission reduction needed to adequately protect the public welfare. Per EPA's request for comment,46 the agency should look first toward the consensus UNFCCC and IPCC goal of limiting global warming to well below 2 degrees Celsius, preferably to 1.5 degrees, compared to pre-industrial levels as its baseline.47 The U.S. has adopted an international commitment to put policies in place consistent with this protective aim. 48 To meet this new target the U.S. has committed is to achieve a 50-52 percent reduction from 2005 levels in economy wide GHG pollution in 2030.49 This commitment is part of the national effort to prevent significant domestic impacts from climate change50 and embodies near term action commensurate with meeting this benchmark.51 As part of this effort, numerous studies have highlighted that electrifying the medium- and heavy-duty fleet as rapidly possible will enable the U.S. to meet its commitment and equitably contribute to emissions reductions that adequately protect the country's health and welfare.52 For example, a central component of the U.S. long-term climate strategy in transportation is the 'rapid expansion of zero-emission vehicles—in as many applications as possible across light-, medium-, and heavy-duty applications.'53 More specifically, 'addressing legacy diesel vehicles and emissions associated with ports, including from ships, port equipment, and trucks, would further contribute to meeting national climate, health, and climate justice goals.'54 Moreover, ALA found that the environmental benefits from electrifying the transportation in the form of avoided climate change impacts, as expressed as the Social Cost of Carbon,55 could surpass $113 billion in 2050 as the transportation systems combust far less fuel and our power system comes to rely on cleaner, non-combustion renewable energy.56 [EPA-HQ-OAR-2019-0055-1219-A1, pp.7-8]

45 74 Fed. Reg. 66496 (Dec. 15, 2009) (Endangerment Finding).

46 87 Fed. Reg. at 15585.

47 See generally, UNFCCC, Key aspects of the Paris Agreement.

48 The United States of America Nationally Determined Contribution Reducing Greenhouse Gases in the United States: A 2030 Emissions Target (date) at 23. ('As noted above, the United States' NDC is consistent with the Paris Agreement temperature goal of holding the increase in the global average temperature to well below 2 degrees Celsius above preindustrial levels and pursuing efforts to limit the temperature increase to 1.5 degrees Celsius above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change (Article 2.1(a)).'

49 White House: FACT SHEET: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies (April 22, 2021).

50 See, President Biden, Executive Order 14008, Tackling the Climate Crisis at Home and Abroad, 86 Fed. Reg. 7619 (Feb. 1,2021).

51 See Nature, Realization of Paris Agreement pledges may limit warming just below 2 °C (April 13, 2022) (Limiting warming not only to 'just below' but to 'well below' 2 degrees Celsius or 1.5 degrees Celsius urgently requires policies and actions to bring about steep emission reductions this decade, aligned with mid-century global net-zero CO2 emissions.)

52 See e.g., IPCC, AR 6, Working Group III, Climate Change 2022: Mitigation of Climate Change (date) at 10-89 (finding in a1.75 degrees scenario decarbonization happens primarily through a switch to hybrid electric and full battery-electric trucks, which leads to a 60% reduction in GHG emissions from freight in 2050 relative to 2015. Khalili et al. 20 (2019) also find substantial shifts to alternative fuels in HDVs under aggressive climate mitigation scenarios. Battery electricity, Hydrogen fuel cell, and plug-in hybrid electric vehicles constitute 50%, 30%, and 15% of heavy-duty vehicles, respectively, in 2050. They also find 90% of buses would be electrified by 2050.); See also, UNFCCC, Nationally determined contributions under the Paris Agreement; Synthesis report by the secretariat (Feb. 26, 2021) at 32 (In terms of specific technologies that Parties intend to use for achieving their adaptation and mitigation targets, the most frequently identified were energy efficient appliances and processes, renewable energy technologies, low- or zero-emission vehicles and hydrogen technologies)(emphasis added).

53 United States Executive Office of the President, The Long-Term Strategy of The United States Pathways to Net-Zero Greenhouse Gas Emissions by 2050 (November 2021) at 31.

54 Id. at 42.

55 See White House, Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990 (Feb. 2021).

56 ALA, The Road to Clean Air Benefits of a Nationwide Transition to Electric Vehicles, at 6.

Further, numerous studies show that the medium- and heavy-duty trucking sector must rapidly decarbonize beginning this decade to meet the U.S. commitments. A recent ICCT study found that a 2030 target of 45% zero emission sales in the U.S. heavy-duty vehicle sector is compatible with limiting warming to less than 2°C.57 Even more is needed to ensure that the protective limiting of overall warming to 1.5°C is reached.58 Another recent analysis found that if 70% of the Class 8 regional haul tractors in the US and Canada were electrified, it would result in the avoidance of almost 29 MMT CO2e annually.59 Other analyses indicate reaching net zero emissions requires 100% BEV sales in the heavy- duty sector by no later than 2045.60 [EPA-HQ-OAR-2019-0055-1219-A1, p.8]

57 ICCT, Emissions Reduction Benefits of a Faster, Global Transition to Zero-Emission Vehicles (Mar. 8, 2022).

58 Id.

59 NACFE, HD Regional Haul Tractors (Dec. 15, 2021).

60 Energy Innovation, The Cost of Delays (Feb. 3, 2020); See also, McKinsey, Climate math: What a 1.5-degree pathway would take (April 30, 2020); WHO, COP26 Special Report on Climate Change and Health (Oct. 12, 2021).

Organization: *United Methodist Church - General Board of Church and Society*

The United Methodist Church affirms the importance of efforts to 'conserve energy and increase energy efficiency' understanding that a just transition 'to energy efficiency and renewable energy sources will combat global warming, protect human health, create new jobs, and ensure a secure, affordable energy future' (2016 Book of Resolutions, 1001: Energy Policy Statement). Trucks and buses, which account for only 4 percent of vehicles on US roadways, produce 25 percent of the nation's total transportation related greenhouse gas emissions. These proposed regulations would capitalize on existing cleaner, more affordable zero-emissions medium and heavy-duty trucks. [EPA-HQ-OAR-2019-0055-1042-A1, p.1]

Organization: *University of California, Berkeley, The Goldman School, Center for Environmental Policy*

Our research shows that EPA proposed truck rules fall significantly short in meeting President Biden’s climate commitment, as detailed in the attached working paper, “Clean truck deployment consistent with President Biden’s climate commitment can save $1 trillion for consumers and avoid 70,000 premature deaths by 2050”. [EPA-HQ-OAR-2019-0055-1327-A1, p. 1]

Organization: *Ute Mountain Ute Tribe Environmental Programs Department*

Climate Change has directly impacted the Tribal Reservation lands. The Four Corners Area is home to the methane hot-spot and temperatures have risen almost two degrees in the last 100 years, with an accelerated increase since 1980. Water, which has historically been a scarce and valued commodity in the southwest is now even more threatened resource with the 'mega drought' the area is experiencing. Emissions from trucks, buses, large engines, and internal combustion engines of all types are major contributors to these unacceptable conditions and well-documented threats. [EPA-HQ-OAR-2019-0055-1259-A1, p. 2]

Organization: *Volvo Group*

Similarly, we believe the Paris Climate Accord goals must be realized to minimize the negative societal impacts of climate change. The Volvo Group acknowledges that it must work aggressively to achieve these goals and believes the best solution to jointly solve our climate change and air quality challenges lies in the acceleration of zero-emission vehicle penetration in the marketplace. [EPA-HQ-OAR-2019-0055-1324-A1, p. 2]

Organization: *William F. Limpert*

The recent UN International Panel on Climate Change sixth report also underscores in very frightening, yet scientifically accurate terms, how fossil fuel driven climate change will continue to negatively impact us, especially in the future. Among other impacts the report states:

- It is unequivocal that human influence has warmed the atmosphere, ocean and land. Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred.

- The likely range of total human-caused global surface temperature increase from 1850–1900 to 2010–2019 is 0.8C (centigrade) to 1.3C, with a best estimate of 1.07C.

- Global warming will exceed 2C this century unless deep reductions in GHG emissions are made.

- Under the very high emission scenario a 2.4C increase is likely by around 2050, and a 4.4C increase by around 2090.

- Under the very low emission scenario a 1.6C increase is likely by around 2050 dropping back to 1.4C increase by around 2090.

- CO2 levels are the highest in 2 million years.

- Methane levels have increased 154%, and are at the highest level in the past 800,000 years

- Weather extremes are more frequent and intense, including heat, precipitation, and category 3-5 tropical cyclones.

- Heavy precipitation events are likely to continue to increase with rising temperatures, including more category 3-5 tropical cyclones.

- The global water cycle is expected to become more variable and extreme

- Natural carbon sinks in the land and ocean will be less effective in removing carbon emissions, leaving more carbon in the atmosphere.

- Sea level is up 0.2 meters since 1900.

  - Relative to 1995-2014, the likely global mean sea level rise by 2100 is 0.41 meters under the very low emissions scenario, and 0.82 meters under the very high emissions scenario. A meter rise cannot be ruled out due to uncertainty about ice sheet processes.

- Sea level will be up 13 feet by 2300 even under the very low emissions scenario.

  - Sea level is committed to rise for centuries to millennia due to continuing deep ocean warming and ice sheet melt, and will remain elevated for thousands of years.

  - Changes in sea level, ice sheets and glaciers, and ocean acidification and deoxygenation will occur, and be irreversible for centuries or millennia.

These changes will especially negatively impact the very young, and the yet to be born. Those who will follow us will inherit a diminished and hostile world that we have passed on to them. These changes could very well end civilization as we know it. We need to make reducing the causes of climate change our biggest national priority, and these rules for the heavily polluting transportation sector will help move us in that direction. [EPA-HQ-OAR-2019-0055]

Organization: *World Resources Institute (WRI)*

EPA studies confirm that medium- and heavy-duty vehicles also generate 23 percent of the transportation sector's greenhouse gas emissions (GHG), contributing to the severity of climate change impacts, including heat waves, drought, sea level rise, extreme climate and weather events, coastal flooding, and wildfires. Some populations may be especially vulnerable to these and other climate change impacts, including low-income communities, people with disabilities, people of color, and Indigenous populations. Furthermore, studies (such as the recent 'Zeroing in on Healthy Air' from the American Lung Association) show that regulations and policies designed to reduce GHG emissions, such as through accelerating electric transportation, will have the added benefit of reducing other forms of pollution, such as air toxics and particular matter, that impact public health and disproportionately impact overburdened communities. [EPA-HQ-OAR-2019-0055-1298-A1, p.2]

<u>EPA Response</u>

EPA is not taking final action at this time as part of this final rule on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards).

3 Criteria pollutant standards

3.1 General comments criteria pollutant standards

3.1.1 General comments on stringency of criteria pollutant standards

<u>Comments by Organizations</u>

Organization: *Alliance for Vehicle Efficiency (AVE)*

AVE supports EPA's effort to reduce emissions, specifically nitrogen oxides (NOx), and particulate matter (PM) from this important segment of the transportation sector.

AVE supports EPA's proposed Option 1 standard, with a modification of the proposed full useful life timelines and warranty requirements, as the best option for driving more rapid adoption of advanced engine and emission control technologies. In 2020 at the commencement of this rulemaking, AVE urged EPA to use this last in a generation opportunity to vastly improve air quality across the country.1 Since EPA's prior rulemaking in 2001 for NOx emissions for heavy-duty (HD) vehicles, automotive suppliers have continued investing in new engine and emission control technology to improve performance and emissions. [EPA-HQ-OAR-2019-0055-1280-A1, p. 2]

1. See https://www.regulations.gov/comment/EPA-HQ-OAR-2019-0055-0460

Today, new engine architecture and advanced emission control technologies are available as cost-effective options for manufacturers to reduce NOx emissions by over 90% from current standards. Since January of 2020, data has emerged that confirms the readiness of technology to meet the most aggressive low-NOx standards. [EPA-HQ-OAR-2019-0055-1280-A1, p. 2]

Without continual developments in ICE technology, the U.S. could miss out on environmental gains that could significantly advance our nation's climate goals. ICE engine advancements can help make faster, impactful improvements, particularly for at-risk communities. [EPA-HQ-OAR-2019-0055-1280-A1, p. 5]

AVE urges EPA to adopt a true "all-of-the-above" strategy that fosters all types of automotive innovation. In 2012, EPA contended that at times it is "…worthwhile to forego modest additional emissions reductions in the near term in order to lay the foundation for the potential for much larger ''game-changing'' GHG emissions and oil reductions in the longer term." 8 We believe such a trade-off can actually stifle innovation and could easily lead to technology backsliding. Supporting improvements to ICE vehicles will also benefit technologies being manufactured in the U.S. that provide hundreds of thousands of direct jobs, making it the nation's largest sector of manufacturing jobs with employees in all 50 states.9 [EPA-HQ-OAR-2019-0055-1280-A1, p. 5]

8 See Federal Register / Vol. 77, No. 199 / October 15, 2012; Federal Register / Vol. 86, No. 151 / August 10, 2021

9 U.S. Labor and Economic Impact of Vehicle Supplier Industry, MEMA and IHS Markit. February 2021.

Organization: *Allison Transmission, Inc. (Allison)*

- Allison believes a single-phase approach to the imposition of emission standards, as in Option 2, is a better long-term strategy given technology disruptions and need for industry to focus on research and development needs associated with reducing carbon dioxide ("CO2") emissions as required by the proposed revisions to the Phase 2 rule and the scheduled Phase 3 rule to address Model Year ("MY") 2030 and later year vehicles. A two-phase approach to new standards would lead to serious gaps in the availability of technology for many segments of the fragmented vocational vehicle market. In the proposed rule, EPA does not account for necessary periods of time, often several years in length, that are needed to validate new technology in the vocational vehicle sector. [EPA-HQ-OAR-2019-0055-1231-A1, p.5]
- EPA has proposed two-different options with regard to the stringency of new standards to control emissions of nitrogen oxides ("NOx") from heavy-duty vehicles ("HDVs"). EPA is also taking comments on the range of alternative standards that lie between the two options.5 On the whole, Allison supports the single-phase regulatory structure of Option 2, rather than imposing two different sets of standards in Model Years ("MYs) 2027 and 2031 under Option 1. As indicated in more detail below, the imposition of new standards for heavy-duty commercial vehicles has historically been preceded by a "pre-buy" period where trucking companies and other fleet and individual purchasers seek to avoid a step-up in price and change in emissions architecture for vehicles that will be used in their business. This is followed by a downturn in business after the new standards take effect (the "low-buy" period). Thus, rather than smoothing out any pre-buy period by phasing-in two sets of standards taking effect within four years of each other, Allison believes that EPA's Option 1 would likely exacerbate the turmoil that normally attaches to the imposition of new standards. [EPA-HQ-OAR-2019-0055-1231-A1, p.7]

Should EPA determine to have a phased-in program, the four-year period between implementation of the MY 2027 and 2031 standards under Option 1 is far too short. While it may comply with the minimum statutory period provided for in the Clean Air Act ("CAA"), for most vehicle categories, the stringency level of NOx standards will be reduced by 50% or more during the second-phase of the Option 1 standards.6 In that four-year timeframe, many OEMs and component suppliers will simply have insufficient resources to accommodate the necessary research, development and testing required to ensure compliance with the MY 2031 standards. This is especially true given that companies will need to allocate their resources on two different pathways for improvement in conventional engine/vehicle emissions and developing new ZEV technology. OEMs will struggle to support installation refreshes of conventional powertrain technology across all vehicle classes in multiple steps. [EPA-HQ-OAR-2019-0055-1231-A1, p.7]

6 The sole exception would be for low-load performance for heavy heavy-duty engines in 2031.

While Allison recognizes that EPA has proposed various flexible compliance mechanisms during this period, all segments of the HDV industry will need to simultaneously prioritize their economic resources towards lower GHG technology, rather than incremental improvements in NOx reduction technology. EPA risks segmenting the industry into “haves” and “have nots” based on the sheer financial capacity of larger companies and OEMs to invest in a broader range of lower NOx and lower GHG technology at the same time. [EPA-HQ-OAR-2019-0055-1231-A1, pp.7-8]

After reviewing EPA’s proposed rule and the supporting documentation available in the docket, Allison believes the Option 2 stringency levels of 50 mg/hp-hr (0.05 g/hp-hr) for all HDV engines as measured by the FTP and the SET duty cycles and 100 mg/hp-hr (0.1 (g/hp-hr) as measured pursuant to the new Low- Load Conditions (“LLC”) cycle is most consistent with EPA’s authority under CAA section 202. [EPA-HQ-OAR-2019-0055-1231-A1 p.8]

EPA is proposing to set standards pursuant to CAA section 202(a) and 202(a)(3)(A). The first authority allows EPA to set standards that “take effect after such period as the Administrator finds necessary to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance within such period.” The second authority specifies that with regard to certain criteria air pollutants, including NOx, standards are to “reflect the greatest degree of emission reduction achievable through application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology.”7 Option 2 standards best reflect this statutory balancing of the factors EPA must take into account when specifying standards that will cover a wide range of commercial vehicles designed specifically to accomplish numerous work tasks and conditions. [EPA-HQ-OAR-2019-0055-1231-A1, p.8]

7 See 87 Fed. Reg. at 17420.

Option 2 standards are also the preferable option for the final rule due to the inherent challenges and lead-time required for the validation of new emission control technologies. In this regard, EPA is concurrently proposing to extend useful life periods for both spark-ignition and compression ignition HDVs. Like the stringency of required NOx emission levels, useful life periods are more aggressive under Option 1 than Option 2 when fully phased-in by MY 2031, although the first phase of Option 1 is somewhat less aggressive than Option 2 as applied to MY 2027 and later MY vehicles.8 Whatever useful life periods are contained in the final rule, however, the longer useful life periods will impose substantial upfront engineering and materials costs. As EPA is aware, systems will need to be designed and built to ensure sufficient “head room” for compliance over many years, which in the case of EPA’s proposed standards, may be up to 15 years. Companies that supply original equipment manufacturers (“OEMs”) with various systems, like Allison, will need to ensure that the lengthy proposed mileage/time periods can be accommodated. Because EPA intends to move this regulation forward to completion in 2022, there will be only four years (perhaps less) time from the finalization of the regulation to the time where fully-engineered vehicle systems will need to be developed, produced, and sold to ultimate purchasers. This means that interim dates for design, testing, validation, production, and distribution will be challenging even under the least stringent options being considered by EPA. [EPA-HQ-OAR-2019-0055-1231-A1, p.8]

8 Table 1 – Proposed Options 1 and 2 Emission Standards for Heavy-Duty CI and SI Engines on Specific Duty Cycles, Id. at 17,422.

The final Southwest Research Institute ("SWRI') report9 contained in the docket for this rulemaking indicates that a diesel engine platform "present[s] a much greater challenge to achieving ultra-low NOx emissions. As with all diesel engines, the combination of lean exhaust and lower exhaust temperatures makes NOx control particularly difficult."10 In the SWRI analysis, traditional approaches to NOx control were not capable of meeting the target 0.02 level; advanced technology approaches were necessary to even approach, much less achieve this level on a consistent basis.11 And, while the advanced approaches examined by the SWRI achieved results showing the potential to even go below 0.02, considerable alterations were necessary to address various issues, including cold start. Relatedly, despite a long-standing California program to allow for certification of vehicles as 0.02, to date, it is notable that only natural gas and liquefied petroleum gas engines have been certified to this level,12 not the diesel and gasoline-powered engines that are the explicit focus of this rulemaking. [EPA-HQ-OAR-2019-0055-1231-A1, p.9]

9 Evaluating Technologies and Methods to Lower Nitrogen Oxide Emissions from Heavy Duty Vehicles, Final Report, April, 2007, Prepared for California Air Resources Board ("CARB Final Report").

10 Id. at xxxv.

11 Id. at xl.

12 87 Fed. Reg. at 17,433

In the SWRI analysis, there were even more issues with maintaining the 0.02 level over time. While a "full useful life" duration of 435,000 was used – substantially less than proposed by EPA in this rulemaking -- the results from this study showed that aged parts achieved levels above 0.02 -- approximately 0.035 -- on a composite FTP duty cycle.13 EPA's Draft Regulatory Impact Analysis ("RIA") also showed measured values above the 0.02 standard after 1,000 hours of accelerated thermal and chemical aging to simulate 435,000 miles of operation. While not at the level of SWRI, EPA's results were above the level of the proposed Option 1.14 Finally, while EPA has proposed longer useful life periods apply, data showing compliance with the 0.02 standard over such time periods were not available in the docket upon Federal Register publication.15 [EPA-HQ-OAR-2019-0055-1231-A1, p.9]

13 CARB Final Report at xlvii, xlix.

14 Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, Draft Regulatory Impact Analysis, Table 3-7, at 115 (“Draft RIA”).

15 EPA indicates that data for 800,000 miles of operation is not available yet, but will be added to the docket when completed. Draft RIA at 129.

EPA should keep in mind several additional perspectives when determining the final standards to apply to MY 2027 and later HDVs:

- Allowing for an adequate compliance margin is absolutely necessary for near-term standards, given the costs, engineering challenges, required testing and verification efforts that are needed to address both stricter standards and longer useful life periods that require increased part durability. Thus, in seeking to impose standards starting in MY 2027, EPA must allow for sufficient “headroom” that is reflective of real-world production and not base standards solely on the thorough – but selective -- testing that has been performed by SWRI or other organizations.
- Setting standards that reflect more stringent levels in the near term could actually inhibit the development of new emission control technologies by incentivizing industry to utilize only the most conservative approaches to controlling emissions. Industry will logically pursue the most tested and verified technologies to reduce compliance risk even if newer technologies could result in additional reductions over the near and long term. [EPA-HQ-OAR-2019-0055-1231-A1 pp.9-10]

EPA must also create a regulatory environment that encourages industry innovation to develop best technology for customer needs and environmental targets over the long-term which can require an assessment and balancing of near-term priorities to improve air quality and reduce GHGs with longer term goals to ensure that the best technology choices are available and sustainable reductions in air pollution are achieved. Different technological approaches can result in different environmental benefits within different timeframes. EPA should not mandate (or preclude) in the final rule the ability for industry to utilize different technological options such as vehicle electrification or alternative fuel pathways like hydrogen. And requirements and timeframes should allow sufficient time and flexibility for private sector investment in different options which may have different tailpipe and “upstream” emissions.[EPA-HQ-OAR-2019-0055-1231-A1, p.34]

EPA should strive to better analyze this larger picture for the development and deployment of vehicles in the vocational vehicle sector where several factors (e.g., the carbon content of electricity used, the production process for hydrogen, the availability of charging/fueling stations) can determine the level of overall emissions. In some cases, longer timeframes may be necessary to allow for full development and market confidence in different equipment and fueling approaches, but these longer timeframes would result in better overall environmental outcomes. In addition, as cited above, it is essential to fully validate new technologies in vocational vehicle applications prior to commercial sale. Further consideration of the timeframes and effort involved in transition to cleaner medium- and heavy-duty vehicles will pay off in the end; it will help obtain the most cost-effective transition for vehicle owners while ensuring that emission reductions can be sustained.[EPA-HQ-OAR-2019-0055-1231-A1, p.35]

One current example of this dynamic lies within EPA's own experience with the Diesel Emissions Reduction Act program ("DERA"). EPA's most recent assessment of this program indicates that $629 million in funding was awarded in Fiscal Years 2008-2016 resulting in approximately $19 billion in monetized health benefits, producing a cost-to-benefit ratio of 27:1.70 These health and environmental gains have largely been achieved through the funding of various technologies, including aerodynamic technologies, diesel oxidation catalysts ("DOCs"), diesel particulate filters, DOC+ Closed Crankcase Ventilation, engine replacement, idling reduction technologies, truck stop electrification and vehicle replacement.71 In other words, no one particular pathway was taken and incremental improvements to the medium- and heavy-duty diesel fleet produced substantial, cost-effective benefits. EPA should consider this past experience in designing programs that will apply prospectively to newly manufactured engines and vehicles and not selectively favor one technological approach to reducing NOx. [EPA-HQ-OAR-2019-0055-1231-A1, p.35]

> 70 DERA Fourth Report to Congress, EPA Office of Transportation and Air Quality, July 2019 at 1.
>
> 71 Id. at 4.

- Allison does not support Option 1 and further believes that attempts to make Option 1 more flexible in implementation (e.g., by shortening useful life or warranties or allowing for additional compliance margins) would not overcome the fundamental issue of the stringency of the NOx standard being imposed. As detailed above, Allison believes that the stringency of the Option 1 NOx standard will dictate that only limited technological pathways will be adopted, excluding other potential options to reduce emissions on a more cost-effective basis over the longer-term. OEMs and vendors will necessarily have to design "to the number" of the final emission standard and will only choose options that have the most proven performance. This dynamic will forfeit the possibility of industry investing in a broad range of alternatives. [EPA-HQ-OAR-2019-0055-1231-A1, p.37]

- EPA will likely receive comments questioning the technical feasibility of engines, vehicles and equipment meeting the Option 1 20 mg/hp-hr (0.02 g/hp-hr) standard. As a transmission manufacturer, Allison does not seek to offer specific comments on the ability of vehicles and equipment to meet the Option 1 standard on an engine-out basis, but believes that the wide variety of vehicle applications and vehicle options in the vocational vehicle sector strongly favors the adoption of Option 2. As pointed out in our comments this is due to several factors including: (a) allowing for a variety of technological options; (b) allowing sufficient time for research, development and validation of technology; (c) recognition that not all options will be available/validated in the vocational vehicle sector at the same time; and (d) our concerns that the two-phase structure of Option 1 will exacerbate issues of pre-buy and low-buy. If EPA proceeds with finalization of a 0.02 g/hp-hr standard, it should strongly consider limiting application of this standard to segments of the market outside of the vocational vehicle sector. [EPA-HQ-OAR-2019-0055-1231-A1, p.37]

Organization: *American Bus Association (ABA) (1070 and 1308)*

In terms of the Proposal, ABA comments are in response to the proposed revisions to the emissions control program outlined in the Notice, and do not address the proposed changes to the Greenhouse Gas Phase 2 program. Specifically, ABA has a number of specific concerns relating to the effect the Proposal will have on feasibility, cost, and operational reliability. [EPA-HQ-OAR-2019-0055-1308-A1, p.5]

As repeated throughout the Notice, EPA must also consider technological feasibility, compliance cost, and lead time, in addition to reducing pollution when establishing or revising standards as part of its statutory mandate. In terms of technological feasibility, based on discussions with engine manufacturers and by reviewing prior submissions to the California Air Resources Board (CARB) Omnibus rulemaking1, ABA is concerned about the technological feasibility of the Proposal, particularly with regard to EPA's favored Option 1. The ABA, as representatives of heavy-duty vehicle users and lacking resources to evaluate the technical complexities involved in developing engines and emissions control systems, must rely on the expertise of such manufacturers. Based on the opinions expressed by the engine manufacturing and the vehicle components manufacturing industries, there remain questions as to the feasibility of complying with the proposed revised standards, particularly Option 1's step 2. Although we understand research conducted by the Southwest Research Institute demonstrated promise, in terms of establishing feasibility for the proposed revised standards pursuant to Option 2, we further understand the research was limited and not actually evaluated in terms of an actual vehicle, let alone a fully loaded motorcoach, or other real-world scenario. Based on the lack of consensus of whether the proposed revised emissions standards are technically feasible, ABA believes EPA should reconsider the underlying data and focus on its proposed Option 2. As the vehicle components manufacturing industry noted in their comments to the CARB Omnibus regulation, technologies continue to develop and can be improved as they are implemented. Since the technology evaluated by the Southwest Research Institute has yet to be actually deployed in an actual vehicle, of any sort, it seems premature for EPA, even with its "technology-forcing" authority, to attempt to impose standards beyond MY 2031, per Option 1. [EPA-HQ-OAR-2019-0055-1308-A1,p.6]

> 1 "Proposed Heavy-Duty Engine and Vehicle Omnibus Regulation and Associated Amendments," California Air Resources Board, Aug. 2020.

EPA should also consider that by acting prematurely, relying on its "technology-forcing" approach, it may again find itself in the position it is now in, seeking revisions to its 2016 Greenhouse Gas Emissions Phase 2 program. As noted in the Notice, EPA premised the 2016 rule on the unlikelihood of the heavy-duty market becoming electrified in the time frame of the program. However, the Agency's outlook has now apparently changed regarding targeted segments of the heavy-duty market. As technological advancement is sure to occur during the proposed Option 2 timeline, as engine and component manufacturers heavily invest in research and development, ABA believes EPA should not consider imposing standards beyond Option 2. [EPA-HQ-OAR-2019-0055-1308-A1, p.6]

If EPA determines to proceed with the Proposal, ABA supports Option 2 only. [EPA-HQ-OAR-2019-0055-1308-A1, p.6]

Organization: *American Truck Dealers (ATD)*

New NOx Standard. Based on a review of information provided by HDE and CMV manufacturers (OEMS), ATD urges EPA to adopt proposed “Option 2,” which will require dramatic but arguably feasible HDE NOx reductions starting with MY 2027. ATD strongly opposes proposed “Option 1” which would mandate an unacceptable two-step set of new standards in MY 2024 and MY 2031 that will not be feasible to comply with without significantly compromising expected vehicle performance characteristics, including fuel economy. [EPA-HQ-OAR-2019-0055-1321-A1, p. 3]

Zero Emission CMVs: Almost daily an HDE or CMV OEM announces a new alternative fuel or technology (natural gas, hydrogen fuel cell, battery-electric, etc) product they are developing. ATD’s members are committed to educating prospective new CMV customers about these exciting new products, to selling, leasing, servicing, and repairing those products as they come to market, and to making the investments in on-site fueling, tooling, and education necessitated by those products. And as evidenced by activities at the March 2022 NADA/ATD Show6, and by its work with the U.S. Departments of Transportation and Energy on the deployment of critical public charging facilities, ATD is likewise committed. But ATD urges EPA to recognize that, while alternative fueled and new technology vehicles are on coming, this NOx rulemaking should focus exclusively on feasible and cost-effective strategies for reducing NOx emissions from the significant number of new CMVs powered by ICE diesel and gasoline HDEs that also will be coming to market in MY 2027 and beyond. [EPA-HQ-OAR-2019-0055-1321-A1, p. 3]

6. See Attachment C, NADA, Everything Electric at NADA/ATD Show 2022 (2022).

As discussed above, ATD urges EPA to move forward with a single set of technologically achievable and customer acceptable national HDE NOx standards for MY 2027 and later, while relegating any consideration of new HDE GHG mandates to a separate “Phase 3” rulemaking. [EPA-HQ-OAR-2019-0055-1321-A1, p. 8]

Organization: *American Trucking Associations (ATA)*

ATA has established 12 fleet Guiding Principles that should be considered in the development of HD2027 including:

- Standards should not adversely impact existing or future regulatory requirements currently in effect whether by EPA or other federal agencies.
- New emission standards should be uniform across the country.
- The wide diversity in truck operations, duty-cycles, and fleet turnover rates must be considered.
- Technologies under consideration should be thoroughly tested in a multitude of fleet operations under varying duty cycles under all climatic conditions.

- The rule should not impede the transition towards the purchase of ZEVs. [EPA-HQ-OAR-2019-0055-1326-A1, p. 5]

HD2027 is closely intertwined with the forthcoming Phase 3 rule to be implemented beginning in 2030. The current low-NOx effort will likely be the final Agency NOx emissions standard for fossil-fueled trucks as our industry begins it efforts towards decarbonization. HD2027 serves as one final step towards clean diesel technology improvements as the future focus of trucking will be redirected towards ZEV technologies. [EPA-HQ-OAR-2019-0055-1326-A1, p. 6]

Manufacturers need certainty in terms of planning, timing, research and development, and investments. Establishing NOx emission milestones beyond 2030, as envisioned under Option 1, creates another layer of technological difficulty as resources will be stretched thin to ensure technology pathways are achievable between both rules. Research and development are never free. Fleets ultimately pay for new technologies as OEMs recoup their investments one increased invoice at a time. [EPA-HQ-OAR-2019-0055-1326-A1, p. 6]

ATA appreciates the opportunity to submit these comments on HD2027. We ask that the agency continue to proceed in a deliberative manner that weighs science over empathy and facts over speculation. EPA's proposed Option 1 is not technologically or economically feasible and we urge that the final rule be set at a place where EPA, fleets, and manufacturers can successfully develop the next pathway for a cleaner tomorrow and keep the nation's supply chains strong. [EPA-HQ-OAR-2019-0055-1326-A1, p. 20]

Organization: *Anonymous 1035*

Reducing the emissions of ozone, oxides of nitrogen (NOx), particulate matter, and greenhouse gases (GHG) in heavy-duty vehicles is critical. While heavy-duty vehicles make up less than 5% of vehicles on the road, they contribute 20% of transportation emissions because commercial heavy-duty vehicles tend to drive further than passenger vehicles [1]. While passenger transportation slowed during the pandemic, freight demand has only grown. The heavy-duty truck market is set to grow by 7% in the next five years, making the regulation of NOx and other emissions in these vehicles a high priority [2]. [EPA-HQ-OAR-2019-1035]

Oxides of nitrogen have detrimental effects on both environmental and human health. It can damage human respiration and sense of smell [3]. As the docket covers in detail, people of color and low-income communities are the most likely populations to be exposed to NOx and suffer from its effects, yet another example of the large trend of environmental harm disproportionately affecting already socially marginalized groups. On the environmental side, high levels of nitrogen dioxide have been known to damage vegetation and reduce crop yields [3]; this threatens growing regions, many of which are already projected to shrink and buckle under demand due to climate change [4]. [EPA-HQ-OAR-2019-1035]

I support the EPA's recommendation of proposed Option 1. Option 1 takes the most aggressive stance on reducing NOx emissions; it is projected to cut the emissions of nitrogen oxides from heavy-duty vehicles in half by 2040, and by 60% in 2045. It is important to note that the world is currently not on track to meet most environmental targets, such as the UN Sustainable Development Goals or the Paris agreement [5]. It is important to overshoot and take an ambitious stance against NOx and other emissions with this reality in mind. To this end, I encourage my fellow readers to weigh both options' economic potential by considering the lower discount rate of 3%. Discount rates take into account that future generations will be wealthier than today's; thus, a dollar today has higher marginal utility than one in the future. Discount rates also take into account reduced future value due to inflation. A higher discount rate signals that we would much rather limit our spending against climate change today, even if it pushes higher expenses to the future because it assumes we will value future dollars less. However, we would err to use a high discount rate when weighing policy towards nitrogen oxides emissions. Firstly, these emissions will have long-term ramifications that we may not fully understand or foresee. Second, the assumption that future generations will be much more prosperous and able to absorb the costs of today's emissions on their society is dubious: global growth is expected to slow through 2023, particularly in developing countries [6]. In some future time, we may hit a breaking point where expenditures may only focus on addressing the immediate severe effects of climate change. To affirm the belief in intergenerational environmental justice, we should apply a prescriptive approach and use a lower discount rate. This would also return to the standard 3% discount rate used by the Obama administration to calculate the social cost of carbon [7]. [EPA-HQ-OAR-2019-1035]

I would like to react to a few particular topics in the docket. It is commendable that Option 1 has followed the guidance of Executive Order 12898, and is suggesting an option they believe will not adversely impact minority and low-income populations. By enacting the emissions reductions, it would actually disproportionately benefit the marginalized populations currently most heavily subject to transportation emissions. These policies would also reduce the atmospheric concentration of ozone and particulate matter, resulting in "avoidance of many adverse environmental and human health impacts in 2045, including reductions in premature deaths and many non-fatal illnesses" (p. 17643). This is important because, in addition to having worse health outcomes [8], minority populations experience the impact of emissions disproportionate to their own consumption [9]. One thing I would have liked to see is more analysis of the impacts of these policies on the Global South, both from an economic and environmental viewpoint. [EPA-HQ-OAR-2019-1035]

This docket is a step in the right direction, but I also encourage the EPA to continue exploring zero-emissions vehicles and trends in the trucking industry. As trucking demand explodes, a growth not even stifled by the pandemic, the freight industry has considered pivoting to more efficient solutions such as powertrains [10]. The EPA should assess that new transportation technologies are also properly and aggressively regulated, especially as more companies may turn in this direction amidst trucker shortages. On the bright side, interest in fuel-efficient fleets and optimized trucking routes (ie. shorter and less fuel-intensive) from the industry side may lead to a useful collaboration with the EPA toward environmental goals. [EPA-HQ-OAR-2019-1035]

[1] https://www.eesi.org/papers/view/fact-sheet-vehicle-efficiency-and-emissions-standards

[2] https://www.mordorintelligence.com/industry-reports/heavy-duty-trucks-market

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we-head-into-2022/?sh=3c041be44475

Organization: *Arizona Public Health Association*

The Arizona Public Health Association urges USEPA to select Option 1 for heavy and medium duty truck emissions. We also urge EPA to include emission limits on particulate pollution in addition to the NOx standards. As it stands, the current rule only sets new goals for NOx – not particulate matter. While cutting NOx emissions can cut particulate matter emissions including more stringent particulate standards will motivate engineers to ensure that both goals are achieved. [EPA-HQ-OAR-2019-0055-2114, p. 1]

Organization: *BorgWarner*

2. EPA's proposed Option 1 standards are technically feasible, once the caveats above on FUL and warranty have been recognized. The proposed Option 1 has the potential to drive more rapid adoption of advanced engine and emission control technologies, benefitting both the environment and economy. In addition, we appreciate EPA's consideration for the following factors for the final rule: [EPA-HQ-OAR-2019-0055-1234-A1, p. 2]

Option 1 represents better harmonization of future national standards with California's Omnibus rules, which would bring the country together to a more unified national program. Vehicle performance and emissions are determined by fundamental vehicle and propulsion architectures which should not change from one state to another. Decisions regarding long-term investment in R&D, capital and tooling are challenging for suppliers like BorgWarner, who support all major automakers in all U.S. markets. Therefore, state-to-state variations in emissions standards create the need for automotive suppliers to invest in multiple technology solutions to meet our customers' needs. With several states already choosing to adopt California's low-NOx Omnibus rules, harmonization of the standards is necessary to provide industry with certainty for investments and efficiencies in product development and manufacturing, and a common technology approach for the full national market. [EPA-HQ-OAR-2019-0055-1234-A1, pp. 2 - 3]

BorgWarner opposes technology mandates, including any Zero-Emissions Vehicle (ZEV) mandate. We consistently urge regulators to develop standards that are technology neutral and performance based to encourage innovation. All technology pathways with practical applications should be included as potential solutions to assist the U.S. in achieving its environmental goals. Regulations based on the end goals of a clean environment, minimizing CO2 emissions and preserving resources should not give preferential treatment to a specific technology. Public policies should let innovation and market dynamics determine the most effective solutions. [EPA-HQ-OAR-2019-0055-1234-A1, p. 3]

Technologies to meet the most stringent NOx standards are available today and ready to deploy to improve air quality across the country. These engine and emission control technologies, if deployed quickly, present an opportunity to significantly lower NOx emissions. This quick deployment is urgently needed in disadvantaged communities, located near highways and heavy truck traffic, that experience poor air quality and the associated health risks. EPA should allow for a review of increased stringency should technology pathways demonstrate earlier readiness to maximize environmental benefits in the near-term as EV trucks become a larger part of the marketplace. [EPA-HQ-OAR-2019-0055-1234-A1, p. 4]

Organization: *California Air Resources Board (CARB)*

Ultimately, the future of heavy-duty vehicles is a full transition to zero emission vehicles (ZEV). But there will be a substantial number of combustion vehicles placed into service even under

California's nation-leading ZEV rules, and there are no such rules nationally. Though CARB urges U.S. EPA to accelerate efforts to promote ZEVs, the agency must also ensure combustion emissions are as low as possible. To achieve the needed oxides of nitrogen (NOx) reductions and healthy air for Californians, future heavy-duty trucks must be dramatically lower emitting than today's new trucks and must stay clean over their entire useful lives. Heavy-duty trucks comprise the largest NOx emission source category in the State, contributing a third of all statewide NOx emissions and over a quarter of total statewide diesel particulate matter emissions. It is also the category that has the biggest impact on our disadvantaged and low income communities. With 50 percent of the heavy-duty truck NOx emissions in California originating from federally certified trucks, it is crucial for U.S. EPA to adopt stringent standards and test procedures that protect our communities as those federal compliant trucks drive through our neighborhoods and highways. [EPA-HQ-OAR-2019-0055-1186-A1, p.1]

U.S. EPA's proposal includes three sets of proposed emissions standards: Option 1, Option 2, and Alternative standards. The most stringent standards are associated with the Alternative standards, followed by the proposed Option 1 standards and the least stringent Option 2 standards. CARB staff is pleased that the proposed Option 1 standards incorporate many elements that are generally aligned with California's Omnibus regulation, although on a delayed timetable, and additionally include some elements that establish requirements that are more stringent than the requirements in the Omnibus regulation. U.S. EPA indicates that its preferred standards for final consideration are either the proposed Option 1 standards, the proposed Option 2 standards, or standards that are in-between those standards. It is clear that Option 1 is feasible for many reasons, including the fact that one major HD manufacturer, Ford, publicly stated at U.S. EPA's public hearing on April 13, 2022, that Option 1 is feasible and should be selected. [EPA-HQ-OAR-2019-0055-1186-A2, p.31]

As set forth in greater detail below, CARB staff strongly opposes the adoption of any standards that are less stringent than the proposed Option 1 standards, but additionally urges U.S. EPA to incorporate CARB staff recommended modifications to Option 1 that are needed to both ensure the associated emissions benefits are not unduly diluted and to better align the Option 1 standards with the Omnibus regulation. CARB staff additionally believes that the proposed adoption of the Option 2 standards is unlawful, because it is directly inconsistent with CAA Section 202(a)'s mandate that U.S. EPA must adopt emissions standards that reduce emissions from heavy-duty engines and vehicles to the greatest extent possible, and is also arbitrary and capricious, in light of U.S. EPA's findings that the emissions technologies needed to comply with the Option 1 standards will be available by the applicable model years, that the Option 1 standards will produce greater emissions reductions and provide greater public health benefits than the Option 2 standards. Option 1 would be more cost effective due to the overall lower costs and greater benefits compared to Option 2. [EPA-HQ-OAR-2019-0055-1186-A2, p.31]

The adoption of the Option 2 standards would be unlawful because such standards are inconsistent with CAA Section 202(a)'s mandates that U.S. EPA must adopt emissions standards that reduce emissions from heavy-duty engines and vehicles to the greatest extent possible, through the application of technology that U.S. EPA '[d]etermines will be available … giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology,'60 and that U.S. EPA must also ensure such emission standards are sufficiently protective of the public health and welfare.61 The adoption of the Option 2 standards would also be arbitrary and capricious, in light of U.S. EPA's findings that the emissions technologies needed to comply with the Option 1 standards will be available by the applicable model years, that the Option 1 standards will produce greater emissions reductions and provide greater public health benefits than the Option 2 standards, and thus Option 1 would be more cost effective than Option 2. CARB staff therefore urge U.S. EPA to adopt the Option 1 standards, in conjunction with CARB staff recommended modifications to Option 1 that are needed to ensure that the emissions benefits associated with Option 1 are not unduly diluted, and to better align the Option 1 standards with the standards of the Omnibus regulation. CARB staff's comments regarding the recommended modifications are set forth in Comments [2.b, 3.a, 4.b, 5.f, 6.f, 9.a, and 10.k.] [EPA-HQ-OAR-2019-0055-1186-A2, p.32]

60 CAA section 202(a)(3)

61 CAA section 202(a)(1).

Applicable Legal Standards

Courts determine the propriety of U.S. EPA's interpretations of the federal CAA using the standard established by the U.S. Supreme Court in Chevron U.S.A. Inc. v. Natural Resources Defense Council, Inc. 467 U.S. 837, 842-843 (1984)62 or the 'statute is silent or ambiguous with respect to the specific issue, the question for the court is whether the agency's answer is based on a permissible construction of the statute.' [EPA-HQ-OAR-2019-0055-1186-A2, p.32]

62 Utility Air Regulatory Group v. EPA, 573 U.S. 302, 315 (2014).

467 U.S. 837, 842-843.
'The question for a reviewing court is whether in doing so the agency has acted reasonably and thus has 'stayed within the bounds of its statutory authority.'63 [EPA-HQ-OAR-2019-0055-1186-A2, p.32]

63 Utility Air Regulatory Group, 573 U.S. 302, 315 citing Arlington v. FCC, 133 S.Ct. 1863, 1868 (emphasis deleted).

Section 307(d)(9) of the CAA authorizes the U.S. Court of Appeals for the District of Columbia to reverse a U.S. EPA action that is 'in excess of statutory jurisdiction, authority, or limitations, or short of statutory right,' or that is 'arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law.' Blue Water Network v EPA, 370 F.3d 1 (D.C. Cir. 2004). [EPA-HQ-OAR-2019-0055-1186-A2, p.33]

The 'arbitrary and capricious' standard of review specified in section 307(d)(9) is essentially the same standard of review as specified in the federal Administrative Procedure Act, 5 U.S.C. 706(2)(A). Ethyl Corp. v. EPA, 51 F.3d 1053, 1064 (D.C. Cir. 1995). 5 U.S.C. 706(2)(A) requires a reviewing court to 'ensur[e] that EPA has 'examine[d] the relevant data and articulate[d] a satisfactory explanation for its action, including a rational connection between the facts found and the choice made,' that the Agency's 'decision was based on a consideration of the relevant factors,' and that the Agency has made no 'clear error of judgment.' ' Blue Water

Network, 370 F.3d 1, 11 quoting Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co., 463 U.S. 29, 43, (1983) (internal citations and quotation marks omitted), (hereinafter ‘State Farm’). [EPA-HQ-OAR-2019-0055-1186-A2, p.33]

An agency action is arbitrary and capricious if the agency relies on factors which Congress has not intended it to consider, the agency has entirely failed to consider an important aspect of the problem, offers an explanation for its decision that runs counter to the evidence before the agency, or its explanation is so implausible that it could not be ascribed to a difference of view or the product of agency expertise. State Farm 463 U.S. at 43. [EPA-HQ-OAR-2019-0055-1186-A2, p.33]

An agency that is proposing a change in preexisting policy must show that ‘the new policy is permissible under the statute, that there are good reasons for it, and that the agency believes it to be better...’ FCC v. Fox Television Stations, Inc., 556 U.S. 502, 515 (2009). (Emphasis in original removed). [EPA-HQ-OAR-2019-0055-1186-A2, p.33]

The Proposed Adoption of the Option 2 Standards Is Unlawful, Because Such Standards Are Directly Inconsistent With CAA 202(a)’s Directives That U.S. EPA Must Reduce Emissions From Heavy-Duty Engines and Vehicles to the Greatest Extent Possible [EPA-HQ-OAR-2019-0055-1186-A2, p.33]

CAA section 202(a)(1) provides, in pertinent part, that the Administrator of U.S. EPA shall prescribe emission standards for new motor vehicles or new motor vehicle engines in order to protect the public's health and welfare. CAA section 202(a)(2) provides that ‘[a]ny regulation prescribed under paragraph (1) of this subsection (and any revision thereof) shall take effect after such period as the Administrator finds necessary to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance within such period.’ CAA Section 202(a)(3) provides, in pertinent part, that emissions standards applicable to HC, carbon monoxide (CO), NOx and PM emitted from heavy-duty engines or heavy-duty vehicles must ‘reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology.’ [EPA-HQ-OAR-2019-0055-1186-A2, pp.33-34]

Although CAA section 202(a)(2) provides that U.S. EPA must determine that the technology needed to comply with proposed standards will be available within applicable time periods, considering associated compliance costs, and CAA section 202(a)(3) provides that U.S. EPA, in determining the availability of technology needed to achieve the greatest degree of reductions can consider cost, energy, and safety factors associated with such technologies, it is clear that the overriding directive of CAA section 202(a)(1) is the protection of the public’s health and welfare, and the nation’s air quality. Motor and Equipment Mfrs. Ass’n, Inc. v. v EPA, 627 F.2d 1095, 1117-1118 (D.C. Cir. 1979); Massachusetts v EPA, 549 U.S. 497, 532, 533 (2007) (stating 202(a)(1) obligates U.S. EPA to protect the public health and welfare). Courts have interpreted CAA section 213(a)(3), which contains virtually identical language to section 202(a)(3),64 to require U.S. EPA, in determining appropriate compliance technologies and associated emissions standards, to primarily consider the impacts on air quality. ‘The overriding goal of the section is air quality and the other listed considerations, while significant, are subordinate to that goal.’ Husqvarna AB v. EPA, 254 F.3d 195, 200 (D.C. Cir. 2001); American Petroleum Inst. v. EPA, 52 F.3d 1113, 1120 (D.C. Cir. 1995). [EPA-HQ-OAR-2019-0055-1186-A2, p.34]

> 64 ‘Such standards shall achieve the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available … giving appropriate consideration to the cost of applying such technology within the period of time available to manufacturers and to noise, energy, and safety factors associated with the application of such technology.’ CAA section 213(a)(3).

Section 202(a)(3)’s express directive that U.S. EPA must achieve ‘the greatest degree of emission reduction possible’ is reinforced by legislative history that reflects Congress’ clear intent that U.S. EPA must affirmatively act to reduce emissions from heavy-duty engines and vehicles to the greatest extent possible. Although U.S. EPA was first authorized to regulate heavy-duty vehicle emissions by the CAA Amendments of 1965,65 it apparently had ‘done little’ to regulate such emissions by the mid-1970’s.66 Congress accordingly enacted mandatory emissions standards for 1979 through 1982 model year heavy-duty vehicles and engines, and emissions targets for 1985 and later model year heavy-duty vehicles or engines in the 1977 Amendments to the CAA.67 The legislative history indicates Congress’ impatience with U.S. EPA’s failure to promulgate sufficiently stringent emissions standards for heavy-duty vehicles. H.R. Rep. No. 95-294, 95th Cong., 1st Sess. at 271-273 (1977) (noting that 1977 federal standards required no reduction of HC, CO or NOx emissions from uncontrolled diesel engines, and citing reports that ’inadequate’ truck emissions standards will cause emissions from heavy-duty vehicles to comprise ‘more than half of all transportation emissions,’) 68 and expresses Congress’ insistence that U.S. EPA promulgate technology-forcing emissions standards for heavy-duty vehicles to achieve needed reductions in emissions from heavy-duty vehicles and engines.69 [EPA-HQ-OAR-2019-0055-1186-A2, pp.34-35]

> 65 Natural Resources Defense Council v. Thomas, 805 F.2d 410, 414 (D.C. Cir. 1986), Clean Air Act Amendments of 1965, Pub. L. No. 89–272 202(a), 84 Stat. 992
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> 66 805 F.2d at 414
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> 67 Clean Air Act Amendments of 1977, Pub.L. No. 95–95, Title II, 214, 224, Title IV, 401(d), 91 Stat. 765, 767, 791; See 805 F.2d 414 to 416.
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> 68 H.R. Rep. No. 95-294, 95th Cong., 1st Sess. 272 (1977)
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> 69 Id. at 273-274.

The U.S. Court of Appeals for the District of Columbia Circuit has interpreted the structure and legislative history of the 1977 Amendments to the CAA that explicitly directed U.S. EPA to regulate heavy-duty vehicles and heavy-duty vehicle engines as evidencing Congress’ intent that U.S. EPA establish heavy-duty emission standards that are technology forcing.70 ‘That the provisions at issue in this case seek to promote technological advances while also accounting for cost does not detract from their categorization as technology-forcing standards.'71 U.S. EPA acknowledges that CAA section 202(a)(3) constitutes a technology forcing provision that reflects Congress' intent that U.S. EPA establish standards achievable as a result of future advances of pollution control technology.72 [EPA-HQ-OAR-2019-0055-1186-A2, p.35]

70 NRDC v. Thomas, 805 F.2d 410, 430 (D.C. Cir, 1986).

71 Id. at 428, fn. 30.

72 NPRM at 17436.

That congressional directive to achieve needed emissions reductions is also evidenced by the technology-forcing directives of CAA section 202(a). Courts interpreting section 202(a) of the CAA have recognized that Congress intended U.S. EPA to rely upon projected future developments and advances in pollution control technology in establishing emission standards, and expected U.S. EPA to 'press for the development and application of improved technology rather than be limited by that which exists today.' Natural Resources Defense Council v. U.S. EPA, 655 F.2d 318, 328 (D.C. Cir. 1981) (NRDC). The NRDC court noted that a longer lead time 'gives the EPA greater scope for confidence that theoretical solutions will be translated successfully into mechanical realizations,'73 and further stated that 'the presence of substantial lead time for development before manufacturers will have to commit themselves to mass production of a chosen prototype gives the agency greater leeway to modify its standards if the actual future course of technology diverges from expectation.'74 Furthermore, in assessing the feasibility of developing and applying technology needed to comply with proposed standards, U.S. EPA may determine whether such standards are attainable by a predominant segment of the regulated industry.75 [EPA-HQ-OAR-2019-0055-1186-A2, p.35]

73 NRDC, 655 F.2d 318, 329 (D.C. Cir. 1981).

74 Ibid.

75 Natural Resources Defense Council v. Thomas, 805 F.2d 410, 423 (D.C. Cir. 1986).

In this NPRM, U.S. EPA has considered two distinct sets of emissions standards that it has determined can be achieved by heavy-duty engines and vehicles in the 2027 and subsequent model years, through the application of technology it has determined will be available by specified years, referred to as Option 1 and Option 2.76 The emissions standards associated with Option 2 are less stringent than the emissions standards associated with Option 1, and it would accordingly be unlawful to adopt the Option 2 standards, because that action would be directly inconsistent with CAA 202(a)'s directives that U.S. EPA must reduce emissions from heavy-duty engines and vehicles to the greatest extent possible, through the application of emission control technology that U.S. EPA has determined will be available. [EPA-HQ-OAR-2019-0055-1186-A2, p.36]

76 NPRM at pp. 17436, 17440, 17458, 17459, 17461-17464, 17467-17468, 17475-17476, 17481, 17487, 17489, 17495-17496, 17500, and 17550.

The proposed adoption of the Option 2 standards would be unlawful because it would necessarily rely upon an interpretation of CAA section 202(a)(3) that is unambiguously precluded by the statutory phrase ‘the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply.’ That statutory mandate is clear – it requires U.S. EPA to prescribe standards associated with the greatest degree of emissions reduction achievable through technologies that U.S. EPA finds will be available by applicable future years. The proposed adoption of the Option 2 standards would necessarily contravene that mandate and would accordingly be precluded, because U.S. EPA has determined that the Option 1 standards represent ‘the greatest emission reductions achievable for the model years to which they are proposed to apply, pursuant to CAA section 202(a)(3),’77 and that the technology needed to achieve compliance with the Option 1 standards will be available by the specified model years.78 Given those findings, the proposed adoption of the less stringent Option 2 standards impermissibly contravenes both the text and the purpose of section 202(a)(3). Chevron, 467 U.S., 842-843.79 [EPA-HQ-OAR-2019-0055-1186-A2, p.36]

77 NPRM at 17436.

78 See Section III.B.3 of NPRM; NPRM at 17436, 17475.

79 Further note that any proposed interpretation of CAA 202(a)(3) that disregards the phrase ‘greatest degree of emissions reduction achievable’ is impermissible, since ‘[i]t is axiomatic that a statute must be construed to avoid that result so that no provision will be inoperative or superfluous.’ Motor & Equip. Mfrs. Ass’n v. EPA, 627 F.2d. 1095, 1108 (D.C Cir. 1979) cert denied, 446 U.S. 952, 100 (1980).

Both of U.S. EPA’s findings are now discussed in greater detail. In the NPRM, U.S. EPA determined that the emissions standards associated with Option 1 are both more stringent than, and are also applicable over longer useful life periods, than the emissions standards of Option 2, 80 and also determined that the Option 1 standards will achieve significantly greater reductions of exhaust emissions than the Option 2 standards. U.S. EPA estimated that the Option 1 standards will produce greater reductions of pollutants than the Option 2 standards, approximately 121,000 short tons per year of NOx reductions and approximately 149 short tons of PM 2.5 reductions, as compared to the Option 2 standards in calendar year 2045.81 U.S. EPA also determined that the Option 1 standards are also more protective of the public health and welfare than the Option 2 standards; the Option 1 standards are estimated to provide present values of monetized health benefits resulting from Option 1 in 2045 between $52 to $150 billion dollars,82 while Option 2 is estimated to provide present values of monetized health benefits in 2045 between $ 41 billion and $ 120 billion dollars.83,84 [EPA-HQ-OAR-2019-0055-1186-A2, pp.36-37]

80 See, e.g., NPRM at 17422 ‘[we consider proposed Option 2 to be less stringent than the standards in the proposed Option 1 because proposed Option 2 has higher numeric NOx emission standards with similar useful life periods as the proposed Option 1 in MY 2027, and shorter length of useful life periods than the proposed Option 1 in MY 2031’. Also see NPRM at pp. 17422-17423, 17427, ‘Table 5 -Projected Heavy-Duty Emission

Reductions in 2045 From The Proposed Options 1 and 2 Standards', 17578, and p. 17427.

81 NPRM at pp. 17579-17580; Tables VI-1 and VI-2

82 At a 7 percent discount rate, (2017$), Table IX-1, NPRM at p. 17589.

83 Ibid.

84 The health benefits account for the reduction of premature deaths and illnesses resulting from the reductions of ozone and PM2.5 emissions associated with Options 1 and 2. NPRM at 17588.

U.S. EPA has additionally reasonably determined that the technologies needed to comply with the Option 1 standards will be available by the requisite time periods.85 U.S. EPA determined that technology packages comprised of cylinder deactivation (CDA) or other valvetrain-related air control strategies and dual selective catalytic reduction (SCR) systems have demonstrated capabilities to reduce emissions of NOx from CI engines by 90 percent.86 CARB also evaluated the same emission control technologies when it developed the California Omnibus regulation, and determined that the technologies that manufacturers will likely use to comply with the California 2024 model year NOx emission standards from CI engines are presently commercially available, and that manufacturers will have sufficient time to develop and implement future technologies or to refine existing emission control technologies needed to comply with the California 2027 and subsequent model year NOx emission standard,87 which is equivalent in stringency to U.S. EPA's Option 1 NOx standard for 2031 MY engines. [EPA-HQ-OAR-2019-0055-1186-A2, p.37]

85 See Section III.B.3 of NPRM; NPRM at 17436, 17475.

86 NPRM at 17467; See also Sections III.B.3 and III.C.3 of NPRM

87 CARB, 2020, Staff Report: Initial Statement of Reasons, Public Hearing to Consider the Proposed Heavy-Duty Engine and Vehicle Omnibus Regulation and Associated Amendments, (hereinafter Omnibus Staff Report) Section III.A.1.2; HD Omnibus ISOR: Revised on 7-9-2020 for Errata (ca.gov); Appendix I to Omnibus Staff Report; Appendix I: Current and Advanced Emission Control Strategies and Key Findings of CARB/SwRI Demonstration Work

For SI engines, U.S. EPA has reasonably determined that the Option 1 standards are currently nearly achievable through the application of existing emissions control technologies.88 In developing the Omnibus regulation, CARB determined that SI engines could comply with California's 2027 MY NOx standard, which is equivalent in stringency to U.S. EPA's Option 1 NOx standard for 2031 MY engines, by incorporating minor refinements to existing compliance technologies.89 [EPA-HQ-OAR-2019-0055-1186-A2, p.38]

88 NPRM at 17480; See Section III.D.3

89 See footnote 86

U.S. EPA has estimated the projected costs of compliance for the proposed emission standards associated with both Option 1 and Option 2. Although the incremental technology costs for the Option 1 emission standards are generally higher than the corresponding technology costs for the Option 2 emission standards, the difference in such costs is minor (the maximum difference in technology costs between Options 1 and 2 is $716 in technology costs for a Class 8 heavy heavy-duty vehicle), and the largest incremental costs associated with the Option 1 standards only constitute a fraction of the base technology costs of new vehicles,90 thereby falling within the range of allowable cost increases. [EPA-HQ-OAR-2019-0055-1186-A2, p.38]

90 For example, the incremental cost of the Option 1 2031 MY standards for Class 8 heavy heavy-duty diesel vehicles is $3931; the base price of a Class 8 heavy heavy-duty diesel vehicle is $8465 (NPRM at 17570).

Furthermore, it is especially notable that U.S. EPA has also determined that the total technology and operating costs associated with Option 1 are lower than the costs associated with Option 2.

91 The total technology and operating costs associated with Option 1 and Option 2's criteria pollutant standards are similar in the early years, but overall (during the 2027 to 2045 time period) the costs for Option 1 are lower than the costs for Option 2 over the 2027 though 2045 time period by $2 to $3 billion dollars.92 [EPA-HQ-OAR-2019-0055-1186-A2, pp.38-39]

91 Compare Table V-16, (Option 1 costs), 17576, with Table V-17 (Option 2 costs), 17577.

92 Discounted at 3 and 7 percent rates, ($2017)

Given those findings, U.S. EPA cannot justify its adoption of the less stringent Option 2 standards on the basis that weaker standards are warranted because the Option 1 standards are associated with higher costs. In Motor and Equip. Mfrs Assoc. v. EPA, 627 F.2d 1095 (D.C. Cir. 1979), the court addressed issue regarding the cost of compliance associated with CAA section 202(a)(2) and stated:

Section 202's 'cost of compliance' concern, juxtaposed as it is with the requirement that the Administrator provide the requisite lead time to allow technological developments, refers to the economic costs of motor vehicle emission standards and accompanying enforcement. See S. Rep. No. 1922, 89th Cong., 1st Sess. 5-8 (1965); H.R. Rep. No. 728 90th Cong., 1st Sess. 23 (1967), U.S. Code Cong. & Admin. News 1967, p. 1938. It relates to the timing of a particular emission control regulation rather than to its social implications. Congress wanted to avoid undue economic disruption in the automotive manufacturing industry and also sought to avoid doubling or tripling the cost of motor vehicles to purchasers. It therefore requires that emission control regulations be technologically feasible within economic parameters. Therein lies the intent of the 'cost of compliance' requirement. 627 F.2d at 1118. [EPA-HQ-OAR-2019-0055-1186-A2, p.38]

Finally, the emissions standards for both Options 1 and 2 are not anticipated to adversely impact safety, because they can be achieved through the use of emission control technologies that are largely being used today.93 Consequently, it is clear that the adoption of the Option 2 standards would contravene the directives of CAA section 202(a), because those standards do not reduce the emissions from heavy-duty engines and vehicles to the greatest extent possible, considering the technology that will be available within the requisite model years. [EPA-HQ-OAR-2019-0055-1186-A2, p. 39]

93 NPRM at 17460.

As explained in detail above, U.S. EPA has determined that the technology needed to comply with the Option 1 standards will be available within the times needed to comply with Option 1's 2027 and 2031 MY requirements, that the Option 1 standards will achieve greater emission reductions than the Option 2 standards, that the Option 1 standards will only fractionally increase the costs of new vehicles, that the total technology and operating costs of the Option 1 standards are lower than the comparable costs of the Option 2 standards, and that the Option 1 standards will produce greater societal benefits than Option 2 standards. These findings fully support U.S. EPA's multiple determinations that Option 1 appears to be more consistent with U.S. EPA's obligation under CAA section 202(a)(3) than Option 2.94 [EPA-HQ-OAR-2019-0055-1186-A2, p. 39]

94 NPRM at pp. 17417,17440, 17459.

The rulemaking record contains no information that would support a determination that the adoption of the less stringent Option 2 standards instead of the more stringent Option 1 standards would be consistent with the text, intent, or goals of CAA section 202(a). It is therefore apparent that any proposed decision to adopt weaker standards that would only increase emissions and consequential harms to the public health and welfare compared to Option 1, while also imposing greater costs to regulated entities and producing fewer benefits, compared to Option 1, could only occur if an agency improperly failed to examine relevant data, failed to consider the factors in section 202(a), or made a clear error of judgment. State Farm, 463 U.S. at 43. 95 CARB staff accordingly reiterates its recommendation that U.S. EPA adopt the Option 1 standards, in conjunction with CARB staff recommended modifications to Option 1 that are needed to ensure that the emissions benefits associated with Option 1 are not unduly diluted, and to better align the Option 1 standards with the standards of the Omnibus regulation. [EPA-HQ-OAR-2019-0055-1186-A2, pp. 39-40]

95 Chemical Mfs. Ass'n v. EPA, 217 F.3d 861, 867 (D.C. Cir. 2000) (EPA regulation was arbitrary and capricious because it did not advance statutory objectives - EPA conceded it had no evidence indicating the regulation was consistent with 'ascertainable legislative intent.')

As discussed in the NPRM and as demonstrated in the CARB Stage 3 and U.S. EPA Stage 3 rework (Stage 3 RW) low NOx demonstration programs, the proposed Option 1 standards together with CARB staff's recommended modifications are technically feasible and cost effective. The proposed Option 1 NOx and PM standards are identical to CARB's Omnibus standards for MYs 2031 and later HDEs. However, for MYs 2027 through 2030, they are less stringent than the corresponding Omnibus standards and fall short of realizing the maximum technically feasible emission reductions for those MYs. CARB staff strongly urges U.S. EPA to adopt in its final rulemaking the proposed Option 1 standards with the following recommended modifications. [EPA-HQ-OAR-2019-0055-1186-A2, p.40]

In fact, significant industry activity has occurred since CARB adopted the Omnibus regulation, and a number of additional technologies, not considered in the Stage 3 demonstration programs, are currently being evaluated by suppliers that are showing potential to further reduce both NOx and GHG emissions. As summarized below, these efforts and ongoing activities further support the feasibility and timing for 2027 MY alignment with California's Omnibus standards:

- Development of integrated high efficiency diesel aftertreatment systems is not limited to CARB and U.S. EPA sponsored demonstrations cited in the Omnibus package. In Europe, the emissions control trade association has fielded an advanced demonstrator showing similar emissions controls NOx reduction efficiency results despite not necessarily having exploited engine calibration to the extent of the CARB and U.S. EPA sponsored demonstrations or adding the additional engine technology levers available to engine manufacturers.98 They report In Service Conformity test trips averaging below 0.030 g/bhp-hr and discuss how the trips that exceed that are due to their engine hardware set's lack of thermal management capability (such as CDA or opposed piston architecture affords for examples) needed to maintain continuous control across numerous stop and go repetitions. These corroborative results were accomplished from an approximately 4 g/bhp-hr average engine out NOx rate--somewhat higher than the CARB and U.S. EPA demonstration engine calibrations. [EPA-HQ-OAR-2019-0055-1186-A2, p.42]

98 Mendoza Villafuerte, Pablo, J. Demuynck, D. Bosteels, P. Recker, T. Wilkes, L. Menne-Robb, 'Ultra-Low NOx Emissions with a Close-Coupled Emission Control System on a Heavy-Duty Truck Application' SAE Technical Paper 2021-01-1228, 2021, https://doi.org/10.4271/2021-01-1228

- Achates Power has announced that the cleaner, HD diesel opposed piston engine it developed in a project funded by CARB and several partners has entered fleet service with Walmart Corporation in a Peterbilt 579 tractor. It is a diesel engine operating on the road currently capable of meeting CARB's 2027 Omnibus regulation, which requires a 90 percent reduction in NOx compared to current standards.99 Work has progressed with the Achates opposed piston Class 8 tractor demonstration program, and early reports of field portable emissions monitoring system (PEMS) testing is demonstrating significant reduction of NOx and GHG emissions. PEMS emissions data evaluated using the three-Bin Moving Average Window (3B-MAW) methodology showed average in-use emissions of 0.15 g/hr for the idle bin, 0.042 g/hp-hr for the low load bin, and 0.020 g/hp-hr for the medium- and high-load bin. These results are significantly lower than what is proposed in the CTP's 2031 MY off-cycle standards. The Class 8 opposed piston demonstration tractor is currently in revenue service and is showing a cost-effective path for meeting both California's 2027 MY Phase 2 GHG and Omnibus NOx levels.100,101,102 CARB and South Coast Air Quality Management District have funded an add-on $1.4 million full UL emissions demonstration for the subsequent next generation version of this engine.103 This adds to the growing body of work on opposed piston technology including $5M of 2020 DOE VTO funding to adapt this technology as a two-cylinder engine for Class 3-6 vehicle applications and another $5M of 2021 DOE VTO funding for hybridization of a two-cylinder opposed piston engine.104,105 The U.S. Army has made significant investments in the related four-cylinder 1000 hp opposed piston Advanced Combat Vehicle Engine that is nearing production under an $87 million contract. [EPA-HQ-OAR-2019-0055-1186-A2, pp.42-43]

99 Ultralow NOx Heavy Duty Diesel Engine Enters Fleet Service FINAL.docx (achatespower.com) April 6, 2022

100 Salvi, A. 'Heavy Duty Opposed Piston Engine Demonstration,' CRC Real World Emissions Workshop. March 15, 2022.

101 Achates Power Heavy Duty Diesel In-Use Testing Results. April 2022.

102 Ultralow NOx during Low-loads and Idle. June 2021.

103 Amend Contract for Emission Testing for Near-Zero Emission Opposed Piston Engine. SCAQMD Board meeting date: November 5, 2021 AGENDA NO. 5

104 DOE announces $139M in funding for 55 projects to advance innovative vehicle technologies. July 17, 2020

105 DOE awarding $71M to 20 RD&D projects to cut GHG emissions, expand EV infrastructure; $5M to Achates for opposed-piston 2-stroke hybrid. November 2. 2021

- Demonstration work on full engine/aftertreatment systems continues looking at various means of providing heat directly to diesel exhaust aftertreatment systems to improve efficiency and broaden the duty-cycle range of highest conversion efficiency operation.106,107,108 In addition, manufacturers are continuing to report on their development activities toward standards and the individual means they are developing to meet the challenges of cold start, low load and idle.'109 Manufacturers are also publicly referencing their prowess in the advanced aftertreatment development space.110 [EPA-HQ-OAR-2019-0055-1186-A2, pp.43-44]

106 Dhanraj, F., Dahodwala, M., Joshi, S., Koehler, E. et al., 'Evaluation of 48V Technologies to Meet Future CO2 and Low NOx Emission Regulations for Medium Heavy-Duty Diesel Engines,' SAE Technical Paper 2022-01-0555, 2022, https://doi.org/10.4271/2022-01-0555.

107 Harris, T., Bellard, R., Muhleck, M., and Palmer, G., 'Pre-Heating the Aftertreatment System with a Burner,' SAE Technical Paper 2022-01-0554, 2022, https://doi.org/10.4271/2022-01-0554.

108 McCarthy, Jr., J., Matheaus, A., Zavala, B., Sharp, C. et al., 'Meeting Future NOx Emissions Over Various Cycles Using a Fuel Burner and Conventional Aftertreatment System,' SAE Technical Paper 2022-01-0539, 2022

109 Singh, N., Adelman, B., and Manis, J., 'Methodology for Controlling Nitrogen Oxides Emissions during Cold Start,' SAE Int. J. Commer. Veh. 14(3):365-374, 2021, https://doi.org/10.4271/02-14-03-0030

110 Achelpohl, Scott. 'Preparing for dual SCR.' FleetOwner. Jan. 11, 2022

- Active work is also progressing on how sensors can be leveraged for better emissions control as well as on the actual sensors and emerging measurement technologies for improving the intrinsic sensor ultimate performance.111,112 [EPA-HQ-OAR-2019-0055-1186-A2, p.44]

111 Funk, S., 'Real World NOx Sensor Accuracy Assessment and Implications for REAL NOx Tracking,' SAE Int. J. Adv. & Curr. Prac. in Mobility 3(6):2761-2769, 2021, https://doi.org/10.4271/2021-01-0593

112 Sur, R., Peng, W., and Kempema, N., 'Laser-Based In-Exhaust Gas Sensor for On-Road Vehicles,' SAE Technical Paper 2022-01-0535, 2022.

CARB staff strongly supports the proposed Option 1 PM, HC, and CO standards and recommends that they be included in the final rule, since they are technically feasible as demonstrated in the Stage 3 RW testing and from current certification data.116 The proposed Option 1 PM standards would also align with the Omnibus requirements, allowing manufacturers to produce a single PM aftertreatment design nationally. [EPA-HQ-OAR-2019-0055-1186-A2, p.46]

116 Sanchez, James. 'Test Results from EPA Diesel Demonstration'. Memorandum to Docket: EPA-HQ-OAR-2019-0055. February 10, 2022.

CARB staff believes the proposed Option 2 is too weak to be considered as reasonable on all aspects of the requirements, especially regarding the proposed emissions standards, UL, and warranty period requirements. The proposed Option 2 standards are not technology forcing standards and undermine the maximum feasible emission reductions achievable as demonstrated in CARB and U.S. EPA led Stage 3 engine testing programs. Based on U.S. EPA emission impacts analysis, in 2045, proposed Option 2 would result in approximately 22 percent less NOx emission reductions nationally compared to Option 1.117 CARB staff strongly opposes U.S. EPA's consideration of the proposed Option 2 standards for the final rule. In fact, as discussed above, CARB staff opposes the adoption of any standards that are less stringent than the proposed Option 1 standards. [EPA-HQ-OAR-2019-0055-1186-A2, p.47]

117 Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards. Draft Regulatory Impact Analysis. EPA-420-D-22-001 March 2022. (Table 5-

34: National Heavy-duty Vehicle NOx Emissions (Annual US Tons) For Calendar Years Between 2027 and 2045. Page 262

The proposed Alternative standards are the most stringent compared to both proposed Options 1 and 2. Although the Alternative has the potential to provide much needed NOx emission reductions, CARB staff understand that U.S. EPA believes that currently no data exists to unequivocally establish the feasibility of the Alternative 20 mg/hp-hr standard over the proposed longer 850,000 mile UL for MY 2027. However, CARB staff strongly supports that U.S. EPA adopt in its final rulemaking the proposed Option 1 standards with CARB staff recommended modifications that would align it with the Omnibus standards as well as strengthen the LLC and idling NOx standards to reflect recently demonstrated emissions performance in the CARB Stage 3 and U.S. EPA Stage 3 RW engine testing as well as the On-Road PEMS demonstration and further engine testing results from the Achates 10.6L Class 8 engine project. Ongoing work is expected this summer from both a second EPA low NOx engine configuration at SwRI and from a CARB and South Coast Air Quality Management District sponsored 800,000 mile aging follow-on emissions demonstration utilizing the second generation Achates engine and simplified aftertreatment. [EPA-HQ-OAR-2019-0055-1186-A2, p.47]

Similar to the proposed Option 2 requirements for CI engines, the proposed Option 2 for SI engines is also a very weak proposal on all aspects of the requirements including the proposed numeric standards, UL, and warranty period requirements. The proposed Option 2 standards are not technology forcing standards and undermine the maximum feasible emission reductions achievable as demonstrated by U.S. EPA's own testing as well as CARB certification data for optional low NOx engines. CARB staff strongly opposes U.S. EPA's consideration of the proposed Option 2 standards for the final rule. [EPA-HQ-OAR-2019-0055-1186-A2, p.48]

CARB staff supports that U.S. EPA adopt the proposed Option 1 SI engine standards including CARB staff proposed modifications that would align federal and CARB requirements. [EPA-HQ-OAR-2019-0055-1186-A2, p.49]

The NOx and PM SI engine standards for the Alternative proposal are numerically identical to MY 2027 Omnibus standards. However, they are applicable for UL periods that are slightly longer than those in the Omnibus, making the Alternative proposal slightly more stringent than the Omnibus standards. Based on the analysis of optional low NOx engine certification data discussed above, the Alternative proposal seems to be technically feasible for MY 2027, since optional low NOx SI engines are currently being certified to the existing CI test procedures which includes more rigorous durability demonstration and longer UL periods. Since the Alternative proposal is technically feasible, CARB staff recommends that U.S. EPA adopt it in its final rulemaking. This would be identical to Omnibus except for the slightly longer UL periods. If U.S. EPA does not feel comfortable with increasing the UL periods, CARB staff urges U.S. EPA to at least align NOx standards and UL periods for SI engines with the Omnibus standards. [EPA-HQ-OAR-2019-0055-1186-A2, p.49]

Organization: *CALSTART*

The Clean Trucks Plan represents a critical opportunity and milestone in the pursuit of a clean transportation system. The emissions and economic benefits of strong standards for combustion engines and the transition to zero-emission medium- and heavy-duty vehicles are well documented (Sen, 2022; Ledna, 2022). The urgency to reduce global warming and criteria emissions is paramount to human health and the economy. While analyses show we must achieve widespread adoption of zero-emission vehicles to attain healthy air and limit the most severe impacts of global warming, combustion vehicles will comprise significant vehicle sales within this decade and will remain on the road for decades more. For this reason, we strongly support NOx emission standards in the final rule that are technology forcing, reflect best-in-class technologies, and result in a net 90 percent reduction in NOx emissions compared to today's engines and vehicles. Option 1 in the proposal is a step in this direction. The larger the fraction of combustion vehicles expected into the future, the stronger the emissions standards must be for these vehicles and their engines. CALSTART supports policy that brings the best available technologies to the marketplace, drives global leadership, and continues to encourage innovation. [EPA-HQ-OAR-2019-0055-1313-A1, p.2]

Many combustion engines will continue to be sold in the transition to zero-emission vehicles. EPA's assessment of the Class 4-8 market indicates just 1.5 percent of vehicles sold in model year 2027 will be zero-emission (below we discuss why we think this estimate is low and should be accelerated). Even in states that have adopted the ACT standard, for example, combustion trucks will comprise a majority of Class 4-8 vehicle sales until model year 2031 and roughly one-third of sales in 2035 and onward.3 Absent federal policy, sales of combustion vehicles will comprise even greater fractions of Class 4-8 vehicles in states that have not adopted the ACT, i.e., 44 states with roughly 80 percent of the national Class 2b-8 vehicle population.4 Thus, combustion engines must incorporate the best available emissions reductions technologies. [EPA-HQ-OAR-2019-0055-1313-A1, p.4]

> 3 In model year 2031, zero-emission vehicles will comprise 55 percent of Class 4-8 straight vehicles and 35 percent of Class 7-8 tractors, or a sales-weighted average of roughly 50 percent. In model year 2035, those percentages increase to 75 percent and 40 percent, respectively, or a sales weighted average of roughly 67 percent.
>
> 4 Class 2b-8 vehicle registrations are based on Atlas' evaluation of 2019 IHS Markit registration data, available at: https://www.atlasevhub.com/materials/medium-and-heavy-duty-vehicleregistrations- dashboard/.

A strong NOx emission standard will result in significant emission reductions, health benefits, and bring innovative best-in-class emissions technologies to the market. Figure 1, for example, shows the annual emission reductions expected if 12 states and the District of Columbia adopted NOx standards in the Heavy-Duty Omnibus regulation compared to those achieved from potential adoption of the ACT. The Heavy-Duty Omnibus results in roughly two times the NOx emission reductions as the ACT through 2050 (ICCT, 2022).5 In some states, such as California, the Heavy-Duty Omnibus will achieve 2.5 times or more cumulative NOx emission reductions as the ACT (CARB, 2019; CARB, 2020). [EPA-HQ-OAR-2019-0055-1313-A1, p.4]

5 Based on ICCT's analysis of emission reductions from the Heavy-Duty Omnibus and Advanced Clean Trucks standard in Colorado, Connecticut, District of Columbia, Maine, Maryland, Massachusetts, North Carolina, New Jersey, Oregon, Pennsylvania, Rhode Island, Vermont, and Washington based on policies taking effect in 2025.

CALSTART supports a final rule that results in engines and vehicles with net NOx emissions that are 90 percent lower than engines in today's vehicles. [EPA-HQ-OAR-2019-0055-1313-A1, p.5]

In addition, it is important for this policy to ensure emission reductions are achieved over the life of the vehicle and that engine warranties protect fleets from liabilities associated with emission controls over similar timeframes. [EPA-HQ-OAR-2019-0055-1313-A1, p.5]

The final rule should result in engines and vehicles with net NOx emissions 90 percent lower than engines in today's vehicles. [EPA-HQ-OAR-2019-0055-1313-A1, p.26]

Organization: *Capital Area Council of Governments (CAPCOG) and Central Texas Clean Air Coalition (CAV)*

The CAC further supports the proposed Option 1 over Option 2 as it represents a greater O3 and PM2.5 reduction. [EPA-HQ-OAR-2019-0055-1274-A1, p.1]

Organization: *Ceres BICEP (Business for Innovative Climate and Energy Policy) Network*

In addition, in order to prevent increased emissions, EPA should preserve the Phase 2 stringency requirements for ICE vehicles and phase out advanced technology credit multipliers as soon as feasible. Finally, a recent Ceres analysis [https://www.ceres.org/resources/reports/electrifying-american-trucking-promise-and-challenges] concluded that, while shifting to electric vehicles increasingly makes economic sense for manufacturers and suppliers, as well as fleet owners and shippers, a federal ZEV mandate and fleet purchasing requirements, similar to California's Advanced Clean Truck (ACT)1 and Advanced Clean Fleet (ACF) standards, will be necessary to accelerate this transition at the rate and scale necessary to meet climate goals, and to ensure the global competitiveness of the U.S. truck industry. Accordingly, we urge you to adopt a ZEV mandate consistent with the targets outlined above. [EPA-HQ-OAR-2019-0055-2714-A1, pp.1-2]

1 The ACT has drawn significant business and investor support. Importantly, given that MHDVs are the largest source of nitrogen oxides (NOx) in the transportation sector, it is critical to strengthen the proposed NOx standards.

Disadvantaged communities, located near highways, ports and distribution centers, have long borne the brunt of negative health and air quality impacts from truck pollution, and it is necessary to reduce this pollution as quickly as possible during the transition to electrification (which in turn, will have additional health benefits). Accordingly, EPA should adopt a strengthened Option 1, requiring a 90% reduction in NOx by 2027, and phase out advanced technology credit multipliers for NOx as soon as feasible. [EPA-HQ-OAR-2019-0055-2714-A1, p.2]

Further, given that medium- and heavy-duty vehicles are the largest source of nitrogen oxides (NOx) in the transportation sector, it is critical to strengthen the proposed NOx standards, which were last updated twenty years ago. Disadvantaged communities have long borne the brunt of negative health and air quality impacts from truck pollution, and we need to reduce these pollutants to the maximum extent possible. [EPA-HQ-OAR-2019-0055-2714-A2, p.1]

Further, given that MHDVs are the largest source of NOx in the transportation sector, it is critical to strengthen the standards to the maximum extent possible in order to reduce air pollution from MHDVs during the transition, which disproportionately increases health and air quality risks in disadvantaged communities located near truck routes, ports, and distribution centers. [EPA-HQ-OAR-2019-0055-2714-A3, p.2]

Organization: *Chesapeake Bay Foundation, Inc. (CBF)*

This rulemaking is an opportunity to achieve considerable reductions in both NOx and GHG pollution, and their associated harms. CBF urges EPA to seize this opportunity by swiftly finalizing a rule that is a modified version of Option 12 requiring achievement of a 90% reduction of NOx by model year 2027. CBF also urges EPA to quickly finalize a rule that accelerates the transition to an entirely zero-emissions heavy-duty fleet. [EPA-HQ-OAR-2019-0055-1295-A1, pp.1-2]

2 87 Fed. Reg. at 17417.

While NOx emissions have decreased since the 1990s, EPA acknowledges that '[h]eavy-duty engines will continue to be one of the largest contributors to mobile source NOx emissions nationwide in the future, representing 32 percent of the mobile source NOx emissions in calendar year 2045.' 87 Fed. Reg. 17418. Pursuant to the Clean Air Act, EPA must finalize a rule that protects public health, especially disproportionately impacted communities near major roadways and in areas with high levels of ozone pollution. 42 U.S.C. 7521(a)(1); see also Exec. Order No. 14,008, 86 Fed. Reg. 7,619 (Jan. 27, 2021) ('Agencies shall make achieving environmental justice part of their missions by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts.'). [EPA-HQ-OAR-2019-0055-1295-A1, pp.9-10]

As the federal signatory to the 2014 Chesapeake Bay Agreement, and as discussed above, EPA also has an ongoing requirement to ensure that the goals of the Agreement are achieved. NOx emissions from heavy-duty trucks contribute algae-fueling nitrogen to the Bay watershed and therefore interfere with the Agreement's water quality and habitat goals. Because heavy-duty trucks travel nationwide, it is critical that EPA implement a standard that will reduce NOx from interstate, heavy-duty trucks travelling within the Bay airshed and watershed. [EPA-HQ-OAR-2019-0055-1295-A1, p.10]

EPA's obligation to protect water quality also stems from the Clean Air Act's directive to issue emission standards for pollutants that threaten environmental resources, including water quality. See 42 U.S.C. 7521(a)(1) (directing Administrator to prescribe standards for pollutants from motor vehicles which endanger public health or welfare); see also 42 U.S.C. 7602(h) (defining effects on welfare to include effects on 'waters'). In July 2020, six Chesapeake Bay jurisdictions—Virginia, Pennsylvania, New York, Maryland, and the District of Columbia—signaled the importance of reducing NOx and GHG from the heavy-duty vehicle sector by signing the Multi-State Zero Emission Medium- and Heavy-Duty Vehicle Memorandum of Understanding ('MOU').43 In an effort to reduce harm to public health and the devastating impacts of climate change, signatories to the MOU agreed to 'strive to make sales of all new medium- and heavy-duty vehicles' in their jurisdictions 'zero emission vehicles by no later than 2050.'44 [EPA-HQ-OAR-2019-0055-1295-A1, p.10]

43 Multi-State Zero Emission Medium- and Heavy-Duty Vehicle Memorandum of Understanding (July 2020), https://www.nescaum.org/documents/mhdv-zev-mou-20220329.pdf/.

44 Id.

In the Proposed Rule, EPA notes that 'Option 1 may be a more appropriate level of stringency as it would result in a greater level of achievable emission reduction for the model years proposed, which is consistent with EPA's statutory authority under Clean Air Act section 202(a)(3).' 87 Fed. Reg. at 17417. While CBF agrees that Option 1 is more stringent and because these human health and environmental benefits are urgently needed, long overdue, promote the administration's environmental justice priority, and are technically and economically feasible45, we urge EPA to swiftly adopt a modified Option 1 requiring reductions of 90% NOx in model year 2027.46 [EPA-HQ-OAR-2019-0055-1295-A1, pp.10-11]

45 See, e.g., Energy.gov, DOE Projects Zero Emissions Medium- and Heavy-Duty Electric Trucks Will Be Cheaper than Diesel-Powered Trucks by 2035 (Mar. 7, 2022), https://www.energy.gov/articles/doe-projects-zero-emissions-medium-and-heavy-duty-electric-trucks-will-be-cheaper-diesel ('by 2030, nearly half of medium- and heavy-duty trucks will be cheaper to buy, operate, and maintain as zero emissions vehicles than traditional diesel-powered combustion engine vehicles.').

46 This standard is achievable. See, e.g., California Air Resources Board, Heavy-Duty Omnibus Regulation, https://ww2.arb.ca.gov/rulemaking/2020/hdomnibuslownox; California Air Resources Board, Facts about the Low NOx Heavy-Duty Omnibus Regulation, at 2, https://ww2.arb.ca.gov/sites/default/files/classic/msprog/hdlownox/files/HD_NOx_Omnibus_Fact_Sheet.pdf.

Organization: *City of Seattle, Office of Sustainability & Environment*

Seattle strongly encourages EPA to finalize stringent NOx engine standards this year. EPA has proposed two options for setting new engine standards:

- Option 2 is deeply problematic because it does not reflect a technology-forcing standard that sufficiently protects public health and welfare.
- Option 1 comes closer to realizing technology potential and provides for a transition period from 2027-2030, where higher emitting engines would continue to be sold. Since we know that trucks sold in 2030 will be on the road and polluting for decades, it is our hope that Option 1 can be strengthened to achieve greater NOx reductions and improve the health of our most-impacted communities. **Please consider building on the success of the Advanced Clean Trucks (ACT) rule adopted by six states, including Washington, and set expectation that at least 50 percent of sales should be zero-emission by 2030, putting the United States on track for all truck sales to be zero-emission by 2035.** [EPA-HQ-OAR-2019-0055-1287-A1, p.1]

Through our city partnership with The International Council on Clean Transportation, we have learned that the U.S. must achieve at least 45% zero-emission truck sales in 2030 and 100% no later than 2040 to meet domestic and global climate goals to limit warming to below 2 degrees Celsius. **EPA risks not meeting these goals if the agency waits until 2030 to require zero-emission HDV sales.** [EPA-HQ-OAR-2019-0055-1287-A1, p.2]

We know that the transition to zero-emission vehicles will not be easy, and funding will be needed to expedite the transition and ensure that drivers benefit from the transition. Seattle has set a goal of 30% of goods delivery to be zero-emission by 2030 to set a clear target for our own electrification effort, and we are deeply committed to a just-transition for workers. We understand there are some 2,000 drayage trucks operating regularly in Seattle, many of which are operated by independent African immigrant drivers. We are committed to ensuring that independent operators/owners are not left behind in the technology transition. In 2021, to begin to tackle the issue, the City established funding for first-in-the-nation city-funded heavy duty electric truck incentive program specifically aimed at electrifying Heavy Duty Trucks in the Duwamish Valley, with a focus on independent and small operators. [EPA-HQ-OAR-2019-0055-1287-A1, p.2]

Organization: *Clean Air Board of Central Pennsylvania*

EPA is proposing two regulatory options for NOx. We support Option 1, which will implement stronger NOx standards in two steps. The first improvement would be required in 2027 with a second more stringent standard 2031 (a NOx standard that would be 90% lower than today's standards). We support Option 1 with longer useful life and warranty periods. Ensuring that the warranty and useful life requirements meet 100% of the expected life of these vehicles will ensure health benefits throughout the life of the vehicles. [EPA-HQ-OAR-2019-0055-1305-A1, p.1]

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

Section 202 of the Clean Air Act requires EPA to promulgate emissions standards that prioritize public health and welfare. To enable EPA to carry out this mandate, Congress directed the Agency to set technology-forcing standards that spur improvements in emissions control technologies. The record of HDVs' negative impacts on public health, environmental justice, climate change, and national parks and wilderness areas shows that protective emissions standards are desperately needed. To satisfy its statutory mandate and to fulfill its duty to engage in reasoned decision-making, EPA must promulgate standards that are supported by the record and that reduce emissions of dangerous air pollutants from heavy-duty vehicles and engines as much as possible. [EPA-HQ-OAR-2019-0055-1302-A1, p.7]

Beyond making those changes, Commenters urge EPA to adopt Option 1 with further improvements to testing provisions, numerical emissions standards, warranty and useful life periods, and implementation schedule. In addition, EPA should revise the proposed durability demonstration, strengthen the proposed anti-tampering and inducement provisions, reject exemptions for vocational vehicles, and finalize the proposed particulate matter (PM) standard and closed crankcase requirements. [EPA-HQ-OAR-2019-0055-1302-A1, p.8]

To carry out its statutory mandate in this rulemaking, EPA must promulgate emissions standards that prioritize public health and welfare by harnessing advancements in emissions reduction technology. The Clean Air Act makes clear that EPA's primary duty is to protect public health and welfare by minimizing harmful air pollution. Congress declared that the express purpose of the Clean Air Act is to 'protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare.' 42 U.S.C. 7401(b)(1). [EPA-HQ-OAR-2019-0055-1302-A1, p.9]

Section 202(a)(1), the source of EPA's general authority to regulate motor vehicles and engines, directs EPA to promulgate standards that 'prevent or control' emissions of air pollutants that 'cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare.' 42 U.S.C. 7521(a)(1). The Supreme Court held in Massachusetts that Congress clearly provided EPA with 'the statutory authority to regulate the emission of [greenhouse] gases from new motor vehicles' pursuant to Section 202(a)(1)–(2). Massachusetts v. EPA, 549 U.S. 497, 532 (2007) (concluding that there is 'nothing counterintuitive' to EPA regulating GHG emissions from vehicles considering the statutory factors). Under the terms of the statute, then, EPA must choose a regulatory response commensurate with the 'endanger[ment]' that pollution from heavy-duty vehicles and engines cause to public health and welfare. C.f. id. at 532 (noting that Section 202(a) 'charge[s] [EPA] with protecting the public's 'health' and 'welfare''); Coal. for Responsible Regulation v. EPA, 684 F.3d 102, 117, 122 (D.C. Cir. 2012) (stating that EPA must carry out 'the job Congress gave it in 202(a)—utilizing emission standards to prevent reasonably anticipated endangerment from maturing into concrete harm.'). Any 'balancing' of factors, such as costs, availability of technology, and lead time, must prioritize the principal harm-reduction mandate animating the statute. See Husqvarna AB v. EPA, 254 F.3d 195, 200 (D.C. Cir. 2001) (emphasizing, in case involving similar statutory language in Section 213, that '[t]he overriding goal of the section is air quality and the other listed considerations, while significant, are subordinate to that goal'). [EPA-HQ-OAR-2019-0055-1302-A1, p.9]

Section 202(a)(3), which gives EPA specific authority to set standards regulating criteria pollutant emissions from heavy-duty vehicles and engines, affirms the central importance of this protective mandate. The Act requires that these standards reflect the '*greatest degree of* *emission reduction achievable* through the application of technology which the Administrator determines will be available for the model year to which such standards apply.' 42 U.S.C. 7521(a)(3)(A)(i) (emphasis added). While EPA must also consider 'cost, energy, and safety factors associated with…such technology,' id., it must place primary importance on achieving the greatest degree of emissions reduction. See Husqvarna, 254 F.3d at 200 (concluding that ''EPA did not deviate from its statutory mandate or frustrate congressional will by placing primary significance on the 'greatest degree of emission reduction achievable' and by considering cost, noise, energy and safety factors as important but secondary factors'). [EPA-HQ-OAR-2019-0055-1302-A1, pp.9-10]

To bring about critical air quality improvements, Congress authorized EPA to set technology-forcing standards that require manufacturers to develop entirely new technologies or significantly improve existing ones. See NRDC v. EPA, 655 F.2d 318, 328 (D.C. Cir. 1981) (stating that 'Congress intended the agency to project future advances in pollution control capability'); 87 Fed. Reg. at 17,436 & n.97. Section 202(a)(2), which pertains to EPA's general motor vehicle and engine authority, provides that emissions standards 'shall take effect after such period as the Administrator finds necessary to permit the development and application of the requisite technology.' 42 U.S.C. 7521(a)(2). This language embodies Congress's intent that EPA 'press for the development and application of improved technology rather than be limited by that which exists today.' NRDC v. EPA, 655 F.2d at 328 (quoting S. Rep. No. 1196, 91st Cong., 2d Sess. 24 (1970)). EPA embraced this 'technology-forcing approach' in its Heavy-Duty Greenhouse Gas Emissions Phase 2 Rule (the subject of targeted updates in this Proposal), promulgating standards 'predicated on performance of technologies not only currently deployed but those which reasonably can be developed during the phase in period.' 81 Fed. Reg. 73,478, 73,493, 73,809 (Oct. 25, 2016). Similarly, Section 202(a)(3)(A)(i) prescribes a technology-forcing approach by directing EPA to establish standards that are 'achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply.' 42 U.S.C. 7521(a)(3)(A)(i); Crete Carrier Corp. v. EPA, 363 F.3d 490, 491 (D.C. Cir. 2004) (stating that this section 'is a technology-forcing provision; it mandates regulations with which manufacturers can comply only by adopting new technologies as they become available'); NRDC v. Thomas, 805 F.2d 410, 428–30 & n.30 (D.C. Cir. 1986) ('Congress intended the EPA…to engage in reasonable predictions and projections in order to force technology.'). [EPA-HQ-OAR-2019-0055-1302-A1, p.10]

While EPA has considerable discretion to set emissions standards that rely on ambitious technological developments, Congress made the important policy decisions. Congress directed EPA, the expert agency with authority over air pollution from vehicles and engines, to develop a record and apply the Section 202(a) criteria to the facts to develop standards. See Gundy v. United States, 139 S. Ct. 2116, 2136 (2019) (Gorsuch, J., dissenting). In doing so, the Agency is 'not obliged to provide detailed solutions to every engineering problem, but ha[s] only to identify the major steps for improvement and give plausible reasons for its belief that the industry will be able to solve those problems in the time remaining.' Nat'l Petrochemical & Refiners Ass'n v. EPA, 287 F.3d 1130, 1136 (D.C. Cir. 2002) (internal quotation marks and citations omitted). Indeed, courts have consistently upheld EPA's technology-forcing vehicle and engine regulations over manufacturers' objections about technological readiness. Id. at 1136–41 (upholding NOx and PM regulations predicated on future developments in pollution control technology); NRDC v. Thomas, 805 F.2d at 428–34 (upholding PM regulation over manufacturers' concerns about the feasibility of trap-oxidizer technology); NRDC v. EPA, 655 F.2d at 331–36 (same). And manufacturers have consistently risen to the challenge, later complying with the very standards they previously claimed were impossible to meet. See, e.g., 87 Fed. Reg. at 17,536 (explaining that manufacturers deployed technologies that EPA had not predicted to meet the 2001 heavy-duty criteria pollutant standards, which they had unsuccessfully challenged in National Petrochemical & Refiners Association). [EPA-HQ-OAR-2019-0055-1302-A1 pp.10-11]

Under the Clean Air Act, EPA's action may be reversed if it is arbitrary, capricious, an abuse of discretion, not in accordance with law, or in excess of statutory authority. 42 U.S.C. 7607(d)(9)(A), (C). 'To withstand review, the agency must have examined all relevant facts and data and articulated a rational explanation for its decision, including a reasonable connection between the facts and ultimate outcome.' Hearth, Patio & Barbecue Ass'n v. EPA, 11 F.4th 791, 805 (D.C. Cir. 2021). 'A rule is arbitrary and capricious if the agency: (1) 'has relied on factors which Congress has not intended it to consider,' (2) 'entirely failed to consider an important aspect of the problem,' (3) 'offered an explanation for its decision that runs counter to the evidence before the agency,' or (4) 'is so implausible that it could not be ascribed to a difference in view or the product of agency expertise.'' U.S. Sugar Corp. v. EPA, 830 F.3d 579, 606 (D.C. Cir. 2016) (quoting Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co., 463 U.S. 29, 43 (1983) and applying the same standard of review under the CAA as under the Administrative Procedure Act). [EPA-HQ-OAR-2019-0055-1302-A1, p.11]

The Proposal's underestimate of the baseline market penetration of HD ZEVs and its failure to propose standards that further drive adoption of zero-emission technologies ignores the Agency's obligations under the Clean Air Act and weakens the proposed standards in several ways:

1. Considering more accurate (higher) baseline HD ZEV market penetration 'could lead to a more stringent NOx emission standard,' as EPA acknowledges. 87 Fed. Reg. at 17,561.
2. Underestimating the baseline market penetration of HD ZEVs will lead to the generation of a significant amount of credits that will dramatically undermine the goals of the NOx standards and fail to protect public health and welfare. 87 Fed. Reg. at 17,561.55 Allowing for ZEVs to generate NOx emissions credits is a significant departure from EPA's prior rules,56 and a revised, more accurate baseline HD ZEV penetration estimate would require reconsideration of these credits to ensure that the rule reflects the greatest degree of emission reduction achievable, as is EPA's statutory mandate.
3. Disregarding the feasibility of zero-emission technologies in establishing the stringency of the proposed criteria pollutant standards unjustifiably takes proven emission reduction technologies off the table. [EPA-HQ-OAR-2019-0055-1302-A1, pp.20-21]

55 EPA notes that it includes an FEL cap on NOx emissions to help limit the impact credits generated from BEVs or FCEVs could have in enabling vehicles to exceed the NOx standard. However, if HD ZEV market penetration is higher than EPA projects, 'there is the potential for a greater portion of CI engines to emit up to the level of the FEL cap,' 87 Fed. Reg. at 17,560, further undermining the goals of the regulatory program. EPA notes the importance of 'consider[ing] what impact NOx emissions credits generated from BEVs and FCEVs

might have on the NOx emission reductions expected from the proposed rulemaking. Id. at 17,561. Further, as discussed in Section IV.D.2.c of these comments, EPA's proposed FEL cap is unreasonably high.

56 See 87 Fed. Reg. at 17,556 ('However, under the current criteria pollutant program, manufacturers do not have a pathway to generate NOx emission credits for HEVs, BEVs, or FCEVs. For BEVs and FCEVs, current 40 CFR 86.016-1(d)(4) stipulates that these technologies may not generate NOx emission credits…'); id. at 17,561–62 (proposing to allow ZEVs to generate NOx emissions credits); 40 CFR 86.016-1(d)(4) ('Electric heavy-duty vehicles may not generate NOx or PM emission credits.').

[EPA-HQ-OAR-2019-0055-1302-A1, p.21]

EPA's inaccurate estimate of baseline HD ZEV market penetration undermines its proposed criteria pollutant standards, but the Agency must also remedy other aspects of its criteria pollutant proposal. EPA must reject proposed Option 2, which fails to achieve the emissions reductions necessary to protect public health and welfare and flouts the Clean Air Act's technology-forcing directive. EPA should incorporate zero-emission technologies into its feasibility analysis, setting stronger emissions standards that both account for the technological feasibility and baseline market penetration of zero-emission technologies *and* accelerate the deployment of those technologies. In addition, EPA must modify its crediting proposal to ensure that credits for electric vehicles and 'transitional' credits do not undermine the effectiveness of its criteria pollutant program. Apart from making those changes, EPA should finalize Option 1, with Commenters' recommended improvements to testing provisions, numerical emissions standards, warranty and useful life periods, and implementation timelines. Finally, regardless of which option it ultimately selects, EPA should revise the proposed durability demonstration, strengthen the proposed anti-tampering and inducement provisions, reject exemptions for vocational vehicles, and finalize the proposed PM standard and closed crankcase requirements. [EPA-HQ-OAR-2019-0055-1302-A1, p.49]

In setting emissions standards, EPA 'must also provide a reasoned explanation of its basis for believing that its projection is reliable. This includes a defense of its methodology for arriving at numerical estimates.' Bluewater Network v. EPA, 370 F.3d 1, 22 (D.C. Cir. 2004) (quoting NRDC v. EPA, 655 F.2d at 328). To comply with the Administrative Procedure Act, the Agency must examine the relevant data and show that the data is accurate and defensible. See Dist. Hosp. Partners v. Burwell, 786 F.3d 46, 57 (D.C. Cir. 2015). Courts require agencies to use 'the best information available.' Catawba County v. EPA, 571 F.3d 20, 45 (D.C. Cir. 2009). If the agency receives new and better data, it must deal with it in a reasonable fashion and cannot blindly accept outdated or inaccurate information. See Dist. Hosp. Partners, 786 F.3d at 57; Flyers Rights Educ. Fund v. FAA, 864 F.3d 738, 745 (D.C. Cir. 2017) ('Agency reasoning…must adapt as the critical facts change.'). [EPA-HQ-OAR-2019-0055-1302-A1, p.11] Finalizing proposed Option 2 would be arbitrary and capricious because it embodies a wholly inappropriate balancing of the statutory factors set forth Section 202(a)(3)(A)(i). See 42 U.S.C 7521(a)(3)(A)(i) (requiring 'appropriate consideration' of cost, energy, and safety). In comparison to Option 1 and the alternative approaches we advocate for in Sections IV.B–H below—all of which would achieve greater public health and welfare gains without imposing unreasonable costs or technological challenges—Option 2 is contrary to EPA's statutory mandate and unsupported by the record. Cf. Bluewater Network v. EPA, 370 F.3d 1, 21–22 (D.C. Cir. 2004) (holding that EPA had not adequately explained its balancing of technological feasibility against cost and other statutory factors in setting emissions standards under Section 213). [EPA-HQ-OAR-2019-0055-1302-A1, p.49]

Second, Option 2 falls far short of the Clean Air Act's technology-forcing directive 231 by letting manufacturers off the hook from improving the durability of emission control components, thereby eroding Option 2's already limited emissions benefits. See 87 Fed. Reg. at 17,437–38. [EPA-HQ-OAR-2019-0055-1302-A1, p.50]

> 231 As discussed in Section IV.B below, both Options 1 and 2 fail to reflect the superiority and feasibility of electrification and other zero-emission technologies that eliminate criteria pollutant tailpipe emissions from HDVs.

In sum, Option 2 amounts to an industry giveaway that sacrifices critically important public health and welfare benefits in favor of political expediency and technological complacency. EPA understands this, flatly admitting that 'Option 1 may be a more appropriate level of stringency as it would result in a greater level of achievable emission reduction for the model years proposed, which is consistent with EPA's statutory authority under Clean Air Act section 202(a)(3).' 87 Fed. Reg. at 17,417, 17,440. Because Option 2 fails to achieve the statutory mandate, finalizing it would constitute an abuse of discretion and arbitrary and capricious agency action. [EPA-HQ-OAR-2019-0055-1302-A1, p.51]

Finally, Option 2's inferior performance on emissions reduction, public health, and technological feasibility grounds cannot be justified by cost, energy, safety, or lead time considerations. Despite its leniency, Option 2 manages to produce higher costs, and fewer net benefits, than Option 1. 87 Fed. Reg. at 17,589; DRIA at 403. Sufficient lead time also exists for manufacturers to comply with both options. See 87 Fed. Reg. at 17,436. And both options present the same safety and energy profiles, with neither having a negative impact on those factors relative to the baseline. 87 Fed. Reg. at 17,440, 17,459–60. Because the Clean Air Act's 'overriding' goal of improving air quality weighs against Option 2, and the Act's 'subordinate' considerations of cost, energy, safety, and lead time point in the same direction or are neutral, EPA must reject Option 2. Husqvarna AB, 254 F.3d at 200; see Bluewater Network, 370 F.3d at 21 (explaining that EPA's standards 'must be grounded in 'appropriate consideration' of the relevant statutory factors,' with support from 'analysis and evidence' in the record). [EPA-HQ-OAR-2019-0055-1302-A1, pp.50-51]

Second, notwithstanding the feasibility and cost-effectiveness of zero-emission technologies, EPA has failed to account for BEV and FCEV technologies in proposing the stringency of its underlying emissions standards. The Proposal's treatment of those technologies is therefore inappropriately asymmetric: EPA excludes their emergence from its assessment of the 'greatest degree of emission reduction achievable,' 42 U.S.C. 7521(a)(3)(A)(i); but it allows that emergence to result in higher-polluting engines through its crediting mechanism. See U.S. Sugar Corp. v. EPA, 830 F.3d 579, 631 (D.C. Cir. 2016) (The Clean Air Act 'demands that [EPA] take the bitter with the sweet,' so that 'if the EPA includes a source in a [regulated category]' it must ‘take into account that source’s emissions levels in setting’ standards.). [EPA-HQ-OAR-2019-0055-1302-A1, p.53]

EPA must remedy these flaws. EPA requests comment on the following scenario: if ‘BEV and FCEV technologies’ are ‘projected to reach a greater degree of market penetration than [the Agency’s current] projections,’ could EPA ‘incorporate that [higher] level of BEV and FCEV penetration into [its] calculation of an appropriate numerical standard to represent the combined benefits of achieving NOx control from engines along with zero tailpipe NOx emissions from BEV and FCEV technologies.’ 87 Fed. Reg. at 17,561. BEV and FCEV technologies are indeed projected to reach far greater market penetration than EPA has assumed. See Section III, supra. The availability and cost-competitiveness of those technologies alone warrants their inclusion in EPA’s standard-setting analysis. See Section IV. B, supra. The need for such inclusion is substantially more acute if EPA allows BEVs and FCEVs to generate credits for use in the standards’ Averaging, Banking and Trading (ABT) program. EPA cannot permit compliance with the standards through technologies that will be relatively widely adopted in the relevant model years, while ignoring those technologies in its standard-setting analysis. A ‘combined’ standard, 87 Fed. Reg. at 17,561, if appropriately based on foreseeable levels of BEV and FCEV penetration (as well has HEV development), would allow the standards and credits to function as they should, and bring EPA’s standards into conformity with the Clean Air Act’s command to require the greatest achievable emission reduction. 42 U.S.C. 7521(a)(3)(A)(i). [EPA-HQ-OAR-2019-0055-1302-A1, p.53]

In addition to incorporating zero-emission technologies into its feasibility analysis and rectifying its BEV and FCEV crediting proposal, as described in Sections IV.B-C above, EPA should improve several features of its proposed Option 1. Below, Commenters recommend changes to EPA’s proposed testing provisions and emissions standards that would achieve greater emissions reductions through the application of feasible technologies. We also highlight the importance of adopting warranty and useful life provisions at least as stringent as those proposed in Option 1, and implementing standards and testing procedures that better control NOx emissions that occur when engines are operating at low speeds or idling. [EPA-HQ-OAR-2019-0055-1302-A1, p.54]

EPA determines whether engines comply with emissions limits using two types of tests, laboratory-based and in-use testing, neither of which currently captures the higher emissions happening at lower speeds when trucks are often nearest to people. [EPA-HQ-OAR-2019-0055-1302-A1, p.55]

EPA’s laboratory-based test procedure measures emissions while an engine is operating over precisely defined ‘duty cycles.’ The current duty cycles involve operating under sustained high load, or transitioning from low to high loads, ‘but do not provide for demonstrating emission control under sustained low-load operations.’ 87 Fed. Reg. at 17,422. [EPA-HQ-OAR-2019-0055-1302-A1, p.55]

EPA also requires compliance with ‘Not-To-Exceed’ (NTE) standards to be shown while engines are in use on the road in the real world. Measurements of emissions occurring below certain torque, power, and speed values are currently excluded from consideration, however, as are data occurring in certain ambient conditions or when aftertreatment temperatures are below a certain level. 87 Fed. Reg. at 17,472. EPA's Proposal notes that less than 10% of the data collected during a typical in-use test is actually subject to EPA's current in-use emissions standards, and that in-use testing data indicates that low load operation could account for more than half of a vehicle's NOx emissions during a typical workday. 87 Fed. Reg. at 17,472. [EPA-HQ-OAR-2019-0055-1302-A1, p.55]

While Commenters prefer the more stringent numerical emissions standards of Option 1 to the unjustifiably lax standards of Option 2, we urge EPA to further strengthen the standards in certain key areas: (1) duty cycle and in-use (off-cycle) standards, (2) idle standards, and (3) the FEL cap. EPA should also reject its proposed two-step approach for Option 1, finalizing the more stringent standards in MY 2027 instead of delaying their application until MY 2031. [EPA-HQ-OAR-2019-0055-1302-A1, p.57]

Commenters urge EPA to consider setting stricter duty cycle and in-use standards. While Option 1 is far superior to Option 2, it still fails to fully capture the emissions reductions that can be achieved by various diesel engine technologies. As outlined in the technical comments of MFN, EPA's feasibility analysis does not give sufficient credit to the emissions reduction capabilities of variable valve actuation strategies (such as cylinder deactivation), mild hybridization, and opposed-piston engines. See Comments of MFN, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022. Similarly, a recent analysis by Roush Industries confirmed the technological feasibility of cylinder deactivation, mild hybridization, and limiting auxiliary emissions control devices.239 [EPA-HQ-OAR-2019-0055-1302-A1, p.57]

> 239 Vishnu Nair & Gary Rogers, Reducing Medium- and Heavy-Duty Fuel Consumption and Criteria Pollutants 6, 8, 23–28, 38–40, Roush Industries (Sept. 2021).

Life-saving emissions reductions must be achieved as swiftly as possible in light of the public health crisis wrought by HDV emissions and the availability of feasible and cost-effective pollution control technologies. Commenters urge EPA to apply the NOx emissions standards for both laboratory-based duty cycle testing and in-use 'off-cycle' testing in a single step, finalizing the more stringent standards in MY 2027 instead of delaying their application to MY 2031. See 87 Fed. Reg. at 17,421–22. There is no reason to wait until 2031. The proposed Option 1 FTP, SET, and LLC NOx standards for MY 2027 are too lenient because they fail to reflect the application of feasible technologies that are already available or can be refined well in advance of that model year, let alone MY 2031. See 42 U.S.C. 7521(a)(3)(A)(i). Commenters support and incorporate by reference comments by MFN and CARB demonstrating the technological feasibility of implementing the more stringent standards in a single step in MY 2027. See Comments of (1) MFN and (2) CARB, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022. And while Commenters urge EPA to strengthen its off-cycle standards, see Section IV.D.2.a, supra, at the bare minimum, the Agency should apply its proposed MY 2031 off-cycle numerical requirements to MY 2027. [EPA-HQ-OAR-2019-0055-1302-A1, p.59]

Commenters also agree with the Manufacturers of Emission Controls Association (MECA) and the Advanced Engine Systems Institute that the technology required by Option 1 is neither new, nor untested, but rather reflects the 'evolution of familiar technology.'268 As these organizations correctly point out: '2027 is not like 2007/2010 when emission controls were put on trucks for the first time. Truck manufacturers and operators have 20 years of experience with hardware and maintenance of systems.'269 [EPA-HQ-OAR-2019-0055-1302-A1, p.72]

268 Rasto Brezny (Manufacturers of Emission Controls Association) & Patrick Quinn (Advanced Engine Systems Institute), Supporting EPA's Clean Trucks Rule 8 (Jan. 18, 2022).

269 Id. at 5.

This rulemaking presents an opportunity for EPA to set a strong foundation for ambitious future rules that will achieve significant emissions reductions through widespread deployment of zero-emission technologies within the heavy-duty sector. Given HDVs' contribution to widespread public health problems and dangerous climate change, it is critical that this sector transition to zero-emission technologies as rapidly as possible. [EPA-HQ-OAR-2019-0055-1302-A1, p.72]

While this Proposal should do more to accelerate the deployment of those technologies to bring about greater emissions reductions, Commenters welcome the opportunity to comment on the goals and principles EPA should follow as it undertakes a series of future rulemakings to clean up the transportation sector. See 87 Fed. Reg. at 17,420 (referencing future light- and heavy-duty rulemakings and requesting comment 'on how the Agency can best consider the potential for ZEV technologies to significantly reduce air pollution from the heavy-duty vehicle sector'). Each rulemaking must be viewed as a stepping stone for the next and with recognition of the interrelationship with other sectors to adequately protect public health and welfare. This rulemaking will be followed by another to set new stringent GHG emissions standards for heavy-duty engines and vehicles starting in MY 2030, and EPA must lay the groundwork now for a rule that protects human health and welfare and leads to the necessary acceleration of zero-emission technologies. Setting insufficiently stringent standards in this rulemaking could jeopardize EPA's ability to fulfill its statutory obligations not only now but in future rulemakings. [EPA-HQ-OAR-2019-0055-1302-A1, pp.72-73]

EPA must finalize a strong rule this year to curtail dangerous emissions from heavy-duty vehicles and engines. Adopting Commenters' recommendations would result in a feasible, cost-beneficial, and technology-forcing rule that fulfills EPA's statutory duty to protect public health and welfare. [EPA-HQ-OAR-2019-0055-1302-A1, p.76]

Organization: *Clean Energy (CE)*

Specifically, **CE supports EPA's proposed 'Option 1' NOx standard which takes a two-step approach by implementing a 0.035 g/bhp-hr standard starting in 2027 and a 0.02 g/bhp-hr standard starting in 2031**. Near-zero heavy-duty truck engines, certified by the California Air Resources Board (CARB), meet or exceed the proposed 2031 standard today and are being deployed in the thousands by American fleets. In-use testing has revealed that NOx emission reductions are greater than their 0.02 g/bhp-hr certification, achieving reductions of up to 98 percent.1 [EPA-HQ-OAR-2019-0055-1350-A1, p.1]

1 'Ultra-Low NOx Natural Gas Vehicle Evaluation,' University of California Riverside, CE-CERT, November 2016. Available at: https://cngvc.org/wp/wp-content/uploads/2017/03/UCR-UltraLow-NOx_NGV-Evaluation_Final-Report.pdf.

Clean Energy supports U.S. EPA's 'Option 1' which establishes a NOx standard of 0.035 g/bhp-hr in 2027 and later lowered to 0.02 g/bhp-hr in 2031. Near-zero engines are already certified by CARB to meet the 0.02 g/bhp-hr standard and we believe compliance with the proposed EPA standard will be met well in advance of 2031. With close to a decade of lead time for other types of engines to comply with the 2031 standard, Clean Energy finds Option 1 both reasonable and necessary given climate and air quality challenges. [EPA-HQ-OAR-2019-0055-1350-A1, p.4]

Organization: *CleanAirNow (CANKC)*

ANKC supports the following recommendations from the Moving Forward Network:

- EPA to pass stringent and protective emission standards that require mandatory emission reduction in EJ communities as well as a sales mandate. [EPA-HQ-OAR-2019-0055-1239-A1, p.2]
- EPA to have 100% zero emission across the freight sector by **2035** at the latest
- Retirement of all combustion trucks, trains and ships on or before **2045.** [EPA-HQ-OAR-2019-0055-1239-A1, p.2]
- The EPA truck rule should be moving towards zero emission solutions to address the freight and logistics system. These policies need to center EJ communities and frontline workers [EPA-HQ-OAR-2019-0055-1239-A1, p.2]
- EPA must move towards a Zero Emissions agenda now. This agenda must cross the freight sector and prioritize environmental justice communities. [EPA-HQ-OAR-2019-0055-1239-A1, p.2]
- EPA to reduce emissions from the heavy-duty vehicle fleet through the most protective and stringent emission standards. [EPA-HQ-OAR-2019-0055-1239-A1, p.2]
- The cumulative impacts from freight need to be considered and addressed. EPA should be requiging lifetime pollution regulations for new trucks as well as legacy pollution from aging diesel polluting trucks [EPA-HQ-OAR-2019-0055-1239-A1, p.3]

Organization: *ClearFlame Engine Technologies (ClearFlame)*

We strongly urge you to include Option 1 in your final Rule, which will reduce emissions of nitrogen oxides (NOx) more quickly and provide deeper reductions than Option 2. [EPA-HQ-OAR-2019-0055-1261-A1, p. 2]

As EPA knows, disadvantaged communities have suffered the health impacts of disproportionate levels of diesel exhaust for decades. These health impacts include increased asthma, bronchitis, cancer, heart disease, and premature death. These communities need NOx reductions as soon as possible. [EPA-HQ-OAR-2019-0055-1261-A1, p. 2]

More broadly, more than 127 million Americans, spread across 209 counties in 23 states and the District of Columbia, live in areas that either have not attained the 8-hour National Ambient Air

Quality Standard for ozone or that are required to take ongoing steps to maintain their attainment of this standard. [EPA-HQ-OAR-2019-0055-1261-A1, p. 2]

For both of these reasons, we support Option 1. We are confident that we will be able to produce our engines at the NOx levels and on the MY 2027 timetable that has been proposed in Option 1. [EPA-HQ-OAR-2019-0055-1261-A1, p. 2]

Organization: *ClearFlame Engine Technologies (ClearFlame), Remora, and SixWheel*

With respect to reducing emissions of nitrogen oxides (NOx) from heavy-duty vehicles and engines, we strongly support Option 1. Option 1 will provide deeper, faster NOx emission reductions that are critical to protecting air quality and human health. [EPA-HQ-OAR-2019-0055-1329-A2, p. 2]

We strongly encourage the Agency to finalize Option 1 for NOx emissions. We encourage the Agency to adopt fuel-neutral, technology-neutral, and performance-based GHG emissions standards that allow industry members to choose how to meet emissions goals, while creating opportunities for technology developers to advance novel solutions. [EPA-HQ-OAR-2019-0055-1329-A2, p. 4]

Organization: *Colorado Energy Office, et al.*

Given the advances in emissions control technology and the need for strong national standards to achieve the significant health benefits estimated from the proposed rule, we strongly urge EPA to pursue and strengthen Option 1 for the proposed NOx engine standards. We recommend EPA consider the following improvements to Option 1 to achieve the greatest health benefits possible, and align with the Low NOx Omnibus rule wherever possible:

- The rule considers a “Potential Alternative” more stringent than Option 1 of 0.020 g NOx/hp-hr engine standard for MY 2027, but requests data on the feasibility of achieving this standard in the MY 2027 time frame. Several studies from CARB, EPA, and other research institutes support the feasibility of introducing a 0.020 gram NOx standard in 2027.1,2,3,4,5,6 Adoption of this standard would align with the Low NOx Omnibus rule nationally, which ICCT modeling estimates would avoid $1.3 trillion in health damages associated with ambient PM2.5 and ozone pollution from 2027-2050.[EPA-HQ-OAR-2019-0055-1297-A1, p.2]

1 Manufacturers of Emission Controls Association, “Technology Feasibility for Heavy-Duty Diesel Trucks in Achieving
90% Lower NOx Standards in 2027,” February, 2020.

2 Southwest Research Institute, “Update on Heavy-Duty Low NOx Demonstration Programs at SwRI,” November
2019.

3 Sharp, Chris; Neely, Gary; Rao, Sandesh; Zaval, Bryan, “An Update on Continuing Progress Towards Heavy-Duty
Low NOx and CO2 in 2027 and Beyond,” Southwest Research Institute, WCX, Detroit, Michigan , April 5-7 2022.

4 U.S. Environmental Protection Agency, “Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engines and
Vehicles, Regulatory Impact Analysis,” March 28, 2022.

5 Achates Power, “Heavy Duty Opposed Piston Engine Demonstration,” CRC Real World Emissions Workshop, March
15, 2022

6 Villafuerte, Pablo Mendoza; Demuynck, Joachim; Bosteels, Dirk, “Ultra-Low NOx Emissions with a Close-Coupled
Emission Control System on a Heavy-Duty Truck Application,” Society of Automotive Engineers See
2021-01-1228.pdf (aecc.eu).

- Additionally, truck manufacturers have already developed the technology to prepare for and comply with California’s standards, and all states could benefit from this research and development. [EPA-HQ-OAR-2019-0055-1297-A1, p.2]

Organization: *Connecticut Department of Energy and Environmental Protection (CTDEEP)*

CTDEEP believes that EPA must establish a stringent, technology-forcing federal rule that will reduce HD truck NOx emissions by at least 90 percent and implement other key requirements to ensure that these reductions will continue to be realized over the full useful life of vehicles beginning not later than model year (MY) 2027. The outcome of this regulatory action is critically important for Connecticut as a state struggling with a persistent ozone non-attainment problem which is due in part to HD NOx emissions. [EPA-HQ-OAR-2019-0055-1306-A1, p.1]

While Connecticut continues to implement programs above and beyond those required by the Clean Air Act, EPA has waited two decades to update its HD truck standards. There is a clear and compelling public health need for much tighter restrictions on HD truck NOx emissions. In the past 20 years, the technical capacity to identify and reduce these emissions has flourished and tremendous experience has been gained. The opportunity to require and achieve deeper reductions in NOx emissions is enormous as reaffirmed through the California Air Resources Board (CARB) Heavy-Duty Omnibus Regulation, which was adopted in August 2020, and ultimately finalized in December 2021, after an extensive public process that was preceded by several years of informal stakeholder input.8 EPA should be leveraging the early experience with the already-final Omnibus 2024-2026 phase-in as well as the finalized 2027 Omnibus standards to the benefit of the final rule rather than ignoring the engineering and commercialization progress made in order to comply with the Omnibus in California and in other states like New York, New Jersey, Massachusetts and other states that have adopted it. [EPA-HQ-OAR-2019-0055-1306-A1, p.5]

8 Heavy-Duty Omnibus Regulation | California Air Resources Board

EPA includes two options in the proposal for HD engine emissions standards, one more stringent than the other. The agency notes that Proposed Option 1, the more stringent of the two, would come with greater public health and environmental benefits; nonetheless, as proposed, this option is insufficient. Proposed Option 2 is wholly unacceptable as the requirements do not reflect the level of control technology that is possible, nor would it lead to meaningful emission reductions. Connecticut supports modifications that would strengthen the overall stringency of Proposed Option 1 by aligning it with the technology-forcing mandate of the CAA and the recently adopted Low NOx Omnibus regulation in California. *Specifically, Connecticut recommends that EPA should revise Proposed Option 1 to pull forward to 2027 the 20 mg/hp-hr NOx emission standard for all classes with an interim useful life standard of 435,000 miles for heavy HD engines*. In fact, the Clean Air Act under CAA section 202(a)(3)(A) requires EPA when setting federal NOx emission standards for HD trucks to reflect 'the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy and safety factors associated with the application of such technology.' [emphasis added] [EPA-HQ-OAR-2019-0055-1306-A1, p.5]

Connecticut citizens have suffered from unhealthy air quality for generations, the magnitude of the State’s ozone noncompliance and the impact on the public health and welfare of our citizens, especially the most vulnerable demands EPA’s action to adopt a rule that achieves a 90% reduction in NOx emissions by 2027. Connecticut strongly supports the comments submitted by NACAA, NESCAUM and OTC. [EPA-HQ-OAR-2019-0055-1306-A1, p.5]

Organization: *Consumer Reports (CR)*

For the NOx emission standards, EPA is proposing two options, Option 1 and Option 2. EPA’s obligations under the CAA to set standards that reflect the greatest degree of emission reduction achievable5 require the agency to adopt Option 1. Compared to Option 2, Option 1 sets stronger NOx emission standards and sets more stringent useful life and warranty periods and is economically and technologically feasible. a. EPA should ensure that credits do not limit the effectiveness of the NOx standards. To this end, EPA should eliminate all multipliers, lower family emission caps, and eliminate or minimize the use of credits for ZEVs. [EPA-HQ-OAR-2019-0055-1285-A1, p.2]

5 The CAA requires the Administrator to set standards that 'reflect the greatest degree of emission reduction achievable through the application of a technology which the Administrator determines will be available for the modely year to which such standards apply. 43 U.S.C. 7521(a)(1).

EPA must adopt Option 1 of the proposed rule; Option 2 simply does not go far enough. [EPA-HQ-OAR-2019-0055-1285-A1, p.3]

Section 202(a) of the CAA requires the Administrator to prescribe ‘standards applicable to the emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines, which in his judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare.'17 Both NOx and GHG have been found to endanger public health and welfare. Section 202(a)(3)(A) of the CAA further requires standards for emissions of NOx, particulate matter, hydrocarbon and carbon monoxide to 'reflect the greatest degree of emission reduction achievable through the application of a technology which the Administrator determines will be available for the model year to which such standards apply, given appropriate consideration to cost, energy, and safety factors associated with the application of such technology.'18 This language authorizes the Administrator to set performance levels that, 'while not achievable immediately, are demonstrated to be achievable in the future based on information available today.'19 Zero-emission technology for many classes of heavy-duty vehicles currently exists,20 and ZEV technology is rapidly advancing.21 By underestimating market penetration of ZEVs, the current proposed standards do not account for this technology, thus do not represent the 'greatest degree of emission reduction achievable,' and thus do not meet EPA's obligations under the CAA. [EPA-HQ-OAR-2019-0055-1285-A1, p.4]

17 43 U.S.C. 7521(a)(1).

18 43 U.S.C. 7521(a)(3)(A).

19 EPA, Setting Emission Standards Based on Technology Performance. Available at: https://www.epa.gov/clean-air-act-overview/setting-emissions-standards-based-technology-performance

20 CAl- Start, Zero-Emission Technology Inventory. Available at: https://globaldrivetozero.org/tools/zero-emission-technology-inventory/

21NREL, Decarbonizing Medium- and Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis, (March 2022). Available at: https://www.nrel.gov/docs/fy22osti/82081.pdf

EPA must meet its obligations under the CAA by setting standards that reflect 'the greatest emission reduction achievable.' To do so, standards must accurately reflect both current and future technology. Moreover, standards should encourage growth of this technology in the future. [EPA-HQ-OAR-2019-0055-1285-A1, p.5]

As stated, CR supports EPA's efforts to reduce NOx emissions from heavy-duty vehicles. Because it is technologically and economically feasible, EPA must adopt Option 1.37 [EPA-HQ-OAR-2019-0055-1285-A1, p.6]

37 California Air Resources Board, Facts about the Low NOx Heavy-Duty Omnibus Regulation. Available at: https://ww2.arb.ca.gov/sites/default/files/classic/msprog/hdlownox/files/HD_NOx_Omnibus_Fact_Sheet.pdf

As stated above, section 202(a)(1) of the CAA requires the Administrator to ‘prescribe standards applicable to the emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines, which in his judgment cause, or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare.’ 38 Section 202(a)(3) of the CAA further states that the standards prescribed under paragraph (1) applicable to emissions of hydrocarbons, carbon monoxide, oxides of nitrogen, and particulate matter from classes or categories of heavy-duty vehicles or engines must ‘reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors.’39 [EPA-HQ-OAR-2019-0055-1285-A1, p.6]

38 42 U.S.C. 7521(a)(1)

39 42 U.S.C. 7251(a)(3)

As proven by EPA’s own regulatory analysis, as well as California Air Resource Board (CARB) studies, Option 1 is both technologically and economically feasible.40 Compared to Option 2, Option 1 sets more stringent NOx emissions standards, and requires longer useful life and warranty periods. Option 1 will result in a 90% reduction in NOx emissions by 2030, whereas Option 2 will only result in a 75% reduction in emission standards by 2030.41 As such, Option 1 reflects 'the greatest degree of emission reduction achievable… given appropriate consideration to cost, energy and safety factors.' Moreover, the benefits of Option 1 more significantly outweigh the costs than is the case with proposed Option 2.42 As such, Option 2 simply does not meet EPA’s obligations under the CAA. [EPA-HQ-OAR-2019-0055-1285-A1, pp.6-7]

40 California Air Resources Board, California Air Resources Board Staff Current Assessment of the Technical Feasibility of Lower NOx Standards and Associated Test Procedures for 2022 and Subsequent Model Year Medium-Duty and Heavy-Duty Diesel Engines, (April 18, 2019). Available at: https://ww2.arb.ca.gov/sites/default/files/classic/msprog/hdlownox/white_paper_04182019a.pdf

41 ICCT, ICCT Proposal on EPA’s Proposed Heavy-Duty Engine and Vehicle Standards. Available at: https://theicct.org/wp-content/uploads/2022/04/public-webinar_10May2022.pdf

42 87 F.R. 17414, 17415-17416.

Organization: *Cummins Inc. (Cummins)*

Cummins has decades of experience using a proprietary methodology to assess the design targets needed for engines to comply with standards of varying stringency, throughout the regulated useful life. The design target represents our own upper limit for the mean emissions of a sample of the population of production engines in an engine family to ensure compliance with an emissions standard throughout useful life. Sufficient margin, called compliance margin, is necessary between our design target and the standard to account for additional factors required by regulation (including deterioration factors and infrequent regeneration adjustment factors, as applicable), as well as production variability, test procedure and measurement variability, and in-use variables that are not within an engine manufacturer's control. Using inputs for the elements of compliance margin based on Cummins' experience and historical data, plus results from EPA's own ongoing research at Southwest Research Institute (SwRI), we can calculate design targets for various combinations of potential NOx standards and emissions useful life periods. [EPA-HQ-OAR-2019-0055-1325-A1, p. 3]

Cummins shared our methodology and an initial analysis as confidential business information (CBI) with EPA in September 2021, six months before EPA's proposal was published. Our analysis concluded that a 20 mg/hp-hr NOx standard at 435,000 miles useful life, which is both California Air Resources Board's (CARB's) model year (MY) 2027 heavy-heavy duty intermediate useful life standard and EPA's proposed Option 1 MY 2031 corresponding standard, results in a negative NOx design target for diesel engines, which, of course, is not feasible. [EPA-HQ-OAR-2019-0055-1325-A1, p. 3]

Now that EPA's proposal, plus additional data from EPA's ongoing research at SwRI, have been made public, Cummins has completed additional design target analyses with updated inputs. Again, the results show that EPA's Option 1 2027 and 2031 NOx standards and associated emissions useful life periods are not feasible. The calculated design targets are lower than can be achieved by diesel engines in production without placing undue compliance risk of recall and other penalties on the manufacturer, due to insufficient compliance margin. That is true even after applying the most optimistic assumption that variability decreases entirely in proportion to the design target. Cummins is prepared to share results of our recent analyses with EPA as CBI. [EPA-HQ-OAR-2019-0055-1325-A1, pp. 3 - 4]

Since Option 1 is not achievable with diesels, it would have negative impacts on the environment if finalized. In the absence of new diesel engines, some customers looking to purchase new diesel engines could switch to purchasing natural gas engines, gasoline engines, or zero emission vehicles (ZEV), which are capable of meeting the Option 1 standards. However, most customers cannot readily switch to those alternatives, due to product capabilities, costs, refueling and recharging infrastructure, and other limitations. Those customers would be left with buying new diesel engines before the new standards take effect or holding on to their older diesels much longer. In either case, the environment does not benefit from improved emissions, which would have been driven by feasible standards that can be met with reliable technologies customers can readily adopt. Option 1 even could be worse for the environment than no new standard at all. With no new standard, customers at least would be able to continue to replace older higher emitting products with current advanced clean diesels. Cummins therefore does not support the adoption of EPA's proposed Option 1 NOx standards, in the same way that Cummins never supported CARB's adoption of its Omnibus 2027+ standards. [EPA-HQ-OAR-2019-0055-1325-A1, p. 4]

EPA additionally proposed an alternative option (called the "Alternative"), which is even more stringent than EPA's proposed Option 1 or CARB's Omnibus standards. Among the elements included in the Alternative is a 20 mg/hp-hr FTP/SET NOx standard for MY 2027 Heavy HDE engines at 850k miles UL. EPA was unable to conclude that the Alternative is feasible in the MY 2027 timeframe due to deterioration in the emission control technologies that EPA has evaluated to date. Given Cummins' design target analysis discussed above and negative impacts to the environment, we agree with EPA that the Alternative is not feasible and warrants no further consideration. [EPA-HQ-OAR-2019-0055-1325-A1, p. 4]

Based on Cummins' technology evaluations, EPA's proposed Option 2 NOx standard of 50 mg/hp-hr will drive a range of additional technologies onto diesel engines, similar to the ones evaluated by EPA and SwRI, e.g., cylinder deactivation (CDA) and dual selective catalytic reduction (SCR) systems, which can achieve NOx improvements over a wide range of real-world operation. While technologies such as CDA and dual SCR are in production already in light-duty applications, they are not in production for heavy-duty vehicles at these emission levels, so considerable effort is still needed to develop, package, and validate the new components, especially considering the more diverse drive trains and vehicle configurations, duty cycles, applications, and much longer useful life of heavy-duty vehicles. [EPA-HQ-OAR-2019-0055-1325-A1, p. 4]

Cummins supports a stringent but feasible single-step NOx standard in 2027. Further NOx reductions should come from zero and near-zero emission technologies, and EPA's anticipated Phase 3 GHG rule should deliver those NOx reductions. Setting aside Option 1's infeasible standards, Option 1's second step in 2031, at any stringency, would be especially disruptive for manufacturers' investments that currently are committed to the development and implementation of zero and near-zero emissions technologies in that same timeframe. A 2031 NOx step would force manufacturers to decrease investments in zero and near-zero technologies in order to increase investments to implement another step of internal combustion engine NOx control technologies. [EPA-HQ-OAR-2019-0055-1325-A1, p. 5]

In these comments, Cummins has discussed the reasons why Option 1 is not the right solution to achieve such a goal. We have also discussed changes that are needed to Option 2 to ensure manufacturers can offer products that are not only compliant to the challenging 50 mg/hp-hr NOx standard but also cost-effective. [EPA-HQ-OAR-2019-0055-1325-A1, pp. 20-21]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

The zero-emission transition is best achieved by encouraging technological innovation in a cost-effective manner that is realistic in terms of timing and implementation. Environmental regulators such as EPA and CARB have an important role to play in facilitating this transition by balancing requirements and incentivizes in their regulatory programs. Unfortunately, the Proposed Rule does not strike the proper balance because, among other things, it:

- Introduces significant technical risk for manufacturers—particularly with respect to long-term recall liability and in-use testing—and contains numerous standards and requirements that are likely not achievable within the timeframes given;
- Dramatically under-estimates technology costs and the anticipated market impacts (including pre-buy, low-buy, and no-buy scenarios) associated with the high costs of compliance that will threaten jobs and increase the cost of transporting goods, impacts

that ultimately will be felt at every level of society and will exacerbate existing inflation and supply chain challenges;

- Will require manufacturers to divert finite resources into development of conventional vehicle technology to meet the Proposed Rule requirements within the timeframes proposed, which has limited environmental benefits and detracts from ZEV research and development (R&D); and
- Proposes stringent emission standards that are based upon a technology demonstration that does not reflect real-world conditions, account for appropriate design margins, cannot be packaged on an actual vehicle, ignores the effects of fuel quality issues on aftertreatment effectiveness, and fails to address the complexities of NOx/CO2 emission tradeoffs. [EPA-HQ-OAR-2019-0055-1168-A1, pp.1-2]

Congress has given EPA clear direction for setting emission standards for new motor vehicles and new motor vehicles engines under Clean Air Act (CAA or the Act) Section 202(a), and the bounds of EPA's authority have been well-established in case law interpreting the provisions of this section. As EPA acknowledges in the Proposed Rule, CAA Section 202(a) sets forth the following key requirements for and limitations on emissions standard-setting for new vehicles and engines:

- First, emission standards promulgated under Section 202(a) may only take effect after the period of time necessary to permit the development and application of the requisite technology, giving 'appropriate consideration to the cost of compliance within such period.'1
- Second, EPA regulations governing HC, CO, NOx, and PM emissions from heavy-duty vehicles or engines must contain standards reflecting the 'greatest degree of emission reduction achievable' through the application of technology that EPA determines will be available for the model year to which such standards apply, giving 'appropriate consideration to cost, energy, and safety factors associated with the application of such technology.'2
- Third, in revising heavy duty vehicle or engine emission standards to address public health effects of air pollutants from the sector, EPA must 'tak[e] costs into account.'3
- Fourth, EPA must give consideration to lead time and stability in setting heavy-duty emission standards, as any standard promulgated under CAA Section 202(a) must apply for a period of no less than three model years and begin no earlier than the model year commencing four years after any revised standard is promulgated.4 [EPA-HQ-OAR-2019-0055-1168-A1, pp.5-6]

1 42 U.S.C. 7521(a)(2).
2 Id. at 7521(a)(3)(A)(i).
3 Id. at 7521(a)(3)(B)(i).
4 Id. at 7521(a)(3)(C).

While EPA has discretion in weighing the various statutory factors that it is to consider in heavy-duty emission standard-setting, there are limits to this discretion. EPA may, for example, look to the future to project anticipated advances in pollution control capability, but these projections are 'subject to the restraints of reasonableness' and do not 'open the door to 'crystal ball' inquiry.'5

Further, the Agency ‘must . . . provide a reasoned explanation of its basis for believing that its projection is reliable. This includes a defense of its methodology for arriving at numerical estimates.’6 [EPA-HQ-OAR-2019-0055-1168-A1, p.6]

> 5 See National Resources Defense Council, Inc. v. U.S. EPA, 655 F.2d 318, 328 (D.C. Cir. 1981) (‘NRDC’) (citing International Harvester Co. v. Ruckelshaus, 478 F.2d 615, 629 (D.C.Cir.1973)).
> 6 Id.

With respect to technical feasibility, ‘where the facts pertinent to [a] standard’s feasibility are available and easily discoverable by technical means,’ EPA is held to a higher standard of demonstrating achievability by relying upon available data.7 Where the feasibility of an emissions control standard turns on the development of a particular technology, the Agency must identify the major steps that are necessary for the development of this technology and must ‘give plausible reasons’ for its belief that industry will be able to solve any impediments to its implementation ‘in the time remaining’ before the standard will be enforced.8 [EPA-HQ-OAR-2019-0055-1168-A1, p.6]

> 7 National Lime Ass’n v. EPA, 627 F.2d 416, 454 (D.C. Cir. 1980).
> 8 NRDC, 655 F.2d at 333.

The Company believes that EPA’s proposal disregards key considerations, including failure to analyze certain costs, for new heavy duty vehicle and engine emission standard-setting, in contravention of the specific congressional directives in CAA Section 202(a). Specifically, if finalized, EPA’s Proposed Rule would:

- Impose inordinate costs on manufacturers and consumers that EPA has not accounted for in its cost analysis. These costs would have significant adverse effects on the heavy-duty transportation market by causing ‘pre-buy’ and ‘no-buy’ scenarios, leading to significant job losses, major market and freight disruption, and other adverse economic impacts. Because its cost analyses are flawed, EPA has not fulfilled its statutory duty to give ‘appropriate consideration’ to costs.
- Be infeasible in implementation and thus impose standards that are not commensurate with the greatest degree of emission reduction that is ‘achievable’ giving appropriate consideration to cost, energy, safety, and other factors.
- Undermine regulatory stability if EPA determines to increase stringency of the Phase 2 GHG standards for certain vocational vehicles and tractor categories starting in MY 2027, upsetting manufacturer reliance on those standards coming out of the Phase 2 rulemaking.
- Disincentivize ZEV development and commercialization, as the Proposed Rule would require manufacturers to invest in conventionally-powered vehicle programs to achieve compliance with the upcoming standards instead of focusing on ZEV technology, which would have significantly greater environmental benefit. Each of these concerns are explained in more detail elsewhere in these comments. [EPA-HQ-OAR-2019-0055-1168-A1, p.7]

Daimler Truck believes that any new HD emission standards that EPA develops in this rulemaking process must be guided by the following principles:

- ***One-Step NOx Stringency***. A one-step program for sensible increases in NOx stringency is key to ensuring manufacturers are able to deliver the technologies needed to develop and commercialize the ZEVs of the future. Daimler Truck strongly believes that ZEVs are the future of the commercial vehicle industry. Keeping next-tier EPA regulations to one NOx standard down-step will help manufacturers focus on the development of ZEV technology, instead of diverting resources to meet an interim NOx standard for conventionally-powered vehicles that has little environmental benefit and may not be technologically achievable.
- ***Feasibility and Cost-Effectiveness***. EPA's next-tier standards must be technologically feasible and cost-effective and, to this end, must be based upon accurate and realistic technical, cost, and market analyses. In evaluating the relative costs and benefits of its proposal, the Agency must take into account widely available literature on cost impacts associated with standard stringency, as well as key manufacturing cost drivers such as meeting extended regulatory useful life and emission warranty requirements.
- ***Realistic NOx Standards.*** EPA's next-tier NOx standards should be realistic and achievable and should be developed in recognition of the inevitable trade-offs between NOx and CO2 emission reductions. The Agency's standards should present manageable and predictable risk in terms of in-use emissions and compliance evaluations, and they should reflect real-world operations and performance.
- ***Lead Time, Stability, and Certainty.*** The timing of standard implementation should allow for sufficient R&D, and should give long-term consideration to manufacturer investments in the technologies of the future.
- ***Incentivizes for ZEV Market Penetration***. EPA should build upon the successes of the compliance flexibility programs that have long been a part of its vehicle emissions regulations. The Agency's NOx and CO2 regulations should enhance (and not diminish) opportunities for manufacturers to generate credits for ZEV development and commercialization and should appropriately incentivize ZEVs with credit multipliers. [EPA-HQ-OAR-2019-0055-1168-A1, p.10]

In proposing adoption of NOx standards below 0.050 g/bhp-hr, EPA has failed to account for appropriate design margins and the inherent technical challenges of meeting the standards as proposed. Since the evolution of 0.2 g/hp-hr NOx standards and related selective catalytic reduction (SCR)-based aftertreatment technologies, Daimler Truck has consistently found it necessary to account for design margins to meet the relevant standards. The Company endorses the section of EMA's comments on this topic entitled 'EMA Assessment of Technical Feasibility of Complying with a 0.020 g/bhp-hr NOx Standard for Heavy-Duty Diesel Engines' and adopts such comments as its own.63 [EPA-HQ-OAR-2019-0055-1168-A1, p.24]

63 See Truck and Engine Manufacturers Association, Comments on EPA-HQ-OAR-2019-0055 (May 13, 2022) ('EMA Proposed Rule Comments').

DTNA strongly believes that a one-step approach, with an aggressive 75% increase in NOx stringency, no earlier than 2027, is the feasible, economical, and environmentally sound approach to emissions reductions for diesel vehicles. [EPA-HQ-OAR-2019-0055-1168-A1, p.53]

Two steps of increasing stringency, as EPA has proposed under Option 1, will force manufacturers to invest in two development programs, closely spaced in time, doubling the necessary investment in R&D, validation, and verification of the new systems needed for compliance with each set of standards. Additionally, releasing new products in both 2027 and 2031 will leave orphaned products sold by manufacturers for the three interim model years before the second tier standards take effect. Under a 'two-step' scenario, manufacturers will struggle to recapture their investment in MY2027-MY2030 vehicles and will not have adequate time to optimize product performance and cost through ongoing improvement efforts. Manufacturers will also have to split their resources between two different programs, likely leading to increased quality issues. [EPA-HQ-OAR-2019-0055-1168-A1, p.53]

Similarly, a two-step approach to increasing emission standard stringency will double the adverse economic effects anticipated from the Proposed Rule (and detailed in Section II.B.2), as the market will likely face two pre-buy scenarios, and fleet operators will face the adoption and integration of new technology twice, in rapid succession. Or worse, a two-step approach may simply cause a more dramatic one-time pre-buy effect, if fleet owners choose to delay new purchases altogether until after 2031 to avoid having to integrate new technology into their fleet twice. Either way, a two-step approach to emissions stringency as EPA has proposed under Option 1 will cause more significant job losses, economic damage, and market frustration, and these adverse effects may further reduce the emissions benefits of EPA's proposed programs. [EPA-HQ-OAR-2019-0055-1168-A1, p.53]

We firmly believe that the future of the commercial trucking segment is in ZEVs—namely, battery-electric and hydrogen powertrains. Daimler Truck is making significant investments in these technologies, and—as EPA notes in the Proposed Rule—Daimler Truck AG, our parent company, has set a goal that all new vehicles sold in Europe, North America and Japan be CO2-neutral by 2039. However, this aggressive strategy for decarbonization requires unprecedented investment in the development of new technologies to meet the wide array of commercial vehicle applications. Further investment in incremental improvements to conventional powertrains, as will be needed to comply with EPA's Option 1 approach, competes with the investments necessary for ZEVs. In other words, EPA's proposal to have two stringent emission reduction steps directly reduces investments OEMs can make in ZEVs, and thereby will slow their market penetration. [EPA-HQ-OAR-2019-0055-1168-A1, p.53]

Organization: *David Luedtke*

The trucking industry has made great strides in pollution control & will move to gain on those strides without further mandates. If there are new mandates the Fed's want to add made they need to look at a long faze in process to get the old equipment out of production. Look at a 10 year process that will allow the older trucks to retire & scrap out. This same time frame will allow manuf. the time to ramp up pollution items so the cost isn't astronomical! [EPA-HQ-OAR-2019-0055-1541]

Organization: *David Wong*

Third, the guidelines seem too gradual and reasonable to be considered radical, when a radical change is needed for the radical improvement in air quality we seek. I am recommending the EPA add amendments to increase the strictness of emission guidelines exponentially every year, or at least every 2 or 3 years for implementation.

Organization: *Delaware Department of Natural Resources and Environmental Control (DNREC)*

The rule should be stringent and technology forcing. The rule should reduce HD truck NOx emissions by at least 90 percent and implement other key requirements to make sure these reductions will continue to be realized over the full useful life of vehicles, beginning no later than MY 2027. Such standards should require not only advanced and emerging technologies, but also technologies consistent with CAA Section 202(a)(3)(A): NOx emission standards for HD trucks are to "reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy and safety factors associated with the application of such technology." [EPA-HQ-OAR-2019-0055-1200-A1, p.2]

In the proposed action, EPA is co-proposing two regulatory options for new NOx standards: Proposed Option 1 and Proposed Option 2. EPA seeks comments on the two options and seeks comment on an alternative option for different numeric levels of the standards and lengths of useful life and warranty periods. Delaware prefers the numeric standards, extended useful life periods and warranty periods of Proposed Option 1. [EPA-HQ-OAR-2019-0055-1200-A1, p.2]

Proposed Option 1 is expected to reduce NOx emissions from HD vehicles in 2040 by more than 50%; by 2045, a year by which most of the regulated fleet would have turned over, HD NOx emissions would be more than 60% lower than they would have been without this action. Proposed Option 2 is expected to reduce HD NOx emissions by 47% in 2045. Proposed Option 1 would result in total annual monetized ozone- and PM2.5-related benefits of $12 and $33 billion at a 3% discount rate, and $10 and $30 billion at a 7% discount rate by 2045. Proposed Option 2 would result in total annual monetized ozone- and PM2.5-related benefits of $9 and $26 billion at a 3% discount rate, and $8 and $23 billion at a 7% discount rate for the same year. [EPA-HQ-OAR-2019-0055-1200-A1, p.2]

Given the analysis presented, Delaware believes that Option 1is a more appropriate level of stringency as it would result in a greater level of achievable emission reduction, health benefits and monetized benefits than Proposed Option 2. Delaware urges EPA to revise Proposed Option 1 to require the 20-mg/hp-hr NOx standard for HD trucks beginning in 2027 with an intermediate useful life of 435,000 miles (versus EPA's Proposed Option 1 approach of 35 mg/hp-hr NOx in 2027); these requirements are entirely feasible. [EPA-HQ-OAR-2019-0055-1200-A1, p.3]

EPA should not exempt any engines from complying with the adopted new emission standards for any amount of time and, therefore, should not adopt the production volume allowance option described in the Notice of Proposed Rulemaking. Delaware supports an increase to the Option 1 regulatory useful life mileage values for new HD engines to better reflect real-world usage, extend the emissions durability requirement for HD engines, and ensure certified emission performance is maintained throughout an engine's operational life. [EPA-HQ-OAR-2019-0055-1200-A1, p.3]

For all these reasons, Delaware urges EPA to act quickly to fully adopt a federal regulation requiring a 20-mg/hp-hr NOx standard for HD trucks by the end of this calendar year so that it will take effect with MY 2027 to reduce air pollution from highway HD vehicles and engines. [EPA-HQ-OAR-2019-0055-1200-A1, p.3]

Organization: *District of Columbia Department of Energy and the Environment (DOEE)*

DOEE has submitted comments to the EPA on this matter before, writing in October 2021 to urge the EPA to accelerate their proposal after the January 2020 Advanced Notice of Proposed Rulemaking. DOEE remains concerned about the delays in issuing stricter heavy-duty engine standards because delays harm the health of the residents of the District, especially historically disadvantaged communities that have long had to live with poor air quality levels due to their proximity to highways such as those in Southeastern Washington, DC. [EPA-HQ-OAR-2019-0055-1299-A1, p. 1]

When EPA finalizes this proposed rulemaking it will mark the first time since 2001 that EPA has taken action to cut harmful NOx emissions from medium- and heavy-duty vehicles. There is a clear and compelling public health need for much tighter restrictions on heavy-duty truck NOx emissions. In the past 20 years, technical capacity to reduce these emissions has flourished and the opportunity to require and achieve deeper reductions in NOx emissions across the many operations would be enormous. [EPA-HQ-OAR-2019-0055-1299-A1, p. 4]

Ideally, EPA's proposed "Alternative Option" would be adopted. The Alternative Option has stricter emission standards implemented four years earlier, compared to the 2031 second-step implementation date in "Option 1." The Alternative Option most closely aligns with the California Heavy-duty NOx Omnibus Regulation, which has been demonstrated as technologically feasible through joint research with the EPA, conducted by the Southwest Research Institute (SwRI). The Alternative Option would give the District a head start in reducing transportation emissions in the District. We understand the reservations the EPA has about implementing the Alternative Option, particularly regarding the timeline for putting this regulation into effect. [EPA-HQ-OAR-2019-0055-1299-A1, p. 5]

If the Alternative Option is not possible, then Option 1 should be selected over Option 2. Option 1 best represents the available emission control technologies that "reflect the greatest degree of emission reduction achievable through the application of technology," as is mandated by under Clean Air Act § 202 (a)(3)(A)(i). Option 1 requires heavy-duty vehicles and engines to meet strict emission standards for NOx and provides for extended warranties and other provisions that ensure trucks are able to meet this strict emission standard for over 800,000 miles of operation. Because Option 1 meets stricter emission standards and is feasible, Option 2 cannot be considered. If EPA decides not to implement the Alternative Option, DOEE urges the EPA to implement Option 1 in accordance with the Clean Air Act § 202 (a)(3)(A)(i). [EPA-HQ-OAR-2019-0055-1299-A1, p. 5]

It is vital that the EPA promulgates new emission standards for heavy-duty engines in a timely fashion, but the rules must also be strict enough for tangible and significant emission reductions. The final rule should be as strict as possible, and the Alternative Option is the strictest option that EPA has presented. The timeline is also an important factor; our residents need cleaner air now. To that end, Option 1 provides real emission reductions on an acceptable timeline, and this is the option EPA should implement if the alternative cannot be implemented in a timely fashion. The EPA has already demonstrated the technologies exist for Option 1 to become a reality and should act without haste. EPA should also set a mandatory idle standard and maintain a strong SCR inducement schedule. DOEE urges the EPA to take immediate action to adopt Option 1 for the health and safety of District residents. [EPA-HQ-OAR-2019-0055-1299-A1, p. 7]

Organization: *Eaton Vehicle Group (Eaton)*

3. Long term regulatory certainty allows the transportation industry to continue to invest in product development and deploy needed capital. Emissions levels must be set such that societal needs for air quality, including GHG and future non-attainment, are in fact achieved without the need of additional local restrictions or short-term changes. [EPA-HQ-OAR-2019-0055-1252-A1, p.4]

The transportation industry needs long term regulatory certainty to enable investments in both Low NOx and Zero Emissions technologies and allocate capital to bring these to the market. A standard that does not resolve the long-term needs of air quality would insert uncertainty and thus inhibit the bold investments that are needed. For example, the Green House Gas rule in effect from 2014 to 2030 drove significant benefits, technology and cost-out, all possible because of (a) long term and (b) societal-acceptable stringencies. We recommend the Agency apply the same approach to the proposed rule. [EPA-HQ-OAR-2019-0055-1252-A1, p.4]

Organization: *Elders Climate Action*

Elders Climate Action requests that EPA revise the standards for HDVs to set a zero emission standard for nitrogen oxides (NOx), PM2.5 and CO2 for the classes of HDVs or types of HDVs that operate in duty cycles for which zero emission power trains are currently in use or which EPA expects will be available by 2027. [EPA-HQ-OAR-2019-0055-1218-A1, p. 1]

The CAA declares that the primary purpose of the Act is "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." 42 U.S.C. §7401(b)(1). To implement this purpose, section 202(a)(3) requires that for HDVs EPA "shall [set] standards which reflect the greatest degree of emission reduction achievable through the application of [available] technology…." The proposed rule does not satisfy that test. [EPA-HQ-OAR-2019-0055-1218-A1, p. 4]

By setting zero emission standards for NOx beginning in 2027 for the vehicle types currently available as zero emission vehicles (ZEVs), EPA could avoid an estimated 20,440 tons of NOx in South Coast and 22,630 tons in San Joaquin Valley. A zero emission standard for CO2 would avoid 54 million MT of CO2 from these three model years between now and 2050. The urgency of the public health and climate crises demands that the U.S. must not forego those reductions. [EPA-HQ-OAR-2019-0055-1218-A1, p. 5.]

We include a legal analysis that demonstrates EPA's failure to set standards that will achieve the maximum deployment of zero emission technologies fails to achieve the public health purpose of the Act, and is not consistent with the statutory text and the legislative history of the Act. [EPA-HQ-OAR-2019-0055-1218-A1, p. 5]

The proposed rule violates numerous duties established by law, including –

1) the statutory duty to set for HDVs "standards which reflect the greatest degree of emission reduction achievable through the application of [available] technology…."

2) the duty to identify, evaluate and propose for consideration a rule that will optimize the implementation of the primary purpose of the Act declared by Congress, to wit, standards that will most effectively "promote the public health and welfare and the productive capacity of its population." 42 U.S.C. §7401(b)(1). [EPA-HQ-OAR-2019-0055-1218-A1, p. 5]

3) the duty to make available to the public when a proposed action is published for public comment the data developed by the Agency and used for making its decision. [EPA-HQ-OAR-2019-0055-1218-A1, p. 5]
4) the duty under Title VI of the Civil Rights Act to avoid actions that create disparate impacts on communities of color and low income communities that are most at risk of suffering the adverse health outcomes caused by exposure to emissions from HDVs. [EPA-HQ-OAR-2019-0055-1218-A1, p. 6]

The proposed standards for NOx and GHGs are not consistent with CAA section 202(a)(3)(A) that mandates the standards for HDVs — "regulations … applicable to emissions of hydro-carbons, carbon monoxide, oxides of nitrogen and particulate matter from classes or categories of heavy duty vehicles or engines … shall contain standards which reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology." 42 U.S.C. 7521(a)(3)(A). [EPA-HQ-OAR-2019-0055-1218-A1, p. 6]

The standard setting authority granted to EPA by section 202 must be viewed in light of the statutory framework which declares the purpose of the Act is "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." 42 U.S.C. §7401(b)(1). Under the structure of the Act, the NAAQS promulgated pursuant to section 109 provide the relevant benchmarks for determining whether the primary purpose of the Act, i.e., protecting public health, is being implemented. [EPA-HQ-OAR-2019-0055-1218-A1, p. 8.]

Here EPA has investigated the impact that the proposed standards will have on attainment and found that 1) controlling emissions from HDVs are necessary for attainment in many ozone NAs because the reductions required by the proposed rules will contribute to attainment in some NAs, but 2) that the reductions are not enough to demonstrate attainment in the worst polluted air pollution control regions.3 [EPA-HQ-OAR-2019-0055-1218-A1, p. 8.]

3. The modeling analysis results reported in the Technical Support Document are useful for drawing these inferences, but the modeling is not adequate to determine the emission reductions needed for timely attainment by the statutory deadlines for each NA. Regional modeling for NAs that are not expected to attain before the statutory deadline should be performed, in collaboration with regional air quality planning agencies, to obtain more precise data regarding the emission reductions needed for attainment.

This statutory mandate to achieve “the greatest degree of emission reduction achievable…”for heavy duty vehicles does not apply to standards for light duty vehicles (LDVs). Section 202(i) specifically authorizes EPA to forego more stringent standards for LDVs if they are not needed for attainment, but that provision does not apply to HDVs. For HDVs, the duty to set standards that reflect “the greatest degree of emission reduction achievable…” is continuing, and is not limited by the need for reductions to attain NAAQS. These differences imply 1) that standards for both HDVs and LDVs must continue to be strengthened as necessary to support the states in developing implementation plans that can attain the NAAQS; and 2) that for HDVs the progressive emission reductions that become available from more advanced technology must continue to be reflected in more stringent standards. [EPA-HQ-OAR-2019-0055-1218-A1, p. 9.]

Prior to the 1977 Amendments, section 202(a) contained general language first enacted in 1963 that authorized the predecessor to EPA to promulgate regulations establishing emission standards for motor vehicles. The statutory directive to set standards for HDVs that “reflect the greatest degree of emission reduction achievable” was first added to the Act in the 1977 Amendments. [EPA-HQ-OAR-2019-0055-1218-A1, p. 9]

That language came from the House bill which enacted authority for the Administrator to “prescribe regulations [that] … shall contain standards which reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to the cost of applying such technology within the period of time available to manufacturers,...”6 [EPA-HQ-OAR-2019-0055-1218-A1, p. 9]

6. House Report, bill text adding paragraph 202(a)(3)(A), at 407.

The Senate bill only required that “regulations shall contain standards which require a reduction of emissions of such pollutants established by the application of the best available control technology, taking into account the cost of compliance….”7 [EPA-HQ-OAR-2019-0055-1218-A1, p. 9]

7. Senate Report, at 92.

The differences between the House and Senate provisions are significant for this rulemaking. The Senate language only required the “application” of “control technology” which limited EPA’s authority to considering technology that could be applied to control emissions from an engine. In contrast the House language was broadly written to allow the Administrator to consider not only control technology, but also engine technology or alternative technologies that can achieve “emission reduction[s].” The House language also authorized the Administrator to consider technology that would become available by the model year when the standard would apply, whereas the Senate language limited EPA to considering control technology that was “available” when the standard was set. [EPA-HQ-OAR-2019-0055-1218-A1, pp. 9 - 10]
In conference, the Senate accepted the House language.8 [EPA-HQ-OAR-2019-0055-1218-A1, p. 10]

8. Clean Air Act Conference Report,

The 1977 Amendments applied the “greatest degree of emission reduction” test to interim standards promulgated by EPA during the period prior to the statutory deadline for achieving percent reduction targets enacted by Congress. That language applied percentage emission reduction targets for CO, VOCs and NOx, but “[r]ecognizing that attainment of the 1985 targets levels may not be achieved in time, the Committee adopted a provision which permits the Administrator to revise these standards temporarily.” 9 The bill required that to revise any standard “the Administrator shall determine the maximum degree of emission reduction that can be achieved by means reasonably expected to be available for production for such period and shall prescribe a revised emission standard in accordance with such determination.” Thus the “greatest degree of emission reduction” test was not a continuing obligation. Once the statutory emission reduction targets were met, EPA’s authority to set additional more stringent standards was at an end. [EPA-HQ-OAR-2019-0055-1218-A1, p. 10]

9. House Report, at 274.

When the 1990 Amendments were enacted, the statutory emission reduction targets enacted in 1977 had been met. Those targets were repealed, but the “greatest degree of emission reduction achievable” language was retained as the current test for standard setting under section 202(a)(3)(A). This history demonstrates congressional intent to progressively continue to advance the stringency of standards as technology improvements make further emission reductions “achievable.” [EPA-HQ-OAR-2019-0055-1218-A1, p. 10]

The question the Administrator is required to answer when setting standards for HDVs is what standard “reflect[s] the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year [2027] to which such standards apply”? [EPA-HQ-OAR-2019-0055-1218-A1, p. 10]

For these reasons, Elders Climate Action asks that EPA adopt zero emission standards for NOx, PM and CO2 for HDVs that EPA has identified in short-haul duty cycles for which zero emission power trains are currently available, and for which zero emission power trains are expected to be available by 2027. At a minimum, zero emission standards should apply to the share of HDVs covered by the ZEV requirement in the CARB ACT rule. [EPA-HQ-OAR-2019-0055-1218-A1, p. 13.]

As discussed above in section II, the Clean Air Act requires EPA to set emission standards for HDVs that "reflect the greatest degree of emission reduction achievable…." [EPA-HQ-OAR-2019-0055-1218-A1, p. 19.]

Given the science informing the world that the climate cannot be stabilized short of achieving "net zero" GHG emissions, and the Presdient's commitment to achieving a net zero economy by 2050, we ask the Administrator to make the determination that emissions of both GHGs and precursors to the criteria pollutants PM and ozone emitted from light duty vehicles must be reduced to zero to protect the public health and welfare from the many adverse effects of climate warming. [EPA-HQ-OAR-2019-0055-1218-A1, p. 19.]

The Act provides that "[a]ny such [standard] under this subchapter may provide for a phase-in of the standard."13 We ask the Administrator to begin phasing in a zero emission standard by establishing a sales mandate that requires each manufacturer to achieve ZEV sales during the 2027 MY that are comparable to CARB's ACT rule with the goal of achieving 100% HDV ZEV sales by 2035 in order to achieve zero emissions from on-road vehicles by 2050. [EPA-HQ-OAR-2019-0055-1218-A1, p. 19.]

13. Id.

Commenters understand that additional rulemaking will be required to establish a zero emission standard and phase-in schedule for HDV classes not addressed by this rule. However, the current proposal can be revised to incorporate this approach for the HDV classes and categories addressed by this proposal. We ask that the Administrator not delay completion of the current proposed rule so that it can apply to 2027-29 MY vehicles. We ask that the Administrator open a rulemaking for the additional vehicle classes to promulgate a zero emission standard and a phase-in schedule that begins with the 2027 MY. [EPA-HQ-OAR-2019-0055-1218-A1, p. 19.]

Organization: *Energy Innovation, LLC*

The EPA's leadership on climate and clean air is more critical than ever. We appreciate the EPA's efforts to initiate a long-overdue update to heavy-duty vehicle pollution and emissions standards. Because vehicles sold over the next few years will remain on the road for decades, the EPA should seize the opportunity to adopt the most stringent standards for greenhouse gas (GHG) emissions, nitrogen oxides (NOx) and other pollutants for heavyduty trucks (HDTs) Model Years 2027-2029 (MY 2027-2029), aligning these standards with science-based emissions targets and relevant policy goals. [EPA-HQ-OAR-2019-0055-1310-A1, p.1]

While the HDT market is still evolving to include more electric models and lower upfront vehicle costs, current market trends and potential consumer savings support the adoption of strong standards. Performance standards are a powerful tool for leveraging accelerated technology advancements and sending clear market signals that spur the private sector to increase deployment of zero-emission, heavy-duty electric vehicles (HDEVs) within this decade. [EPA-HQ-OAR-2019-0055-1310-A1, p.1]

The EPA should adopt the most stringent NOx standard for HDTs, while also considering the role zero-emission electric vehicles can and should play in eliminating NOx and other pollutants altogether. Proposed Option 1 is a start and should be significantly strengthened. Similarly, the EPA should forgo any credit approaches that erode the strength of the standard. We elaborate on these points herein. [EPA-HQ-OAR-2019-0055-1310-A1, p.1]

In the context of this and future rulemakings, we encourage the EPA to set a higher standard to prompt private sector investments and accelerate the adoption of proven technologies that can mitigate the climate crisis and improve public health, especially in the most burdened communities. [EPA-HQ-OAR-2019-0055-1310-A1, p.4]

However, the EPA need not wait for major breakthroughs in technologies to reduce NOx from combustion engines. Zero-emission electric vehicles emit no NOx emissions or other harmful pollutants, and their scaled adoption in the heavy-duty sector offers a streamlined path to reduce not just GHG emissions but all transportation air pollution throughout the U.S. Proposed Option 1 is a start but should be significantly strengthened, and the EPA should consider how to further facilitate the adoption of HDEVs in the context of the NOx rule. Along similar lines, the EPA should forgo any credit approaches that significantly erode the standard to avoid further burdening communities and individuals with future pollution. [EPA-HQ-OAR-2019-0055-1310-A1, p.7]

Organization: *Engine and Truck Organizations*

The U.S. EPA has proposed a new rule to significantly increase the stringency of the national nitrogen oxide (NOx) emissions standard for medium- and heavy-duty commercial vehicles. As a Mack Trucks dealer, I fully support clean air improvements and healthier communities for all. But my concern EPA's proposal risks significant unintended consequences for our medium- and heavy-duty vehicle customers, for the trucking industry generally, and for the U.S. economy as a whole. [EPA-HQ-OAR-2019-0055-1177-A1, p.1]

Based on our assessment, EPA's "Option 1" rule as proposed will be:

- **Cost prohibitive**. The additional technology required for diesel engines will drive new and used vehicle prices higher, reducing or delaying fleet turnover to newer, cleaner, safer trucks. Higher operating costs will also deter the attractiveness of those trucks.
- **Disruptive of business**. The additional costs and downtime associated with increased repairs and maintenance will directly impact our customers' day-to-day operations and inhibit their ability deliver goods and services.
- **Bad for jobs**. As was caused by previous EPA NOx rules, we anticipate a pre-buy/no buy scenario, that could result in dramatic job losses for our employees.
- **Counter to environmental goals**. When new truck prices rise and their costs of operation increase, customers will hold onto older, higher emitting trucks longer, undermining the continuous improvements in air quality we all seek. [EPA-HQ-OAR-2019-0055-1177-A1, p.1]

I urge EPA to reject "Option 1" and to instead work with industry stakeholders to develop a final is workable and cost-effective, that keeps the trucking industry healthy, and that accelerates, not undermines, environmentally beneficial fleet turnover. [EPA-HQ-OAR-2019-0055-1177-A1, p.1]

[Additional comment provided by two companies that joined this letter campaign:] Based on our assessment, EPAs “Option 1” rule as proposed will be … Product Limiting. Our truck manufacturer suppliers may be forced to reduce their product portfolios, limiting the options we can make available for our customers, and their ability to provide vital freight transportation for their customers. [EPA-HQ-OAR-2019-0055-1179 and EPA-HQ-OAR-2019-0055-1235]

Organization: *Environmental Defense Fund (EDF) (1265 and 2855)*

EPA has clear authority to establish technology-forcing emission standards for medium and heavy-duty trucks under Section 202(a)(1). The text of Section 202(a)(1) directs EPA to promulgate ‘standards applicable to the emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines’.73 Such regulations are to ‘take effect after such period as the Administrator finds necessary to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance within such period.’74 Authority to regulate GHGs under this section was confirmed in 2007, with Massachusetts v. EPA.75 [EPA-HQ-OAR-2019-0055-1265-A1, p.17]

73 42 U.S.C. 7521(a)(1).

74 Id. at 7521(a)(2).

75 549 U.S. 497 (2007).

EPA has a long history of promulgating technology-forcing emission standards that have driven innovation and secured pollution reductions. For instance, EPA standards under section 202 resulted in the development and proliferation of the catalytic converter in 1975 and the three-way catalyst in 1981.76 Particulate and NOx standards for heavy-duty vehicles also resulted in the development of the diesel particulate filter and NOx aftertreatment.77 [EPA-HQ-OAR-2019-0055-1265-A1, p.17]

76 See, e.g., David Gerard and Lester B. Lave, Implementing technology-forcing policies: The 1970 Clean Air Act Amendments and the introduction of advanced automotive emissions controls in the United States, 72 TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE 761 (2005), available at http://repository.cmu.edu/tepper/1356/

77 See, e.g., Chris Wold, Climate Change, Presidential Power, and Leadership: We Can’t Wait, 45 CASE WESTERN RESERVE J. OF INT’L LAW 303, 346, available at http://law.case.edu/journals/jil/Documents/45CaseWResJIntlL1&2.15.Article.Wold.pdf.

Courts have consistently and specifically affirmed EPA's authority to establish technology-forcing standards under section 202(a)(1)78 Section 202(a)(3), which addresses emissions of NOx and certain other pollutants, but not GHGs, from medium and heavy duty vehicles, directs EPA to promulgate standards 'reflect[ing] the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology.'79 Courts have interpreted this to mean that section 202(a)(3) authorizes EPA to force the development of new technology that does not yet exist.80 EPA's authority under section 202(a)(1) is similar: in promulgating standards under 202(a)(1) EPA may make projections about future technology 'subject' only 'to the restraints of reasonableness,'81 and a 'finding that the requisite technology exists or may be feasibly developed'.82 [EPA-HQ-OAR-2019-0055-1265-A1, pp.17-18]

78 See, e.g., Natural Res. Def. Council v. Envtl. Prot. Agency, 655 F.2d 318, 328 (D.C. Cir. 1981) (upholding EPA's technology-forcing standards under Section 202(a)(1)-(2) authority); Natural Res. Def. Council, Inc. v. Reilly, 983 F.2d 259, 268 (D.C. Cir. 1993) (referencing Natural Res. Def. Council v. Envtl. Protection Agency, 655 F.2d at 322 and affirming EPA's technology-forcing authority under Section 202(a)(1)-(2)).

79 42 U.S.C. 7521(a)(3)(A)(i) (emphasis added).

80 For an example of the D.C. Circuit upholding 202(a)(3) regulations which forced the development of new technology, see Nat. Res. Def. Council v. Thomas, 805 F.2d 410 (1986). In that case, the D.C. Circuit upheld EPA's 1985 regulations for PM emissions from heavy-duty vehicles, and emphasized that Section 202(a)(3) authorizes EPA to force development of new technology to meet EPA's standards. Id. at 429. The 'PM standards provision, on its face, does not constrict the agency to technology that is 'now' available,' wrote the court. Id. Further, it was 'impossible for [the court] to conclude that Congress clearly intended to restrict PM standards to adequately demonstrated technology.' Id. at 430. Instead, noting that 'Congress intended the EPA in promulgating standards with an adequate lead period to engage in reasonable predictions and projections in order to force technology,' the court 'recognize[d] a Congress concerned with promoting advances in emissions control technology for PM as well as other substances.' Id; See also Nat'l Petrochemicals & Refiners Ass'n v. EPA, 287 F.3d 1130, 1136 (D.C. Cir. 2002) (upholding EPA's MY 2007 PM and NOx emissions standards against industry challenge because 'EPA is authorized to adopt 'technology-forcing' regulations, [and] a petitioner's evidence that current technology is inadequate is not enough to show that the EPA was arbitrary in predicting future success.').

81 655 F.2d at 328 (citing International Harvester Co. v. Ruckelshaus, 478 F.2d 615, 629 (D.C.Cir.1973)).

82 Natural Res. Def. Council, Inc. v. Reilly, 983 F.2d 259, 268 (D.C. Cir. 1993).

In 1980, for example, EPA promulgated PM emission standards for light-duty diesel vehicles and trucks under Section 202(a)(1) authority, requiring that emissions decrease to 0.20 grams per mile in the 1985 model year.83 EPA determined that the standard would be achievable in 1985 with the perfection of a particle trapping device (a ‘trap oxidizer’), which at the time had achieved only partial success in a prototype stage.84 In NRDC v. EPA, the D.C. Circuit upheld these standards, holding that EPA ‘will have demonstrated the reasonableness of its basis for prediction if it answers any theoretical objections to the . . . method, identifies the major steps necessary in refinement of the device, and offers plausible reasons for believing that each of those steps can be completed in the time available.’85 Further, although EPA had identified a number of other technological strategies in addition to the trap oxidizer, the court acknowledged that the standard had been ‘set in reliance on [that] one preferred method.’86 In upholding the rule, therefore, the court established that the existence and utility of the trap-oxidizer alone was sufficient for the rule to survive.87 [EPA-HQ-OAR-2019-0055-1265-A1, p.18]

83 655 F.2d at 328. The regulation was promulgated by the agency under 202(a)(3)(iii), but the court held that the agency should have cited Section 202(a)(1).

84 655 F.2d at 328 (citing International Harvester Co. v. Ruckelshaus, 478 F.2d at 629).

85 655 F.2d at 331.

86 Id. at 332.

87 Id. at 332 n.25.

We urge EPA to strengthen its NOx standards to ensure they deliver the maximum possible reductions in harmful NOx pollution, consistent with reductions California and other states need to protect public health, and in a manner that ensures diesel vehicles are fully deploying available technologies to reduce harmful NOx pollution and that the standards drive adoption of ZEV technologies. EPA’s standards must be strengthened in several important regards to achieve these goals. First, we urge EPA to adopt a multipollutant approach that considers the availability of ZEV technologies in reducing NOx pollution. We then discuss a series of critical improvements to EPA’s proposed NOx standards for diesel vehicles, including recommended adjustments to the ZEV NOx credits, and the importance of strengthening the idle standards. Finally, we address and rebut claims by other stakeholders that protective NOx standards will result in a pre-buy of high-polluting diesel vehicles. [EPA-HQ-OAR-2019-0055-1265-A1, p.21]

If EPA relies on just the GHG standards to drive the deployment of ZEVs in its final rule, it must strengthen its proposed NOx standards for diesel vehicles to deliver the maximum possible NOx reductions, ensuring full technology development. EPA must strengthen its proposed NOx standards for diesel vehicles to deliver maximum possible NOx reductions, consistent with the needs of California and other section 177 states. In particular, EPA should adjust its approach to ZEV NOx credit generation. And regardless of whether EPA adopts multipollutant standards, we urge the agency to finalize stronger idle standards, consistent with those in the Omnibus Rule. We discuss each of these recommendations more fully below. [EPA-HQ-OAR-2019-0055-1265-A1, p.22]

Organization: *Environmental Protection Network (EPN)*

EPN recommends that EPA's decision be guided by the demonstrated need for very large NOx reductions from the heavy-duty (HD) sector. This need is especially great for those populations living near major traffic areas. The goal should be to achieve the lowest feasible NOx standard, which will provide California, other states, and disadvantaged communities the NOx reductions they desperately need. [EPA-HQ-OAR-2019-0055-1233-A1, p. 1]

EPN advocates that decisions on the level of the standards, the useful life period, the applicable Model Years (MY), and other standard-setting and compliance related issues should all be guided by this goal. This means that when EPA balances the various relevant factors, EPN recommends that EPA place great weight on the clear need for major NOx reductions to protect public health and welfare. EPN suggests that EPA should be clear in its reasoning that this factor appropriately carries great weight, and that it is an important part of EPA's justification for deciding to make changes in the direction of more, not less, reduction of NOx emissions. [EPA-HQ-OAR-2019-0055-1233-A1, p. 1]

Organization: *Evangelical Environmental Network (EEN)*

With so many lives and so much of our future dependent on heavy-duty truck pollution reduction, we strongly urge EPA to require maximum NOx and PM2.5 standards in a single-phase rulemaking to be in effect model year 2027. Secondly, we urge 100% zero emission medium and heavy-duty trucks sales by 3035. [EPA-HQ-OAR-2019-0055-0993-A1, p.2]

These standards are achievable and readily available today and will deliver critical cost savings for operators and drivers.

- Dozens of zero-emission medium- and heavy-duty trucks already available or coming to the market within a couple of years.
- Today, electric trucks and buses are already capable of supporting most freight, delivery, and transit uses and needs.
- Across nearly every vehicle class, zero-emission electric trucks and buses are projected to be cheaper to own and operate than their combustion engine counterparts within 5 years. [EPA-HQ-OAR-2019-0055-0993-A1, p.2]

In fact, a recent DOE study predicts that by 2030, zero-emission trucks could grow to 42% of sales just based on the fact that they will be cheaper to buy and own, but we need strong policies to incentive this reality. [EPA-HQ-OAR-2019-0055-0993-A1, p.2]

The reality is that trucks regulated by this standard will be on the road for decades, so these vehicles must be cleaned up as soon as possible. [EPA-HQ-OAR-2019-0055-1134-A1, p.2]

Zero-emission electric trucks are the best available technology to both reduce harmful NOx and carbon pollution. The EPA must put our national bus and truck fleet on a clear path to 100% zero-emission all-electric vehicles by 2035 – as a matter of life and a matter of justice. [EPA-HQ-OAR-2019-0055-1134-A1, p.2]

While the proposed rules are a good start, they must be strengthened. Specifically

o Regarding proposed Option 1of the NOx part of the rule. As written, it would result in higher emissions of smog and soot-causing NOx pollution than California's Heavy Duty Omnibus rule, which should be the bare minimum baseline for smog and particulate matter reduction goals. EPA must also eliminate credit giveaways that significantly erode the standard and proposed Option 2 shouldn't be seriously considered. [EPA-HQ-OAR-2019-0055-1134-A1, p.2]

Organization: *Evergreen Action*

We offer support for Proposed Option 1 to reduce nitrogen oxide (NOx) emissions in a manner that is consistent with the need to reduce the public health burdens caused by heavy duty vehicle emissions, and align emissions standards with the administration's climate goals. [EPA-HQ-OAR-2019-0055-1289-A1, p.1]

This is why we support Proposed Option 1 for reducing NOx emissions, as this plan would provide greater pollution reduction over Option 2, thereby better protecting Americans from MHDV pollution while reducing greenhouse gas emission while maintaining technological and financial feasibility. [EPA-HQ-OAR-2019-0055-1289-A1, p.1]

Organization: *Ford Motor Company (Ford)*

Ford supports EPA's effort to increase the stringency of the heavy-duty emission and greenhouse gas standards, starting in 2027 model year. We believe that the Option 1 alternative, along with the recommendations outlined in our attached comments, represents the appropriate level of stringency. [EPA-HQ-OAR-2019-0055-1300-A1, p. 2]

Ford supports the criteria emission standards in Option 1. The standards proposed in Option 1 would reduce NOx and particulate matter (PM) standards to the same level as the California Low NOx regulation by 2031 MY. In addition, the EPA proposal would reduce hydrocarbon (HC) emissions by 71% and Carbon Monoxide (CO) emissions by 60% versus the current standards. [EPA-HQ-OAR-2019-0055-1300-A1, p. 3]

Ford believes that complying with the 2031 model year and later 20 mg/bhp-hr NOx standard will require the same robust and durable technological solutions as are needed to comply with the CARB requirements in 2027 model year. [EPA-HQ-OAR-2019-0055-1300-A1, p. 3]

Organization: *General Motors LLC (GM)*

GM supports EPA's effort to finalize more stringent criteria emissions regulations than today's standards for medium- and heavy-duty engines and vehicles, in 2027 and beyond. [EPA-HQ-OAR-2019-0055-1246-A1, p.2]

GM supports efforts to improve air quality and is committed to a zero emissions future. Diesel and gasoline engines can reduce real world emissions of the fleet today and meet customer requirements in many medium- and heavy-duty applications. Reasonable updates to criteria emissions standards can recognize advancements in emissions reducing technologies, while markets mature for ZEV deployment and widespread adoption. GM supports more stringent criteria emissions regulations than today's standards for medium- and heavy-duty engines and vehicles. [EPA-HQ-OAR-2019-0055-1246-A1, p.3]

When finalizing standards, EPA should consider that manufacturers may have limited time to recoup the investment in internal combustion engine technologies incorporated to comply with the standard. Developing new products and production capacity to meet higher standards takes years of development. Major markets may adopt ZEV mandates, curtailing the addressable market for internal combustion engine vehicles and limiting the number of years that emissions reducing internal combustion engine technologies may be sold. [EPA-HQ-OAR-2019-0055-1246-A1, p.3]

Other technologies, such as battery electric vehicles or fuel cell vehicles will be necessary for manufacturers to meet high stringency standards. EPA does not fully consider the cost of these technologies in the technology pathways considered in the proposal. These technology pathways, with an ABT program, are appropriate to consider for cost-benefit analysis of high stringency proposals, though the costs of equipment and costs of fuel will differ significantly from those considered by the agency in Option 1 and Option 2 of the proposal. [EPA-HQ-OAR-2019-0055-1246-A1, pp.3-4]

In Option 1, the EPA proposes to decrease NOx emissions from the current standard by 82.5% in 2027, and 90% In 2031. At the same time, the agency proposed to revise upwards the useful life and warranty of new equipment in 2027, and then again in 2031. Different technology packages may be necessary to achieve these different requirements.7 Proposed restrictions to averaging, banking, and trading credits decrease a manufacturer's ability to respond to these stepped changes. [EPA-HQ-OAR-2019-0055-1246-A1, p.4]

7 Engine hardware, emissions systems, on-board diagnostic software, electrification, etc.

GM encourages the agency to consider a one-step standard that considers technological feasibility, and the air quality goals of the standard. A program with a straightforward one-step structure, with full ABT, that includes ZEVs is preferred.[EPA-HQ-OAR-2019-0055-1246-A1, p.4]

GM supports EPA's effort to finalize medium- and heavy-duty emissions regulations that are more stringent than today's standards. As the market matures for infrastructure, and as operators get more comfortable with ZEVs in many applications, battery electric vehicles and fuel cell vehicles will be increasingly attractive, and adoption will accelerate over time. Over the next decade, new gasoline and diesel engines can reduce transportation emissions, especially when replacing older vehicles. GM encourages EPA to finalize standards that are technologically feasible, and economically practicable. [EPA-HQ-OAR-2019-0055-1246-A1, p.7]

Organization: *Hyliion, Inc.*

We encourage new HD NOx emissions standards and additional test cycles that will drive additional NOx emissions reductions on the road and encourages best-in-class technologies. These standards should be performance-based and technology-neutral and the test-cycles should reflect real use of vehicles. Both the standards and test cycles should enable multiple technology paths to achieve compliance. [EPA-HQ-OAR-2019-0055-1238-A1, pp. 4 - 5]

Organization: *Institute for Policy Integrity at New York University School of Law (Policy Integrity)*

In the Proposed Rule, EPA presents two regulatory options, as well as one more stringent alternative. Because EPA is statutorily required to set standards for heavy-duty vehicles reflecting the "greatest degree of emission reduction achievable," at a minimum it should select Option 1 in the Final Rule, as this regulatory proposal is feasible, net beneficial, and would produce the largest emission reduction of the options considered in the Proposed Rule. However, given the numerous overly conservative economic assumptions outlined below, EPA should also revise its cost-benefit and distributional analyses to better reflect the considerable benefits to society from strong emission standards for heavy-duty trucks. This revised analysis may show that even more stringent alternatives beyond Option 1 are feasible and net beneficial. EPA should presumptively select the alternative that maximizes net benefits, and, if it does not select that policy, should offer an adequate justification for rejecting the alternative that is most economically efficient. [EPA-HQ-OAR-2019-0055-1256-A1, p. 1]

In the Proposed Rule, EPA acts under the authority of the Clean Air Act section 202.3 Unlike the open-ended discretion provided to EPA in setting standards for light-duty vehicles, EPA is required to set standards for heavy-duty vehicles that "reflect the greatest degree of emission reduction achievable" for the model year, with "appropriate considerations to cost, energy, and safety factors associated with the application of such technology."4 Also in contrast to its discretion with respect to lead time in setting standards for light-duty vehicles, EPA is required to provide at least 4 years of lead time when it sets new standards for heavy-duty vehicles.5 This extended lead time evidences Congress' intent that EPA set stringent, technology-forcing standards to reduce emissions from heavy-duty vehicles.6 [EPA-HQ-OAR-2019-0055-1256-A1, p. 4]

3. 85 Fed. Reg. at 17,420.

4. Clean Air Act § 202(a)(3); 42 U.S.C. § 7521(a)(3).

5. Compare Clean Air Act § 202(a)(2) (standards "shall take effect after such period as the Administrator finds necessary to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance") with § 202(a)(3)(B) (heavy-duty vehicle standards "shall apply… beginning no earlier than the model year commencing 4 years after such revised standard is promulgated").

6. See Nat. Res. Def. Council v. EPA, 655 F.2d 318, 328 (D.C. Cir. 1981) ("The legislative history of both the 1970 and the 1977 amendments demonstrates that Congress intended the agency to project future advances in pollution control capability. It was 'expected to press for the development and application of improved technology rather than be limited by that which exists today.'") (quoting S.Rep.No.1196, 91st Cong., 2d Sess. 24 (1970)).

Congress has prioritized the dangers of heavy-duty truck pollution since it amended the Clean Air Act in 1977, recognizing that EPA needed to "require rigorous control of heavy-duty vehicles… which have become an increasing pollution problem."7 While the 1970 Clean Air Act required a 90% reduction in light-duty vehicle emissions, it did not set a comparable target for heavy-duty vehicles.8 Congress addressed this shortcoming in 1977 when it required EPA to set initial heavy-duty vehicle standards reflecting the "best available control technology" that were designed to achieve a 90% reduction in hydrocarbons and carbon monoxide, and a 75% reduction in nitrogen oxides by 1981.9 EPA failed to act as Congress directed until March 1985, when it promulgated heavy-duty regulations for the 1991 and 1994 model years—a decade later than Congress intended, and only upon court order.10 Thus, Congress once again intervened, amending the Clean Air Act's heavy-duty provisions in 1990 to limit the sulfur content of diesel fuels after significant testimony regarding the dangers of diesel exhaust and other pollution from heavy-duty vehicles.11 The Proposed Rule is the first time EPA has acted to reduce heavy-duty vehicle emission in more than two decades, since it last issued standards in 2000. This history of intermittent agency action, continually pushed by Congress and the courts to go further, shows the necessity for EPA to act now by issuing strong, protective standards. [EPA-HQ-OAR-2019-0055-1256-A1, p. 4]

7. S.Rep.No.127, 95th Cong., 1st Sess. (1977) at 15.

8. Id. at 65.

9. Id. at 66.

10. S.Rep.228, 101st Cong., 1st Sess. (1989) at 111.

11. Id.

Instead, even the most stringent of the two options EPA has proposed can hardly be said to be the "greatest emission reduction achievable" when California has already issued similar heavy-duty vehicle standards that are being implemented three years earlier.12 [EPA-HQ-OAR-2019-0055-1256-A1, p. 5]

12. See Cal. Air Res. Bd., Comparison of CARB Heavy-Duty Omnibus Regulation (Omnibus) and U.S. Environmental Protection Agency (U.S. EPA) Clean Trucks Plan (CTP) Proposed Options, ("Option 1 includes many elements of CARB's Omnibus program and is approximately as stringent, although it takes effect about three years later… Option 1 is significantly weaker and the standards do not reflect the performance of demonstrated emission control technologies."), https://perma.cc/9PNB-JNPY.

EPA has "co-proposed" two regulatory options, along with one more stringent alternative for which EPA was unable to determine feasibility.13 Option 2 is the "less stringent" of the two co-proposals.14 EPA found that the more stringent emission standards in Option 1 are "achievable" and "feasible."15 And EPA acknowledges that proposed Option 1 will result in greater emission benefits,16 lower costs,17 and higher net benefits.18 Thus, as EPA acknowledges, Option 1 is the "more appropriate level of stringency as it would result in a greater level of achievable emission reduction for the model years proposed, which is consistent with EPA's statutory authority[.]"19 Yet EPA "co-proposes" both options as "potentially appropriate."20 This cannot be true. Finalizing standards equivalent to Option 2—when at least one other regulatory option produces greater emission benefits, has higher net benefits, and is feasible—would be inconsistent with EPA's statutory duty under the Clean Air Act. At a minimum, EPA must finalize standards that are at least as stringent as Option 1. [EPA-HQ-OAR-2019-0055-1256-A1, p. 5]

13. 85 Fed. Reg. at 17,420.

14. Id. at 17,421.

15. Id. at 17,438–39.

16. Id. at 17,438 (projecting that Option 1 would reduce NOx emissions by 44% by 2040, while Option 2 would reduce NOx emissions by 55% over the same period).

17. Id. at 17,589 (annualized costs at 3% discount rate of $1.9 billion for Option 1 versus $2.1 billion for Option 2).

18. Id. (net present benefits at 3% discount rate of $61-220 billion for Option 1 versus $41-170 billion for Option 2).

19. Id. at 17,440

20. Id.

EPA should fully evaluate the costs and benefits of all regulatory options presented and should strongly consider including at least one more stringent alternative than proposed. In order to fulfill its statutory duty, EPA should compare the costs and benefits of all regulatory alternatives under consideration in order to ensure that it selects the net-beneficial alternative that will generate the greatest emission reduction. It should also consider whether more stringent alternatives would also be cost-justified and generate greater emission reductions than the options in the Proposed Rule. [EPA-HQ-OAR-2019-0055-1256-A1, p. 1]

It is well established that agencies should consider a range of regulatory alternatives in order to properly evaluate the costs and benefits of a regulatory proposal. Executive Order 12,866 explains that "agencies should select those approaches that maximize net benefits" when "choosing among alternative regulatory approaches."21 Accomplishing such a goal of maximizing net benefits is impossible without first considering a broad range of alternatives at different levels of stringency.22 The Office of Management and Budget ("OMB") Circular A-4 directs agencies to "describe the alternatives available to [the agency] and the reasons for choosing one alternative over another."23 When, as here, there is a continuum of possible alternatives based on the level of stringency, agencies "generally should analyze at least three options: the preferred option; a more stringent option that achieves additional benefits (and presumably costs more) beyond those realized by the preferred option; and a less stringent option that costs less (and presumably generates fewer benefits) than the preferred option."24 Circular A-4 makes clear that an analysis that, as here, does not discuss the incremental costs and benefits of alternatives is not adequate.25 [EPA-HQ-OAR-2019-0055-1256-A1, pp. 5 - 6]

21. 58 Fed. Reg. 51,735 §1(a) (Oct. 4, 1993).

22. See Richard L. Revesz & Samantha P. Yi, Distributional Consequences and Regulatory Analysis, 52 ENV'T L. 53, 91–92.

23. OFFICE OF MGMT. & BUDGET, CIRCULAR A-4: REGULATORY ANALYSIS 16 (2003).

24. Id.

25. Id.

Since the Supreme Court held in State Farm that the National Highway Traffic Administration ("NHTSA") had acted arbitrarily and capriciously by refusing to consider a "technological alternative within the ambit of [its] existing standards,"26 the U.S. Court of Appeals for the D.C. Circuit has repeatedly held that rational decisionmaking by administrative agencies requires consideration of "significant alternatives to the course it ultimately chooses."27 Agencies must consider "obvious" alternatives and provide an explanation when alternatives are rejected.28 And in explaining why alternatives are rejected, agencies may not "put a thumb on the scale by undervaluing the benefits and overvaluing the costs of more stringent standards."29 EPA's failure to fully evaluate alternatives is particularly egregious here, where proposing and evaluating alternative performance standards with varying levels of stringency is such a "familiar tool in [EPA]'s tool kit."30 [EPA-HQ-OAR-2019-0055-1256-A1, p. 6]

26. Motor Vehicle Mfrs. Ass'n of U.S., Inc. v. State Farm Mut. Auto. Ins. Co., 463 U.S. 29, 51 (1983).

27. Allied Local & Reg'l Mfrs. Caucus v. EPA, 215 F.3d 61, 80 (D.C. Cir. 2000).

28. Int'l Ladies' Garment Workers' Union v. Donovan, 722 F.2d 795, 816 n.41 (D.C. Cir. 1983).

29. Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin., 538 F.3d 1172, 1198 (9th Cir. 2008).

30. See Chamber of Com. of U.S. v. Sec. & Exch. Comm'n, 412 F.3d 133, 144 (D.C. Cir. 2005).

With a full analysis of only Option 1,31 and only a limited analysis of the less-stringent Option 232 and the more stringent alternative, EPA cannot rationally determine which of its proposed regulatory options is the most reasonable approach. At a minimum, EPA should fully evaluate the costs and benefits of Option 2 and the more stringent alternative described in the Proposed Rule, as Circular A-4 recommends.33 The agency should presumptively select the alternative that maximizes net benefits,34 and, if it does not select that policy, should offer an adequate justification for rejecting the alternative that is most economically efficient.35 [EPA-HQ-OAR-2019-0055-1256-A1, p. 6]

31. Even EPA's analysis of Option 1 is oddly incomplete, as it acknowledges that there are differences between the scenario modeled in the DRIA and the standards presented in the rule. See 85 Fed. Reg. at 17,589 n.781("As noted in draft RIA Chapter 5.4, there are differences between the standards, emission warranty, and useful life provisions of proposed Option 1 presented in Sections III and IV and those included in our control case scenario modeled for the air quality analysis (as noted in Section VII, due to resource constraints we only conducted air quality modeling for the proposed Option 1). As detailed in draft RIA Chapter 8, estimates of health benefits are based on our air quality analysis, and thus differences between proposed Option 1 and modeling are not reflected in the benefits analysis.") (emphasis added).

32. See id.

33. CIRCULAR A-4, supra note 23, at 16.

34. Exec. Order 12,866, supra note 21, §1(a) ("[A]gencies should select those approaches that maximize net benefits…, unless a statute requires another regulatory approach.").

35. EPA, Guidelines for Preparing Economic Analyses 1-4 (2010) ("The policy that maximizes net benefits is considered the most efficient").

EPA's draft regulatory impact analysis ("RIA" or "DRIA") indicates the strong potential that more stringent regulations would produce additional social benefits.36 It is important that EPA consider more stringent alternatives than Option 1 in order to identify whether the agency is leaving incremental net benefits on the table.37 In the Proposed Rule, EPA introduces one more stringent alternative, but cannot determine whether it is technologically feasible and therefore does not analyze its costs and benefits.38 Instead of ending its analysis there, EPA should consider other options in between Option 1 and the more stringent alternative. Showing whether a more stringent alternative would, or would not, produce higher net benefits would improve the overall transparency of the rulemaking process. Further, consideration of more than three alternatives would be consistent with past regulatory practice, such as the SAFE Rule's contemplation of eight different regulatory options.39 [EPA-HQ-OAR-2019-0055-1256-A1, p. 7]

36. See, e.g., 85 Fed. Reg. at 17,438 (a more stringent alternative will reduce NOx emissions by 44% by 2040, as compared to 55% over the same period for a less stringent alternative); Id. at 17,589 (net present benefits at a 3% discount rate of $61-220 billion for more stringent alternative versus $41-170 billion for less stringent alternative).

37. See CIRCULAR A-4, supra note 23, at 16.

38. 85 Fed. Reg. at 17,589 n.782.

39. 83 Fed. Reg. 42,986, 42,990 (Aug. 24, 2018) (proposing 8 different regulatory alternatives).

EPA's distributional and employment analyses of the regulation further support the consideration of strong alternatives. Specifically, EPA's current analysis demonstrates that strong regulation as represented by Option 1 improves the air quality faced by disadvantaged groups in the most polluted areas. A wider distributional analysis as recommended in Section II, infra, combined with a wider set of alternatives would allow EPA to analyze the extent to which stronger regulations could benefit disadvantaged communities already suffering from high levels of air pollution. Moreover, since the current analysis finds little to no negative impact on sales or employment from Option 1,40 the additional benefits of further reducing air pollution could substantially increase the incremental net benefits of more stringent regulation. Indeed, the effect of building and installing the necessary technologies for vehicle improvements required by more stringent standards could even lead to higher levels of employment at the manufacturing level and overall. Ideally, EPA should quantify the overall employment impacts along with the wider set of alternatives to determine the direction and magnitude of these employment effects, though EPA could consider making these points qualitatively at a minimum. [EPA-HQ-OAR-2019-0055-1256-A1, p. 7]

40. See sections V & VI, infra.

Organization: *International Council on Clean Transportation (ICCT)*

EPA has proposed two options for setting new engine standards for nitrogen oxides. Since Option 2 does not require maximum technically feasible emission reductions, we recommend this option be dismissed. Option 1 is technically feasible and is cost effective, with a benefit-to-cost ratio of 5.3. Option 1 comes closer to realizing technology potential, but it would allow for a transition period from MY2027-2030 where higher emitting engines continue to be sold. Strengthening Option 1 to align with state HDV omnibus rules for model year 2027 would avoid this delay in NOx emission benefits. We disagree with concerns expressed by the Engine Manufacturers Association with respect to cost, warranty and compliance margin. We view this engine standard as the most important opportunity EPA has under this Administration to address transportation-related environmental injustice and exposure disparities in disadvantaged communities across this country. We find that adopting and strengthening EPA's Option 1 will especially benefit communities exposed to high traffic emissions near major roadways across all states. [EPA-HQ-OAR-2019-0055-1211-A1, p. 3] RECOMMENDATION: We recommend EPA dismiss Option 2 and adopt a strengthened Option 1 to fully align with a 90% NOx reduction in MY2027. [EPA-HQ-OAR-2019-0055-1211-A1, p. 3]

Combination long-haul trucks, combination short-haul trucks, and single unit short-haul trucks account for nearly 89% of estimated NOx reductions in 2035 under EPA's Option 1. Combination long-haul trucks alone account for more than 60% of the NOx benefits of EPA's Option 1. Our analysis of the spatial patterns of vehicle emissions shows that securing these benefits would especially reduce the impacts of transportation pollution in communities living near interstates and highways. Since each of these segments have distinct spatial patterns, any relaxation of requirements for any one of these modes in EPA’s final rule – such as for combination unit long-haul vehicles - would be expected to generate an unequal and disproportionate burden in disadvantaged communities. [EPA-HQ-OAR-2019-0055-1211-A1, p. 6]

Full alignment of federal NOx requirements with state HDV Omnibus rules and the adoption of GHG requirements consistent with 100% zero-emission HDV sales by 2035 could avoid $5.7 billion in health damages annually in 2035, 46% of which would benefit communities that meet at least one of the criteria defined by the EPA Climate and Environmental Justice Screening Tool. This estimate represents a 15% increase in NOx benefits in 2035 compared with Option 1 benefits in this year. These additional benefits are approximately evenly divided among combination unit long-haul trucks, combination unit short-haul trucks, and single-unit short-haul trucks. These combined emission reductions would benefit communities across the U.S., especially population centers and areas near major freight corridors. The most populous states such as California and Texas have among the highest potential health benefits in absolute terms. Yet multiple states are projected to experience outsized benefits compared to their population, such as Pennsylvania, Delaware and several states in the Midwest and South, including Indiana, Arkansas, Ohio, Missouri, North Carolina, and Georgia. [EPA-HQ-OAR-2019-0055-1211-A1, p. 6]

Technical feasibility. EPA has provided a comprehensive analysis of the feasibility of the proposed Option 1 NOx standards in its technical support document. Its conclusion is clear: The standards proposed for all three test cycles for large, long-life engines are feasible. [EPA-HQ-OAR-2019-0055-1211-A1, p. 7]

The Stage 3 SWRI test programs sponsored by California Air Resources Board (CARB) and EPA demonstrate that the NOx standards can be met with available technologies, using optimized SCR aftertreatment and cylinder deactivation. EPA has provided proof of feasibility that goes far beyond that provided in previous rulemakings, such as the rulemaking for the current 2010 NOx and PM standards. The remaining issues are proof of emission durability beyond 600,000 miles to the full useful life of 800,000 miles, with early results showing NOx levels below the standard at 800,000 miles, and the emission margin available to assure production and in-use compliance. [EPA-HQ-OAR-2019-0055-1211-A1, p. 8]

Regarding durability beyond 600,000 miles, an EPA test program with aftertreatment aged to full useful life is nearing completion. The proposed 2031 NOx standard for 800,000 miles is double the mid-life standard at 435,000 miles, providing room for emission deterioration as the engine ages. Projecting the data at 600,000 miles to full useful life, EPA shows that the demonstration engine will emit below the full life standard on the FTP (Figure 3-16, EPA TSD). The projected 2031 NOx emissions for the new, low-load cycle are about 25% below the proposed mid-life standard and more than 50% below the proposed full life standard (Figure 3-17, EPA TSD), suggesting adequate margin for compliance. The EPA figures are reproduced below. [EPA-HQ-OAR-2019-0055-1211-A1, p. 8]

Manufacturers also claim that the Stage 3 aged-engine does not consistently meet the in-use NOx standards when laboratory tested on "road-cycles" that mimic real-world operation. [EPA-HQ-OAR-2019-0055-1211-A1, p. 10]

Based on a thorough review of the EPA proposal and the most recent findings from SwRI, we draw the following conclusions:

• The research conducted by SwRI provides compelling evidence of the feasibility of achieving the EPA proposed Option 1 FTP emission standards for both MY2027-2030 and MY2031 and later models. Compliance margins are sufficient for Option 1, especially given the 8 years remaining to increase margins if needed.

• Adoption of a supplemental low-load cycle with corresponding emission standards is necessary to assure emission reductions during urban driving, and the SwRI data show emission levels well below the proposed standards throughout the full useful life.

• A highly capable single research group with limited funding and only a few years working with a suitable technology package (Stage 3) was able to demonstrate emission levels at or below the EPA's most stringent proposed standards. Based on its results, SwRI has pointed out additional possible advancements that could result in further reduction in NOx emissions, such as catalyst size increases and reformulations, and control algorithm improvements. EPA has provided proof of feasibility that goes far beyond that provided in previous rulemakings, such as the rulemaking for the current 2010 NOx and PM standards. It is reasonable to conclude that the industry as a group, with their enormously greater resources and 8 more years of time before the final standards and useful life go into effect, will be able to produce durable engines with even lower emissions and greater emission compliance margins both in certification and in-use over the future extended UL.

• By law, heavy-duty engine standards must reflect "the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which standards apply". The technologies developed by SwRI and their demonstrated ultra-low NOx emissions are consistent with the technology-forcing statutory requirements and the EPA proposed Option 1 standards for 2027 and 2031. The statutory requirement would not be met if EPA chose to adopt less stringent standards. [EPA-HQ-OAR-2019-0055-1211-A1, p. 11]

The NOx benefits of EPA's proposal are determined, in part, by the degree of future ZEV uptake. To understand this relationship, we modeled several scenarios for ZEV uptake under both proposed Options for new NOx engine standards. More detailed modeling methodology and scenario descriptions can be found in Attachment 1 – Appendix A. [EPA-HQ-OAR-2019-0055-1211-A1, p. 15]

We find that EPA Option 1 and 2 standards combined with faster future ZEV deployment can lower overall NOx emissions, as shown in Table 3. We estimate EPA's Option 1 would reduce NOx emissions by 0.4 to 5.1 million tonnes over the period 2027–2050 compared to EPA 2010 standards. Strengthening EPA's Option 1 to align with state HDV Omnibus rules would increase NOx emission benefits by an additional 0.1- 0.5 million tonnes over this period. We find the greatest NOx reductions - up to 5.9 million tonnes - would come from both accelerating ZEV uptake in line with the most ambitious Alternative 3 scenario and adopting requirements similar to state HDV Omnibus rules (compared to Baseline EPA 2010). [EPA-HQ-OAR-2019-0055-1211-A1, p. 15]

The Clean Air Act requires heavy-duty standards for new engines to "reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year which the standards apply, …" (section 202(a)(3)(A) of the Act). EPA has clearly stated its finding (see quote from the NPRM in the section of our comments on Technical Feasibility) that Option 1 standards are technically feasible within the lead time provided. The Option 2 proposed NOx standards are much less stringent than Option 1: 1.4 times higher in 2027 and 2.5 times higher in 2031+ for the FTP cycle. Clearly Option 2 standards do not meet the Clean Air Act definition of the greatest degree of emission reduction achievable, given EPA's definitive statement that Option 1 standards are technically feasible. [EPA-HQ-OAR-2019-0055-1211-A1, p. 16]

Under a scenario in which 17 states adopt and implement an Advanced Clean Trucks Rule, we estimate that Option 2 standards will result in nearly 1 million additional cumulative tonnes of NOx emitted from 2027 through 2050, compared to Option 1, as shown in Figure 7. EPA estimates Option 1 will deliver over 1.25 million additional tons of NOx reductions when compared with Option 2 (Table 5-34, EPA RIA). The additional health damages of Option 2 are $9–$16 billion (Table 8-8, EPA RIA). [EPA-HQ-OAR-2019-0055-1211-A1, pp. 16 - 17]

Less stringent emission standards proposed in Option 2 higher proposed FEL caps explain the emission differences with Option 1. For example, the highest allowed 2031+ FTP FEL in Option 2 is 150 mg NOx for HHD engines —3 times the proposed standard of 50 mg and only 25 percent below the current standard. By comparison, the highest 2031+ HHD FTP FEL under Option 1 is 70 mg at full useful life—only 1.75 times the proposed standard of 40 mg and less than half the Option 2 FEL. These are shown in the table below. [EPA-HQ-OAR-2019-0055-1211-A1, p. 17]

One implication of low FELs under Option 2 is many trucks that operate in or near disadvantaged communities could be allowed to achieve only a 25% NOx reduction compared to the current standards. Residents living in these communities are already exposed to a higher air pollution burden. The results of EPA's analysis indicates that environmental justice would not be served by adoption of Option 2, with its laxer standards, much higher FELs, shorter useful life and a warranty more than 40% shorter in mileage coverage and 50% lower in years compared to Option 1. [EPA-HQ-OAR-2019-0055-1211-A1, p. 18]

For the above reasons, ICCT recommends Option 2 be dismissed. [EPA-HQ-OAR-2019-0055-1211-A1, p. 18]

Combination long-haul trucks, combination short-haul trucks, and single unit short-haul trucks are the segments with the greatest potential NOx emissions reductions from strengthened policies. [EPA-HQ-OAR-2019-0055-1211-A1, p. 52]

These 3 segments account in our modeling for nearly 89% of estimated NOx reductions in 2035, assuming adoption of EPA's Option 1. (Table 18) These segments also account for more than 85% of the additional NOx reduction potential we assume is still available. Compared to EPA's Option 1, a strategy to reduce HDV tailpipe NOx emissions by at least 90% via NOx engine standards and increase ZEV uptake in line with reaching 100% zero-emission HDV sales by 2035 via GHG standards, could reduce NOx emissions across all vehicle segments by 46,400 tonnes in 2035—a 15% increase in NOx benefits compared to EPA Option 1. [EPA-HQ-OAR-2019-0055-1211-A1, p. 52]

EPA's Option 1 will especially benefit communities living near interstates and highways in all states. More than 60% of the NOx benefits of EPA's Option 1 are expected to come from combination long-haul trucks; these emission reductions are estimated to be concentrated on major roads across the U.S. Securing these benefits is especially important to reduce the impacts of transportation pollution in communities living near interstates and highways (Figure 15). EPA's Option 1 would also significantly reduce emissions from combination unit short-haul and single unit short-haul trucks; the latter are especially concentrated in densely populated areas. [EPA-HQ-OAR-2019-0055-1211-A1, p. 52.]

Adopting requirements similar to state HDV Omnibus rules and accelerating ZEV uptake would further benefit communities all over the U.S., including in densely populated areas and communities near interstates and highways. [EPA-HQ-OAR-2019-0055-1211-A1, p. 54.]

Compared to EPA's Option 1, the additional benefits of EPA action represented by our modeling scenarios Federal omnibus + Alternative 3 are approximately evenly divided among combination unit long-haul trucks, combination unit short-haul trucks, and single-unit short-haul trucks. Since each of these segments have distinct spatial patterns, these combined emission reductions would benefit communities across the U.S., especially population centers and areas near major freight corridors (Figure 16). [EPA-HQ-OAR-2019-0055-1211-A1, p. 54.]

We analyzed health benefits at a census tract level for communities meeting select environmental justice criteria versus all others. The definitions of these groups of census tracts are mostly based on criteria in EPA's Climate and Environmental Justice Screening tool83:

1. Disadvantaged: Communities designated as disadvantaged are considered overburdened both in terms of environmental or climate indicators and underserved socioeconomically. This definition is not limited to impacts from transportation;

2. High diesel particulate exposure (diesel PM): Communities at or above the 90th percentile for diesel particulate matter exposure, or the top 10% that are adversely impacted by diesel particulate matter exposure in the U.S., and above the threshold for socioeconomic indicators;

3. High traffic (traffic): Communities at or above the 90th percentile for traffic proximity and volume and above the threshold for socioeconomic indicators;

4. High ambient PM2.5 exposure (PM): Communities at or above the 90th percentile for PM2.5 in the air on an annual average basis and above the threshold for socioeconomic indicators;

5. High rates of air pollution related diseases (disease): Communities at or above the 90th percentile for asthma OR diabetes OR heart disease OR low life expectancy and above the threshold for socioeconomic indicators;

6. High proportion of low-income households (income): Communities at or above the 65th percentile for low income versus all others. Low income is defined as ‘Percent of a census tract's population in households where household income is at or below 200% of the Federal poverty level’;

7. High proportion of people of color (POC): Communities at or above the 65th percentile for percent people of color, people of color defined as Latinos of any race and any non-Latino, nonwhite people;

8. Meets any criteria (any): Communities that meet any of the criteria above. This group represents 47.3% of total population in 48 states and the District of Columbia as shown in Table 19. [EPA-HQ-OAR-2019-0055-1211-A1, pp. 54 - 55]

> 83. Methodology. Climate and Economic Justice Screening Tool. https://screeningtool.geoplatform.gov/en/methodology

Nearly half of the health benefits of aligning federal NOx engine standards with state Omnibus rules and accelerating ZEV uptake would occur in EJ communities. [EPA-HQ-OAR-2019-0055-1211-A1, p. 55]

Our modeling results show that a scenario represented by Federal omnibus + Alternative 3 could avoid an additional $753 million in health damages annually in 2035 compared to EPA’s Option 1; 47% of these benefits ($350 million) are projected to occur in communities that meet at least one of the selected environmental justice criteria, which represent over 150 million people. Communities with high proportions of people of color and low-income households, two of the most populous groups we identified, are projected to benefit the most from accelerating ZEV uptake, followed by disadvantaged communities and those that experience high rates of air pollution related disease. Those that experience high rates of air pollution related disease are also the group that experience the largest benefits relative to their population, benefitting 13% more than average on a per-capita basis. [EPA-HQ-OAR-2019-0055-1211-A1, pp. 55 - 56]

EPA's Option 1 will benefit communities in all states; adopting requirements similar to the scenario represented by Federal omnibus + Alternative 3 would further increase benefits by approximately 15% across U.S. states. [EPA-HQ-OAR-2019-0055-1211-A1, p. 57.]

The most populous states, such as California and Texas have among the highest potential health benefits in absolute terms from heavy-duty vehicle emission regulations. Yet multiple states are projected to experience outsized benefits compared to their population, such as Pennsylvania and Delaware, as well as Midwest and Southern states, including Indiana, Arkansas, Ohio, Missouri, North Carolina, and Georgia. [EPA-HQ-OAR-2019-0055-1211-A1, p. 57.]

Organization: *International Union, United Automobile, Aerospace & International Union, United Automobile, Aerospace & Agricultural Implement Workers of America - UAW Region 1A*

Commercial vehicle manufacturers are committed to partnering with EPA and other stakeholders to further reduce emissions from heavy-duty trucks without diverting resources necessary to foster a phased transition to ZEVs. **We urge you to work with them – not against them – to finalize a cost-effective rule that will further reduce emissions, protect American jobs, and result in cleaner air and healthier communities for all.** [EPA-HQ-OAR-2019-0055-1062-A1, p.2]

Please do not discount the concerns expressed by commercial vehicle manufacturers. The economy of Michigan – indeed, the entire country – is dependent on their continued growth, research, and reinvestment as we collectively work toward a cleaner environment. [EPA-HQ-OAR-2019-0055-1062-A1, p.2]

Organization: *International Union, United Automobile, Aerospace and Agricultural Implement Workers of America (UAW)*

The heavy-duty vehicle industry is complex and crafting new regulations on nitrogen oxides (NOx) and other pollutants for medium and heavy-duty engines and vehicles is an extremely arduous task for a variety of reasons. For instance, unlike CAFE and GHG (greenhouse gas) regulations, NOx reductions do not provide a financial benefit to purchasers through improved fuel efficiency. Despite this additional challenge, we know from experience that it is possible to craft a regulation that sets reasonable standards while promoting good jobs and protecting public health and the environment. Striking this careful balance will be difficult and the challenge it presents should not be understated. We stand ready to work with the EPA and all other stakeholders on developing standards that are good for working people and our environment. [EPA-HQ-OAR-2019-0055-1138-A1, p.1]

We are urging the EPA to reject Option 1 and to develop a final rule that is workable, cost-effective, and minimizes the disruptions in truck production levels that jeopardize good paying manufacturing jobs that benefit all Americans. Proposed Option 1 raises major concerns about feasibility, costs, job impacts, unintended consequences, and lack regulatory certainty. The industry has demonstrated its commitment to producing more efficient vehicles and investing in a zero-emission future, but policies designed with flawed assumptions could inadvertently set back those goals while doing significant harm to workers and the economy. Option 2 sets ambitious targets for the industry that lowers the heavy-duty NOx standard by 75% and is better suited to serve as the basis for crafting final regulations with the understanding that modifications will be needed as final rules are crafted. [EPA-HQ-OAR-2019-0055-1138-A1, p.1]

Over the last decade, UAW members have played a vital role in reaching a hard-fought consensus among a wide variety of stakeholders to significantly reduce both heavy-duty and passenger vehicle emissions. We hope that the EPA will pursue a final rule based on a similar consensus-driven process that incorporates input from a variety of stakeholders. In this, we encourage all stakeholders to be transparent and keep an open mind as all will need to compromise to reach a consensus. A standard that does not have buy-in from major stakeholders makes it even more likely that standard will be held up in the courts and politicized, potentially creating significant uncertainty and delaying progress. We proudly worked with other stakeholders to contribute to rulemaking for Phase 2 GHG reduction and fuel efficiency targets. We again urge the EPA to pursue a consensus-driven process and promulgate rules that reduce NOx and harmful pollutants, are compatible with Phase 2 requirements, and establish regulatory clarity and stability for the truck manufacturing industry. This rulemaking process should avoid extended political or legal battles that create uncertainty, which discourage investment and harm workers in the industry. [EPA-HQ-OAR-2019-0055-1138-A1, pp.2-3]

Organization: *King County, Washington County Executive*

The final rule should strengthen EPA's proposed Option 1 to set the expectation that at least 50 percent of sales should be zero-emission by 2030, and to put the United States on track for all truck sales to be zero-emission by 2035, in order to support the science-based targets to reduce global warming. As we advance our goals to transition to zero-emission trucks as quickly as possible, EPA must ensure the remaining new diesel truck purchases operate as cleanly as possible to protect public health, especially in our most overburdened communities. [EPA-HQ-OAR-2019-0055-1188-A2, p.2]

It is critical that EPA's truck rule:

- Provides pollution reduction that is at least as protective as the reductions that are codified in California's recent Heavy-Duty Omnibus Rule. This means, at a minimum, EPA should meet or exceed California's Heavy-Duty Omnibus program by setting a standard that achieves a greater than 90 percent reduction in NOx emissions by 2027. [EPA-HQ-OAR-2019-0055-1188-A2, p.2]
- Builds on the successes of the Advanced Clean Trucks (ACT) rule adopted by six states and sets the expectation that at least 50 percent of new truck sales should be zero-emission by 2030, putting the United States on track for all new truck sales to be zero-emission by 2035. [EPA-HQ-OAR-2019-0055-1188-A2, p.2]
- Offers a unified national program that will provide needed equity and ensure cleaner air for all communities. [EPA-HQ-OAR-2019-0055-1188-A2, p.2]

Organization: *Labor Network for Sustainability (LNS)*

Specifically, LNS recommends the following actions:

- EPA must not leave emission reductions and requirements to future rule and should transition to zero-emission trucks and buses by setting stringent emission standards and zero-emission-vehicle sales mandates now.
- EPA should require that all new trucks have zero emissions beginning in 2035 and retire all combustion trucks before 2045. [EPA-HQ-OAR-2019-0055-1257-A1, p.15]

Organization: *Lion Electric Co. USA Inc. (Lion)*

Lion appreciates the EPA's efforts in estimating the costs and benefits for multiple proposed options for lowering NOx and GHG emissions starting in Model Year 2027. This gives stakeholders a clear picture of how each option might affect air quality, health, and fleets. After reviewing the proposed data, Lion supports several aspects of Option 1, which offers the most stringent nitrogen oxide (NOx) and greenhouse gas (GHG) emission reductions of the two options presented. We believe that the EPA should take most of the actionable steps presented in Option 1 to urgently address the need for strong emission controls. However, we encourage the EPA to consider some flexibility in implementation to accommodate smaller fleets, which might struggle to meet these proposed regulations without adequate incentives and guidance. [EPA-HQ-OAR-2019-0055-1151-A2, p. 1]

Organization: *Maine Department of Environmental Protection (Department)*

The Department would first like to commend EPA's efforts to strengthen criteria pollutant emission standards for heavy-duty engines for the first time in almost 20 years. [EPA-HQ-OAR-2019-0055-1288-A1, p.1]

In-use testing data suggest that real-world NOx emissions are higher than modeled estimates, underscoring the need to achieve substantial NOx emission reductions from the heavy-duty diesel truck sector.7 [EPA-HQ-OAR-2019-0055-1288-A1, p.4]

> 7 Tan, et al., "On-Board Sensor-Based NOx Emissions from Heavy-Duty Diesel Vehicles," Environmental Science and Technology, 53: 5504-5511 (2019).

In Maine, heavy-duty on-road vehicles account for 28 percent of mobile source NOx emissions, exceeded only by the on-road (non-diesel) light duty vehicles as shown in Figure 4. In the absence of stringent new engine NOx standards, emissions from heavy-duty vehicles will only increase in future years as truck vehicle miles traveled (VMT) grows. The Federal Highway Administration (FHWA) projects that HDV VMT will increase by approximately 20 percent over the next 25 years, as shown in Figure 5. This growth in VMT, if not counteracted by increased stringency of new engine emissions standards, will result in significantly increased heavy-duty truck emissions. [EPA-HQ-OAR-2019-0055-1288-A1,pp.4-5]

Additional NOx reductions from heavy-duty vehicles are critical for addressing public health and environmental concerns not only in Maine, but throughout the country. Given this, the Department strongly recommends the adoption of heavy-duty NOx emission limits that are consistent with those in the CARB Heavy-Duty Omnibus Regulation. More specifically, Maine supports the adoption of a 0.020 gram NOx engine standard in 2027 at intermediate useful life and a 0.035 gram NOx standard at full useful life as specified in the Omnibus Regulation. The heavy-duty NOx limits and useful life requirements established in the Omnibus Regulation have been thoroughly vetted, and there is a range of data from CARB, EPA, and other research programs supporting the feasibility of introducing a 0.020 gram NOx standard at intermediate useful life in 2027. 9,1011,12,13,14 [EPA-HQ-OAR-2019-0055-1288-A1, p.6]

9 Manufacturers of Emission Controls Association, “Technology Feasibility for Heavy-Duty Diesel Trucks in Achieving 90% Lower NOx Standards in 2027,” February 2020. Available at http://www.meca.org/resources/MECA_2027_Low_NOx_White_Paper_FINAL.pdf (accessed February 7, 2020).

10 Southwest Research Institute, “Update on Heavy-Duty Low NOx Demonstration Programs at SwRI,” November 2019. Available at https://ww3.arb.ca.gov/msprog/hdlownox/files/workgroup_20190926/guest/swri_hd_low_nox_demo_programs.pdf. (accessed February 7, 2020).

11 Sharp, Chris; Neely, Gary; Rao, Sandesh; Zaval, Bryan, “An Update on Continuing Progress Towards Heavy-Duty Low NOx and CO2 in 2027 and Beyond,” Southwest Research Institute, WCX, Detroit, Michigan , April 5-7, 2022.

12 U.S. Environmental Protection Agency, “Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engines and Vehicles, Regulatory Impact Analysis,” March 28, 2022, https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10144K0.pdf

13 Achates Power, “Heavy Duty Opposed Piston Engine Demonstration,” CRC Real World Emissions Workshop, March 15, 2022.

14 Villafuerte, Pablo Mendoza; Demuynck, Joachim; Bosteels, Dirk, “Ultra-Low NOx Emissions with a Close-Coupled Emission Control System on a Heavy-Duty Truck Application,” Society of Automotive Engineers See 2021-01-1228.pdf (aecc.eu)

EPA’s Proposed Option 1 Should be Revised to Provide Additional Technologically-Feasible and Cost-Effective Emission Reductions. Once fully implemented, Option 1, which phases in a 35 mg/bhp-hr NOx limit beginning with model year 2027 and a more stringent 20 mg/bhp-hr beginning with model year 2031, will reduce heavy-duty vehicle NOx emission by 90% in comparison with the 2001 (current) standards. While this represents a significant improvement over the current standards, Option 1 unfortunately fails to fully capitalize on recent technological advancements for both internal combustion engines and zero emission vehicle (ZEV) technology. [EPA-HQ-OAR-2019-0055-1288-A1, p.6]

EPA's Proposed Option 2. The Department is strongly opposed to Option 2 in EPA's proposal. Technical analyses demonstrate that substantially more stringent NOx controls are feasible and cost-effective for model year 2027 and later heavy-duty engines and vehicles than would be required under this option. Certification data from current model year engines show that mass NOx emissions from some engines are close to the level proposed for the Option 2 FTP and SET NOx standards for model year 2027 and later engines.19,20,21 The standards proposed for Option 2 would only require minor calibration adjustments and minimal hardware modification. Further, EPA's own analysis found that Option 2 is less cost-effective than Option 1. Option 2 will not deliver the needed emissions reductions in Overburdened Communities or provide sufficient assistance to states in attaining the ozone NAAQS and would leave substantial and cost-effective NOx reductions on the table. [EPA-HQ-OAR-2019-0055-1288-A1, p.8]

> 19 Volvo, "Executive Order: 2020 VOLVO GROUP TRUCKS TECHNOLOGY HHDD A-242-0139 (ca.gov) | California Air Resources Board.
>
> 20 Cummins's 0.07 MCEXH0912XCA 15l engine family New Vehicle and Engine Certification: Executive Orders for MY2021 Medium-Duty and Heavy-Duty Engines.
>
> 21 DDC's 0.06 13L Executive Order: 2019 DETROIT DIESEL CORPORATION HHDD A-290-0168-1 (ca.gov).)

While the Department recognizes that NOx reductions are EPA's top priority for this rule, the proposed updates can provide benefits in the form of increased fuel efficiency and reduced fuel consumption, thereby setting the stage for a more ambitious rule to be implemented as soon as MY2030. [EPA-HQ-OAR-2019-0055-1288-A1, p.8]

In summary, EPA should finalize a stringent and technology forcing rule in accordance with Section 202(a)(3)(A) of the Clean Air Act23 that will reduce heavy-duty vehicle emissions by at least 90 percent and implement other key requirements to make sure these reductions will continue to be realized over the full useful life of vehicles, beginning not later than model year 2027. [EPA-HQ-OAR-2019-0055-1288-A1, p.9]

> 23 CAA Section 202(a)(3)(A): NOx emission standards for HD trucks are to "reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy and safety factors associated with the application of such technology."

Organization: *Manufacturers of Emission Controls Association (MECA)*

Technology commercialization has a long cycle, including design, testing, vehicle integration and real-world deployment across many trucks in the field to make sure systems are reliable and durable. This cycle is why long-term regulatory certainty and stringent standards are a critical signal to industry to begin making investments and collaborating with their suppliers of technologies that will be needed in the future. MECA members have been engaged in developing a large portfolio of technology options that can be installed on a vehicle to optimize the lowest

NOx and CO2 emissions. MECA supports standards founded on technologically feasible and cost-effective solutions that allow communities to meet their air quality goals. In 2013, SwRI was granted a contract to demonstrate the technical feasibility for achieving a 90% reduction in NOx emissions below current standards while not negatively impacting CO2, N2O, methane, ammonia and other criteria pollutants including PM. This demonstration program has evolved and grown through EPA's support and continues to yield results to this day. [EPA-HQ-OAR-2019-0055-1320-A1, p.4]

MECA supports EPA's proposed phased-in implementation dates beginning with MY 2027 and fully phased in by MY 2031, as these align with CARB's second phases of the Omnibus Regulation. The initial implementation starting with MY 2027 coincides with the final step in the Heavy-Duty GHG Phase 2 standards. Aligning criteria and GHG standard implementation dates enables optimization of NOx and CO2 emission reductions from engines and aftertreatment simultaneously. This alignment is the most cost-effective approach for engine manufacturers and suppliers as many technologies described below offer simultaneous and synergistic reductions in both NOx and CO2. [EPA-HQ-OAR-2019-0055-1320-A1, p.4]

Based on the technical work of Manufacturers of Emission Controls Association (MECA), it is estimated that a 90% reduction in NOx emissions from these mobile sources (to a rate of 0.02 g/bhp-hr) is both technically feasible and cost effective adding only 1% to 1.6% to the cost of a model year (MY) 2027 Class 8 truck. See 'STATEMENT OF THE MANUFACTURERS OF EMISSION CONTROLS ASSOCIATION ON THE U.S. ENVIRONMENTAL PROTECTION AGENCY'S ADVANCED NOTICE OF PROPOSED RULEMAKING: CONTROL OF AIR POLLUTION FROM NEW MOTOR VEHICLES: HEAVY-DUTY ENGINE STANDARDS' February 20, 2020, EPA-HQ-OAR-2019-0055-0365. According to MECA's estimate of a cost benefit of $1,000-$5,000 per ton of NOx reduced is cost effective relative to most remaining stationary controls. [EPA-HQ-OAR-2019-0055-1272-A1, p.6]

MECA supports regulations that set fuel neutral standards for vehicles and engines. [EPA-HQ-OAR-2019-0055-1320-A1, p.31]

In conclusion, MECA appreciates EPA's work in demonstrating pathways to meeting future heavy-duty low-NOx engine standards. We strongly support a modified Proposed Option 1 as outlined in our comments above. Proposed Option 1 along with our suggested modifications would result in cost effective air quality benefits for millions of Americans living in ozone and PM nonattainment areas. MECA believes that the standards in Proposed Option 1 are technically achievable for implementation by 2027 and stepping down, as proposed, in 2031. The test program at Southwest Research Institute has shown that engines equipped with advanced technologies paired with state-of-the-art aftertreatment systems can achieve levels consistent with the standards in Proposed Option 1 over certification cycles. Off-cycle testing over low load operation using real-world duty cycles, is showing that comfortable compliance margins exist in all three compliance bins. Furthermore, it has been demonstrated that low load and idle standards can be tightened to levels below those proposed.. [EPA-HQ-OAR-2019-0055-1320-A1, p.34]

Organization: *Mass Comment Campaign sponsored by Environment America (11,390)*

We write to urge you to create the strongest possible limits on heavy-duty vehicle pollution. [EPA-HQ-OAR-2019-0055-1611-A1, p.1]

Transportation is the largest source of global warming pollution in the United States. To avoid the worst impacts of climate change, we need to zero out emissions from transportation by 2050. That means replacing trucks, buses, freight vehicles, delivery vans, and any other vehicle that relies on fossil fuels with a clean, electric version. [EPA-HQ-OAR-2019-0055-1611-A1, p.1]

EPA should strengthen this rule to meet two key goals. 1) reduce deadly NOx pollution 90% by 2027, and 2) put our heavy duty vehicle fleet on a clear path to 100% zero-emission all-electric vehicles by 2035. [EPA-HQ-OAR-2019-0055-1611-A1, p.1]

Proposed Option 1 for NOx pollution is a start, but it must be strengthened to protect public health. Environment America supports requiring a 90% reduction in nitrogen oxide pollution from trucks and buses by 2027. Reducing smog and soot-causing NOx pollution from trucks will improve air quality and save lives. [EPA-HQ-OAR-2019-0055-1611-A1, p.1]

Cleaner trucks can deliver cleaner air. EPA should go back to the drawing board to create a rule that will accelerate the market for electric trucks and produce significant reductions in the pollution that harms our health and climate. [EPA-HQ-OAR-2019-0055-1611-A1,p.2]

Organization: *Mass Comment Campaign sponsored by Moms Clean Air Force and Arizona Climate Action Coalition (198)*

To protect our children's health and future as well as our large Senior citizen population, and to address environmental injustice, EPA needs to immediately take urgent and bolder action. The proposed rule for heavy duty vehicle pollution should be strengthened. On the NOx portion of the rule, Option 1 is a start but is insufficient. It would result in higher emissions of smog and soot-causing NOx pollution than California's Heavy Duty Omnibus rule, which should be the baseline for smog and particulate matter reduction goals. [EPA-HQ-OAR-2019-0055-1192-A1, pp.2-3]

Organization: *Mass Comment Campaign sponsored by Sierra Club (11,740)*

Sierra Club collected 11,740 public comments urging the Environmental Protection Agency to pass a rule for curbing emissions from heavy duty trucks by setting a smog reduction target that makes engines 90% cleaner by 2027 and a greenhouse gas target that puts zero-emission trucks on the road to protect our climate and the health of our communities. [EPA-HQ-OAR-2019-0055-1620-A1, p.1]

To deliver on the Biden Administration's environmental justice, public health, and climate goals, the EPA must finalize a strong heavy-duty vehicle rule this year that sets us on a rapid path to cleaning up and electrifying the most polluting vehicles on the roads: our trucks and buses. [EPA-HQ-OAR-2019-0055-1620-A1, p.1]

We appreciate President Biden making clean transportation a day-one priority and EPA moving quickly to propose long-overdue regulations to clean up pollution from dirty heavy-duty vehicles. However, our communities and our planet require bolder standards that will reduce health-harming smog and cut greenhouse gas emissions to a degree that matches the urgency of the climate and public health crisis. That can only happen if both the NOx standard and the greenhouse gas standards are strong enough to make trucks cleaner while moving quickly to get zero-emission trucks on the road. [EPA-HQ-OAR-2019-0055-1620-A1, p.1]

Moreover, the standards must not be undermined by giveaways to an industry that would allow manufacturers to keep producing fossil fuel trucks far into the next decade. EPA must strengthen the final rule by accelerating the trajectory towards zero-emission vehicles and eliminating the various credit giveaways that significantly erode the standard. [EPA-HQ-OAR-2019-0055-1620-A1, p.1]

Thank you for initiating action on this important issue. We look forward to EPA once again responding to health, equity, and environmental advocates, and particularly frontline communities bearing the brunt of the toxic diesel pollution, by making much-needed improvements to this rule. [EPA-HQ-OAR-2019-0055-1620-A1, p.1]

Organization: *Mass Comment Campaign sponsored by Union of Concerned Scientists - 2 (959)*

We, the undersigned scientists, researchers, health professionals, economists, engineers, and planners respectfully submit this comment in support of the strongest possible heavy-duty nitrogen oxides (NOx) truck pollution standards. [EPA-HQ-OAR-2019-0055-1608-A1, p.1]

First, the rule falls short in setting us on a clear path to all electric trucks. The science and technology, as well as the urgency of this health crisis, are clear on this front: zero-emission trucks are available today and must be the number one priority.2 This has also long been an ask of environmental justice communities across the country. Electric trucks are here today, and new research demonstrates that by 2027, pollution-free trucks will be cost competitive with diesel over the lifetime of the vehicle.3 At the same time, as this rule acts to accelerate the deployment of electric trucks, it must reduce emissions from diesel trucks to the maximum extent possible. The EPA's own data shows that the strong diesel tailpipe standards adopted by states are achievable—the EPA must strengthen its 2027 targets to be at least as protective as these state rules. [EPA-HQ-OAR-2019-0055-1608-A1, p.1]

2 https://ucsusa.org/resources/electrify-trucks
3 https://www.edf.org/media/new-study-finds-rapidly-declining-costs-zero-emitting-freight-trucks-and-buses

The urgency of this issue demands a strong response. For far too long, truck pollution has been devastating the health of communities across the country.5 The solutions are here—and we urge the EPA to stand up to this moment and enact the strongest truck pollution standards in history. [EPA-HQ-OAR-2019-0055-1608-A1, p.2]

5 https://ucsusa.org/resources/diesel-engines-public-health

Organization: *Mass Comment Campaign sponsoring organization unknown - 3 (605)*

As a supporter of the League of Conservation Voters I am urging the EPA to adopt the strongest rules possible on heavy-duty vehicles and accelerate toward 100% electrification of new big rigs, trucks, and buses by 2035. [EPA-HQ-OAR-2019-0055-1606, p.1]

I'm doing my part. I drive an all electric car, have rooftop solar, compost garbage. But we will not be able to tackle the climate crisis without cleaner trucks on our roads. The transportation sector is our countrys largest source of carbon pollution, with heavy-duty vehicles contributing substantially to our total greenhouse gas emissions. In order to curb our emissions by at least 50% by 2030, a pace that scientists agree is necessary to mitigate the worst effects of climate change, we must adopt the strongest possible standards for trucks and buses. This will promote a transition to fully electric vehicles and slow the sale of dirty diesel trucks over the next decade. [EPA-HQ-OAR-2019-0055-1606, p.1]

We have the technology and the ability to cut pollution and save money today. At this moment, electric trucks and buses are already capable of supporting the majority of the United States freight, delivery, and transit uses and needs and there are dozens more zero-emission vehicles coming to the market within a couple of years, which are projected to be cheaper to own and operate than their combustion engine counterparts within five years. [EPA-HQ-OAR-2019-0055-1606, p.1]

Time is running out fast. We need this administration to get serious about climate change by setting the strongest standards possible because many lives depend on it. While Option 1 is a start, the standards should at least align with Californias recent clean trucks rule. These standards must reduce deadly pollution from nitrogen oxides by 90% by 2027, and put our nations buses and trucks on a clear path to 100% zero-emission all-electric vehicles by 2035 [EPA-HQ-OAR-2019-0055-1606, p.1]

Organization: *Mass Comment Campaign sponsoring organization unknown - 7 (4,668)*

I urge the EPA to set the strongest standards possible to reduce greenhouse gas and nitrogen oxides emissions from medium- and heavy-duty trucks manufactured in 2027 and beyond:

--At a minimum, adopt Option 1 for nitrogen oxide standards to meet the EPAs obligations under the Clean Air Act and to bring the most benefit to our health, air, and environment.

--Adopt more stringent greenhouse gas standards which are necessary to achieve the nations goal of a 60% reduction in new vehicle greenhouse gas emissions by 2030.

--Eliminate credits and loopholes that would severely limit the effectiveness of these standards. [EPA-HQ-OAR-2019-0055-1604]

Organization: *Mass Comment Campaign sponsoring organization unknown - 10 (1,087)*

As a person of faith and conscience, I recognize that we have a moral obligation to cut carbon emissions and other pollutants that harm our health and our communities. People of all faiths and spiritual traditions share a common bond to care for their neighbor and this planet we all share. [EPA-HQ-OAR-2019-0055-1602]

To stop climate change and ensure our national security we MUST get off fossil fuels! It's NOT an option! That means electric vehicles. Again, NOT an option. This is a NECESSITY. Stop denying the obvious, bite the bullet, do what needs to be done, and switch to electric vehicles! Don't waste our time and money on fossil fuel vehicles when you KNOW our use of fossil fuels has a very limited shelf life at this point (because if they don't, WE DO). [EPA-HQ-OAR-2019-0055-1602]

President Biden's larger climate agenda cannot be accomplished without a strong rule on America's 13 million heavy-duty trucks and buses. I view much of this rule as a good starting point, but I would like to see it strengthened given the urgency of the climate crisis, the rapid advancement of EV technology and the increasingly understood human health impacts, particularly on communities of color and our most vulnerable residents. [EPA-HQ-OAR-2019-0055-1602]

The EPA should use these standards to rapidly accelerate the transition to electric trucks and put our nation's medium- and heavy-duty vehicles on a pathway to 100% zero-emission electric vehicles by 2035. [EPA-HQ-OAR-2019-0055-1602]

I urge the EPA to set the strongest standards possible recognizing the health and well being of current and future generations who will be impacted by this rule. [EPA-HQ-OAR-2019-0055-1602]

It is essential that the final standards reduce dangerous NOx pollution 90% by 2027 and put our buses and trucks on a clear path to 100% zero-emission all-electric vehicles by 2035. [EPA-HQ-OAR-2019-0055-1602]

Organization: *Mass Comment Campaign sponsoring organization unknown – 11 (1,027)*

As EPA develops the final rule on tailpipe emissions from heavy-duty trucks as part of the "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards," I urge you to amend the proposed rule so that it reduces emissions, protects American jobs, and results in cleaner air and healthier communities for all. [EPA-HQ-OAR-2019-0055-1598]

Specifically, EPA must reject Option 1 and revise Option 2. An overly aggressive standard will result in higher costs for fleet operators, jeopardize thousands of good-paying jobs, slow the transition to zero- emission vehicles, and fail to achieve the desired environmental benefits. [EPA-HQ-OAR-2019-0055-1598]

Instead, EPA must recognize the importance of a single-step, national rule. To be effective, the final rule must be:

- Customer-acceptable. If truck owners and operators choose not to purchase new trucks due to cost or reliability concerns that result from a bad federal rule, older trucks will stay on the roads longer and environment goals will not be achieved.

- Economically viable. If the final rule results in higher costs for manufacturers and fleet owners, manufacturers and small business owners may have no choice but to lay off workers and eliminate jobs.

- Environmentally beneficial. An unworkable rule will delay fleet turnover and prevent environmental progress, creating greater harm in communities most at-risk for high air pollution.

- A bridge to a zero-emissions future. The final rule must not prevent continued progress toward zero- emission commercial vehicles by forcing excessive, costly redesigns of traditional combustion engines at the expense of investments in the research and development of zero-emission vehicles. [EPA-HQ-OAR-2019-0055-1598]

I hope you will listen to this feedback and develop a final rule that meets the needs of the industry, the environment, and the economy. [EPA-HQ-OAR-2019-0055-1598]

Organization: *Mayor, City of Albuquerque, NM et al.*

The heavy-duty rule must accelerate deployment of zero-emission vehicles in order to safeguard clean air and improve public health in our communities. Our residents cannot wait a decade for cleaner air. Thankfully, due to strong state and local action, the medium- and heavy-duty zero-emission truck market is growing. Today there are over 100 commercially available models of zero-emissions medium- and heavy-duty trucks and buses, with additional models expected to enter into production this year.2 EPA has a critical role to play to ensure that zero-emission technologies for all types of trucks and buses are deployed in all communities. [EPA-HQ-OAR-2019-0055-1316-A1, p.1]

2 https://californiahvip.org/vehicles

The final rule should strengthen EPA's proposed Option 1 to set the expectation that at least 50 percent of sales should be zero-emission by 2030, and put the United States on track for all truck sales to be zero-emission by 2035. This target is aligned with the Moving Forward Network's3 zero-emission truck recommendation, which was recently outlined in a letter [https://www.movingforwardnetwork.com/wp-content/uploads/2021/11/MFN-Zero-Emission-in-Freight-Letter-to-EPA-10_26_21.pdf] urging the EPA to prioritize environmental justice by aggressively advancing zero-emission technology and solutions across the freight sector. As we advance our goals to transition to zero-emission trucks as quickly as possible, EPA must ensure the remaining new diesel truck purchases operate as cleanly as possible to protect public health, especially in our most overburdened communities. [EPA-HQ-OAR-2019-0055-1316-A1, pp.2-3]

3 The Moving Forward Network (MFN) is a national network of organizations that center grassroots, frontline knowledge, expertise, and engagement with the communities across

the US that bear negative impacts of the global freight transportation system. In collaboration with allies and partners, MFN identifies local solutions that call for community, industry, labor, government, and political action that advances equity, environmental justice, and a zero-emissions focused just transition.

It is critical that EPA's truck rule:

- Provides pollution reduction that is at least as protective as the reductions that are codified in California's recent Heavy-Duty Omnibus Rule. This means, at a minimum, EPA should meet or exceed California's Heavy-Duty Omnibus program by setting a standard that achieves a greater than 90% reduction in NOx emissions by 2027.
- Builds on the successes of the Advanced Clean Trucks (ACT) rule adopted by six states, and sets the expectation that at least 50 percent of new truck sales should be zero-emission by 2030, putting the United States on track for all new truck sales to be zero-emission by 2035.
- Offers a unified national program that will provide needed equity and ensure cleaner air for all communities. [EPA-HQ-OAR-2019-0055-1316-A1, p.3]

Electric vehicle technology is here and it will be cost competitive with diesel over the lifetime of the vehicles starting in 2027. Zero-emission trucks produce substantial savings, even more than zero-emission cars due to reduced fuel and maintenance costs and more predictable maintenance schedules.5 Municipalities will benefit from transitioning to zero-emission truck fleets based on truck operation and maintenance cost savings and from local job growth through the deployment of charging infrastructure. [EPA-HQ-OAR-2019-0055-1316-A1, p.2]

5 https://eta-publications.lbl.gov/sites/default/files/updated_5_final_ehdv_report_033121.pdf

Organization: *Minnesota Pollution Control Agency (MPCA)*

Minnesota needs NOx reductions from heavy-duty vehicles to reduce ozone formation, address disparities in air pollution exposure, and improve overall air quality and related health outcomes. Future NOx reductions from heavy-duty trucks will help Minnesota reach its Regional Haze targets and reduce ozone transport. [EPA-HQ-OAR-2019-0055-1044-A1, p. 1]

Minnesota has sought and achieved significant NOx reductions at industrial and electric generation sources, but needs federal leadership to achieve on-road transportation reductions. The MPCA looks to EPA to develop appropriately protective policies for heavy duty vehicle-related pollution. [EPA-HQ-OAR-2019-0055-1044-A1, p. 2]

The MPCA requests that EPA adopt Option 1 as an appropriately stringent and feasible standard. Given the range of available pollution control technologies and the emission reductions already achieved without regulation, the MPCA feels that EPA has an obligation to pursue standards at the highest stringency within the proposed range. As described in the proposed rulemaking, ninety percent reductions by Model Year 2027 (MY27) are technically and economically feasible. Delaying or weakening the standards would allow excess NOx emissions, which would subsequently negatively impact human health. [EPA-HQ-OAR-2019-0055-1044-A1, p. 2]

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

EPA's last update of the HD NOx standards was nearly 20 years ago. EPA's proposed rulemaking presents a unique opportunity for further reductions in HD NOx emissions standards and sets a signal for best-in-class emission control technologies that will ultimately preserve U.S. competitiveness globally. The U.S. has a strong history of being a global leader in HD emissions technology innovation and is uniquely positioned to continue to lead the world in HD advanced fuel efficiency and emissions-reducing technologies. A comprehensive federal HD NOx rulemaking will advance U.S. innovation in these technologies. Maintaining stringency in the HD NOx standards will improve the environment and support a strong motor vehicle supplier manufacturing sector, which is the largest sector of manufacturing jobs in the U.S. and is critical for the U.S. to secure its position as the global technology leader.[EPA-HQ-OAR-2019-0055-1322-A1, p. 3]

MEMA supports new HD NOx emissions standards and additional test cycles that will drive additional NOx emissions reductions on the road and encourages best-in-class technologies. These standards should be performance-based and technology-neutral and the test-cycles should reflect real use of vehicles. Both the standards and test cycles should enable multiple technology paths to achieve compliance. [EPA-HQ-OAR-2019-0055-1322-A1, p. 3]

MEMA supports a NOx rule that relies on certification cycles and in-use tests that better represent real-world use and will encourage best-in-class technology adoption while effectively meeting lower NOx emissions requirements. [EPA-HQ-OAR-2019-0055-1322-A1, p. 3]

MEMA opposes the Alternative Option as it could harm suppliers, places unnecessary strain on the industry, and lacks research and technical support as already indicated by EPA. [EPA-HQ-OAR-2019-0055-1322-A1, p. 3]

MEMA supports an NOx rule that relies on certification cycles and in-use tests that better represent real-world use and will encourage best-in-class technology adoption while effectively meeting lower NOx emissions requirements. MEMA supports Option 1 with important modifications to warranty time period/mileage, covered warranty parts, and FUL. MEMA believes the technology exists to comply with this emissions standard and it also has a two-step approach to implementation. The staged approach will be beneficial and allow time to gain significant additional data as we approach the second step in 2031. [EPA-HQ-OAR-2019-0055-1322-A1, p. 4]

MEMA opposes the Alternative Option as it could harm suppliers, places unnecessary strain on the industry, and lacks research and technical support. [EPA-HQ-OAR-2019-0055-1322-A1, p. 5]

EPA suggests that new emission control technologies (i.e., not based on CDA and a dual SCR) would be needed to meet the Alternative NOx standards for Heavy HDEs. MEMA opposes the

Alternative Option and agrees with EPA that not enough data and research has been done to support this Option. [EPA-HQ-OAR-2019-0055-1322-A1, p. 5]

Regarding EPA's request for comments on whether technologies are available that would enable a PM standard lower than 5 mg/bhp-hr, MEMA does not yet view this as a workable option due to the lack of specific supporting data and the fact that it is even more stringent than the CARB Omnibus. Further testing is required to determine if current technologies are capable of reaching this lower PM standard. [EPA-HQ-OAR-2019-0055-1322-A1, p. 5]

MEMA supports a NOx rule that relies on certification cycles and in-use tests that better represent real-world use and will encourage best-in-class technology adoption while effectively meeting lower NOx emissions requirements. Therefore, MEMA recommends Option 1 with modifications to warranty time period/mileage, covered warranty parts, and full useful life as well as modified standards for vocational vehicles. [EPA-HQ-OAR-2019-0055-1322-A1, p. 9]

Organization: *Moving Forward Network (MFN)*

The following section describes how ZE truck requirements must be properly incorporated into the final rule to meet the Clean Air Act's technology forcing mandate for criteria pollution standards. EPA's failure to require this available cleaner technology is unconscionable given the impacts in freight-adjacent communities and will actually undermine combustion engine emission reductions. [EPA-HQ-OAR-2019-0055-1277-A1, p. 16]

EPA's proposed NOx emission standards violate the law and must be fixed in this rulemaking. The Clean Air Act requires EPA to adopt "technology-forcing" standards to regulate emissions of NOx, carbon monoxide, hydrocarbons, and particulate matter from heavy-duty vehicles and engines. 42 U.S.C. § 7521(a)(3). As courts have explained, EPA cannot satisfy this mandate by adopting status quo standards. EPA's NOx emission standards should "project future advances in pollution control capability . . . [and] press for development and application of improved technology rather than be limited by that which exists today." Nat. Res. Def. Council v. EPA, 655 F.2d 318, 328 (D.C. Cir.1981) (quoting S.Rep. No. 91-1196, at 24 (1970) S.Rep. No. 91-1196, at 24 (1970)). The Act contemplates strong action to "force substantial change on the status quo on an industry-wide basis." Cent. Valley Chrysler-Jeep, Inc. v. Goldstene, 529 F. Supp. 2d 1151, 1178 (E.D. Cal. 2007), as corrected (Mar. 26, 2008). Specifically, the Act mandates that these regulations "shall contain standards which reflect the greatest degree of emission reduction achievable" by applying technology which "the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology." Id. § 7521(a)(3)(A)(i). Importantly, the "overriding goal" of section 202 is addressing air quality and public health. Husqvarna AB v. EPA, 254 F.3d 195, 200 (D.C. Cir. 2001).65 "[T]he other listed considerations, while significant, are subordinate to that goal." Id. [EPA-HQ-OAR-2019-0055-1277-A1, pp. 16 - 17]

65 While Husqvarna AB relates to Section 213 of the Clean Air Act, the court's conclusions are just as relevant here because the statutory text of Section 213 and

> Section 202 are almost identical, and the court itself relied on cases interpreting the Section 202 language to support its analysis. Husqvarna AB, 254 F.3d at 201.

In light of this clear directive, EPA must revise its proposed NOx standards because neither Option 1 nor Option 2 come close to meeting this statutory obligation. MFN urges EPA to adopt a zero-emission NOx standard that appropriately reflects not merely the current and projected availability of zero-emission heavyduty truck technology across the United States, but a level of transition to ZE truck technologies that is technologically feasible. The Clean Air Act plainly authorizes EPA to propose stringent NOx emission standards that rely on a reasoned prediction that a particular control technology “will be available for the model year to which such standards apply,” so long as this prediction is supported by substantial evidence. Id. at 331-32; 42 U.S.C. § 7521(a)(3). EPA can demonstrate the reasonableness of its technology projections where it “answers any theoretical objections to the technology, identifies the major steps necessary for development of the technology, and gives plausible reasons for its belief that the industry will be able to solve these problems in the time remaining.” Nat. Res. Def. Council, 655 F.2d at 331-32. Critically, EPA is “not required to rebut all speculation that unspecified factors may hinder ‘real world’ emission control.” Nat. Res. Def. Council v. Thomas, 805 F.2d 410, 434 (D.C. Cir. 1986) (quoting id., 655 F.2d at 334). EPA has made such forward-looking predictions that certain technology will be available, and should do so again here. See, e.g., Husqvarna AB, 254 F.3d at 201 (“Substantial evidence . . . supports EPA’s determination that the continued rapid development of engine technologies makes it probable that [specified engine technologies] will enable manufacturers to comply with the emission standards within the phase-in period.”). [EPA-HQ-OAR-2019-0055-1277-A1, p. 17]

If EPA insists on retaining ZE trucks in a vehicle NOx standard,85 EPA must lower the NOx standard to reflect the greatest degree of emission reductions achievable across the entire truck fleet based on the feasibility of widespread transition to ZE trucks. As discussed further below, the current proposed NOx standards, even under the more stringent Option 1, do not reflect the greatest degree of emission reductions achievable even looking only at feasible combustion technologies. The addition of ZE trucks to the compliance average entirely undermines any claim that the standards meet the technology-forcing requirements of the Act. [EPA-HQ-OAR-2019-0055-1277-A1, p. 20]

> 85. EPA's proposed regulations label 40 C.F.R. Part 1036 as standards for heavy-duty "engines," but as EPA clarifies in the preamble, the standards for all regulated pollutants apply to all heavy-duty vehicle types including EVs. See 87 Fed. Reg at 17457- 58.

EPA acknowledges that Option 1 of the proposed Criteria Pollutant Program is the strongest of the two co-proposals it is considering and claims that setting the level of standard outlined in Option 1 would be consistent with the agency’s statutory authority.86 However, even Option 1 contains glaring deficiencies, including failing to match the stringency of state trucks standards in the Heavy-Duty Omnibus (Omnibus) rule, improperly incorporating ZEV, excessive family emission limit (FEL) caps, and enabling false solutions through early crediting. [EPA-HQ-OAR-2019-0055-1277-A1, p. 21]

86. 87 Fed. Reg. at 17436.

Meanwhile, Option 2 is woefully inadequate and does not warrant serious consideration. By EPA's own analysis, "Option 1 may be a more appropriate level of stringency, as it would result in a greater level of achievable emission reduction." Option 2 underperforms on all meaningful public health, environmental, and economic metrics and would be a disaster if adopted. [EPA-HQ-OAR-2019-0055-1277-A1, p. 21]

We request comment, including relevant data and other information, on the feasibility of the implementation model year, numeric levels of the emission standards, and useful life and warranty periods included in the Alternative, or other alternatives outside the range of options covered by the proposed Options 1 and 2 standards." (87 FR 17471) [EPA-HQ-OAR-2019-0055-1277-A1, p. 28]

Data from the CARB Phase 3 and EPA Phase 3 RW projects at SwRI are the most thorough assessments of the technical capability to reduce diesel emissions in the 2027 timeframe.118 Additional projects, including those mentioned above, extend some of that capability or provide manufacturers with alternate strategies to achieve levels of compliance that are at least as stringent as those in the Omnibus rule. [EPA-HQ-OAR-2019-0055-1277-A1, p. 28]

118. See, Sharp, C.A., Further development and validation of technologies to lower oxides of nitrogen emissions from heavy-duty vehicles: Low NOx demonstration program – Stage 3. Final report, prepared for California Air Resources Board, April 16, 2021; Sharp, C.A., "Update on continuing progress towards 2027 heavy-duty low NOx targets," presented to the 32nd CRC real world emissions workshop, March 14, 2022; and Draft RIA Tables 3-3 through 3-9.

Organization: *National Association of Chemical Distributors (NACD)*

NACD appreciates the EPA's transparency in sharing the two options the agency is considering for implementation of this rule. Giving stakeholders this information in proposed rules allows impacted entities to understand better the EPA's thought process and tailor comments to what is being considered. [EPA-HQ-OAR-2019-0055-1279-A1, p. 3]

With that said, while NACD is concerned with both proposed options for reasons stated above, we find the second option to be much more realistic and palatable for the chemical distribution industry. First, by taking a one-step approach, the EPA builds in necessary flexibility with this rulemaking. Emission regulation in the vehicle industry has proven to be extremely complicated, fast moving, and unpredictable. By only taking a one-step approach, the EPA would allow more information to be gathered prior to future rulemakings. The two-step approach taken in option 1 removes this flexibility until 2031. There may be unforeseen developments that require a shift from what is expected, making regulating in multiple steps farther into the future less practical. A pertinent example of this is the reconsideration of Phase 2 greenhouse gas emissions (GHG) in this rule as discussed below. [EPA-HQ-OAR-2019-0055-1279-A1, p. 3 - 4]

Furthermore, when assessing the impacts of both options, there are insignificant differences for roughly the first decade after implementation. According to EPA estimates, there would be a difference of only six percent in the reduction of NOx in calendar year 2036 between the two options. While this deviation widens as option 1 does not have any more requirements after Model Year (MY) 2027, the EPA can add a second step after option 1 is implemented in a separate rulemaking that would have the availability of more present data and stakeholder input from additional comment processes. This additional step would undoubtedly close that gap and may even lead to more NOx reduction than option 1 in the long term if technology and consumer behavior points to more stringent measures being possible. [EPA-HQ-OAR-2019-0055-1279-A1, p. 4]

Organization: *National Association of Clean Air Agencies (NACAA)*

On multiple occasions over the past seven years NACAA has urged EPA to set cleaner standards for nitrogen oxide (NOx) emissions from heavy-duty (HD) trucks. We are pleased that the agency has now reached the milestone of putting forth a proposal for public comment. [EPA-HQ-OAR-2019-0055-1232-A1, p. 1]

As we have described to EPA over the years, NACAA strongly supports establishment of a stringent, technology-forcing federal rule that will reduce HD truck NOx emissions by at least 90 percent and implement other key requirements to ensure these reductions will continue to be realized over the full useful life of vehicles beginning not later than with model year (MY) 2027. [EPA-HQ-OAR-2019-0055-1232-A1, p. 1]

We have consistently highlighted the importance of such a federal program adopted no later than 2022 so implementation will begin no later than MY 2027. We are now at the “final hour.” If EPA does not finalize a rule before the end of this calendar year it will not take effect with MY 2027. With clean air and public health on the line, our nation cannot afford to sacrifice another year of NOx reductions from this significant source of emissions. [EPA-HQ-OAR-2019-0055-1232-A1, p. 1]

It has been over 21 years since EPA last set federal NOx emission standards for HD trucks. Given the interstate nature of trucking – both cross-border operations and downwind atmospheric transport – federal standards are necessary to achieve the broad NOx reductions needed across the nation. Over the past two decades, technological advances to reduce HD truck NOx emissions have soared as has the potential for even further advances, but EPA failed to take regulatory advantage of the opportunities these advances afford. At the same time, emission limits for most other major NOx sources have been ratcheted down repeatedly. HD trucks will continue to be one of the largest contributors to the national mobile source NOx inventory in 2028 without additional regulations to reduce emissions. [EPA-HQ-OAR-2019-0055-1232-A1, p. 2]

The Puget Sound Clean Air Agency (PSCAA) in Seattle, WA seeks a technology-forcing standard to reduce NOx emission from HD trucks due to several ozone-related concerns. Reducing NOx would help reduce exposure in the near-road communities, which are disproportionately affected by air pollution, and also assist in addressing ozone-impacted areas.

More important to PSCAA, however, are the proposed rule's requirements for better longevity of the PM controls' performance under more-varied duty cycles and for longer warranty requirements. Combined, these would help alleviate the expensive breakdowns that reports say are leading truck owners to tamper with the PM controls on trucks used in drayage service, where the typical duty cycle for these older trucks includes low speeds, lots of queueing and short trips that clog diesel particulate filters (DPF) designed for long-haul, high-temperature operation. Over the last decade, EPA has provided millions of dollars in Diesel Emission Reduction Act (DERA) grants nationwide to replace older diesel drayage trucks with newer, 2007+ trucks to reduce their emissions in, and adverse impacts on, port-adjacent communities; the U.S. Department of Transportation has also provided millions in funding under the Congestion Mitigation and Air Quality Improvement (CMAQ) program for the same purpose. PSCAA and local ports received over $10M of these grant funds and replaced more than 400 pre-2007 drayage trucks with 2007+ and 2010+ trucks, reducing PM2.5 by 17 tons per year and NOx by 390 tons per year. Unfortunately, the sustainability of these and other DERA- and CMAQ-funded emission reductions is in question due to the poor performance of the PM emissions controls under these duty cycles and the risk of tampering to disable the controls as a result. Had the PM standards for 2007+ engines included the more-diverse testing scenarios for meeting emissions standards and the longer warranties that are in EPA's current proposal, the public's investments would have resulted in more durable emission reductions and health benefits. [EPA-HQ-OAR-2019-0055-1232-A1, p. 5]

When EPA finalizes a HD truck rule it will mark the first time since 2001 that EPA has taken action to cut harmful NOx emissions from these vehicles. There is a clear and compelling public health need for much tighter restrictions on HD truck NOx emissions. In the past 20 years, technical capacity to reduce these emissions has flourished and tremendous experience has been gained; the opportunity to require and achieve deeper reductions in NOx emissions across the many operations is enormous. [EPA-HQ-OAR-2019-0055-1232-A1, p. 8]

In August 24, 2020, written comments to CARB,16 NACAA supported the state's proposed Heavy-Duty Omnibus Regulation, which was adopted on August 27, 2020, and ultimately finalized in December 2021, after an extensive public process that was preceded by several years of informal stakeholder input.17 The research supporting CARB's Omnibus – including research jointly funded by EPA and the California Air Resources Board and conducted by the Southwest Research Institute (SwRI) – is rigorous and the data and findings solidly supportive of the Omnibus standards. Structurally, EPA's Proposed Option 1 numeric standards are similar to the Omnibus. However, despite the affirmative data and the unyielding nationwide public heath need, the agency's Proposed Option 1 falls far short in some very critical ways, including by failing to align with the Omnibus' on a number of key provisions, including, among others, on the heavy HD NOx emission standard and interim useful life (IUL) in 2027, and by proposing important program elements that lack the stringency of the Omnibus and/or that severely erode the benefits of the numerical standards. Moreover, in some cases, which we discuss below, research and findings that have emerged since adoption of the Omnibus support even more stringent standards and approaches. EPA's Proposed Option 2 conclusively misses the mark and leaves on the table critical tons necessary for attainment, maintenance and the protection of underserved communities while being, by EPA's own analysis, less cost effective. Proposed Option 2 is inherently unacceptable in light of the CAA mandate for maximum feasible stringency in HD standard setting, as evidenced by EPA's proposal of Option 1 as a viable option. [EPA-HQ-OAR-2019-0055-1232-A1, pp. 8 - 9]

16. https://www.4cleanair.org/wp-content/uploads/Documents/NACAA_Comments-CARB_HD_NOx_Omnibus_Proposal-082420.pdf

17. https://ww2.arb.ca.gov/rulemaking/2020/hdomnibuslownox

Finally, in his August 5, 2021, Executive Order (EO), "Strengthening American Leadership in Clean Cars and Trucks,"18 President Biden, in calling upon EPA to develop this heavy-duty truck rule, states, "Given the significant expertise and historical leadership demonstrated by the State of California with respect to establishing emissions standards for light-, medium-, and heavy-duty vehicles, the Administrator of the EPA shall coordinate the agency's activities pursuant to sections 2 through 4 of this order [including establishing NOx standards for heavy-duty engines and vehicles for 2027 and later] as appropriate and consistent with applicable law, with the State of California as well as other States that are leading the way in reducing vehicle emissions, including by adopting California's standards." [EPA-HQ-OAR-2019-0055-1232-A1, p. 9]

18. https://www.whitehouse.gov/briefing-room/presidential-actions/2021/08/05/executive-order-on-strengthening-american-leadership-in-clean-cars-and-trucks/

We urge EPA to pursue this EO-directed collaboration and coordination with the states, openly and in a manner that will meaningfully contribute to the agency's ultimate decision on the final rule. In the Multi-State Medium- and Heavy-Duty Zero Emissions Vehicle Memorandum of Understanding (MOU) 17 states and the District of Columbia acknowledge the "introduction of low-NOx heavy duty trucks" as essential for reducing harmful emissions of NOx, PM and toxic air contaminants that adversely affect public health.19 This MOU establishes a ZEV sales goal under which at least 30 percent of all medium HD trucks sold in the MOU states by 2030 would be ZEVs. Five states have already individually exercised their right of self-determination under section 177 of the Clean Air Act and joined California with adoption of heavy-duty new vehicle policies.20,21,22,23,24,25 A sixth state has passed enabling legislation26 and others are considering similar bills or have taken public process steps related to regulatory development. States are also demonstrating non-regulatory leadership by taking collaborative action through efforts such as the Regional Electric Vehicle Midwest MOU with five signatories.27 We urge EPA to actively and collaboratively leverage the tremendous expertise, interest and commitment of states toward the most effective final rule in line with these efforts. [EPA-HQ-OAR-2019-0055-1232-A1, p. 9 - 10]

19. https://www.nescaum.org/documents/mhdv-zev-mou-20220329.pdf/

20. https://www.mass.gov/guides/massachusetts-low-emission-vehicle-lev-program

21. https://www.nj.gov/dep/rules/adoptions/adopt_20211220a.pdf

22. https://www.dec.ny.gov/regulations/26402.html

23. https://www.oregon.gov/deq/rulemaking/Pages/ctr2021.aspx

24. https://ecology.wa.gov/Air-Climate/Climate-change/Reducing-greenhouse-gases/ZEV

25. https://ecology.wa.gov/Regulations-Permits/Laws-rules-rulemaking/Rulemaking/WAC173-423-400Jan18

26. https://portal.ct.gov/Office-of-the-Governor/News/Press-Releases/2022/04-2022/Governor-Lamont-Applauds-Final-Passage-of-Climate-Legislation-That-Includes-New-Emissions-Standards

27. https://www.michigan.gov/-/media/Project/Websites/leo/REV_Midwest_MOU_master.pdf?rev=6dd781b5a4eb4551b3b3a5b875d67fb9

EPA includes two options in the proposal, one more stringent than the other. The agency notes that Proposed Option 1, the more stringent of the two, would come with greater public health and environmental benefits; nonetheless, as proposed, this option is insufficient. Proposed Option 2 is wholly unacceptable. NACAA supports modifications that would strengthen the overall stringency of Proposed Option 1 by aligning it with the technology-forcing mandate of the CAA. [EPA-HQ-OAR-2019-0055-1232-A1, p. 10]

When setting federal NOx emission standards for HD trucks, EPA is required, under CAA section 202(a)(3)(A), to reflect “the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy and safety factors associated with the application of such technology.” [emphasis added] [EPA-HQ-OAR-2019-0055-1232-A1, p. 10]

Just because a regulated entity is not already producing, or committing to produce, engines incorporating a particular technology does not mean that the technology does not exist or will not exist by 2027 or that standards based on that technology are not achievable by 2027 – which is over four years from today. EPA must fully comply with this statutory technology-forcing mandate. However, the agency utterly fails to do so in Proposed Option 2 and even in Proposed Option 1. [EPA-HQ-OAR-2019-0055-1232-A1, p. 10]

Although Proposed Option 1 comes closer to meeting this requirement than Proposed Option 2, Proposed Option 1 does not meet the statutory bar. Falling short is insupportable given that there are emission controls that are technologically feasible, commercially available and justified based on benefits relative to costs not only for meeting the Proposed Option 1 emission standards and deadlines, but also for meeting a cleaner 2027 standard – 20 mg/hp-hr – for heavy HD engines, and without the need for the excessive and indefensible flexibilities EPA proposes or on which the agency seeks comment (which NACAA discusses below) and which would seriously erode any emission standards finalized by EPA. Additionally, there has been more than adequate time to prepare for a substantially more rigorous federal standard; EPA and stakeholders have been aware for years that such a standard was necessary and forthcoming. Manufacturers must prepare for these MY 2027 standards across a growing number of states anyway. EPA should be leveraging the early experience with the already-final Omnibus 2024-2026 phase-in as well as the finalized 2027 Omnibus standards to the benefit of the final rule rather than ignoring the engineering and commercialization progress made in order to comply with the Omnibus in California and in other states that have adopted it. [EPA-HQ-OAR-2019-0055-1232-A1, p. 10]

EPA should revise Proposed Option 1 to pull forward to 2027 the 20 mg/hp-hr NOx emission standard for all classes with an IUL standard of 435,000 miles for heavy HD engines. [EPA-HQ-OAR-2019-0055-1232-A1, p. 10]

Importantly, as EPA reports in the NPRM, Proposed Option 1 will result in substantially superior emission, health and monetized benefits than Proposed Option 2. The agency also states, "Given the analysis we present in this proposal, we currently believe that proposed Option 1 may be a more appropriate level of stringency as it would result in a greater level of achievable emission reduction for the model years proposed, which is consistent with EPA's statutory authority under Clean Air Act section 202(a)(3)."28 While NACAA appreciates and agrees with EPA's recognition that the greater stringency of Proposed Option 1 would result in "a greater level of achievable emission reduction," we challenge the agency's statement that this "is consistent with EPA's statutory authority under Clean Air Act section 202(a)(3)." The CAA requires not a greater level of achievable emission reduction but "the greatest degree of emission reduction achievable." [emphasis added] [EPA-HQ-OAR-2019-0055-1232-A1, pp. 10 - 11]

28. Supra note 1, at 17,440

Proposed Option 2, or anything remotely similar, is entirely unacceptable and must be rejected. As discussed above, it has been demonstrated that significantly more rigorous NOx emission standards and other program requirements are feasible and cost effective for 2027 and beyond. The standards in Proposed Option 2 require virtually no effort on the part of manufacturers beyond negligible calibration adjustments and minor hardware modification – nowhere near the technology-forcing standards required by CAA section 202(a)(3)(A). Further, EPA acknowledges in the proposal that Option 2 would deliver inferior emission, health and cost benefits, thus sacrificing emission reductions and health protections sorely needed in areas struggling to attain or maintain health-based NAAQS and overburdened communities. In addition, the flexibilities EPA proposes to offer, or on which it seeks comment, that are excessive and indefensible for Proposed Option 1 are even more unjustified for Proposed Option 2. [EPA-HQ-OAR-2019-0055-1232-A1, p. 11]

Organization: *National Association of Small Trucking Companies (NASTC)*

We are well aware of the tremendous clean-air strides our transportation industry has made over the past 30 years, such as the implementation of low-sulfur fuel, the implementation of ultralow-sulfur fuel, the diminishing of idling time through the use of auxiliary power units (APUs), the implementation of catalytic converters and DEF, and a myriad of fuel efficiency practices in tires and aerodynamics. The costs of reaching these gains have been paid by trucking and, ultimately, by end-users through higher costs and inflated prices. We reject proposed, unrealistic mandates that seek the immediate replacement of fossil fuels. The subsidies for wind, solar, and battery solutions to our energy problems have documented failure after failure. “Green New Deals,” government largesse for electrification and corporate welfare, and empty billion-dollar bullet trains have not and won’t take the place of a free market-based, forward-thinking, ecofriendly evolution into using all power sources to get the job done. [EPA-HQ-OAR-2019-0055-1130-A1, p. 1]

In addition to rectifying the overly aggressive inducement and imbalanced serviceability rules that presently affect commercial motor carriers, there are other important reasons to enact the above and most of the other proposed regulatory reforms in these areas. As NASTC members and other transportation industry commenters in the ANPRM made clear, the present rules, including those relating to inducement and serviceability, cause extensive unpredictability, uncontrollability, and unduly burdensome and economically harmful effects, such as unreasonable costs and delays for truckers and supply chain disruptions for businesses and consumers. [EPA-HQ-OAR-2019-0055-1130-A1, pp. 3 - 4]

The reason for far too many of the consequences suffered under present inducement and serviceability rules is the underlying emissions standards and the highly complex, expensive equipment created in response to the mandates on newer model diesel engines and heavy-duty vehicles. [EPA-HQ-OAR-2019-0055-1130-A1, p. 4]

As welcome as regulatory relief from the status quo is regarding these respects, the underlying proposed NOx and GHG emissions reduction standards in this NPRM will certainly result in OEMs introducing even more complex, expensive diesel engines and associated systems. The mandates on OEMs will surely result in unpredicted, adverse spillover effects on commercial vehicle owners—including even more equipment unreliability, unpredictability, additional uncontrollable expenses, delays keeping truckers from productive use of time and resources, lost business, and sweeping adversity and deprivation visited upon businesses and consumers across the nation. [EPA-HQ-OAR-2019-0055-1130-A1, p. 4]

As welcome as the proposals such as more sensors, monitors, an engine “health” system, in-cab displays, etc. are, each of these novel inventions introduces additional risks of new problems, more tows and repairs, etc. We need the proposed relief just to stay even. [EPA-HQ-OAR-2019-0055-1130-A1, p. 4]

These facts cast the proposed rule as overly ambitious, particularly in light of the significant realities constraining long-haul trucking and the supply chain. These include significantly higher costs on new models, which slows turnover of older trucks, compounded parts (including semiconductor) shortages and the scale of complex technologies’ malfunctions, and throw a green monkey wrench into a highly uncertain economic situation that involves both sky-high inflation and interest rate hikes that may tip the economy into recession. Notably, semiconductor delivery time has more than doubled since the onset of the COVID pandemic and economic whipsaw. It now takes more than 26 weeks—half a 2 year—between chip order and delivery. And semiconductors are in practically every electronic device, from cell phones to toys to computers to automobiles. Thus, the net effects of the rule, under either Option 1 or Option 2, will be to increase costs and headaches for consumers, as well as motor carriers and truckers, and to underachieve on the promised health and environmental goals. [EPA-HQ-OAR-2019-0055-1130-A1, pp. 4 - 5]

2. Ian King, "Wait Times for Chips Grow Modestly in March," Transport Topics, April 5, 2022. https://www.ttnews.com/articles/wait-times-chips-grow-modestly-march

At a minimum, the proposed rule will inconvenience and at most endanger consumers while stressing the already stressed, just-in-time inventory systems and supply chains that most industrial and commercial players depend on. The rule will cause unnecessary harm to our economy in many ways. The EPA's ill-timed regulatory emissions changes come right when businesses, companies, and consumers struggle under 40-year-high inflation; interest rate increases meant to stem inflation but are as likely to overcool the economy; and business sectors including trucking experience an unusually tight labor market. At what point are the cumulative costs—to truck owners, OEMs, customers, and consumers—greater than the estimated benefits? The answer depends on how rosy one's assumptions and choice of facts and data. Let's just say that the underlying assumptions, data, and estimates employed to justify this rulemaking's emissions goals are very much rosier than are NASTC's. [EPA-HQ-OAR-2019-0055-1130-A1, p. 5]

The proposed rule would change from the present 0.2 gram per brake horsepower-hour (PBHPH), the standard as of 2010, to 0.035 gram PBHPH for model years (MY) '27-'30 and then 0.02 gram PBHPH beginning in MY '31 under Option 1 or, alternatively, to 0.05 gram PBHPH starting in MY '27. Both options set extremely ambitious goals for diesel engines in heavy-duty vehicles, such as the power units NASTC members operate in interstate commerce. The more ambitious of the two proposed alternatives is breathtaking—setting a standard an order of magnitude below the current standard. [EPA-HQ-OAR-2019-0055-1130-A1, p. 5]

This rulemaking comes amidst serious challenges detrimentally affecting the trucking sector. Supply chain stresses, component and parts shortages, tight labor markets facing certain motor carriers, and the resulting downstream effects will affect both trucking and the economy at large. Also, war in Ukraine, a lagging pandemic, tensions in China with Taiwan (home to the world's primary maker of semiconductor chips), and other stress points continue to pose problems for the global supply chain, the world economy, and national security. Together, these translate into hurdles to keeping America supplied with everything from consumer goods to manufacturers' raw materials. [EPA-HQ-OAR-2019-0055-1130-A1, pp. 6 - 7]

The COVID-19 pandemic has had a huge impact on supply chains in every industry. In trucking, this includes the global microchip shortage causing American trucking companies extreme hardship because of the unavailability of new vehicles (which makes used vehicles scarcer and more expensive) and replacement parts such as diesel exhaust fluid (DEF) sensors. [EPA-HQ-OAR-2019-0055-1130-A1, p. 7]

Nevertheless, the chip shortage affects both the availability of replacement parts for currently owned commercial vehicles and installation parts for new trucks at manufacturing plants. This is a double-edged sword that threatens the ability of many trucking businesses to remain in business. [EPA-HQ-OAR-2019-0055-1130-A1, p. 7]

The residual adverse effects of the supply chain problems and the dangerous combination of high inflation, rising interest rates (which obviously increase carriers' costs of financing truck purchases), and the probability of a slowed or receding economy will likely cause long-haul trucking to suffer. Adding the sort of ambitious proposed emissions reduction to the emerging combination will only worsen the harmful effects. This rule's emissions goals will thus make life harder on the American people, including the middle class and the environmentalists who would like even stricter emissions standards imposed on large trucks. [EPA-HQ-OAR-2019-0055-1130-A1, p. 7]

It should be remembered that trucking is vital to America's economic health.6 The serious problem at several of our busiest ports of ships waiting months for their freight to be offloaded and then transported by trucks just scratches the surface if sufficient numbers of heavy-duty diesel trucks and truck drivers are not available. Truckers who haul 80 percent of America's freight proved their essential service throughout the COVID pandemic and economic shutdowns, keeping U.S. hospitals, clinics, and medical research labs supplied and groceries, pharmacies, and retail stores and online retailers' warehouses adequately stocked—even as roadside bathrooms and restaurants became inaccessible to truckers. [EPA-HQ-OAR-2019-0055-1130-A1, p. 7]

> 6. "When Trucks Stop, America Stops," American Trucking Associations. https://www.trucking.org/sites/default/files/2019-12/When%20Trucks%20Stop%20America%20Stops.pdf

To everything that trucking touches, this proposed rule will add to its cost to consumers and business customers. Forcing long-haul trucking to bear significantly higher costs for vehicles and maintenance of more complicated engines that have novel emissions technologies, whose kinks are yet to be worked out over several product lifecycles, for instance, necessarily contributes to higher wholesaler, retailer, and consumer prices. Thus, 40-year-high inflation rates should be expected to rise higher still, in part due to this rule. This fact is already recognized by many; the rest of the American public will realize the economic costs this rule places on them very soon and very often.7 [EPA-HQ-OAR-2019-0055-1130-A1, pp. 7 - 8]

> 7. Carrie Sheffield, "Biden is waging a war on truckers and everyone will pay the price," New York Post, March 8, 2022. https://nypost.com/2022/03/08/bidens-war-on-truckers-will-makeeverything- more-expensive/

In closing, it would be most prudent to set any new heavy-duty vehicle and engine standards at more modest, reasonable emissions levels. As the current proposal stands, any cleaner air is likely to be accompanied by unintended economic consequences that could include costing jobs, families' paychecks and means of putting food on the table and gas in the tank, and our country's economic health sufficient to ensure U.S. prosperity and security. Assuming the agency will press forward with new emission reduction standards anyway, the proposed inducement and serviceability reforms would help mitigate current and future problems affecting truckers. [EPA-HQ-OAR-2019-0055-1130-A1, p. 8]

Organization: *National Parks Conservation Association (NPCA)*

The Clean Air Act (CAA) explicitly calls on EPA to promulgate emission standards for motor vehicles that 'cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare.'1 This duty applies to both the traditional air pollutants covered under this rule, (i.e., NOx), as well as to greenhouse gas (GHG) pollutants. As held by the Supreme Court in Massachusetts vs. EPA, CO2 and other GHGs qualify as air pollutants that endanger public welfare under 202(a)(1).2 EPA, thus, has an affirmative duty to develop both NOx and GHG standards for HD vehicles that reflect the 'greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply.'3 While the CAA provides some room for considerations of cost, energy, and safety,4 'it must place primary importance on achieving the greatest degree of emissions reduction.'5 It is through this mandate that we urge EPA to both finalize these heavy-duty vehicle regulations by the end of this calendar year, as well as to strengthen its proposal to achieve the greatest degree of reductions that protect public health and welfare. [EPA-HQ-OAR-2019-0055-1314-A1, pp.1-2]

1 42 U.S.C. 7521(a)(1).

2 See generally, 549 U.S. 497, 531 (2007).

3 42 U.S.C. 7521(a)(3)(A)(i).

4 Id.

5 See Husqvarna AB v. EPA, 254 F.3d 195, at 200 (D.C. Cir. 2001).

While we are pleased to see EPA moving forward with this rulemaking to control one of the largest remaining underregulated sources of air and climate pollution in the US, we believe improvements to EPA's proposal must be made to ensure the final rule is in line with the CAA's mandate that the agency enact the greatest level of emission reductions achievable to protect public health and welfare.35 First and foremost, NPCA urges EPA to move quickly to finalize this rule before the end of the calendar year to guarantee emission reductions can begin at the earliest possible date. We further ask that EPA take steps to improve upon the options provided to achieve greater NOx and GHG reductions. [EPA-HQ-OAR-2019-0055-1314-A1, p.6]

35 See Supra note 1, 3, and 5.

Of the two options proposed by EPA, NPCA supports proceeding with a final rule that is no less stringent than Option 1's 90% reduction in HD NOx emissions by 2031. However, we disagree with EPA's assessment that Option 1 provides the greatest emission reductions feasible for HD engines, and request that EPA strengthen this option to mirror the 2027 deadline for 90% HD NOx reduction, which is already required under the HD omnibus low-NOx rules adopted by

California and a growing number of additional states. We believe the omnibus rule’s 2027 date is technologically and economically feasible, especially when considering recent advances in low NOx engine technologies and the growing pace of zero-emission vehicle (ZEV) technologies, including short and long-haul HD electric vehicle (EV) advancements. Moreover, given this feasibility we believe additional stringency is required under the CAA as it is necessary to protect the health and welfare of the millions of individuals impacted by HD vehicle air pollution. [EPA-HQ-OAR-2019-0055-1314-A1, p.6]

NPCA strongly opposes Option 2, which achieves only a 75% reduction in NOx emissions from HD vehicles and would result in far more emissions compared to Option 1 between 2027-2050. In 2045 alone, Option 2 would result in 120,000 tons more NOx than Option 1 and achieve only a 47% reduction in NOx emissions from the baseline, compared to Option 1’s 61% reduction.36 This option is an obvious giveaway to industry and is inadequate to protect health and welfare. There is more than sufficient lead time to require a more stringent standard than Option 2. Moreover, EPA itself states that Option 1 is technologically feasible, thus it would be arbitrary and capricious and a violation of EPA’s mandate under CAA 202(a)(3)(A)(i) to push through standards that weigh technological obstacles and economic costs to industry over public welfare. [EPA-HQ-OAR-2019-0055-1314-A1, pp.6-7]

36 87 Fed. Reg. at 17,579.

We strongly encourage EPA move quickly to improve upon the NOx reductions proposed under Option 1 and require additional GHG reductions under the Phase II standards. [EPA-HQ-OAR-2019-0055-1314-A1, pp.7-8]

Organization: *National Propane Gas Association (NPGA) and Propane Education & Research Council (PERC)*

In response to the agency’s request for industry feedback, Option 1 of the proposal presents the most advantageous scenario for the propane industry to assist the agency in meeting its GHG and criteria pollutant reduction goals.6 Our research on the currently available propane engine equipment and future progress indicates the timelines suggested under Option 1 are feasible for the industry. Current generation propane engines are certified to the California Optional Low NOx standard,7 which is the same as the 0.02g brake horsepower hour (g/bhp-hr) standard EPA proposed for MY 2031 and later medium and heavy-duty engines. [EPA-HQ-OAR-2019-0055-1263-A1, p.2]

6 Supra note 1, at 17422.

7 Press Release, Power Solutions International, Power Solutions International 8.8-liter Ultra-Low NOx Propane Engine Receives EPA Certification (Oct. 21, 2020), https://psiengines.com/power-solutions-international-8-8-liter-ultra-low-nox-propane-engine-receives-epa-certification/; see also CARB Certifies Next-Generation Propane Engine in Blue Bird School Buses to Lowest NOx in Market, BUSINESSWIRE (Jan. 18, 2022), https://www.businesswire.com/news/home/20220118005991/en/CARB-Certifies-Next-Generation-Propane-Engine-in-Blue-Bird-School-Buses-to-Lowest-NOx-in-Market.

Organization: *National Tribal Air Association (NTAA)*

Option 1 in Section IX clearly is preferable to Option 2 and would more closely reflect that which is as clean as possible with respect to nitrogen oxide emissions reductions. [EPA-HQ-OAR-2019-0055-1382-A2, p.2]

Organization: *Natural Gas Vehicles for America (NGVAmerica)*

We support the setting of more stringent standards but believe that tighter standards do not necessarily translate directly to significant reductions in emissions or cleaner air where it is most needed. Other factors such as vehicle miles traveled, life of vehicles in service, and fleet turnover, and where and how vehicles are deployed are also very important. We encourage EPA to ensure that other programs intended to affect these issues also allow for flexibility and encourage a variety of available, scalable, and cost-effective technologies. [EPA-HQ-OAR-2019-0055-1330-A1, p.2]

NGVAmerica and its members submit the following recommendations for policies and programs that the EPA and other federal agencies can advance to encourage the use of cleaner trucks.

5) Implement proposed new test cycles and conditions for verifying emissions that are performance based and technology neutral; these test cycles should reflect the real use of vehicles. [EPA-HQ-OAR-2019-0055-1330-A1, p.13]

Organization: *Navistar, Inc. (Navistar)*

In particular, we support: Reducing NOx emissions from HDOH vehicles beginning in MY 2027 by setting feasible standards with adequate compliance margins and no negative fuel efficiency impacts; [EPA-HQ-OAR-2019-0055-1318-A1, p. 2]

In particular, we support: A single national rule with the broadest support; [EPA-HQ-OAR-2019-0055-1318-A1, p. 3]

In particular, we support: Alignment with existing OBD, inducements and compliance levels; and [EPA-HQ-OAR-2019-0055-1318-A1, p. 3]

Navistar supports EPA's rulemaking objectives to: "(1) control emissions over a broader range of operating conditions; (2) maintain emissions control over a greater portion of an engine's operational life; and (3) provide manufacturers with flexibilities to meet the proposed standards." 87 Fed. Reg. at 17420-21. However, EPA's analysis, which focuses on whether a specific provision or proposed standard is technically feasible, fails to capture the magnitude and severity of EPA's proposed rule. EPA's proposal represents a fundamental change to all aspects of the HDOH diesel-emissions control program. The proposed rule includes a 90% reduction of the applicable NOx standard, a new certification test procedure for operating modes not previously regulated, a stringent new in-use emissions protocol, significant increases to the mileage over which compliance will be required, and extended useful life and warranty requirements. When taken together, these changes undercut EPA's claims of feasibility. [EPA-HQ-OAR-2019-0055-1318-A1, p. 3]

EPA is requesting comment on whether "a margin between the demonstrated emissions performance and the proposed standards should be included, and, if so, what that value should be." 87 Fed. Reg. at 17471. Navistar, like other manufacturers, designs our engines to perform significantly better than the NOx compliance standards when first sold in order to ensure that the emissions are below the standard throughout useful life, even as the emissions controls deteriorate. Compliance margins, which allow manufacturers to show compliance with increasingly stringent NOx standards, typically range from less than 25 percent to 100 percent of the family emission limit ("FEL"). See 87 Fed. Reg. at 17467. Compliance margins are necessary to account for production, fuel and emissions-testing variabilities, real-world operating conditions, and for the expected emissions deterioration over the proposed lengthened full useful life periods of HDOH engines. [EPA-HQ-OAR-2019-0055-1318-A1, p. 3]

Navistar agrees with EPA's statements on the importance of compliance margins. Specifically, that "manufacturers generally aim to design and build vehicles not only with a sufficient margin to ensure the emissions control technology is meeting the applicable standards throughout the full useful life, but also an additional margin to reflect the fact that not every vehicle manufactured and every vehicle application will perform identically to the laboratory tests." 87 Fed. Reg. at 17564. EPA noted that a compliance margin "is particularly important, and challenging for manufacturers, when new technologies and test procedures are being implemented." Id. (emphasis added). [EPA-HQ-OAR-2019-0055-1318-A1, p. 3]

Navistar supports EPA's adoption of the proposed Option 2 NOx certification standard of 50 mg/hp-hr beginning in MY 2027, provided that in the final rule EPA set higher interim in-use standards for NOx (i.e., using a 2x conformity factor as opposed to a 1.5x conformity factor). This approach is consistent with EPA setting "interim in use standards to account for uncertainties about potential variabilities in performance during the early years of implementing new technology." 87 Fed. Reg. at 17564. It also addresses the compliance margin considerations discussed above. Notably, in the proposed rule, EPA sought comment on "providing engine manufacturers with higher (numerical) standards for an interim period to gain experience with the additional emissions control technologies needed to meet the proposed Heavy HDE standards (and their rates of deterioration) while those technologies are operating in the field." 87 Fed. Reg. at 17563. [EPA-HQ-OAR-2019-0055-1318-A1, p. 4]

Organization: *North Carolina Assembly House of Representatives, John Faircloth*

The commercial vehicle sector literally drives the American economy. As you well know, trucks move first responders on critical missions, deliver all goods and services to consumers, and serve as an integral component to the rebuilding of American infrastructure. The production, sale, service, and operation of these vehicles also provides quality, high-paying jobs to hundreds of thousands of American workers. [EPA-HQ-OAR-2019-0055-2446, p. 1]

As you know, North Carolina – your home state and ours – has the largest concentration of commercial vehicle companies, suppliers and employees in America. Therefore, we are especially interested in the continued success of this critical sector. [EPA-HQ-OAR-2019-0055-2446, p. 1]

That is why we write today: we are concerned that the proposed rule from EPA on tailpipe emissions from heavy-duty trucks as part of the “Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards,” may not be technologically feasiable. That means Original Equipment Makers(OEMs) will spent hundreds of millions of dollars chasing at worst an unattainable standard, and at best a costy standard, rather than strategically deploying critical resources on proven technologies. [EPA-HQ-OAR-2019-0055-2446, p. 1]

We share your commitment to the environment and applaud the accomplishments already achieved by commercial vehicle manufacturers to reduce nitrogen oxides (NOx) emissions from heavy-duty trucks. We support the ongoing efforts for cleaner air and healthier communities for all. But we also recognize the importance of preserving – not effectively dismantling through higher costs and wasted expenditures –this critical industry. [EPA-HQ-OAR-2019-0055-2446, pp. 1 - 2]

We urge you to amend the proposed rule so that it reduces emissions, protects American jobs, and results in cleaner air and healthier communities for all. To be effective, the final rule must be customer-acceptable, economically viable, environmentally beneficial, and a bridge to a zero-emissions future. [EPA-HQ-OAR-2019-0055-2446, p. 2]

Organization: *North Carolina General Assembly, Philip E. Berger*

Simply put, the commercial vehicle sector literally drives the American economy. As you well know, trucks move first responders on critical missions, deliver all goods and services to consumers, and serve as an integral component to the rebuilding of American infrastructure. The production, sale, service, and operation of these vehicles also provides quality, high-paying jobs to hundreds of thousands of American workers. [EPA-HQ-OAR-2019-0055-1105-A1, p. 1]

As you know, North Carolina - your home state and ours - has the largest concentration of commercial vehicle companies, suppliers and employees in America. Therefore, we are especially interested in the continued success of this critical sector. [EPA-HQ-OAR-2019-0055-1105-A1, p. 1]

That is why we write today: we are concerned that the proposed rule from EPA on tailpipe emissions from heavy-duty trucks as part of the "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards," has not been demonstrated to be technologically feasiable. That means Original Equipment Makers (OEMs) will spent hundreds of millions of dollars chasing at worst an unattainable standard, and at best a costy standard, rather than strategically deploying critical resources on proven technologies. [EPA-HQ-OAR-2019-0055-1105-A1, p. 1]

We are also concerned about the proposed rules attempts to add new certification, warranty and useful life requirements to zero emission vehicles. This will add cost to ZEV and delay their deployment. [EPA-HQ-OAR-2019-0055-1105-A1, p. 1]

We share your commitment to the environment and applaud the accomplishments already achieved by commercial vehicle manufacturers to reduce nitrogen oxides (NOx) emissions from heavy-duty trucks. We support the ongoing efforts for cleaner air and healthier communities for all. But we also recognize the importance of preserving - not effectively dismantling through higher costs and wasted expenditures - this critical industry. [EPA-HQ-OAR-2019-0055-1105-A1, p. 1]

We urge you to amend the proposed rule so that it reduces emissions, protects American jobs, and results in cleaner air and healthier communities for all. To be effective, the final rule must be: Customer-acceptable. If truck owners and operators choose not to purchase new trucks due to cost or reliability concerns that result from a bad federal rule, older trucks will stay on the roads longer and environment goals will not be achieved. [EPA-HQ-OAR-2019-0055-1105-A1, p. 2]

To be effective, the final rule must be: Economically viable. If the final rule results in higher costs for manufacturers and fleet owners, manufacturers and small business owners may have no choice but to lay off workers and eliminate jobs. [EPA-HQ-OAR-2019-0055-1105-A1, p. 2]

To be effective, the final rule must be: Environmentally beneficial. An unworkable rule will delay fleet turnover and prevent environmental progress, creating greater harm in communities most at-risk for high air pollution. [EPA-HQ-OAR-2019-0055-1105-A1, p. 2]

To be effective, the final rule must be: A bridge to a zero-emissions future. The final rule must not prevent continued progress toward zero-emissions commercial vehicles by forcing excessive, costly redesigns of traditional combustion engines at the expense of investments in the research and development of zero emissions vehicles, nor add cost to these new technologies. [EPA-HQ-OAR-2019-0055-1105-A1, p. 2]

Organization: *North Carolina House of Representatives, Office of the Speaker, Tim Moore*

Simply put, the commercial vehicle sector literally drives the American economy. As you well know, trucks move first responders on critical missions, deliver all goods and services to consumers, and serve as an integral component to the rebuilding of American infrastructure. The production, sale, service, and operation of these vehicles also provides quality, high-paying jobs to hundreds of thousands of American workers. [EPA-HQ-OAR-2019-0055-1146-A1, p. 1]

As you know, North Carolina -your home state and ours - has the largest concentration of commercial vehicle companies, suppliers and employees in America. Therefore, we are especially interested in the continued success of this critical sector. [EPA-HQ-OAR-2019-0055-1146-A1, p. 1]

That is why we write today: we are concerned that the proposed rule from EPA on tailpipe emissions from heavy-duty trucks as part of the "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards," has not been demonstrated to be technologically feasiable. That means Original Equipment Makers (OEMs) will spent hundreds of millions of dollars chasing at worst an unattainable standard, and at best a costy standard, rather than strategically deploying critical resources on proven technologies. [EPA-HQ-OAR-2019-0055-1146-A1, p. 1]

We are also concerned about the proposed rules attempts to add new certification, warranty and useful life requirements to zero emission vehicles. This will add cost to ZEV and delay their deployment. [EPA-HQ-OAR-2019-0055-1146-A1, p. 1]

We share your commitment to the environment and applaud the accomplishments already achieved by commercial vehicle manufacturers to reduce nitrogen oxides (NOx) emissions from heavy-duty trucks. We support the ongoing efforts for cleaner air and healthier communities for all. But we also recognize the importance of preserving - not effectively dismantling through higher costs and wasted expenditures - this critical industry. [EPA-HQ-OAR-2019-0055-1146-A1, p. 1]

We urge you to amend the proposed rule so that it reduces emissions, protects American jobs, and results in cleaner air and healthier communities for all. To be effective, the final rule must be: Customer-acceptable. If truck owners and operators choose not to purchase new trucks due to cost or reliability concerns that result from a bad federal rule, older trucks will stay on the roads longer and environment goals will not be achieved. [EPA-HQ-OAR-2019-0055-1146-A1, pp. 1 - 2]

To be effective, the final rule must be: Economically viable. If the final rule results in higher costs for manufacturers and fleet owners, manufacturers and small business owners may have no choice but to lay off workers and eliminate jobs. [EPA-HQ-OAR-2019-0055-1146-A1, p. 2]

To be effective, the final rule must be: Environmentally beneficial. An unworkable rule will delay fleet turnover and prevent environmental progress, creating greater harm in communities most at-risk for high air pollution. [EPA-HQ-OAR-2019-0055-1146-A1, p. 2]

To be effective, the final rule must be: A bridge to a zero-emissions future. The final rule must not prevent continued progress toward zero-emissions commercial vehicles by forcing excessive, costly redesigns of traditional combustion engines at the expense of investments in the research and development of zero emissions vehicles, nor add cost to these new technologies. [EPA-HQ-OAR-2019-0055-1146-A1, p. 2]

Organization: *North Carolina State House of Representatives, Larry W. Potts*

The commercial vehicle sector literally drives the American economy. As you well know, trucks move first responders on critical missions, deliver all goods and services to consumers, and serve as an integral component to the rebuilding of American infrastructure. The production, sale, service, and operation of these vehicles also provides quality, high-paying jobs to hundreds of thousands of American workers. [EPA-HQ-OAR-2019-0055-1061-A1, p. 1]

As you know, North Carolina -your home state and ours - has the largest concentration of commercial vehicle companies, suppliers and employees in America. Therefore, we are especially interested in the continued success of this critical sector. [EPA-HQ-OAR-2019-0055-1061-A1, p. 1]

That is why we write today: we are concerned that the proposed rule from EPA on tailpipe emissions from heavy-duty trucks as part of the "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards," may not be technologically feasiable. That means Original Equipment Makers (OEMs) will spent hundreds of millions of dollars chasing at worst an unattainable standard, and at best a costy standard, rather than strategically deploying critical resources on proven technologies. [EPA-HQ-OAR-2019-0055-1061-A1, p. 1]

We are also concerned about the proposed rules attempts to add new certification, warranty and useful life requirements to zero emission vehicles. This will add cost to ZEV and delay their deployment. [EPA-HQ-OAR-2019-0055-1061-A1, p. 1]

We share your commitment to the environment and applaud the accomplishments already achieved by commercial vehicle manufacturers to reduce nitrogen oxides (NOx) emissions from heavy-duty trucks. We support the ongoing efforts for cleaner air and healthier communities for all. But we also recognize the importance of preserving - not effectively dismantling through higher costs and wasted expenditures - this critical industry. [EPA-HQ-OAR-2019-0055-1061-A1, pp. 1 - 2]

We urge you to amend the proposed rule so that it reduces emissions, protects American jobs, and results in cleaner air and healthier communities for all. To be effective, the final rule must be customer acceptable, economically viable, environmentally beneficial, and a bridge to a zero-emissions future. [EPA-HQ-OAR-2019-0055-1061-A1, p. 2]

Organization: *North Central Texas Council of Governments (NCTCOG)*

EPA’s Option 1 is the preferred proposal that, if achievable, can result in significant emission reductions and health benefits. Option 1 approaches reductions in a faster timeframe and remains sensitive to multi-pollutant impacts, including particulate matter (PM). For the Dallas-Fort Worth (DFW) nonattainment area under two ozone standards (see graph below), emissions reductions need to occur as soon as possible. [EPA-HQ-OAR-2019-0055-1254-A2, p.2]

The North Central Texas Council of Governments (NCTCOG) observes that the proposed and significantly lower NOx engine standards will be difficult to achieve and maintain for diesel engines due to literature suggesting diesel vehicles operating in real world environments with current technologies are unable to meet existing 0.2 g/bhp-hr NOx standards. A 2019 EPA report1 covering the Motor Vehicle Emission Simulator (MOVES) model points out that selective catalyst reduction (SCR) technology, when employed at low speeds in real world operations, did not achieve the NOx reduction that the Model Year 2010 diesel emissions standard intended. When a diesel vehicle is traveling on nonfreeway facilities, such as arterials, collectors, and local streets, the diesel engine is experiencing low temperatures at which current technologies are unable to function properly. In addition, when a diesel vehicle is on the freeway in either recurring congested conditions or within a non-recurring situation (i.e., crash or accident) the diesel engine experiences low temperatures and, therefore, excessive emissions.

The two graphics below from EPA's MOVES model show that when diesel engine equipped trucks are experiencing speeds below approximately 35 mph, their emission rates significantly increase. These conditions are more likely to occur around neighborhoods and heavily populated areas, compounding local health impacts. [EPA-HQ-OAR-2019-0055-1254-A2, pp.2-3]

> 1 U.S. EPA. Updates to MOVES Heavy Duty Running Exhaust Rates: Diesel, Gasoline, and Natural Gas. https://www.epa.gov/sites/production/files/2019-06/documents/04-updates-hd-running-exhaust-rates- 2019-04-10.pdf.

(Please note that the Heavy-Duty Diesel Truck (HDDT) in the graphs below is the Combination Long-Haul Truck (Diesel) vehicle type in the EPA's MOVES model.) Proposed lower standards need to have Original Equipment Manufacturers' (OEM) buy-in to develop appropriate technologies, and the certification rules on these technologies need to take into account real-world operating conditions so outcomes in the lab are reflected in the environment. [EPA-HQ-OAR-2019-0055-1254-A2, p.3]

Organization: *Northeast States for Coordinated Air Use Management (NESCAUM)*

Given the urgent need to reduce NOx emissions from heavy-duty vehicles to improve public health and air quality, we strongly encourage EPA to finalize model year 2027 engine NOx emission limits equivalent to those in the California Air Resources Board (CARB)'s Heavy-Duty Omnibus Regulation. The Clean Air Act requires ozone NAAQS attainment "as expeditiously as practicable," and EPA's proposed Options 1 and 2 do not meet this requirement. Since the introduction of EPA's 2007/2010 heavy-duty engine emissions standards, there have been significant technology advances that provide a foundation for reducing NOx emissions a further 90 percent beyond current standards. To do this, manufacturers can introduce hardware upgrades and new aftertreatment systems that, while significant, build upon the architecture of current emissions control systems. Manufacturers will have ample time to integrate new technologies into heavy-duty engines assuming standards will be implemented for model year 2027 engines and vehicles. [EPA-HQ-OAR-2019-0055-1249-A1, p. 9]

We note that the Clean Air Act is a "technology forcing" statute in which Congress clearly intended to pull technology forward, rather than wait for technology to advance before setting future requirements.26 Even if the technology feasibility record was less robust, and it is already quite robust, it would be contrary to congressional intent to promulgate a NOx limit that aims low. The introduction of readily foreseeable effective and available heavy-duty engine and vehicle pollution reduction technologies capable of achieving a 0.02 gram NOx standard in MY 2027 will assist jurisdictions in the NESCAUM region to reach attainment of the ozone standards. This is the most "expeditiously as practicable" path called for by the Clean Air Act and anything less than this will not be acceptable.[EPA-HQ-OAR-2019-0055-1249-A1, pp. 9 - 10.]

> 26. See Krier. J.E.; Ursin, E., "Pollution and Policy: A Case Essay on California and Federal Experience with Motor Vehicle Air Pollution 1940–1975," University of California Press: Berkeley, CA, 1977, quoting Sen. Edmund Muskie of Maine during debate on 1970 Clean Air Act: The first responsibility of Congress is not the making of

> technological or economic judgments—or even to be limited by what is or appears to be technologically feasible. Our responsibility is to establish what the public interest requires to protect the health of persons. This may mean that people and industries will be asked to do what seems to be impossible at the present time. But if health is to be protected, these challenges must be met.

We strongly oppose Option 2 in EPA's proposal. EPA is proposing to establish an FTP and SET standard of 50 milligrams or 0.05 g/bhp-hr for 2027 and subsequent model year engines. Technical analyses demonstrate that substantially more stringent NOx controls are feasible and cost effective for model year 2027 and subsequent heavy-duty engines and vehicles than would be required under this option. Certification data from current model year engines show that mass NOx emissions from some engines are already close to the level proposed for the Option 2 FTP and SET NOx standards for model year 2027 and later engines.45,46,47 The standards proposed for Option 2 would only require minor calibration adjustments and minimal hardware modification. Further, EPA's own analysis found that Option 2 is less cost effective than Option 1. Option 2 will not deliver the needed emissions reductions in Overburdened Communities or provide sufficient assistance to states in attaining the ozone NAAQS and would leave substantial and cost-effective NOx reductions on the table. [EPA-HQ-OAR-2019-0055-1249-A1, p. 16]

> 45. CARB Executive Order A-242-0139, "Volvo Group Trucks Technology," (FTP of 0.06 g/bhp-hr, SET of 0.04 g/bhp-hr), January 3, 2020, see https://ww3.arb.ca.gov/msprog/onroad/cert/mdehdehdv/2020/volvogrouptrucks_hhdd_a2420139_12d8_0d20-0d01.pdf (accessed April 25, 2022).
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> 46. CARB Executive Order A-021-0723, Cummins engine family MCEXH0912XCA (FTP of 0.07 g/bhp-hr, SET of 0.03 g/bhp-hr), see "New Vehicle and Engine Certification: Executive Orders for MY2021 Medium-Duty and Heavy-Duty Engines" at https://ww2.arb.ca.gov/new-vehicle-and-engine-certification-executive-orders-my2021-medium-duty-and-heavy-duty-engines (accessed April 25, 2022).
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> 47. CARB Executive Order A-290-0168-1, Detroit Diesel Corporation engine family KDDXH12.8FED (FTP of 0.06 g/bhp-hr, SET of 0.02 g/bhp-hr), see "New Vehicle and Engine Certification: Executive Orders for MY2019 Medium-Duty and Heavy-Duty Engines" at https://ww2.arb.ca.gov/new-vehicle-and-engine-certification-executive-orders-my2019-medium-duty-and-heavy-duty-engines (accessed April 25, 2022).

Organization: *NTEA - The Association for the Work Truck Industry*

The EPA recently proposed regulations that could add as much as $40,000 to the cost of a new truck. The proposed regulations aim to further reduce NOx (nitrogen oxides) emissions from heavy duty engines and possibly set more stringent greenhouse gas (GHG) emissions. [EPA-HQ-OAR-2019-0055-1164-A1, p. 2]

Currently, heavy duty truck emissions are 98% cleaner than in 2010 and truck manufacturers are diligently working on the development of ZEV's (zero emission vehicles) that will eliminate tailpipe emissions. [EPA-HQ-OAR-2019-0055-1164-A1, p. 2]

NTEA opposes the EPA's first, and most expensive, option which would take a two-phased approach to reach its goal NOx emissions by 2031. The proposal would increase the regulatory useful life of a truck from 435,000 miles to 800,000 and increase the emissions warranty by 500% from 100,000 to 600,000 miles by 2031. [EPA-HQ-OAR-2019-0055-1164-A1, p. 2]

The second option under consideration is a single-step, 75% reduction in remaining NOx emissions by 2027, with a 38% increase in the useful life period (from 435,000 to 600,000 miles) and a 250% increase in the emission warranty period (from 100,000 to 350,000 miles). [EPA-HQ-OAR-2019-0055-1164-A1, p. 2]

According to engine manufacturers, the California-like option 1 is currently not technologically feasible. [EPA-HQ-OAR-2019-0055-1164-A1, p. 2]

EPA should focus on Option 2, which is challenging, but working with truck chassis and engine manufacturers to further modify the proposal it could form the basis for a workable national rule. [EPA-HQ-OAR-2019-0055-1164-A1, p. 2]

Organization: *Our Children's Trust*

EPA must set stronger NOx, PM, and CO2 standards for heavy duty trucks, and other combustion engines, beginning in model year ("MY") 2027, that tracks with and signals the end of production and sales of the internal combustion engine by 2030. [EPA-HQ-OAR-2019-0055-1317-A1, p.3]

Organization: *Owner-Operator Independent Drivers Association (OOIDA)*

Clean air is a priority for everyone, including truckers, but the technology used in heavy-duty trucks to improve air quality has to be affordable and reliable. Small-business truckers and owner-operators should not be used as trial cases for testing new technology, while getting priced out of business in the process. Unfortunately, each of the proposed timelines to achieve nitrogen oxides (NOx) emissions reductions leave us wondering if the same mistakes from previous rulemakings will be repeated. [EPA-HQ-OAR-2019-0055-1266-A1, p.2]

EPA must consider a more feasible implementation timeline that would provide reliable and affordable heavy-duty vehicles for consumers, particularly small trucking businesses and individual owner-operators. We believe there is a more realistic path forward to reducing commercial vehicle emissions that involves listening to the men and women of the trucking industry. EPA should continue seeking out feedback from these stakeholders as the agency develops any final rule. Truckers know all too well that poorly implemented regulations will result in breakdowns, downtime, and ultimately set back the goal of achieving cleaner air. [EPA-HQ-OAR-2019-0055-1266-A1, p.2]

As currently proposed, both option 1 and option 2 introduced in the NPRM fail also fail to provide adequate production timelines to ensure vehicle reliability for motor carriers. Again, other hurried emissions timelines have led to breakdowns, downtime, and ultimately set back the goal of achieving cleaner air. [EPA-HQ-OAR-2019-0055-1266-A1, p.5]

As an initial matter, EPA is required under the Clean Air Act to consider "cost, energy and safety factors" in proposing standards of emissions for new heavy-duty motor vehicles or engines. As referenced in the NPRM: "Under CAA section 202(a)(3)(A), standards for emissions of NOx, PM, HC, and CO emissions from heavy-duty vehicles and engines are to 'reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology.'" Id. at 17420. [EPA-HQ-OAR-2019-0055-1266-A1, p.8]

42 U.S.C. §7521(a)(2) provides that "[a]ny regulation prescribed under paragraph 1 … shall take effect after such period as the administrator finds necessary to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance within such period." Id. The "cost of compliance" criteria in 42 U.S.C. §7521(a)(2) apply to users of new motor vehicles or engines, i.e., in addition to manufacturers. See, e.g., American Trucking Associations, Inc. v. E.P.A., 600 F. 3d 624, 629 (D.C. Cir. 2010) (considering national trucking association's challenge to EPA's approval of California emissions rule for failure to give "appropriate consideration to cost of compliance" under 42 U.S.C. §7521(a)(2)). [EPA-HQ-OAR-2019-0055-1266-A1, pp.8-9]

Organization: *Ozone Transport Commission (OTC) and Mid-Atlantic/Northeast Visibility Union (MANE-VU)*

Absent adoption of stringent new engine NOx standards, emissions from HDVs will increase in future years as truck vehicle miles traveled (VMT) grows. The Federal Highway Administration (FHWA) projects that HDV ton miles travelled will increase by more than 30 percent over the next 25 years, as shown in Figure 4. This growth, if not counteracted by increased stringency of new engine emissions standards, will result in a significant increase in heavy-duty truck emissions. [EPA-HQ-OAR-2019-0055-1250-A1, p.7]

We also note that highway trucks often travel long distances and can be registered in states far from where they operate. Therefore, a strong national program is needed to reduce highway truck emissions and maximize public health benefits in the OTR and nationally. [EPA-HQ-OAR-2019-0055-1250-A1, p.7]

Because of the importance of HDVs to air quality and public health in the OTR, in 2019, the OTC requested that EPA make the Cleaner Trucks Initiative one of its most urgent priorities.12 In February of 2020, the OTC and MANE-VU provided comments on EPA's Advanced Notice of Proposed Rulemaking calling on EPA to set emission standards for heavy-duty vehicles at 90 percent below the current standard and to harmonize with the California Omnibus regulation.13 In June of 2020, the OTC sent a letter to EPA calling on the Agency to expeditiously propose a heavy-duty engine NOx standard 90 percent below current levels.14 And in October of 2021, the OTC Mobile Sources Committee wrote to the EPA Administrator and to the Council on Environmental Quality asking EPA to act expeditiously to set stronger standards for heavy-duty engines and vehicles.15 EPA's response to a 2016 petition joined by a number of the OTC states recognized the importance of NOx emission reductions for the OTC region and across the country.16 In addition, EPA's Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles –Phase 2 final regulation also detailed the importance of NOx reductions to the Northeast and Mid-Atlantic regions, stating that: EPA received compelling letters and comments from [NACAA, NESCAUM, OTC, and SCAQMD], explaining the critical and urgent need to reduce NOx emissions that significantly contribute to ozone and fine particulate air quality problems in their represented areas. The comments describe the challenges many areas face in meeting both the 2008 and recently strengthened 2015 ozone NAAQS. These organizations point to the significant contribution of heavy-duty vehicles to NOx emissions in their areas.17 [EPA-HQ-OAR-2019-0055-1250-A1, pp.8-9]

12 OTC letter to A. Wheeler, EPA Administrator, re: Cleaner Trucks Initiative, August 28, 2019. Available at https://otcair.org/upload/Documents/Correspondence/EPA%20NOx%20Letter.pdf.

13 OTC comments to EPA on its Advance Notice of Proposed Rulemaking entitled 'Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine Standards,' February 20, 2020. Available at https://otcair.org/upload/Documents/Correspondence/OTC-MANEVU CTI ANPR comments 20200220 final.pdf.

14 OTC letter to A. Wheeler, EPA Administrator, re: expeditious development of NPRM, June 3, 2020. Available at https://otcair.org/upload/Documents/Correspondence/20200603 OTC Letter to EPA MHDV NOx.pdf.

15 OTC letter to M. Regan, EPA Administrator, and A. Brown, CEQ Senior Director for Transportation Emissions, October 22, 2021. Available at https://otcair.org/upload/Documents/Correspondence/OTC%20letter%20to%20EPA%20CEQ%20re%20HDV%20NOx%20standards%2020211022.pdf.

16 U.S. EPA, 'Memorandum in Response to Petition to EPA for Rulemaking to Adopt Ultra Low NOx Exhaust Emission Standards for On-Road Heavy-Duty Trucks and Engines,' December 20, 2016. Available at https://www.epa.gov/sites/production/files/2016-12/documents/nox-memorandum-nox-petition-response-2016-12-20.pdf. Accessed April 25, 2022.

17 81 Fed. Reg. 73478 (Oct. 25, 2016), at 73523.

Emission standards for medium- and heavy-duty trucks were last finalized in 2001, more than 20 years ago. Since then, extensive experience in implementation and monitoring has provided a substantial body of evidence supporting more stringent standards over the Federal Test Procedure (FTP), Supplemental Emissions Test (SET), and Ramped Modal Cycle (RMC). [EPA-HQ-OAR-2019-0055-1250-A1, p.12]

Advanced catalyst formulations, passive and active thermal management strategies, approaches to reducing pumping losses, engine calibration and hardware changes, and electrification are examples of technologies that can be used to substantially reduce NOx emissions while maintaining carbon dioxide emissions at levels required by the Phase 2 heavy-duty greenhouse gas (GHG) standards. Some of these technologies will most likely be explored prior to model year 2027 to meet the EPA Phase 2 GHG and California Air Resources Board (CARB) 2024 Low NOx programs. [EPA-HQ-OAR-2019-0055-1250-A1, p.13]

Heavy-Duty Engine NOx Standards in 2027: Given the urgent need to reduce NOx emissions from heavy-duty vehicles to improve public health and air quality, we strongly encourage EPA to finalize NOx emission limits equivalent to those in the CARB Heavy-Duty Omnibus Regulation. Specifically, OTC supports the adoption of a 0.020 gram NOx engine standard in 2027 at intermediate useful life and a 0.035 gram NOx standard at full useful life, as specified in CARB's Omnibus regulation. There is ample data from CARB, EPA, and other research programs that support the feasibility of introducing a 0.020 gram NOx standard at intermediate useful life in 2027. 22,23,24,25,26,27 [EPA-HQ-OAR-2019-0055-1250-A1, p.13]

> 22 Manufacturers of Emission Controls Association, 'Technology Feasibility for Heavy-Duty Diesel Trucks in Achieving 90% Lower NOx Standards in 2027,' February, 2020. Available at https://www.meca.org/wp-content/uploads/resources/MECA_2027_Low_NOx_White_Paper_FINAL.pdf. Accessed May 4, 2022.
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> 23 Southwest Research Institute, 'Update on Heavy-Duty Low NOx Demonstration Programs at SwRI,' November 2019. Available at https://ww3.arb.ca.gov/msprog/hdlownox/files/workgroup_20190926/guest/swri_hd_low_nox_demo_programs.pdf. Accessed May 12, 2022.
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> 24 Sharp, C.; Neely, G.; Rao, S.; Zaval, B., 'An Update on Continuing Progress Towards Heavy-Duty Low NOx and CO2 in 2027 and Beyond,' Southwest Research Institute, WCX, Detroit, Michigan, April 5-7, 2022.
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> 25 U.S. EPA, 'Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards Draft Regulatory Impact Analysis,' EPA-420-D-22-001, March 2022. Available at https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10144K0.pdf. Accessed May 12, 2022.
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> 26 Achates Power, 'Heavy Duty Opposed Piston Engine Demonstration,' CRC Real World Emissions Workshop, March 15, 2022.
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> 27 Mendoza Villafuerte, P.; Demuynck, J.; Bosteels, D., 'Ultra-Low NOx Emissions with a Close-Coupled Emission Control System on a Heavy-Duty Truck Application,' Society of Automotive Engineers, September 21, 2021. Available at https://www.aecc.eu/wp-content/uploads/2021/09/2021-01-1228.pdf. Accessed April 25, 2022.

Proposed Option 2: We strongly oppose Option 2 in EPA's proposal. Technical analyses demonstrate that substantially more stringent NOx controls are feasible and cost effective for model year 2027 and later heavy-duty engines and vehicles than would be required under this option. Certification data from current model year engines show that mass NOx emissions from some engines are close to the level proposed for the Option 2 FTP and SET NOx standards for model year 2027 and later engines.41,42,43 The standards proposed for Option 2 would only require minor calibration adjustments and minimal hardware modification. Further, EPA's own analysis found that Option 2 is less cost effective than Option 1. Option 2 will not deliver the needed emissions reductions in Overburdened Communities or provide sufficient assistance to states in attaining the ozone NAAQS and would leave substantial and cost-effective NOx reductions on the table. [EPA-HQ-OAR-2019-0055-1250-A1, p.17]

41 CARB Executive Order A-242-0139, 'Volvo Group Trucks Technology,' (FTP of 0.06), January 3, 2020, at https://ww3.arb.ca.gov/msprog/onroad/cert/mdehdehdv/2020/volvogrouptrucks_hhdd_a2420139_12d8_0d20-0d01.pdf. Accessed April 25, 2022.

42 CARB Executive Order A-021-0723, Cummins engine family MCEXH0912XCA (FTP of 0.07), see 'New Vehicle and Engine Certification: Executive Orders for MY2021 Medium-Duty and Heavy-Duty Engines' at https://ww2.arb.ca.gov/new-vehicle-and-engine-certification-executive-orders-my2021-medium-duty-and-heavy-duty-engines. Accessed April 25, 2022.

43 CARB Executive Order A-290-0168-1, Detroit Diesel Corporation engine family KDDXH12.8FED (FTP of 0.06), see 'New Vehicle and Engine Certification: Executive Orders for MY2019 Medium-Duty and Heavy-Duty Engines' at https://ww2.arb.ca.gov/new-vehicle-and-engine-certification-executive-orders-my2019-medium-duty-and-heavy-duty-engines. Accessed April 25, 2022.

Organization: *PACCAR, Inc (PACCAR)*

In particular, PACCAR agrees with the following aspects of EMA's comments: The feasibility of centering a program around a 0.02 g/bhp-hr FTP/RMC NOx standard (as opposed to a core standard set at or above Option 2-like levels) has not been, and cannot be, established. [EPA-HQ-OAR-2019-0055-1346-A1, p.2]

In particular, PACCAR agrees with the following aspects of EMA's comments: The low-NOx regulations, if centered around a 0.02g/bhp-hr standard, could result in decreased fuel-efficiency, which could threaten the feasibility and implementation of the HDOH Phase 2 GHG standards, especially the 2027 MY standards, which should not be revised. [EPA-HQ-OAR-2019-0055-1346-A1, p.2]

PACCAR is pleased that EPA included two options in the Proposed Rule and supports a stringent, but implementable, single step low-NOx standard in MY 2027. The data and supporting information provided herein will demonstrate that Option 2 with certain flexibilities, and features of Option 1, represent a reasonable, technically-feasible regulation. By contrast, Option 1 on its own is technically infeasible. [EPA-HQ-OAR-2019-0055-1346-A1, pp.2-3]

PACCAR agrees with EMA's assessment that the proposed standards are technically infeasible and incorporates below certain aspects of EMA's comments, sometimes verbatim, in addition to providing our own comments. [EPA-HQ-OAR-2019-0055-1346-A1, p.4]

CARB's recently promulgated Heavy-Duty Omnibus low-NOx Regulation aims to reduce NOx emission standards by 90% compared to the current 2010 emission standards and prescribes a 50% reduction in the PM mass standard. This aggressive action seeks to reduce the last one to two percent of HDOH NOx engine emissions. [EPA-HQ-OAR-2019-0055-1346-A1, p.4]

EPA's proposed 'Option 1' mirrors the CARB Omnibus requirements in nearly every respect, including the proposed 0.020 g/bhp-hr NOx certification standard for MY 2031. However, the a 90% NOx reduction, coupled with the proposed new 'low-load' certification cycle and a completely new in-use emissions testing and compliance protocol (with barely measurable NOx limits), presents an inherently infeasible technical challenge for HDOH diesel engines. [EPA-HQ-OAR-2019-0055-1346-A1, p.4]

Adopting a single-step feasible rule for MY 2027 will enable manufacturers to focus on the multiple different development paths required for future powertrain solutions. [EPA-HQ-OAR-2019-0055-1346-A1, p.16]

PACCAR summarizes below the major issues that EPA should take into account as it moves forward with this rulemaking:

- PACCAR encourages EPA to adopt a single-step, technologically-feasible rule introduced in MY 2027 to enable manufacturers to focus on the several different development paths required for future powertrain solutions.
- PACCAR supports the proposed Option 2 regulatory levels (0.05 NOx) in laboratory controlled demonstrations, such as durability aging (DF programs) and SEA.
- In commerce, PACCAR requests EPA provide a 'variability allowance' of 30 mg/hp-hr to address emissions variation due to the real-world conditions and production variability. This allowance would apply to testing engines that are acquired from field systems, such as DF verification, and other compliance conformity testing. [EPA-HQ-OAR-2019-0055-1346-A1, p.59]

Organization: *Pennsylvania Chamber of Business and Industry (PCBI)*

Pennsylvania is home to the 8th largest manufacturing base in the country and continues to see substantial development and investment into logistics and distribution infrastructure across the state. The state's proximity to several major interstate highways and ports afford companies across multiple industrial categories, such as consumer packaged goods, pharmaceuticals and medical devices, automotive components, and electronics, to site and distribute goods across North America. According to the American Transportation Research Institute, trucking alone supports more than 300,000 Pennsylvania workers and their families, and approximately 86 percent of the state's total manufactured goods are moved by truck each year. It is imperative that as regulatory requirements are implemented, engine manufacturers are given sufficient time to incorporate new controls into product lines, supply chain vendors are able to scale up production of controls as well, and end-users are able to effectively and affordable transition their fleets during turnover. [EPA-HQ-OAR-2019-0055-1319-A1, p.2]

To that end, the options outlined in EPA's most recent Notice of Proposed Rulemaking are overly aggressive and threaten to reduce investment and increase costs in the logistics sector at a time of significant inflation and supply chain constraints. These options also threaten to impede environmental progress. The PA Chamber supports a single-step, national rule that encourages adoption of more efficient trucks, that is economically feasible for logistics companies and trucking fleets, and that is environmentally beneficial. Of the two options outlined in the NOPR, we recommend EPA reject Option 1 and substantially revise Option 2 in line with the concerns outlined in this letter and that of other stakeholders. [EPA-HQ-OAR-2019-0055-1319-A1, p.2]

Organization: *Public Citizen and Healthy Port Communities Coalition (HPCC)*

Option 1 of the Proposal would clearly provide significant benefit to communities, and the EPA should not consider any rulemaking less stringent than Option 1. [EPA-HQ-OAR-2019-0055-1417-A2, p. 1]

Option 2 within the Proposal should be rejected by the EPA. Option 2 does not adequately protect human health. [EPA-HQ-OAR-2019-0055-1417-A2, p. 1]

Improvements to compression ignition engines are welcome but may be better directed toward advancing electrification. [EPA-HQ-OAR-2019-0055-1417-A2, p. 2]

The Proposal states that "emission levels demonstrated for certification are not achieved under the broad range of real-world operating conditions," and thus proposes strategies to increase the efficiency of emissions controls of compression ignition (CI) engines. [EPA-HQ-OAR-2019-0055-1417-A2, p. 2]

This statement in the proposal reflects our understanding based on our experience examining heavy duty truck emissions in Texas. Research centered on the greater Houston region reported similar findings. A 2018 study by the Texas Transportation Institute2 for the Houston-Galveston Area Council that analyzed PAMS and GPS data found that the vehicles studied operated at low speeds, 18 mph on average, with 63% of time at speeds less than 10 mph. Vehicles idled for 54% of the time (185 minutes per day) with most of the activity happening during weekdays between 6 am and 7 pm, when nearby residents are active. This study found that truck engines operated at temperatures suboptimal for SCR functionality almost 60% of the time, meaning that the SCR would be unable to achieve the expected emissions reductions. [EPA-HQ-OAR-2019-0055-1417-A2, p. 2]

2. https://www.h-gac.com/getmedia/12a1530d-ad4f-4705-8e8b-68ccd2f29787/Vehicle-Activity-Data-09192018

EPA's efforts in this proposal to increase stringency of emissions testing of compression ignition engines is welcome. However, vehicle manufacturers have lost a tremendous amount of faith from the public due to diesel emissions cheating scandals. [EPA-HQ-OAR-2019-0055-1417-A2, p. 2]

Prohibition of diesel defeat devices will not ensure compliance. Furthermore, SCRs and other emissions controls on heavy-duty diesel trucks can easily fail, making it more difficult for emissions targets to be met. Extending regulatory emission warranties may help prevent tampering while also ensuring that operators are covered for necessary repairs should their emission control devices fail. However, the best defense against pollution is to stop it before it begins. Transitioning to zero emissions trucks ensures full compliance with emissions standards, and we recommend that the EPA prioritize the deployment of zero emission vehicles. [EPA-HQ-OAR-2019-0055-1417-A2, p. 3]

Organization: *Rivian Automotive, LLC (Rivian)*

EPA "co-proposed" two potential regulatory options for addressing NOx emissions. Because of the immediate public health impacts of NOx emissions, finalizing a proposal that achieves the greatest reductions is of paramount importance. EPA's own findings show that of the options weighed, Option 1 is most protective, delivering larger reductions by 2045 of NOx, PM2.5, volatile organic compounds, and carbon monoxide than Option 2. These reductions in pollutants would "significantly decrease" ozone concentrations across the country with benefits for areas attempting to attain, or avoid nonattainment of, national air quality standards.5 And even more importantly, EPA estimates that the ozone and PM2.5 benefits will accrue in greater measure in parts of the country with the "worst baseline air quality," and "where larger numbers of people of color are projected to reside."6 This analysis is a testament to the power of a strong NOx emissions standard to deliver real-world benefits to Americans. [EPA-HQ-OAR-2019-0055-1229-A1, p.3]

5 Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, 87 Fed. Reg. 59, 17,427 (Mar. 28, 2022) (revising 40 C.F.R. Parts 2, 59, 60, 80, 85, 86, 87, 600, 1027, 1030, 1033, 1036, 1037, 1039, 1042, 1043, 1045, 1048, 1051, 1054, 1060, 1065, 1066, 1068, and 1090).

6 Id. at 17,427.

Balanced against the costs, EPA again finds that Option 1 is the most compelling of the two options analyzed. The agency calculates that by 2045 the annual net benefits of Option 1 would be as much as 50 percent greater than those for Option 2.7 In Rivian's view, these clear findings compel EPA to finalize a NOx standard at least as stringent as Option 1, consistent with both the Biden Administration's stated goals and priorities and, perhaps most significantly, with the directive of Executive Order 12,866, later reaffirmed by Executive Order 13,563, that "in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits…"8 Finalizing Option 2 would not be justifiable on cost-benefit grounds. Accordingly, Rivian supports the EPA finding that Option 1 is the most compelling of the options proposed. [EPA-HQ-OAR-2019-0055-1229-A1, p.3]

7 Id. at 17,428.

8 Exec. Order No. 12,866, 58 Fed. Reg. 190 (Oct. 4, 1993); Exec. Order No. 13,563, 76 Fed. Reg. 14 (Jan. 21, 2011).

Organization: *South Coast Air Quality Management District*

It has been over 20 years since EPA last issued a heavy-duty NOx standard. Emissions from heavy-duty diesel mobile sources represent a significant and ever-increasing portion of the emissions inventory in the Basin, resulting in adverse impacts on public health and regional air quality. Legal authority to regulate these sources of pollution primarily sits with EPA and the California Air Resources Board (CARB). CARB has taken significant steps to address NOx emissions from heavy-duty trucks through its Heavy-Duty Engine and Vehicle Omnibus Regulation (Omnibus Regulation). Federal regulation, however, is needed for trucks initially registered outside of California. As the South Coast AQMD noted in its 2016 Petition for Rulemaking to Adopt Ultra-Low NOx Exhaust Emission Standards for On-Board Heavy-Duty Trucks and Engines (2016 Petition), a nationwide standard is necessary because the majority of heavy-duty trucks operating in California are purchased out of state and operated as part of a nationwide fleet. [EPA-HQ-OAR-2019-0055-1201-A1, pp.1-2]

CARB's 2020 Mobile Source Strategy noted that by 2030, NOx emissions from federally regulated sources in the South Coast will exceed emissions from California-regulated sources.2 It is also worth noting that without a proposed rule in place, EPA's own analysis shows that by Calendar Year 2045, 8-hour ozone design values in certain nonattainment areas will remain in the range of 92-98 ppb.3 Thus, substantial NOx emission reductions are urgently needed from the nationwide fleet to not only help with the extreme ozone non-attainment status in Southern California but with other areas nationwide. [EPA-HQ-OAR-2019-0055-1201-A1, p.2]

2 CARB, 2020 Mobile Source Strategy, available at https://ww2.arb.ca.gov/sites/default/files/2021-09/Proposed_2020_Mobile_Source_Strategy.pdf, pg. 6.

3 EPA, Regulatory Impact Analysis (RIA), available at https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10144K0.pdf, pg. 291, Table 6-2 (Change in 8-hour Ozone Design Values for Counties Projected to be Above the Level of the 2015 8-hour Ozone NAAQS in 2045).

The South Coast AQMD continues to have high confidence that a 0.02 g/bhp-hr standard is technologically feasible and can be commercially proven. We also believe a technological pathway can be implemented in a commercial product prior to 2027. The majority of today's Otto-cycle heavy-duty engines have already been certified far below a low-NOx standard of 0.02 g/bhp-hr. Projects undertaken by the Southwest Research Institute (SwRI), and the availability of advanced engine technologies and aftertreatment systems, all support the conclusion that conventional diesel standards can achieve a low-NOx standard of 0.02 g/bhp-hr. The advances in engine technology have been successfully demonstrated and proven to be cost-effective, including 6.7, 8.9, and 12-liter natural gas engines from Cummins, diesel engines that are 70% cleaner than the current standard, idle reduction technology, engine down-speeding, and advances in exhaust after-treatment technologies. Zero emission technologies, including battery-electric and fuel cell power trains, continue to emerge and see rapid advancement. [EPA-HQ-OAR-2019-0055-1201-A1, p.2]

Because of the critical need for NOx reductions, the South Coast AQMD urges EPA to adopt the most stringent rule with the fastest implementation timeline supported by the record. We support EPA's proposed Alternative Option to the extent that it is modified to include a low NOx standard of 0.05 g/bhp-hr on the low load cycle (LLC), as envisioned by CARB's Omnibus Regulation and supported by SwRI's latest test results. The Alternative Option, which already includes longer useful life and warranty mileages than either Option 1 or the Omnibus Regulation, will elicit the greatest emission reductions of all proposed options, so long as it is modified to harmonize its LLC limit with the limit proposed by CARB. However, to the extent that pursuit of the Alternative Option will delay rule implementation beyond 2027 we support Option 1 so long as it can be aligned with CARB's Omnibus Regulation, setting implementation of a 0.02 g/bhp-hr standard in Model Year (MY) 2027. [EPA-HQ-OAR-2019-0055-1201-A1, pp.2-3]

Above all else, the South Coast AQMD believes that a revised NOx standard should be finalized as swiftly as possible, by the end of 2022. To be clear, Option 1, as written, is less than ideal as it would allow for more emissions than adoption of a standard equivalent to CARB's own Omnibus Regulation, particularly in the early years of the program. South Coast AQMD staff is also concerned that the flexibilities built into the current version of the proposal may result in a strong standard only on paper. For instance, enabling manufacturers to generate overly generous NOx credits from sales of zero-emission engines may disincentivize investments in clean technologies for internal combustion engines, thereby delaying needed emission reductions. For these reasons, it is imperative that EPA adopt its proposed Alternative Option, with the modifications suggested above or, if doing so delays the rulemaking process beyond 2022, adopt Option 1 to align with Omnibus. Newer, stronger standards for on-highway heavy-duty engines and vehicles are long overdue, and we ultimately support EPA taking the necessary, decisive action to help clear the air of truck emissions for all residents in the South Coast Air Basin and nationwide, including those disadvantaged communities that are most likely to live near highways, port complexes, and warehouses. [EPA-HQ-OAR-2019-0055-1201-A1, p.3]

EPA proposes two primary options for consideration –Option 1 and Option 2 – stating that both include emissions standards based on technology improvements that have become available over the course of the past 20 years since the last major heavy-duty engine rule revisions. Option 1 is a two-step process wherein a 0.035 g/bhp-hr standard is implemented for MY 2027 through 2030 and then ratcheted down to 0.02 g/bhp-hr for MY 2031 and beyond. Option 2 would implement a 0.05 g/bhp-hr standard for MY 2027 and beyond. EPA also proffers an Alternative Option which it suggests is more stringent than either Options 1 or 2. We believe that both the Alternative and Option 1 are technologically feasible. [EPA-HQ-OAR-2019-0055-1201-A1, p.7]

Under the Alternative Option, heavy duty HDEs will be subject to a 0.02 g/bhp-hr standard beginning in MY 2027. The Alternative also includes useful life and warranty mileages that are longer than those proposed in either Option 1 or the Omnibus Regulation. However, we believe that the Alternative will achieve maximum emission reductions only to the extent that it is amended to include a NOx standard of 0.05 g/bhp-hr on the LLC, beginning in MY 2027. As written, the Alternative has a higher LLC standard of 0.10 g/bhp-hr which mirrors EPA's least stringent proposal, Option 2. Alternatively, CARB's Omnibus Regulation will reduce the current heavy-duty NOx standard for FTP/RMC-SET from 0.20 g/bhp-hr to 0.05 g/bhp-hr from MY 2024-2026, and down to 0.02 g/bhp-hr starting MY 2027, while setting the initial 0.2 g/bhp-hr LLC from MY 2024-2026 down to 0.05 g/bhp-hr starting MY 2027 at 435,000 miles. Omnibus also includes slightly higher levels for both FTP/RMC-SET and LLC to account for deterioration at full useful life. EPA appears to dismiss the viability of its proposed Alternative Option by noting that less lead time to a 0.02 g/bhp-hr standard, a lower numeric standard for hydrocarbon, and longer useful life and mileage constraints 'would be very challenging to meet in the MY 2027 timeframe.'26 As we will discuss in further detail below, a 0.02 g/bhp-hr NOx standard is most certainly feasible for MY 2027.

Still, to the extent that EPA reasonably believes it cannot finalize rulemaking on a modified Alternative Option before 2023, for implementation by MY 2027, we believe there is ample evidence, including EPA's own analysis, showing that Option 1, modified to achieve an Omnibus Nationwide scenario in 2027, would bring significant NOx reductions. As alluded to above, EPA has improperly rushed to dismiss the viability of implementing a 0.02 g/bhp-hr standard in MY 2027. The research backing California's Omnibus Rule proves as much. CARB's Omnibus rule provides for an interim decrease in NOx emission standards as early as 2024.

To reiterate, in order to avoid delay, we are willing to support a modified Option 1 to the extent that it would align with CARB's Omnibus by requiring the most stringent feasible standard – a 0.02 g/bhp-hr – for MY 2027. Based on data presented in EPA's own draft RIA, an Omnibus Nationwide scenario in MY 2027 would bring 160,395 tons of NOx reduction annually for CY 2030, exceeding all three options outlined in the NPRM.39 A 0.02 g/bhp-hr standard is doubtlessly feasible and achievable for MY 2027, even as full commercialization is not realized as of today. [EPA-HQ-OAR-2019-0055-1201-A1, pp.9-10]

39 RIA at pg. 277, Table 5-49.

The South Coast AQMD continues to urge that EPA's highest priority should be to secure the maximum emission reductions possible and without delay. We do not believe pursuit of a modified Option 1 that would track CARB's Omnibus Regulation would delay this rulemaking effort beyond 2022. This alignment would include, among other things, a required idle-NOx standard of 10 g/hr, a lower FTP/RMC-SET standard of 0.02g/bhp-hr and a more stringent LLC standard at 435,000 miles. As acknowledged in the RIA, the standards and useful life periods in both steps of CARB Omnibus are not only feasible but would result in emission reductions for the applicable model years.40 While Option 1 would see significant NOx reductions of 16.4%, 55.9% and 60.5% in 2030, 2040, and 2045, respectively, an Omnibus Nationwide scenario in 2027 is projected to achieve additional NOx reductions of 4.2%, 0.6% and 0.2% in the same respective years over Option 1, with consistent 3-4% additional benefit between MY 2027 and MY 2031.41 [EPA-HQ-OAR-2019-0055-1201-A1, p.10]

40 87 Fed. Reg. at 17459.

41 RIA at pgs. 245-46.

When compared to the single level proposed for Option 2 and the Alternative Option, Option 1 would provide the second highest NOx reductions at full useful life, aligning with the Omnibus Regulation. The South Coast AQMD further notes that the feasibility of Option 1 has already been demonstrated based on more recent data presented by SwRI at the 2022 SAE WCX conference in April 2022. At 800,000 miles, the Stage 3 'Re-work' results were 0.037 g/bhp-hr NOx on the composite FTP, 0.030 g/bhp-hr NOx on the RMC-SET, and 0.034 g/bhp-hr NOx on the LLC.42 More data is also set to become available for the Achates engine aging to 800,000 miles. [EPA-HQ-OAR-2019-0055-1201-A1, p.10]

42 EPA, OAR, Test Results from EPA Diesel Engine Demonstration (May 3, 2022), available at https://www.regulations.gov/document/EPA-HQ-OAR-2019-0055-1082.

Should EPA move forward with Option 1 modified to achieve a 2027 Omnibus nationwide scenario, the South Coast AQMD strongly urges against deferring implementation of the second step standards to an uncertain future rulemaking effort involving heavy-duty GHG emissions. As we have stressed above, not only does Option 1 delay alignment with CARB's Omnibus Rule but it also overlooks the fact that low-NOx technology is available within the relevant timeframes. To unnecessarily put implementation of a tighter standard on hold in order to review additional options – options which CARB, MECA, SwRI and others have already reviewed –will have a devastating impact on air quality throughout the nation. EPA also requests comment and data to support higher penetrations of HD ZEV's in the MY 2027-2029 timeframe. Specifically, EPA floats the idea of supporting HD ZEV penetration rates of 5-10 percent or higher in this timeframe in conjunction with permitting HD ZEV manufacturers to generate NOx emission credits so long as CO2 standards were made more stringent for specific Phase 2 vehicle subcategories based on higher projected penetrations of HD ZEVs in the allotted timeframe.43 EPA proposes to permit HEV, BEV and FCEV technologies to generate these emission credits as a form of flexibility for manufacturers to spread out their investments and prioritize technology adoption in way that makes the most sense for their businesses while transitioning to meet the more stringent proposed standards. [EPA-HQ-OAR-2019-0055-1201-A1, pp.10-11]

43 87 Fed. Reg. at pg. 17599.

South Coast AQMD generally opposes overly generous flexibilities that will result in manufacturing of engines with higher NOx emissions. Not only is this antithetical to the goals of the Clean Air Act but it would also weaken the intent of this rulemaking. [EPA-HQ-OAR-2019-0055-1201-A1, p.11]

The South Coast AQMD cannot meet its upcoming attainment deadlines without significant emission reductions from sources under federal authority. As has been made clear above, there is ample evidence to support the feasibility of a stringent 0.02 g/bhp-hr standard by MY 2027. As we have noted previously, we believe this can be done via implementation of a modified Alternative Option that harmonizes its LLC standard with CARB's Omnibus Regulation. To avoid unnecessary delay, and only insofar as EPA reasonably believes it cannot complete rulemaking on the Alternative option in 2022, we believe the necessary emission reductions can be achieved via implementation of a version of Option 1 that *fully* aligns with CARB Omnibus. Given upcoming attainment deadlines, there is also a significant need to achieve the greatest level of emissions reductions as soon as possible. [EPA-HQ-OAR-2019-0055-1201-A1, p.11]

EPA itself acknowledges that it is compelled by Clean Air Act Section 202(a)(3)(A) to set NOx emission standards that ‘reflect the greatest degree of emission reduction achievable through the application of technology that will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology.’45 Further, EPA is required to prescribe ‘and from time to time revise standards applicable to the emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines[.]’46 These standards are to take effect after such period as the Administrator finds necessary to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance within such a period.’47 These regulations may apply no sooner than the model year commencing four years after a revised standard is promulgated and will apply for at least three model years.48 [EPA-HQ-OAR-2019-0055-1201-A1, pp.11-12]

45 87 Fed. Reg. at 17418; 42 U.S.C. Section 7521(a)(3)(A).

46 42 U.S.C. Section 7521(a)(1).

47 Id.

48 Id. at Section 7521(a)(3)(C).

In its 2016 petition to the EPA, the South Coast AQMD urged the importance of ‘cooperative federalism’ as ‘a defining feature of the [Clean Air Act].’49 As EPA has explained, the Clean Air Act sets out the ‘blueprint’ by which nonattainment areas will attain the NAAQS— a blueprint that couples locally-directed reductions with ‘Federal measures such as reductions from mobile source measures promulgated by EPA under Title II of the Act.’50 The South Coast AQMD has advanced the most stringent air quality regulations in the nation, but it requires EPA to give heed to cooperative federalism principles. The District’s emissions inventory puts the issues in stark relief; the Basin will not be able to meet the 70 ppb standard without a stringent rule. Going further, attainment will also require other controls on sources within federal regulatory authority, such as locomotives, marine vessels, and aircraft Thus, here and elsewhere, the South Coast AQMD needs EPA to follow blueprint of the Clean Air Act by adopting the strongest rule possible, as soon as possible, without any further unwarranted delay. [EPA-HQ-OAR-2019-0055-1201-A1, p.12]

49 2016 Petition citing GenOnREMA. LLC v. EPA, 722 F.3d 513, 516 (3d Cir. 2013).

50 See 62 Fed. Reg. 1150, 1153 (January 8, 1997).

Organization: *Southern Environmental Law Center (SELC)*

As discussed further below, proposed Option 1 for the criteria pollutant emissions standards and the revised Phase 2 greenhouse gas (GHG) emissions standards do not go far enough. [EPA-HQ-OAR-2019-0055-1247-A1, p.1]

Under the Clean Air Act, EPA must set criteria pollutant emissions standards 'that reflect the greatest degree of emissions reduction achievable' after considering certain statutory factors.31 EPA determined that more-stringent Option 1 is feasible, and EPA should, at minimum, adopt these proposed standards.32 However, California recently adopted the Heavy- Duty Omnibus Regulation (the Omnibus Regulation), which is even more stringent. This indicates that standards stricter than Option 1 are feasible. In line with the Omnibus Regulation, EPA should adopt NOx standards that are 90 percent below current standards starting in model year 2027. [EPA-HQ-OAR-2019-0055-1247-A1, p.5]

31 The standards shall 'reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology.' 42 U.S.C. 7521(1)(3)(A)(i).

32 Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, 87 Fed. Reg. 17414, 17436 (proposed Mar. 28, 2022). EPA should not consider less-stringent Option 2, which it found to be feasible in model year 2027 but also to 'result in lower levels of emissions reductions compared to proposed Option 1.' Id.

Beyond more stringent numeric standards, EPA is also proposing important improvements to test procedures, life periods, and warranty requirements to ensure that medium and heavy-duty vehicles run cleanly under more operating conditions across the lifetime of a vehicle.36 These improvements contribute to the effectiveness of the standards. Longer regulatory useful life and emissions-related warranty requirements will also help to maintain emissions control through more of the operational life of these vehicles and we urge EPA to consider whether these requirements can be better aligned with the Omnibus Regulation. [EPA-HQ-OAR-2019-0055-1247-A1, p.6]

36 See e.g., Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, 87 Fed. Reg. at 17422-26.

37 Id. at 17464.

38 Letter from Paul J. Miller, NORTHEAST STATES FOR COORDINATED AIR USE MGMT., to Mary D. Nichols, CAL. AIR RES. BD. 3 (Aug. 25, 2020), https://www.nescaum.org/documents/nescaum-comments-carb-hdv-nox-omnibusregulation-20200825.pdf/.

39 The proposed voluntary certification is based on California's Clean Idle NOx standard. Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, 87 Fed. Reg. at 17464.

At a minimum, EPA should fully align its criteria pollutant emissions standards with the California Heavy-Duty Omnibus Regulation in in 2027, establish minimum ZEV production requirements, and preserve the stringency of GHG emissions requirements for internal combustion engine vehicles. [EPA-HQ-OAR-2019-0055-1247-A1, p.8]

Organization: *States of California, et al. (The States)*

Recognizing the critical need to address emissions from this significant source, President Biden's Executive Order 14037, "Strengthening American Leadership in Clean Cars and Trucks," directed EPA to establish new standards for emissions from heavy-duty engines and vehicles beginning with model year 2027 through at least model year 2030. Specifically, EPA is co-proposing two regulatory options for reducing NOx emissions: Option 1 implements stronger NOx standards in a two-step approach by first increasing stringency in model year 2027 and then increasing stringency again for model year 2031; Option 2 sets a one-time stringency for only model year 2027 and would achieve less NOx emissions than Option 1. Option 1 will achieve greater emission reductions than Option 2, will reduce NOx emissions from heavy-duty vehicles by almost 60 percent in 2045, and "will provide society with a substantial net gain in welfare, notwithstanding the health and other benefits [that EPA was] unable to quantify."4 [EPA-HQ-OAR-2019-0055-1255-A1, p. 2]

4. EPA, Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards: Draft Regulatory Impact Analysis, § 9.2, pp. 403-4 (March 2022), EPA-HQ-OAR-2019-0055-0979 ("Draft RIA").

The States strongly encourage EPA to adopt Option 1, which is the regulatory option that reflects "the greatest degree of emission reduction achievable" as required by Clean Air Act (CAA) section 202(a)(3) and most closely aligns with the Heavy-Duty Engine and Vehicle Omnibus Regulation (Omnibus Rule) recently adopted by the California Air Resources Board (CARB). Given the record supporting the Proposed Rule, and CARB's robust record supporting the Omnibus Rule, Option 1 is unquestionably both technologically feasible and cost-effective, better addresses the significant impact of emissions from the heavy-duty vehicles on environmental justice communities,5 and enhances the States' ability to attain and maintain national ambient air quality standards for ozone and particulate matter. EPA's proposed adoption of Option 2 would be inconsistent with CAA section 202(a)(3) and would be arbitrary and capricious in light of the rulemaking record. [EPA-HQ-OAR-2019-0055-1255-A1, pp. 2 - 3]

5. Environmental justice is defined by EPA as the "fair treatment and meaningful involvement of all people regardless of race, color, national origin or income with respect to development, implementation, and enforcement of environmental laws, regulations and policies." EPA, EPA-300-B-1-6004, EJ 2020 Action Agenda: The U.S. EPA's Environmental Justice Strategic Plan For 2016-2020, at 1 (Oct. 2016) ("EJ 2020 Action Agenda"). For the purpose of this comment, the term "environmental justice community"

> refers to a community of color or community experiencing high rates of poverty that, due to past and/or current unfair and inequitable treatment, is overburdened by environmental pollution and the accompanying harms and risks from exposure to that pollution.

As noted above, under Section 202(a)(3) of the CAA, EPA must adopt criteria pollutant emissions standards that "reflect the greatest degree of emission reduction achievable through the application of technology that the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology."58 In light of this statutory mandate, the States strongly encourage EPA to adopt Option 1 because Option 1 would "result in a greater level of achievable emission reduction for the model years proposed, which is consistent with EPA's statutory authority under Clean Air Act section 202(a)(3)."59 According to EPA's analysis, Option 1 would achieve greater emission reductions from highway heavy-duty vehicles than Option 2. Specifically, Option 1 will reduce NOx emissions by 61 percent, primary exhaust PM 2.5 emissions by 26 percent, volatile organic compounds by 21 percent, and carbon monoxide by 17 percent nationwide in 2045.60 Thus, EPA is compelled to adopt standards that are at least as stringent as Option 1 to meet its obligations under 202(a)(3) and EPA's proposed adoption of Option 2 is both inconsistent with 202(a)(3) and would be arbitrary and capricious given EPA's findings that the Option 1 standards are technologically feasible and cost effective. [EPA-HQ-OAR-2019-0055-1255-A1, p. 14]

58. 42 U.S.C. § 7521(a)(3)(A)(i).

59. 87 Fed. Reg. at 17,417.

60. Id. at 17,579; Draft RIA at § 5.3.1.

These emission reductions are essential to begin to reduce the inequitable burden on to environmental justice communities. Under Executive Order 12,898, each federal agency has been directed, "to the greatest extent practicable and permitted by law" to "make achieving environmental justice part of its mission by identifying and addressing as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories . . . ."61 Additionally, EPA recently committed to "make achieving environmental justice part of [its] mission[] by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts."62 The adoption of proposed Option 1 is consistent with EPA's commitment to ameliorating existing environmental injustices by achieving the maximum emission reductions and thus reducing air pollution that disproportionately impacts environmental justice communities.63 [EPA-HQ-OAR-2019-0055-1255-A1, pp. 14 - 15]

61. 64 Fed. Reg. 7629 (Feb. 16, 1994).

62. Exec. Order 14,008, § 219.

63. Id.

Option 1's emissions standards, useful life, and warranty periods also most closely align with CARB's Omnibus Rule, and as the records for both the Proposed Rule and CARB's Omnibus Rule demonstrates, Option 1 is technologically feasible and cost-effective.67 Option 1 provides a harmonization of standards that allows manufacturers to design a single engine nationally, thereby reducing complexity and costs. [EPA-HQ-OAR-2019-0055-1255-A1, p. 15]

67. See Comments of CARB, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022.

The States share EPA's goal of achieving effective NOx reductions without unnecessary hardship to manufacturers or vehicle owners or operators. Many of the compliance flexibilities set forth in the Proposed Rule—such as NOx credits for averaging, banking, and trading—are also components, to a degree, of the Omnibus Rule, and the States support including these where they would not reduce the stringency of the final standards and are justified by the record. However, the combined effect of multiple and redundant flexibilities contemplated in the Proposed Rule would be to, in practical effect, adopt standards weaker than those ostensibly adopted in regulation. Such a discrepancy between the emission standards "on paper" and "in the real world" would be problematic for at least three reasons. [EPA-HQ-OAR-2019-0055-1255-A1, pp. 15 - 16.] [EPA-HQ-OAR-2019-0055-1255-A1, p. 15]

First, were EPA to adopt compliance flexibilities that effectively loosen the emission standards' stringency, the final regulation would not "reflect the greatest degree of emission reduction achievable through the application of [available] technology," in violation of the CAA's plain mandate. 42 U.S.C. § 7521(a)(3)(A)(i). Moreover, because the CAA obligates EPA to choose the most effective achievable standards, adopting standards that in reality will be far less effective than purported would also undermine the "rational connection between the facts found and the choice made" and disregard "an important aspect of the problem." Motor Vehicle Mfrs. Ass'n of U.S., Inc. v. State Farm Mut. Auto Ins. Co., 463 U.S. 29, 43 (1983). The arbitrariness of such a result is especially pronounced where multiple, cumulative flexibilities and leniencies overlap to address the same industry concern. Cf. Amer. Lung Ass'n v. EPA, 134 F.3d 388, 392 (D.C. Cir. 1998) (agencies must "explain their decisions with precision"). [EPA-HQ-OAR-2019-0055-1255-A1, p. 16]

Second, the Proposed Rule is of critical importance for States' attainment or maintenance of NAAQS. As described in Section I.C, heavy-duty vehicles are nationally the largest mobile-source contributor of NOx emissions, and in nonattainment areas near Los Angeles and New York City, contribute roughly one third to one half of the on-road NOx emissions, respectively. States risk nonattainment and corresponding penalties if a final rule in fact secures far less NOx emissions reduction than EPA projects—especially where the States premise their SIPs on these ostensible federal reductions. For many of the States, every ton of NOx that heavy-duty engines emit above the ostensible emission limit is another ton the State will have to eliminate from other sources within its regulatory authority. Nat'l Ass'n of Clean Air Agencies v. EPA, 489 F.3d 1221, 1227 (D.C. Cir. 2007) ("[W]hen EPA allows higher NOx emissions from [federally regulated sources], state agencies have no choice but to impose greater restrictions on other sources of NOx.”). Reducing NOx from many of these other state-jurisdictional sources will be far more costly than controlling heavy-duty truck emissions.68 Thus, lost emissions reductions disrupt the cooperative federalism that is the backbone of the CAA’s statutory and regulatory scheme and defeat the goals of carefully crafted SIPs. [EPA-HQ-OAR-2019-0055-1255-A1, p. 16]

> 68. For example, the Northeast States for Coordinated Air Use Management (NESCAUM) estimate the costs of additional NOx controls from industrial, commercial, and institutional boilers as ranging from $2,700 to $21,000 per ton of NOx reduced, as compared to a cost range of $1,000 to $5,000 per ton of NOx reduced from heavy-duty vehicles. Comment submitted by Paul J. Miller, Executive Director, NESCAUM, at pp. 4-5 & nn.4,5 (Feb. 23, 2022), EPA-HQ-OAR-2019-0055-0001.

Third, flexibilities that would, in practical effect, undermine the projected reductions from the final emission standards would violate EPA’s (and States’) commitment to addressing environmental injustice. As described further in Section I.B, environmental justice communities would bear the brunt of the negative health and environmental effects of NOx emissions that are left unmitigated due to outsized and redundant compliance flexibilities, due to proximity to the major transportation corridors and logistics facilities. These already overburdened communities should not continue to bear the inequitable costs of pollution for the sake of unwarranted and unnecessary industry protections. Following that path would harm these communities and further erode trust. [EPA-HQ-OAR-2019-0055-1255-A1, pp. 16 - 17]

Accordingly, EPA should scale back or reject altogether flexibilities whose aggregate effect will be to significantly reduce the real-world emission benefits of Option 1. In particular, EPA should (1) reject the proposed interim in-use standards;69 (2) adopt a stricter inducement schedule that meaningfully incentivizes real-world compliance;70 and (3) further limit the use of NOx credits, especially those generated from heavy-duty electric vehicles.71 [EPA-HQ-OAR-2019-0055-1255-A1, p. 17]

> 69. 87 Fed. Reg. at 17,563-5.
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> 70. Id. at 17,536-46.
>
> 71. Id. at 17,556-62.

In sum, the States support Option 1 of EPA’s Proposed Rule, and as detailed in these comments, respectfully request that certain elements of the Proposed Rule be revised and strengthened before finalization. Further, due to statutory lead time requirements, the States strongly urge EPA to finalize the Proposed Rule by the end of this year to support standards for model year 2027. [EPA-HQ-OAR-2019-0055-1255-A1, p. 28]

Organization: *Truck and Engine Manufacturers Association (EMA)*

It is important to highlight from the outset that while there are various details of EPA’s rulemaking proposal (particularly with respect to Option 1) that EMA and its members fundamentally disagree with, there are multiple major points of substantial agreement. In that regard, EMA agrees with EPA that:

> (i) The NOx emission standards for HDOH vehicles should be reduced substantially starting in model year ("MY") 2027, perhaps by as much as 75% from the current standards; [EPA-HQ-OAR-2019-0055-1203-A1, p. 5]
>
> (ii)
>
> (iii) The current emission warranty and useful life periods for HDOH engines and vehicles should be revised to increase the durability and efficacy of in-use emissions compliance; [EPA-HQ-OAR-2019-0055-1203-A1, p. 5]
>
> (iv) Most or all of the multiple aftertreatment components that the Southwest Research Institute ("SwRI") has configured and assessed in testing its "Stage 3" prototype engine systems should be utilized by OEMs to achieve optimal NOx emission reductions from HDOH engines starting in MY 2027; [EPA-HQ-OAR-2019-0055-1203-A1, p. 5]
>
> (v) ...
>
> (vi) The proposed low-NOx rulemaking should serve as a cost-effective bridge to the transition of HDOH trucks to zero-emission vehicles ("ZEVs") in as many applications as possible, and as soon as practical. ["…" above indicates text is included in other sections of this Response to Comments document] [EPA-HQ-OAR-2019-0055-1203-A1, p. 5]

Accordingly, EMA supports the Agency's overall objectives to: "1) control emissions over a broader range of operating conditions; 2) maintain emissions control over a greater portion of an engine's operational life; and 3) provide manufacturers with flexibilities to meet the proposed standards." (87 FR at pp. 17420-21.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 5]

In light of all of these major points of agreement, EMA is hopeful that the Agency's final rule will be consensus-based, highly cost-effective, and fully implementable starting with the 2027 MY. EMA also hopes that all stakeholders will take note of the multiple major points of agreement spelled out in these comments, and will not unduly focus on the finer points where EMA and its members have data-driven disagreements with the Agency regarding the technical feasibility of what the Agency has proposed, especially as pertains to Option 1. Again, notwithstanding those differing fact-based assessments of what is feasible at the margins of EPA's proposal, a consensus based rulemaking should be achievable. [EPA-HQ-OAR-2019-0055-1203-A1, p. 5]

In that regard, EMA and its members acknowledge the significant ozone air quality attainment problems that still exist in several highly-populated areas of the country, and we recognize why EPA is seeking additional HDOH NOx emission reductions and regulatory improvements. EMA's members are willing to develop and introduce advanced low-NOx technology solutions to effect very significant NOx reductions, including through the types of "Stage 3" emission-control componentry being demonstrated at SwRI. Indeed, EMA encouraged prior

Administrations to take the lead in proposing such next-tier low-NOx regulations. EMA remains willing to collaborate on the finalization of an ambitious technology-forcing low-NOx program that will yield substantial in-use NOx reductions, while avoiding the unintended consequences of setting standards beyond the technical capabilities and compliance margins that frame what a cost-effective program should be. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 5 - 6]

Simply stated, EMA is fully committed to making this rulemaking a fully implementable success. [EPA-HQ-OAR-2019-0055-1203-A1, p. 6]

In order to ensure the adoption of fully achievable and cost-effective HDOH low-NOx regulations, and notwithstanding our broader agreement, the Agency should revise the proposed standards in the following manner:

> (i) Any low-NOx program that the Agency finalizes must be a one-step program with one set of new standards, not a multi-step program with increasingly stringent requirements. All stakeholders should recognize that one of the core objectives of this rulemaking is to establish a cost-effective “clean-diesel” bridge to a ZEV-truck future, which future will be mapped out, in part, through EPA’s anticipated “Phase 3” GHG rulemaking, set to be proposed next year. The low-NOx requirements of this rule should not spill over into the operative years of the envisioned Phase 3 rule. Otherwise, one of the unintended consequences of this low-NOx rule will be to divert manufacturers’ limited research and development resources away from the primary long-term goal of transitioning the commercial trucking industry to ZEVs. [EPA-HQ-OAR-2019-0055-1203-A1, p. 6]
>
> (ii) ...
>
> (iii) Manufacturers will not produce Option 1-compliant products because the Option 1 standards are not feasible. Accordingly, the FTP/RMC certification standards for NOx must be set at Option 2-like levels, not 0.02 g/bhp-hr. Otherwise, the standards will fail to provide the requisite compliance margins, which will render them infeasible in practice, and will cause unacceptable compliance and recall risks for manufacturers. In addition, a program centered around Option 2-like levels will be more beneficial from an emissions-inventory perspective, once potential fleet turnover market responses, including pre-buy/no-buy responses, are taken into account. [EPA-HQ-OAR-2019-0055-1203-A1, p. 6]
>
> (iv) ...
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> (v)-(vi) ...
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> (vii) ...
>
> (viii) The proposed low-NOx program should be revised so that there is a better overall match of the program’s costs and monetized health benefits, and, as noted, to guard against counter-productive pre-buy/no-buy market responses

(ix) .... ["…" above indicates text is included in other sections of this Response to Comments document] [EPA-HQ-OAR-2019-0055-1203-A1, p. 7]

As already noted, EMA's comments are being submitted to facilitate the full and successful implementation of new HDOH emission standards, not to block that implementation. [EPA-HQ-OAR-2019-0055-1203-A1, p. 8]

The Agency will need to fashion a final rule that can meet the broader goal at issue — to build a cost-effective and accessible regulatory bridge to a ZEV-truck future. To that end, the Agency will need to finalize just one set of HD low-NOx standards to take effect in MY 2027, not multiple regulatory steps with multiple standards phasing-in through 2031 and beyond. Otherwise, the low-NOx program for diesel engines will overlap with and undermine the implementation of the "Phase 3" GHG standards (which are slated to lead to the broader transition to ZEV trucks), and will divert OEM's inherently limited R&D resources to multiple iterations of diesel engine enhancements instead of focusing those resources on the needed advancements in HD ZEV technologies. All stakeholders recognize that diesel technologies will start to phase-out over the next decade. The scope and costs of this rulemaking need to account for and reflect that reality as well. [EPA-HQ-OAR-2019-0055-1203-A1, p. 8]

Section 202 of the federal Clean Air Act ("CAA"), 42 U.S.C. §7521, governs the Agency's establishment of emission standards for new mobile sources, including HDOH engines and vehicles. CAA section 202(a)(3)(B) specifically governs the Agency's establishment of "revised standards for heavy-duty trucks." Unlike the general standard-setting provisions contained in section 202(a)(3)(A) – which call for the establishment of emission standards that "reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply" – section 202(a)(3)(B), the specific provision that applies here, simply states that the Administrator may set revised emissions standards "taking costs into account." [EPA-HQ-OAR-2019-0055-1203-A1, pp. 15 - 16]

Consequently, in assessing the details for the proposed revised low-NOx regulations at issue, costs, not the absolute limits of potential technological feasibility, are a paramount consideration. In this case, a full and fair consideration of costs and benefits leads to the conclusion that a low-NOx program centered around an Option 2-like program will yield an optimized final rule, while a program centered around the Option 1 proposal is simply not workable. [EPA-HQ-OAR-2019-0055-1203-A1, p. 16]

CARB's recently promulgated Omnibus low-NOx regulations include a NOx standard reduced by another 90% from the US10 limit, and another 50% reduction in the PM mass standard. The PM reduction is intended primarily to serve as a backstop against the potential adoption of less effective DPF designs than the current ceramic wall-flow systems capable of performing well below the US10 limit. The additional 90% NOx reduction, however, especially when coupled with a new "low-load" certification cycle, and a completely new in-use emissions testing and compliance protocol (with barely measurable NOx limits), presents an inherently infeasible technical challenge for HDOH diesel engines. It should be noted that these aggressive targets are actions to reduce the last 1 to 2% of NOx emissions from these engines. EPA's proposed

"Option 1" mirrors the CARB Omnibus requirements in almost every respect, including a 0.020 g/bhp-hr NOx certification standard proposed to be effective in MY 2031. [EPA-HQ-OAR-2019-0055-1203-A1, p. 17]

Throughout the rulemaking process for the Omnibus low-NOx regulations, CARB asserted that its new low-NOx requirements are technically feasible. The primary basis for CARB's assertion, like EPA's here, is the technology demonstration effort undertaken by Southwest Research Institute ("SwRI"). CARB contracted with SwRI to develop a diesel engine and aftertreatment prototype capable of meeting a 0.020 g/bhp-hr NOx certification standard when aged to the equivalent of 435,000 miles of operation. The 435,000 mile threshold is the current US10 heavy heavy-duty Useful Life requirement (CARB's rule extends that Useful Life requirement to 800,000 miles, but with a doubling of the NOx standard (to 0.04 g/bhp-hr) for the interval from 435,000 miles to 800,000 miles). SwRI modeled a variety of combinations of aftertreatment components, coupled with engine improvements intended to elevate exhaust temperatures, and ultimately focused on what came to be known as the "Stage 3" technology package for the 435,000 mile-aged emissions demonstration prototype. [EPA-HQ-OAR-2019-0055-1203-A1, p. 17]

To support its low-NOx rulemaking, EPA also contracted with SwRI to perform an aged emissions demonstration with a technical solution very similar to the CARB "Stage 3" technology package. Thus, the laboratory experiment that SwRI has run on the "Stage 3" prototype is the sole source of actual emissions data supporting EPA's assertion regarding the purported feasibility of the 0.020 g/bhp-hr NOx standard. In some instances, that support amounts to a single data point. [EPA-HQ-OAR-2019-0055-1203-A1, p. 17]

EMA has been engaging with EPA and CARB from the outset on these HDOH low-NOx rulemakings, including the underlying SwRI demonstration program. Our conclusion is that the Omnibus/Option 1 low-NOx standards have not been demonstrated to be technically feasible, and are in fact infeasible, for the following reasons: [EPA-HQ-OAR-2019-0055-1203-A1, p. 17]

Our conclusion is that the Omnibus/Option 1 low-NOx standards have not been demonstrated to be technically feasible, and are in fact infeasible, for the following reasons:

1) The aged-engine "Stage 3" NOx emissions results do not meet the proposed future 0.020 g/bhp-hr NOx standard across all required certification cycles, nor do they consistently meet the in-use NOx standards when laboratory tested using "road cycles" that mimic real world operation (which, practically speaking, makes the case that the SwRI program was a demonstration of technical infeasibility.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 18]

   [see section 3.2.1 of this Response to Comments document for additional reasons provided by the commenter]

EMA shares broad agreement with the Agency on all of the core concepts of the proposed regulations. EMA's comments are therefore directed at the margins of EPA's proposal, particularly with respect to Option 1, not at the NPRM's core objectives. To that end, EMA has offered detailed recommended revisions, along with a more over-arching recommendation that the proposed regulations should be centered around revised Option 2-like requirements to enhance the feasibility and cost-effectiveness of the Agency's proposal. The changes that EMA recommends are not material from an overall emissions inventory perspective, but are vitally important to the finalization of a fully implementable low-NOx rulemaking that can serve as a cost-effective bridge to a ZEV-truck future. [EPA-HQ-OAR-2019-0055-1203-A1, p. 173]

The stakes of this rulemaking are very high. Indeed, if EPA were to finalize its proposed Option 1, that would, as a practical matter, preclude the production and sale of HD diesel engines starting in 2027. OEMs cannot and so will not be able to build Option 1-compliant products. Such an unacceptable outcome from this rulemaking must be avoided. EMA is ready to work with the Agency to fashion the necessary revisions that will lead to the finalization, adoption and implementation of the fully optimized low-NOx program for new HDOH engines and vehicles that all stakeholders are seeking. [EPA-HQ-OAR-2019-0055-1203-A1, p. 173]

EPA's "Clean Trucks Plan" is a rulemaking that will significantly impact all of the core elements of EPA's HDOH diesel-emissions control program. The NPRM proposes sweeping changes to those core regulatory program components, including up to a 90% reduction of the applicable NOx standard, reopened reductions to the Phase 2 CO2 emissions standards, an entirely new certification test procedure targeting operating modes never-before regulated, and a completely overhauled in-use emissions protocol, which requires a careful analysis of PEMS-based (and OBD) in-use measurement capabilities and procedures. [EPA-HQ-OAR-2019-0055-1203-A1, p. 170]

Until all of the foregoing research needs are met in a comprehensive and credible manner, the record supporting the Agency's rulemaking will be at risk of being deemed incomplete and insufficient. This is a fundamental problem that will require collaboration to resolve. Falling that, this is a problem that could preclude the implementation of a final rule on the timeline that EPA is trying to maintain. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 172 - 173]

Organization: *Truck Renting and Leasing Association (TRALA)*

Accordingly, TRALA supports the Option 2 certification standard of .05. That said, we urge EPA to work with CARB and the other states who have pledged to adopt CARBs standards for NOx, to persuade those states not to proceed with regulations that would exceed the EPA's standard. TRALA urges the EPA to adopt regulations based on Option 2 and to work with every state including California to agree to a new national low-NOx certification standard of .05. TRALA believes that a national standard would reduce the regulatory burden on the OEMs that would not have to meet multiple standards in a shortened time period. A national standard of .05 would reduce the catastrophic disruption these rules could have on the new and used truck markets. [EPA-HQ-OAR-2019-0055-1180-A1, p. 4]

Organization: *U.S. Chamber of Commerce*

While we are supportive of a national standard that drives cutting-edge technology deployment and lowers emissions, the Chamber has strong concerns that, as proposed, EPA's preferred

Option 1 fails to adhere to these core principles, and as a result would likely lead to unintended negative consequences for both the economy and the environment. [EPA-HQ-OAR-2019-0055-1245-A1, pp. 2 - 3]

Relatedly, we have concerns that the reasoning and factual predicates for aspects of the proposed rule are undermined by weaknesses that give rise to legal vulnerabilities. As EPA acknowledges, section 202(a)(2) of the Clean Air Act provides that standards to regulate air pollutants from mobile sources “shall take effect after such period as the Administrator finds necessary to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance within such period.” Accordingly, as EPA notes, in establishing or revising such standards, “EPA also must consider issues of technological feasibility, compliance cost, and lead time,” and “may consider other factors such as safety,” as well as “the impacts of potential standards on the heavy-duty industry, fuel savings, oil conservation, energy security and other energy impacts.” (See also Clean Air Act section 202(a)(3), as further discussed in the preamble to the proposed rule.) Careful attention to each relevant factor must be given in proposing and promulgating new standards; and to the extent that an agency decision ignores significant factual problems, including questions of practicability, or otherwise is incomplete or erroneous, the agency risks invalidation of its decision pursuant to the Clean Air Act and the Administrative Procedure Act. [EPA-HQ-OAR-2019-0055-1245-A1, p. 3]

Opportunity cost impacts associated with diversion of capital away from Zero-Emissions Vehicle (ZEV) investments. Original Equipment Manufacturers (OEM) are undertaking enormous investments to develop zero-emissions vehicles that will power the future transportation system. The Chamber has serious concerns that if finalized as proposed, EPA’s rulemaking will require OEMs to divert significant amounts of capital investment -- currently planned for ZEV development -- into compliance with this rulemaking. This would not just impact the trucking industry’s efforts to plan for the energy transition; it would have implications for a broad range of economic sectors in the form of customers and fleet owners working to address greenhouse gas emissions throughout their supply chain. [EPA-HQ-OAR-2019-0055-1245-A1, p. 8]

The framework outlined in Option 2 would provide more of an incentive for turnover of older fleet vehicles due to more familiar technology and lower costs for replacement vehicles, particularly those heavy-duty trucks that were certified prior to model year 2010. Around fifty percent of trucks on the road today are certified to meet EPA’s 2010 standards, so a large percentage of the fleet is still emitting significantly higher levels of NOx due to lack of fleet turnover. For example, the emissions from one truck certified to 2006 standards is equivalent to 10 trucks certified to the 2010 standards, and one truck certified to the 1990 standards is equivalent to 30 trucks certified to the 2010 standards. The air quality improvements attributable to retiring these older vehicles are tremendous, especially in communities where there is a large concentration of diesel vehicles. [EPA-HQ-OAR-2019-0055-1245-A1, p. 8]

The opportunities for this rulemaking are similar and illustrate why it is so important to set durable, achievable, and cost-effective standards. The framework described in Option 2 offers the best ability to achieve emissions reductions that will benefit communities most impacted by medium- and heavy-duty vehicles. [EPA-HQ-OAR-2019-0055-1245-A1, p. 9]

Technological feasibility and compliance costs go hand in hand. Establishing standards that are technologically feasible will help ensure that standards are achievable and cost-effective. Although the agency views these standards to be technology-forcing, the timeline for actual adoption of those technologies in the marketplace will in significant part depend upon the increased cost to consumers for the new vehicles. Other aspects of the design and successful deployment of new technologies needed to meet more stringent environmental standards can sometimes be difficult for companies and the agency to anticipate. [EPA-HQ-OAR-2019-0055-1245-A1, p. 9]

Many companies are investing significantly in new, lower-emitting and zero-emitting medium-duty and heavy-duty vehicles across various vehicle classes; however, overcoming consumer acceptance is one challenge that is difficult to anticipate and to model. This is a particularly important issue when considering major shifts in technology or compliance costs, as mentioned above. [EPA-HQ-OAR-2019-0055-1245-A1, p. 9]

Other challenges also remain for engine and vehicle manufacturers as consumers and fleet owners may need to make significant investments in charging infrastructure necessary to support zero-emitting vehicles. For smaller fleets, it raises more uncertainty as they will increasingly rely on infrastructure investments made at the federal and state levels. Adding better performing engine or post-combustion emissions control technologies to meet the proposed requirements for Option 2 will pose challenges, and the specific provisions of Option 2, as proposed, should be carefully considered and adjusted to ensure feasibility and to avoid imposing unnecessary costs and burdens; however, Option 2 would likely not require the same shift in infrastructure that Option 1 would demand. [EPA-HQ-OAR-2019-0055-1245-A1, pp. 9 - 10]

Some additional costs attributable to Option 1 also merit thorough consideration. First, consumers and fleet owners who choose to adopt zero or near-zero emitting vehicles would need to consider the cost and time needed to install recharging and other fueling infrastructure at appropriate distances across their distribution supply chains to avoid disruptions. Second, EPA should consider the costs due to optimization of distribution routes, as companies would spend significant resources on optimizing their supply chains to reduce operating costs. [EPA-HQ-OAR-2019-0055-1245-A1, p. 10]

The Chamber supports EPA's efforts to continue making progress to reduce emissions from the mobile source sector and strongly recommends that the agency avoid the numerous potential counterproductive economic and environmental consequences that could result from Option 1 of the proposal. Instead, EPA should proceed toward a final rule based on the framework outlined in Option 2, while making sensible modifications and clarifications in the framework as appropriate to ensure feasibility, maximize legal defensibility, and promote reductions in a cost-effective fashion, while reducing unwarranted and unnecessary burdens on innovation and investment. [EPA-HQ-OAR-2019-0055-1245-A1, p. 11]

Organization: *University of California, Berkeley, The Goldman School, Center for Environmental Policy*

We find the differences between the President's climate commitment scenario and the current EPA proposal to be notable across many elements of analysis:

Air pollution: While the EPA Proposed rules would reduce NOx emissions from new trucks, President's Climate Commitment scenario would nearly eliminate them, which would dramatically reduce the PM2.5 exposures and avoid 70,000 premature deaths over the EPA proposed rules. This is an important environmental justice issue. Studies have shown that low income groups and minorities bear a disproportionate proportion of the environmental burden from freight movement. For instance, it is estimated that in California, African American, Latino, and Asian Californians experience, respectively, 43, 39, and 21% higher levels of PM2.5 pollution from cars, trucks, and buses relative to white Californians. [EPA-HQ-OAR-2019-0055-1327-A1, p. 2]

In total, the air pollution and CO2 emissions reductions in the President's Climate Commitment scenario equate to over $500 billion in health and environmental savings through 2050, compared with the EPA Proposed rules. The net economic and environmental benefit of the President's Climate Commitment case over the EPA proposed case is over $1.5 trillion through 2050. [EPA-HQ-OAR-2019-0055-1327-A1, p. 3]

Organization: *Union of Concerned Scientists*

[*From Hearing Testimony, April 13, 2022, Dr. David Cooke, Union of Concerned Scientists*]
The heavy-duty truck rules proposed by EPA are the first step the Agency has taken and over 20 years to limit the harmful particulate and smog-forming emissions from heavy-duty trucks. USCIS is concerned that even after so much time, EPA's proposal matches neither the need nor the technical capacity to reduce these harmful emissions. Today, we have the opportunity to eliminate the harmful truck emissions that plague local communities. Unfortunately, EPA's rule chooses to treat these zero-emission vehicles as a curiosity, and yet even as the Agency ignores the market readiness and technical potential of such zero-emission vehicles, its proposal also fails to propose a standard for diesel trucks that reflects the best available conventional technologies. UCS is an advocate for science-based policy. As such, we simply ask EPA to look at the data. Together with the California Air Resources Board, EPA has funded millions of dollars of research at the Southwest Research Institute, yet it has in inexplicably deviated from what that data supports, which is the omnibus regulations. EPA must align it standards, beginning in 2027, with the omnibus. The Agency has already chosen to adopt the structure of the omnibus, which UCS supports, including the addition of a low load cycle, a more robust in-use testing program, and extended full useful lifetimes and warranties. The omnibus was adopted by California and now other states after a successful multi-year process, and the Agency's own data supports the diesel emission reductions required under the omnibus, so it's unclear why EPA has chosen to adopt these structural elements while not also proposing stringencies in line with that program. With regards to electric vehicles, EPA's proposal has unfortunately adopted the worst of all options. It has chosen to credit these vehicles under the NOx Program while ignoring them as a NOx solution in setting the standard. This means that every electric truck

sold, including those already required under state policies, will lead to a dirtier diesel truck being sold. This is untenable for communities dealing with truck pollution. EPA must make a choice: either fully recognized zero-emission vehicles and set a NOx standard predicated on the sale of such vehicles, or it should exclude credits for electric trucks entirely to guarantee emissions reductions from the dirty diesel trucks driving through freight-impacted communities. UCS can provide technical and economic data to support our various asks regarding EPA's policy, and we will continue to engage with EPA to strengthen the rule. If EPA is to uphold its technology-forcing mandate under the Clean Air Act, we expect a final rule that will reduce emissions from diesel trucks in line with the omnibus regulation and for EPA to ensure 50 percent of new trucks sold in 2030 are zero-emission vehicles. [EPA-HQ-OAR-2019-0055-2867]

Organization: *Ute Mountain Ute Tribe Environmental Programs Department*

Option 1 in Section IX clearly is preferable to Option 2 and would more closely reflect that which is as clean as possible with respect to nitrogen oxide emissions reductions. [EPA-HQ-OAR-2019-0055-1259-A1, p. 2]

Organization: *Valeria Trujilo Aguilar*

Therefore, on behalf of private citizens living and working in Denver exposed to dangerous levels of NOX and O3, I submit comments in support of the advanced notice of proposed rule for Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine Standards or Cleaner Trucks Initiative (CTI) released on January 6, 2020. A recommendation to reduce criteria pollutant emission standards and shorter useful life periods for new heavy-duty diesel and gasoline engines used in Class 2b through 8 vehicles by 2027 as proposed in Option 2 is highly favorable due to the potential to help states like Colorado meet National Air Quality Standards sooner and combat air quality challenges such as ozone pollution. [EPA-HQ-OAR-2019-0055-1223]

I fully support the implementation of stringent NOx emission standards proposed in Option 2 of ANPR Clean Trucks Initiative [EPA-HQ-OAR-2019-0055-1223]

Organization: *Valero Energy Corporation**:** Valero Energy Corporation*

EPA is required to consider impacts on endangered species of any action that may affect a listed species or any critical habitat for a listed species. In the proposal, however, EPA does not mention consideration of impacts on endangered species or any consultation required by the Endangered Species Act. EPA's proposal to shift the heavy-duty engine/vehicle market to electric vehicles should account for the emissions expected from production of electric vehicles, batteries, and the electricity for the vehicles, including the harm to endangered species from mines, windmills, and solar fields as well as the environmental impacts from any new mineral extraction facilities, including open-pit and subsea mining, as well as mineral processing and battery manufacturing facilities. [EPA-HQ-OAR-2019-0055-1328-A2, p.8]

Organization: *Volvo Group*

The Volvo Group strongly supports the Environmental Protection Agency's (the Agency) goal of significantly decreasing criteria pollutant emissions from heavy-duty engines, particularly for those local communities where air quality does not meet National Ambient Air Quality Standards (NAAQS). [EPA-HQ-OAR-2019-0055-1324-A1, p. 2]

If we are to truly maximize emission reductions, it is critical that this new federal oxides of nitrogen (NOx) standard under the Clean Trucks Plan be stringent enough to improve air quality – particularly in environmental justice communities – without creating unintended consequences that could postpone market adoption of cleaner technology vehicles and undermine the goals the regulation is seeking to achieve. [EPA-HQ-OAR-2019-0055-1324-A1, p. 2]

While both options proposed by the EPA in the NPRM are extremely aggressive, we are convinced that, as currently drafted, both would fail to produce the anticipated real-world emission reductions. In fact, it is precisely because we believe both options would foster unintended consequences that would undermine the agency's air quality and climate change goals that we are advocating for a modified version of Option 2 as providing the best opportunity for success. Without some modifications to finalize a robust, achievable version of Option 2, we fear the regulation could worsen air quality as older technology stays on roads longer, and the introduction of ZEVs (Zero Emission Vehicles) across the medium- and heavy-duty vehicle market is delayed due to overly burdensome costs on both fleets and OEMs (Original Equipment Manufacturers). [EPA-HQ-OAR-2019-0055-1324-A1, p. 2]

Having said this, the Volvo Group agrees with EPA that the NOx emission standards for heavy duty on highway (HDOH) vehicles should be reduced substantially starting in model year (MY) 2027; we also agree with EMA that this reduction could be as much as 75% from the current standard. Achieving our air quality and climate change goals requires a pragmatic accounting of the many factors that must be addressed if we are to be successful. The Volvo Group is working towards a commercial ZEV future. We want to manufacture the cleanest possible diesel vehicles which encourage fleet adoption, while maximizing our investment in accelerating zero emission technology in the marketplace. [EPA-HQ-OAR-2019-0055-1324-A1, pp. 2 - 3]

The Volvo Group, the industry, and a host of other stakeholders have worked with the Agency in good faith over several decades to reduce NOx and particulate matter (PM) emissions from heavy-duty trucks and buses by 98% from unregulated levels. The industry has invested billions of dollars to develop advanced, durable technical solutions and engine calibrations to meet this challenge, just as our customers invest heavily in clean air with every new truck purchase. These efforts have paid huge dividends in air quality improvements. Even today, the level of improvement is remarkable, especially given that less than 50% of the heavy-duty fleet is operating with the latest advancements in NOx emissions control as driven by EPA's fully phased-in 2007/2010 standards. [EPA-HQ-OAR-2019-0055-1324-A1, p. 3]

EPA's analysis when setting new NOx standards must give full weight to the gains that will naturally play out as the remainder of the fleet is steadily upgraded to the latest control technology. New vehicles compliant to the new 2027 NOx standards promulgated under the

Cleaner Trucks regulation will not begin to have an appreciable environmental impact until some years later. Any technological advancements needed to chip away at the remaining 1 to 2% of residual NOx emissions will come at a much higher cost per ton than the achievements of the previous two decades. Such costs and the associated development efforts will be additive to the technology advancements already committed by EPA's comprehensive, technology-forcing greenhouse gas regulations. These requisite costs, the current positive trajectory toward widespread ozone attainment, and the inevitable negative consequences to greenhouse gas requirements present and future, demand that the Agency take extreme care when establishing this next set of NOx standards and related protocols. [EPA-HQ-OAR-2019-0055-1324-A1, p. 3]

The Volvo Group is fully aligned with EMA's comments in opposition to the Proposed Option 1 Certification NOx Standard. As EMA noted, EPA has not demonstrated the full useful life feasibility of this standard with the associated CO2 standard. The exhaust thermal management required to achieve this lower NOx standard makes the existing GHG (Greenhouse Gas) CO2 reduction even more challenging. Technical feasibility must consider the needed margin for aging, production, fuel quality, and measurement variability. The premise that this standard can be reached is based on only one set of data as part of a prototype engine operating in a test environment and not in a vehicle operating under real world conditions across the full range of customer applications. [EPA-HQ-OAR-2019-0055-1324-A1, p. 3]

The proposed longer 600,000-mile and 800,000-mile useful life requirements drive greater aging margin and greater warranty challenges, making the extrapolation of test cell results as proof for real life durability at those levels to be impracticable. Demonstrating the technical feasibility of such an aggressive standard requires a broad full useful life in-use evaluation of the vehicle achieving all the requirements with sufficient margin. [EPA-HQ-OAR-2019-0055-1324-A1, p. 3]

It is important to elaborate further that NOx reductions are always paid for with CO2. Even if there is a technology capable of reducing both NOx and CO2, it does not eliminate the diesel engine NOx/CO2 tradeoff governed by the laws of physics, but merely shifts the tradeoff curve. As the graphic below illustrates, once EPA has committed manufacturers to the deployment of costly technology through rulemaking, the Agency controls where along the new NOx/CO2 tradeoff curve the engine is to be calibrated. The lower the NOx standard, the higher the CO2 emissions. Whether motivated by future GHG rules or market pressures for fuel economy, the lower NOx standard will limit current and future potential CO2 gains. The point is, EPA should be certain that the NOx reductions demanded by these new standards will be considered of higher priority in the timeframe that compliant products will have a meaningful environmental impact (post-2030) than the CO2 reductions they will forever preclude. [EPA-HQ-OAR-2019-0055-1324-A1, p. 4]

In conclusion, the Volvo Group believes the following principles must be reflected in the final regulation: a single step NOx reduction which accounts for the additional CO2 emission reductions required of OEMs under the existing Greenhouse Gas Phase 2 regulation in 2027. [EPA-HQ-OAR-2019-0055-1324-A1, p. 10]

Organization: *WE ACT for Environmental Justice*

With respect to the NOx portion of the proposal, we urge the EPA to disregard Option 2, which would require full implementation of the NOx standard starting with model year 2027. The EPA should not opt for the weakest proposal. As the Agency rightly points out, Option 2 would achieve 75% less NOx emissions reductions than today's standards in addition to having less stringent useful life and warranty periods. The Agency should be ambitious to safeguard low-income communities of color throughout the country and not pander to internal pressures or industry polluters. [EPA-HQ-OAR-2019-0055-1347-A1, p.3]

Instead, the EPA should pursue and enhance Option 1,which can achieve 90% NOx emissions reductions from medium- and heavy-duty vehicles and engines by 2027 relative to 2010 standards and aligns with California's Heavy-Duty Omnibus rule.18 Meeting or exceeding the omnibus program is the level of lifesaving ambition needed to deliver clean air to overburdened communities before 2031. Research shows that alignment with the rule could avoid $1.3 trillion in health damages linked to fine particulates and ozone pollution from 2027-2050.19 In addition, the EPA should not allow crediting as it compromises the NOx emission standard, and allows dirty diesel trucks and buses to continue to be sold, compounding air pollution and health burdens for the 72 million people, many of which are low-income and people color living within 200 meters of major trucking routes for years to come.20 [EPA-HQ-OAR-2019-0055-1347-A1, p.3]

18 https://ww2.arb.ca.gov/rulemaking/2020/hdomnibuslownox

19 https://theicct.org/publication/air-quality-and-health-impacts-of-heavy-duty-vehicles-in-g20-economies/

20 https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10144K0.pdf

Organization: *Western States Air Resources Council (WESTAR)*

As noted in the proposal, it has been over 20 years since the last revisions to NOx standards for on-highway heavy-duty trucks and engines, while the total vehicle miles traveled by these mobile sources has steadily increased. We agree that emission control technologies have improved and will continue to improve. Along with implementing better technologies, it is important that EPA accelerate fleet changes so that emissions reductions in both urban and rural vehicle populations benefit state Clean Air Act planning requirements due within the next 10 years. [EPA-HQ-OAR-2019-0055-1230-A1, p.1]

Reducing mobile emissions is important to Western states because they are a large part of the emissions inventory in the West. These reductions can be achieved with existing emission control technologies that were funded and fostered through partnerships between EPA, California and other states, and industry. While several western states that adopted California's vehicle standards under Section 177 of the Clean Air Act1 will benefit from these newer technologies, the greater benefit will be achieved when emissions reductions are implemented through a national rule. [EPA-HQ-OAR-2019-0055-1230-A1, p.1]

[1] 42 U.S.C. §7507.

One of EPA's stated goals with this proposed rule is to help states comply with the ozone NAAQS and improve visibility as part of the Regional Haze program. The proposal states that "The proposed Option 1 standards would significantly decrease ozone concentrations across the country, with a population- weighted average decrease of over 2 ppb in 2045.4 " In terms of emissions reductions, EPA estimates that Option 1 would reduce NOx emissions from heavy-duty vehicles in 2040 by more than 50 percent and by 60 percent in 2045. Most nonattainment areas for the 2008 and 2015 ozone NAAQS are required to attain the standard within the next six years (2028). While the proposed emission reductions are welcome, they will be too late to impact current ozone nonattainment areas and won't prevent the short-term transport of pollution throughout the western states. For this reason, we encourage EPA to find ways to foster quicker adoption of heavy-duty engine controls and technology within the industry through incentives and the proposed early adoption credits. [EPA-HQ-OAR-2019-0055-1230-A1,pp.3-4]

[4] Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, 87 Fed Reg. 17427 (March 28, 2022)

Organization: *William F. Limpert*

I appreciate EPA's work in proposing these rules, and in protecting our environment, our climate, and our fellow citizens. Full adoption of these rules will offer great public benefit, and I am very grateful for President Biden through his August 5, 2021 Executive Order, and EPA for moving forward with these major steps toward a better future, including full electrification of this industry as soon as possible. [EPA-HQ-OAR-2019-0055-1190]

I agree with EPA's assessment that failure to act to reduce NOx and greenhouse gas emissions would result in continued negative health impacts, further catastrophic impacts to our climate, both now, and in the future, poor air quality and visibility, and higher costs, especially for those who would be most impacted by negative health and climate impacts, generally our fellow citizens of low income status. [EPA-HQ-OAR-2019-0055-1190]

I would like to see EPA adopt Proposed Option 1 for reducing NOx emissions from heavy duty vehicles, since this option would achieve more emission reductions than Proposed Option 2. [EPA-HQ-OAR-2019-0055-1190]

I would like to see EPA require longer useful life periods for engines, and longer emission warranties to better assure decreased NOx emissions over the life of the vehicle. [EPA-HQ-OAR-2019-0055-1190]

I would like to see EPA further tighten the "Phase 2" GHG standards for certain subcategories of vehicles, and to further increase the stringency of the standards beyond what is currently proposed for MYs 2027 through 2029, including progressively stronger CO2 standards. [EPA-HQ-OAR-2019-0055-1190]

I would like to see EPA set stronger emission standards for MY 2027 and later commercial pickup trucks and vans. [EPA-HQ-OAR-2019-0055-1190]

I would also prefer that the time frames for adoption of these standards be shortened as much as possible, and the new limits be tightened as much as possible beyond what EPA has proposed. Any delays or compromised limits will cause more health issues, and drive us further down a catastrophic climate hole that we may not be able to escape. [EPA-HQ-OAR-2019-0055-1190]

Organization: *Wisconsin Department of Natural Resources (WDNR)*

EPA should finalize the more stringent Option 1. By 2045, Option 1 will reduce nationwide NOx emissions by about 120,000 tons more per year than Option 2. These additional NOx reductions are a critical part of the multi-sector, regional strategy required to ensure Wisconsin's ozone nonattainment areas are able to attain the 2015 ozone NAAQS. EPA modeling shows that without this rule Sheboygan County would remain in nonattainment through at least 2045, 30 years after the standard was promulgated. The same modeling shows that under Option 1, ozone at Sheboygan would decrease by 1.9 ppb by 2045, helping the area to attain the 2015 ozone NAAQS. [EPA-HQ-OAR-2019-0055-1162-A1, p. 2]

Highway heavy-duty NOx controls have simply not kept pace with reductions from other sectors. Prior to this proposal, heavy-duty NOx standards had not been updated for 20 years, despite the availability of demonstrated technology. EPA must take this opportunity to set more stringent NOx standards for heavyduty vehicles as soon as possible, but no later than MY 2027. Per 40 CFR 1036.150(a)(2), manufacturers must have four or more model years of lead time to meet revised criteria pollutant standards that would begin to apply. Therefore, revised standards applicable to MY 2027 must be finalized before January 1, 2023. [EPA-HQ-OAR-2019-0055-1162-A1, p. 3]

Emission control technology for heavy-duty vehicles will continue to advance. It is critical that EPA plan to review the NOx standards for heavy-duty vehicles more frequently moving forward and commit to revising standards soon after new technologies are adequately demonstrated. [EPA-HQ-OAR-2019-0055-1162-A1, p. 3]

Achieving GHG emission reductions from onroad vehicles, including heavy-duty vehicles, is a critical component to achieving long-term climate goals. EPA's continued efforts to improve the current Phase 2 GHG program for heavy-duty vehicles and upcoming commitment to set new GHG and fuel efficiency standards for MY 2030 are welcome.3 EPA's efforts to reduce GHG emissions must not delay final action on the much-needed NOx engine standards. [EPA-HQ-OAR-2019-0055-1162-A1, p. 4]

> 3. Executive Order 14037, Executive Order on Strengthening American Leadership in Clean Cars and Trucks. August 2021.

As previously described, the NOx standards must be finalized by December 2022. Should EPA determine it is not able to finalize the targeted updates to the Heavy-Duty GHG Phase 2 program on the same timeline, the updates to the Phase 2 program should be finalized separately. [EPA-HQ-OAR-2019-0055-1162-A1, p. 4]

Organization: *Worldwide Equipment Enterprises, Inc.*

Because of this role, Worldwide Equipment opposes this additional regulatory burden as it is being proposed. [EPA-HQ-OAR-2019-0055-1275-A1, p.1]

Worldwide Equipment's opposition to the Proposed Rule is due to several reasons. The first, and primary, reason is that the new requirements within Option #1 are technologically infeasible and, therefore, not realistic. [EPA-HQ-OAR-2019-0055-1275-A1, p.1]

Organization: *Zero Emission Transportation Association (ZETA)*

Based on ZETA's comprehensive understanding of the EV market and our shared goals to improve public health and environmental protection, we urge EPA to adopt NOx emissions standards at least as stringent as Option 1. EPA's Option 2 is not stringent enough compared to Option l because it has lower NOx emission standards and assumes shorter useful life periods. Therefore, adopting Option 2—which would reduce nitrogen oxide (NOx) emissions by just 47% in 2045—would ensure that we fall far short of our emissions reduction goals. In turn, this would have significant public health and corresponding economic consequences. The resulting analysis shows that Option 1 is technically feasible and would result in a greater reduction of emissions. However, based on available technologies, we believe that EPA should adopt a standard even more stringent than Option 1. The market for Class 2b and heavier electric vehicles (EVs) is prepared for a more stringent rule than EPA determined in its initial assessment. EPA should also increase the stringency of the Model Year (MY) 2027–2030 GHG standards by eliminating multipliers for HDEVs. Issuing a more stringent rule will send a strong market signal to manufacturers that zero- and low-emission vehicles are the future, which will enable EPA to issue strong Phase 3 greenhouse gas (GHG) standards that align with California's standards. Strong Phase 3 standards will be necessary to achieve the electrification goals President Biden called for in his executive order,1 and they will be imperative in our collective effort to meet international climate commitments. [EPA-HQ-OAR-2019-0055-1283-A1, p.1]

> 1https://www.whitehouse.gov/briefing-room/presidential-actions/2021/08/05/executive-order-on-strengthening-american-leadership-in-clean-carsand-trucks/

EPA should implement a more stringent rule than Option 1. The proposed options do not adequately reflect advancements in zero-emission vehicle (ZEV) technology. The number of HDVs on the road has grown significantly and can be expected to increase further as a result of the ongoing global e-commerce boom.16 [EPA-HQ-OAR-2019-0055-1283-A1, p.3]

> 16 https://www.bloomberg.com/news/newsletters/2021-11-16/theelectric-vehicle-invasion-is-already-here

<u>EPA Summary and Response</u>

Numerous commenters provided general input on the stringency of the proposed criteria pollutant standards. This section briefly summarizes the main themes across comments, which include: 1. General Support for One of the Proposed Options or Opposition to the Proposed Rule; 2. Consideration of ZEVs in the Final Standards; 3. Single- or Two-step Program. EPA's responses to each theme immediately follow the theme summary; given the general nature of comments in this section, our responses point readers to other relevant sections of this Response to Comments document, or the preamble for detailed discussion relevant to these comments.

General Support for One of the Proposed Options, or Opposition to the Proposed Rule

Many commenters supported proposed Option 1; some of these commenters suggested specific modifications to proposed Option 1. For example, some of these commenters urged EPA to adopt standards more stringent than proposed Option 1, with several commenters stating that EPA should fully align with the CARB HD Omnibus program and/or adopt the Alternative presented in the proposal. In addition, many of these commenters further stated what they characterized would be necessary for EPA to meet the Clean Air Act requirements to adopt standards that reflect the greatest degree of emission reduction achievable, with some stakeholders stating that only proposed Option 1 standards would fulfill the requirements, while others stated neither proposed Options 1 or 2 would fulfill the requirements and only standards more stringent than proposed Option 1 (e.g., full alignment with the CARB Omnibus or the Alternative included in the proposal) would fulfill the requirements. One commenter further stated that the proposed rule did not fulfill EPA's duty to set standards that will "most effectively 'promote public health and welfare and the productive capacity of its population'". A subset of commenters also raised concerns that some of the compliance flexibilities in the proposed rule would reduce the stringency of the final standards.

In addition, some of these commenters stated that adopting standards at least as stringent as proposed Option 1 would be consistent with EPA's commitment to addressing environmental injustices and reducing air pollution that disproportionately impacts environmental justice communities. One commenter further stated that the proposal did not fulfill EPA's duty under Title VI of the Civil Rights Act to avoid actions that create disparate impacts on communities of color and low-income communities. A subset of commenters also stated that EPA's feasibility analysis did not fully credit the emissions reductions capabilities of different types of emission control technologies (i.e., variable valve actuation strategies, mild hybridization, and opposed-piston engines); these commenters pointed to a report on the technological feasibility of cylinder deactivation, mild hybridization, and limiting auxiliary emissions control devices

Many other commenters stated that proposed Option 1 standards would not be technologically feasible, and urged EPA to adopt proposed Option 2, or something similar in terms of stringency of the standards. Some engine manufacturers pointed to concerns related to meeting the proposed Option 1 standards over multiple duty-cycles and stated that the engine demonstration testing EPA has conducted did not adequately show the proposed standards are feasible; some commenters further pointed to concerns related to packaging emission control systems in existing vehicles. Some engine manufacturers also stated that, in their view, reducing NO_X emissions would result in higher emissions of CO_2. Other commenters note that improving fleet turnover is important for reducing emissions from heavy-duty engines and state that the proposed Option 2 standards, or standards similar in terms of stringency would better encourage fleet turnover. Still other commenters expressed concerns related to meeting the proposed standards over the longer useful life periods included in either of the proposed options, but particularly the useful life periods in proposed Option 1. In addition, several commenters opposed both of the proposed options and urged EPA to consider unintended consequences of setting standards that are too stringent (e.g., reduced fleet turnover). For example, while one commenter welcomed the proposed updates to inducements and serviceability, they expressed concerns that more stringent emissions standards would result in more complex and expensive engines and emission control technologies.

Some of these commenters also discussed their views on the need for adequate compliance margin in the final standards. Several engine manufacturers stated that additional margin is needed under either proposed option, but particularly the most stringent step of proposed Option 1 to ensure that the final standards will be met throughout the useful life period of the final standards. In contrast, other commenters, including suppliers of heavy-duty emission control components, stated that existing data show sufficient margin to meet the proposed Option 1 standards.

In addition, some commenters provide perspectives on lead time for the final standards. A subset of some commenters stated additional lead time would be needed to meet the proposed standards, particularly the proposed Option 1 MY 2031 standards; some of these commenters further expressed concerns that the reliability and affordability of new trucks would be impacted without additional lead time to meet the MY 2027 standards under either of the proposed options. In contrast, other commenters stated that work funded by CARB, EPA, and others has been ongoing for years and should serve as a basis for setting very stringent standards starting in MY 2027. One commenter suggested EPA should "increase the strictness" annually or every 2-3 years. Still other commenters noted that the final standards would not be in place in a timely enough manner from their perspectives (e.g., to impact current ozone nonattainment areas), and thus urged EPA to incentivize the early introduction of emission control technologies.

Finally, some commenters reference the proposed averaging, banking, and trading (ABT) program, with several commenters urging EPA to lower the proposed Family Emission Limit (FEL) caps, not include the proposed NO_X emission credit multipliers, or otherwise adjust the proposed ABT program. Commenters also provided varying perspectives on some of the proposed compliance flexibilities. For instance, some commenters strongly opposed the EPA request for comment in the proposal to allow manufacturers to produce up to five percent of their production volume in model years 2027 through 2029 as compliant with the existing standards; however, other commenters stated that this type of allowance would be necessary to ensure a smooth transition to new standards, particularly for small volume products.

Response:

Section 1 of this Response to Comments document discusses EPA responses to more general comments that support or oppose the proposed rule. Preamble Sections I III, and IV include more detailed discussion on the final standards. Specifically, as discussed in Sections I.D and III.A, EPA is promulgating the new heavy-duty engine criteria pollutant standards under our authority in CAA section 202(a)(3)(A)[4] and the final standards reflect the greatest degree of emission reduction achievable through the application of technology that we have determined will be available for MY 2027, giving appropriate consideration to the statutory factors. EPA's assessment of the statutory factors in CAA section 202(a)(3)(A) justify the final emission standards. As an initial matter, we disagree with commenters that seemingly assert EPA must demonstrate technical feasibility through demonstration data of an engine actually meeting the standards at the time of promulgating the standards; rather, our technology-forcing statutory authority under CAA 202(a)(3)(A) is such that we must project future technology and provide a reasoned explanation for believing that projection is reliable.[5]. Nevertheless, data from our engine demonstration programs do meet the final standards, supporting our determination that the final standards are technically feasible. The final standards are appropriately based on further consideration of the data included in the proposed rule, as well as additional supporting data from our own test programs, and consideration of the extensive public input EPA received in response to the proposed rule.[6]

As discussed in the preamble of the proposed rule (87 FR 17417, March 28, 2022), we have considered a range of options (proposed Options 1 and 2, and the range between them); in setting the final standards, we gave appropriate consideration to the statutory factors as those factors would apply for each of the options. We note that, in reference to commenters' assertions that EPA stated in the proposed rule that proposed Option 1 would meet the requirements of CAA section 202(a)(3), we have refined in the final rule our assessments and consideration of the feasibility of the combination of the standards and useful life periods, particularly for the largest CI engines (Heavy heavy-duty engines (Heavy HDEs)), such that the final standards and requirements reflect our assessment of the CAA section 202(a)(3) factors, as discussed immediately above in this section. We further note that, as described in the preamble of the proposed rule (87 FR 17421, March 28, 2022), EPA is unable to conclude that the Alternative is feasible in the MY 2027 timeframe over the useful life periods in the Alternative in light of deterioration in the emission control technologies that we have evaluated, and we did not receive additional supporting data or other information that leads us to be able to conclude that the

[4] Regarding the comment stating that EPA is setting standards under CAA section 202(a)(3)(B), the commenter has failed to adequately explain why CAA section 202(a)(3)(B) does not allow EPA to set the technology-forcing standards we are promulgating in this rule. CAA section 202(a)(3)(B) is not so limited nor does it require EPA to give greater weight to reducing costs. We also note that, as explained elsewhere in this response, EPA has considered costs in setting the final standards.

[5] *See, e.g.*, Nat. Res. Def. Council v. EPA, 655 F.2d 318, 331-334 (D.C. Cir. 1981) (determining that there is substantial room for deference to EPA's expertise in projecting the likely course of development; that a reasonable basis would be demonstrated where EPA answers any theoretical objections to control technologies, identifies the major steps necessary to refine the technology, and offers plausible reasons for believing that each of those steps can be completed in the time available; and that EPA is not required to rebut all speculation that unspecified factors may hinder "real world" emission control); Nat. Res. Def. Council v. Thomas, 805 F.2d 410, 434 (D.C. Cir. 1986).

[6] In response to one commenter's statement that EPA has a "to make available to the public when a proposed action is published for public comment the data developed by the Agency and used for making its decision", the data supporting the proposed rule was included in the public docket for this rulemaking at the time of publication of the proposal; as appropriate, we have continued to added relevant, supporting information for transparency with the public.

Alternative is feasible in the MY 2027 timeframe.[7] Preamble Sections III and IV, and RIA Chapter 3, as well as section 3.2 of this document, include additional details on our assessment of the final standards, including our consideration of the technologies available to achieve the greatest degree of emission reduction in MY 2027, meeting the final standards over the useful life periods in the final rule, emission control performance over multiple test cycles, packaging constraints, impacts on CO_2 emissions, compliance margin, and lead time in the final rule.[8] In response to the commenter requesting annual changes to the emission standards, we note that our authority under CAA section 202(a)(3) requires that we provide three years of stability in promulgating criteria pollutant emission standards for heavy-duty vehicles or engines. In response to comments that EPA's technical feasibility analysis did not fully credit emission control technologies, we refer to RIA Chapter 3 for our analysis of the emissions reductions from the technologies included in our engine demonstration programs, and note that manufacturers may choose other technology pathways to comply with the final performance-based standards (see preamble Section III and section 3.10 of this Response to Comments document for additional discussion on other technology pathways to meet the final standards). As discussed, in RIA Chapter 3, the technologies we expect to be used to meet the final standards build upon the technologies used in today's light- and heavy-duty engines, which we expect will significantly reduce the potential complexity, reliability, and affordability concerns some commenters raise. Our costs analysis of the final standards (i.e., cost of compliance for manufacturer associated with the application of such technology) is included in preamble Sections III and V, with additional detail in RIA Chapters 3 and 7 and section 18 of this document. As explained in preamble Sections V-X and XII and sections 17-27 this document, we also evaluated additional factors, including factors to comply with E.O. 12866; our assessment of these factors lend further support to the final rule.

Our discussion of environmental justice and the impacts of this final rule on communities overburdened by pollution is included in preamble Sections VII and XII, with additional information in section 23 of this Response to Comments document. EPA is committed to taking decisive action to advance environmental justice and civil rights as part of its FY2022-2026 Strategic Plan. This rulemaking advances that strategic goal by setting stronger national emission standards for heavy duty engines and vehicles. In response to commenters who discuss the

[7] We disagree with one commenter's perspective that EPA should conduct additional analyses of the Alternative presented in the proposal, as well as proposed Option 2. As described in the proposed rule, and noted here, EPA lacked information on what technology pathway(s) would be necessary to meet the standards of the Alternative presented, and therefore was unable to conduct an analysis of costs and benefits. Similarly, as discussed in this section and preamble Sections I and III of the final rule, the final standards reflect the maximum emission reductions achievable based on our analyses and consideration of relevant statutory factors, and our assessment is that the more stringent aspects of the proposed Option 1 not adopted in the final rule would necessitate additional or different technology than what we analyzed at proposal. Also as noted in the proposed rule, due to resource constraints, we only conducted air quality modeling for the proposed Option 1.

[8] We note that some commenters point to certification data some engine manufacturers provided to CARB as evidence that manufacturers are currently capable of controlling emissions below the existing standards; however, some engine manufacturers stated in their comments that they chose not to generate emission credits from these engines certified to NO_X emission levels below the existing standards. Manufacturers further stated in their comments that, in their view, the certification data indicated that they had accounted for deterioration and other factors that can impact emissions performance in the field over the current useful life period, rather than declaring an FEL below the standard to generate credits as they likely were not confident they could comply with a lower emission limit in-use for the existing full useful life.

importance of fleet turnover for reducing emissions, we point to discussion in preamble Section X and section 25 of this Response to Comments document; section 26 of this document includes additional discussion on other potential economic impacts of the final rule. In addition, preamble Section IV, and sections 5 and 8 of this Response to Comments document discuss approaches to improve serviceability and update inducements, respectively in this final rule. In response to comments suggesting modifications to one or more of the proposed duty-cycle standards for CI or SI engines, we point to discussion included in Sections 3.2 and 3.3 of this Response to Comments document, with additional information available in preamble Section III. Finally, in response to comments on the proposed useful life and warranty periods, we point to discussion in sections 3.8 and 4 of this document, with additional information included in preamble Section IV.

We acknowledge that several commenters urged EPA to finalize proposed Option 1 or to modify proposed Option 1 to more closely align with the HD Omnibus; while we are not finalizing Option 1 as proposed, as further explained in preamble Section III, our independent evaluation of the greatest degree of emission reduction achievable for a national program includes consideration of the points the commenters raised. Section 3.1.2 of this document includes further discussion regarding our evaluation, and the different considerations relevant to setting Federal standards under CAA 202(a) relative to considerations relevant to reviewing California's submission of a waiver of preemption under CAA section 209(b) for the HD Omnibus program. Section 2 of this document further discusses how we considered comments relevant to the need for additional air quality improvements and CAA requirements related to public health and welfare.

Finally, information on the final ABT program, including our rationale for the FEL caps in the final rule, is included in preamble Section IV.G, with additional information on comments received relevant to the proposed ABT program included in section 12 of this Response to Comments document. We note that the request for comment in the proposal for a compliance flexibility to allow manufacturers to certify a limited production volume as compliant with the existing standards is also discussed in preamble Section IV.G, with additional information in section 12 of this document. Additional discussion on the compliance flexibilities in the final rule is included in preamble Section III.B.

Consideration of ZEVs in the Final Standards

Several commenters stated that EPA should or must consider the use of ZEV technologies when setting the final criteria pollutant standards, and/or that EPA should reconsider the proposed allowance for ZEVs to generate NO_X emissions credits. Some commenters also included discussion of GHG standards when providing input on the proposed criteria pollutant standards. Other commenters stated that EPA should not mandate that certain technologies be used to meet the final standards. Finally, some commenters noted that emissions that occur upstream of the vehicle (e.g., from electricity generation) should be part of EPA's considerations of the emissions impacts of various technologies.

<u>Response:</u>

As discussed in the preamble of the proposed rule, we did not rely on the use of ZEV technologies in the development of the proposed options because we did not expect that existing or projected market penetration rates in the MY 2027 timeframe would meaningfully impact our analysis for developing the numeric level of the proposed standards (87 FR 17458, March 28, 2022). While recent Federal actions, such as the Inflation Reduction Act of 2022, include incentives to encourage the production of ZEV technologies in the MY 2027 timeframe beyond what was expected at the time of the proposed rule, these actions and related events took place in a timeframe that precluded additional analysis for the final heavy-duty engine criteria pollutant standards starting in MY 2027.[9] As explained in preamble Sections I and II, it is imperative that we finalize such criteria pollutant standards in calendar year 2022 in order that we may meet the minimum CAA lead time requirements and begin achieving emission reductions starting in MY 2027, consistent with the goals of the statute. Consistent with our CAA 202(a)(3)(A) authority, the final, performance-based heavy-duty engine standards that we are setting include consideration of comments submitted, including comments related to the use of ZEV technologies in setting the standards. As discussed in preamble Section III.A, the final standards in this rule are not based on the projected utilization of ZEV technology, though manufacturers may choose to comply with the standards through using ZEV technologies, or other technology pathways than included in our demonstration program.

In addition to considering comments on including ZEV technologies in setting the standards, we have considered comments related to the proposed allowance for manufacturers to generate NO_X emissions credits from ZEV technologies. We agree with comments that raised a concern with allowing ZEV technologies to generate NO_X emissions credits given that ZEVs were not utilized in setting the standards and the potential for higher than anticipated penetration of ZEV technologies. In preamble Section IV.G, we discuss our decision not to finalize the proposed allowance for manufacturers to generate NO_X emissions credits from heavy-duty ZEVs (see section 12 of this Response to Comments document for additional details on our decision not to finalize this proposed allowance). We further explain in preamble Section IV.G that we have designed the final ABT program to best ensure the expected emission reductions from the final standards.

As noted in preamble Section I, EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards); we intend to consider ZEV technologies in developing that separate proposed rulemaking. Section 28 of this Response to Comments document details the comments we received specific to the proposed revisions to the GHG Phase 2 standards. Section 3.10 of this document provides additional comments received relevant to multiple technology pathways to meet the final standards, as well as EPA's responses to those comments. Finally, section 19.3 of this document includes additional comments relevant to upstream emissions impacts and EPA's response to those comments.

[9] The Inflation Reduction Act (IRA) has many incentives for promoting zero-emission vehicles, including support for refueling infrastructure (e.g., Section 13404 Alternative Fuel Refueling Property Credit); however, it was finalized in August 2022, which is well beyond the close of the comment period for this final rule. We intend to consider the implications of the IRA and other Federal actions in future rulemakings focused on heavy-duty vehicle standards for the heavy-duty sector.

Single- or Two-step Program

Several commenters also provided input on whether EPA should finalize a single- or two-step program. Commenters broadly supported finalizing a single-step program, but based on different considerations. For instance, some commenters supported a single-step program due to considerations related to implementation (e.g., commenter viewed the two-step approach as potentially resulting in market disruptions; commenters suggested single-step approach will better allow manufacturers to focus on ZEV development) or general stringency (e.g., commenter believes a two-step approach would require additional lead time to validate new technology for an additional step in stringency). Other commenters supported a single-step program in order to avoid a delay in the most stringent standards proposed (i.e., commenters urged EPA to implement all or some of the proposed MY 2031 standards starting in MY 2027). Similarly, one commenter discussed the value of regulatory certainty to enable industry investments and meet long-term air quality goals.

Response:

As noted immediately above in this response, preamble Section III.A discusses our assessment of the final standards, including our decision to implement a single-step program beginning in MY 2027. We believe the combination of the single step program and the final standards will provide regulatory certainty for the industry and provide meaningful air quality benefits across the country.

Analyses Supporting the Rule

Finally, several commenters provided input on the analyses that supported the proposed rule. For example, one commenter stated that EPA should conduct regional scale air quality modeling to evaluate the impacts of the rule on nonattainment areas. As also noted above, other commenters provided perspectives on our analyses of costs, benefits, and/or economic impacts, particularly pre- and low-buy. Some commenters also provided input relevant to our analysis of impacts to small businesses.

Response:

Information on our final analyses can be found in preamble Sections V through X and XII, with additional information in RIA Chapters 5 – 10 and our responses to comments in sections 17-27 of this document. Regarding one commenter's statement that the "cost of compliance" criteria in 42 U.S.C. §7521(a)(2) applies to users of new motor vehicles or engines (in addition to manufacturers), we first note that new standards like those being promulgated in this rule were not at issue in the case cited by the commenter. Additionally, as explained above and in section 17 of this document (which includes additional discussion on comments relevant to small businesses), we disagree and maintain that cost of compliance under CAA section 202(a) includes only costs for regulated entities under the final standards, i.e. manufacturers. *See, e.g., Coalition for Responsible Regulation v. EPA*, 684 F. 3d 102, 129 (D.C. Cir. 2012). Our response to the comment on conducting regional scale air quality modeling is included in section 2.2 of this Response to Comments document. We note that some comments relevant to analyses to support the rule may not have specified if they were relevant to GHG or criteria pollutant portions of the rule, see Section 28.5 of this document for additional discussion.

3.1.2 Nationwide standards and CARB alignment

<u>Comments by Organizations</u>

Organization: *Achates Power, Inc.*

Achates Power supports a strong federal heavy duty vehicle standard that harmonizes with California's Omnibus ultralow NOx regulations, albeit with more phase-in time for the federal regulation (i.e. full stringency in 2031). We base the position based on demonstrations that suggest the fully implemented CARB omnibus regulations can be met in a robust, practical, and cost-effective manner. In addition, Achates Power fully supports the California Air Resources Board's position regarding the use of emissions credits in the proposed standard. [EPA-HQ-OAR-2019-0055-1216-A1, p. 1]

Organization: *Alliance for Vehicle Efficiency (AVE)*

AVE Supports harmonization of future national standards. [EPA-HQ-OAR-2019-0055-1280-A1, p. 4]

In July 2021, AVE, South Coast Air Quality Management District, and other stakeholders wrote to EPA seeking for harmonization of EPA's low-NOx rulemaking with California's Omnibus regulations.6 A unified national program will enable heavy vehicle manufacturers and suppliers to streamline the engine and aftertreatment integration to simultaneously meet GHG and criteria pollutant standards. [EPA-HQ-OAR-2019-0055-1280-A1, p .4]

> 6. See Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards

Harmonization is also a top priority of President Biden. On August 5, 2021, the President explicitly instructed EPA to coordinate its Heavy-duty NOx standards with California. [EPA-HQ-OAR-2019-0055-1280-A1, p. 4]

(c) Given the significant expertise and historical leadership demonstrated by the State of California with respect to establishing emissions standards for light-, medium-, and heavy-duty vehicles, the Administrator of the EPA shall coordinate the agency's activities pursuant to sections 2 through 4 of this order, as appropriate and consistent with applicable law, with the State of California as well as other States that are leading the way in reducing vehicle emissions, including by adopting California's standards.7 [EPA-HQ-OAR-2019-0055-1280-A1, p. 4]

> 7. https://www.whitehouse.gov/briefing-room/presidential-actions/2021/08/05/executive-order-on-strengthening-american-leadership-in-clean-cars-and-trucks/

Alignment in MY2027 and MY2030 would provide a national heavy-duty regulation that is important to automotive vehicle suppliers. Suppliers have invested significant resources in research and development for new engine and emission control technologies so that new heavy-duty trucks meet future lower NOx standards. Harmonization with California's Omnibus standards will provide suppliers with the necessary certainty to keep investing in the next generation of vehicle technologies. Regarding FUL, EPA could consider reevaluating its standard based on new data once it becomes available. [EPA-HQ-OAR-2019-0055-1280-A1, p. 4]

Organization: *Allison Transmission, Inc. (Allison)*

- Allison supports efforts to align EPA standards with programs that have been recently promulgated by the California Air Resources Board ("CARB"). However, alignment is not an unmitigated good; there are areas where EPA should not adopt CARB requirements but rather seek to have state requirements become more consistent with EPA's approach to regulating criteria and GHG emissions. In general, EPA should avoid predicating new standards on assumptions that predict the adoption of limited technology avenues for reducing emissions, such as overreliance on market adoption of ZEVs. Apart from technological challenges, efforts should be made to further assess the broader environmental footprint of different options for address both criteria and GHG emissions to ensure that sufficient time is allowed to develop and validate different technological pathways. [EPA-HQ-OAR-2019-0055-1231-A1, pp.6-7]

Given the federal/state relationship in the mobile source sector as defined in the Clean Air Act, Allison also believes there is significant in value in the coordination of CARB and EPA requirements. This extends far beyond just the stringency of criteria and GHG emission limits. Testing, certification, recordkeeping and reporting procedures (as well as the potential for parallel compliance and enforcement provisions) have a very large potential to affect the overall cost-effectiveness of federal and state HDV programs. The chart below illustrates current disparities as between existing CARB requirements and EPA's Proposed Rule:[EPA-HQ-OAR-2019-0055-1231-A1, p.33]

		Mobile emissions regulations (US/CAN)	Current	2024-2026	2027 / 2028 / 2029 / 2030	2031 / 2032 / 2035
Option 1 has more in common with CARB HD Omnibus Two step 27/31	EPA	SI & CI MHD & HHD Engine Certification NOx	0.20 g/bhp-hr		0.035 g/bhp-hr (82.5% reduction) on FTP/SET	0.02 g/bhp-hr (90% reduction) on FTP/SET through IUL; 0.04 g/bhp-hr through EUL
		CI/Compression Ignition Engine Emissions Warranty / EUL (MHD/HHD*) *HHD includes certain SI engines (e.g. natural-gas fuel engines in CL8)	5Y/100K mi ; 10Y/185K mi 5Y/100K mi ; 10Y/435K mi, or if 22K hours is reached		7Y/[illegible] 7Y/450K mi/22K hr; 11Y/[illegible]	10Y/[illegible] 10Y/[illegible] or 40K hours
		CI/Compression Ignition Engine Intermediate Useful Life (IUL) for HHD/CL8				[illegible]
		SI/Spark Ignited Engines Emissions Warranty/ EUL (MHD)	5Y/50K mi; 10Y/110K mi		7Y/110K mi; 12Y/155K miles	10Y/[illegible] mi; 15Y/200K miles
		Low Load Cycle			[illegible] g/bhp-hr on new Low Load Cycle	[illegible]
		HDE Off-Cycle NOx Standards 3-bin (idle / low-load/ med-high load) IUL to EUL only applyies to HHD/CL8	no current standard	CARB only standard	idle 20 (g/hr); low load [illegible] (mg/hp-hr); [illegible] medium high load (mg/hp-hr)	[illegible]
CARB HD Omnibus Three steps 24/27/31	CARB	Engine Certification NOx	0.20 g/bhp-hr	0.05 g/bhp-hr	0.02 g/bhp-hr to intermediate useful life [illegible] then 0.035 g/bhp-hr	0.02 g/bhp-hr to intermediate useful life [illegible] then 0.04 g/bhp-hr
		Additional Compliance /testing		Low Load Cycle, Moving Average Window, OBD REAL In-use compliance	Revised Low-load cycle & intermediate Useful life used for [illegible]	
		HD Diesel Emissions Warranty ; EUL (MHD/HHD)	5Y/100K mi; 10Y/185K mi 5Y/100K mi; 10Y/435K mi	5Y/150K mi; 10Y/185K mi 5Y/350K mi; 10Y/435K mi	7Y/220K mi/11K hr; 11Y/270K mi 7Y/450K mi/22K hr; 11Y/[illegible]	10Y/280K mi or 14K hr; 12Y/350K mi 10Y/[illegible] or 40K
Option 2 like CARB HD Omnibus 2024-2026	EPA	SI & CI MHD & HHD Engine Certification NOx	0.20 g/bhp-hr		0.05 g/bhp-hr (75% reduction) on FTP/SET	
		CI/Compression Ignition Engine Emissions Warranty / EUL (MHD/HHD*) *HHD includes certain SI engines (e.g. natural-gas fuel engines in CL8)	5Y/100K mi ; 10Y/185K mi 5Y/100K mi ; 10Y/435K mi, or if 22K hours is reached		5Y/150K mi; 10Y/325K mi 5Y/350K mi; 10Y/[illegible] or 22K hours	
		SI/Spark Ignited Engines Emissions Warranty/ EUL (MHD)	5Y/50K mi; 10Y/110K mi		5Y/110K mi; 10Y/150K miles	
		Low Load Cycle	no current standard	CARB only standard	[illegible] g/bhp-hr on new Low Load Cycle	
		HDE Off-Cycle NOx Standards 3-bin (idle / low-load/ med-high load)			idle 15 (g/hr); low load 150 (mg/hp-hr); 75 medium/high load (mg/hp-hr)	

Allison Transmission, Inc. comparison of regulations Option 1 and Option 2 vs. CARB HD Omnibus

- Allison appreciates the challenge EPA faces in weighing differing stakeholder perspectives regarding importance of full alignment with CARB HD Omnibus versus other alternatives approaches. These comments are based on our interest in maintaining a regulatory landscape that strengthens American industry and supports vocational workforce while achieving clean air and long-term environmental goals. Allison believes there is significant in value in coordinating requirements between CARB and EPA for testing and certification procedures, as well as compliance provisions. Alignment of federal and state programs can, if set at the right level of stringency, help to reduce costs and achieve better efficiency in research and development expenses, allowing for shared product lines. However, Allison believes that EPA needs to consider that alignment is not an unmitigated good in all cases; as reflected in comments above, a different set of considerations and challenges need to be considered when promulgating regulations for products that will serve diverse applications in commercial vehicle markets. These include the need for reasonable access to energy and fueling infrastructure where a transition to different systems to power commercial vehicles is contemplated. Either explicit or implicit mandates for certain vehicle types cannot be reasonably achieved unless there is corresponding availability of the necessary fueling infrastructure. [EPA-HQ-OAR-2019-0055-1231-A1, p.34]

In the comments above, Allison has referenced several areas where EPA's Proposed Rule could be improved. Specifically, with respect to the interrelationship of EPA and CARB standards, Allison would offer several additional comments and perspectives: [EPA-HQ-OAR-2019-0055-1231-A1, p.35]

- CARB's Omnibus NOx standards post MY 2027 are based on assumptions concerning certain alternative fuels and the electric grid; but these assumptions may or may not prove out over the next few years and choosing one technology pathway like ZEVs could realistically constrain participation by other technologies and emerging alternative fuels in the heavy-duty sector. Again, Allison would urge EPA to continue promulgating standards that may be achieved by a variety of different technological approaches and, consistent with its CAA authority, only promulgate standards that appropriately consider costs as well as allow for a sufficient timeframe for necessary research, development and demonstration. [EPA-HQ-OAR-2019-0055-1231-A1, pp.35-36]

- The CARB HD Omnibus Rule utilizes standards and measures that are meant to address regional air quality concerns. The standards also require coordination with supporting infrastructure. Such coordination is inherently more feasible to take in a regional context, which is more capable of supporting and targeting infrastructure development for ZEV deployments, necessary alternative fuels and fueling capacity. Such efforts are likely impracticable and potentially unattainable at the federal level within the same timeframes. Several factors distinguish California's efforts from EPA capability in this area:
    - From a practical standpoint, California has exhibited unwavering support for statewide greenhouse gas reductions and electrification goals and incentives for the transportation sector. Starting with approval of the Global Warming Solutions Act of 2006, California has developed a legal and regulatory framework to enable a noteworthy push to accelerate ZEV technology. In more recent rulemakings, ZEV technology has become a primary focus for efforts in the mobile source sector.
    - In this effort, CARB has conducted multiple workshops and engaged in extensive coordination with the California Energy Commission to plan the infrastructure development necessary to support ZEVs at an accelerated pace. While there are currently some federal efforts in this area, including through passage of the 2021 infrastructure package,72 similar efforts do not exist throughout the United States at the same level of legal/regulatory commitment or public funding. [EPA-HQ-OAR-2019-0055-1231-A1, p.36]

72 Infrastructure Investment and Jobs Act, Pub. L. 117-58.

- CARB HD Omnibus NOx standards post 2027 are based on certain alternative fuels and grid assumptions considered at the time of rulemaking. As a result, these standards may not consider the benefits of other emerging alternative fuels that could be applied to heavy duty internal combustion engines as a tool to achieve near-term criteria air pollutant and long-term CO_2 reduction goals in vehicle applications that resist electrification. They also may not fully consider the need to leverage existing infrastructure when transitioning to stricter standards. Given these limitations, variation from the structure of CARB regulatory requirements is both justified and necessary. [EPA-HQ-OAR-2019-0055-1231-A1, p.36]
- Otherwise, one of the reasons that the CARB HD Omnibus Rule may be able to achieve its aggressive standards and implementation schedule is by leveraging federally certified engines through allowable exemptions that serve to mitigate impacts to end-user productivity (e,g., numerous exemptions were included by CARB in the final rule because transit, motorcoach, refuse, and heavy haul end-users provided information that justified additional flexibility. Again, the state's ability to take particular regulatory approach to reducing emissions does not mean that similar approaches are justified or workable at a federal level. [EPA-HQ-OAR-2019-0055-1231-A1, pp.36-37]

Organization: *American Trucking Associations (ATA)*

In developing the next pathway to further reduce NOx emissions from the trucking sector, ATA worked closely with EPA and other stakeholders with our overall aim to further advance our positive record of environmental progress. We believe in the establishment of one national low-NOx standard that is flexible, considers the wide diversity of trucking operations, is based upon technology paths that are thoroughly tested and affordable, and does not disrupt fleet operations and the economy. Interstate trucks are not bound by geographic boundaries. Trucks purchased anywhere in the country should be compliant wherever their business may take them. [EPA-HQ-OAR-2019-0055-1326-A1, p. 5]

Non-uniformity of national NOx pathways is of particular concern to ATA member fleets. If the final HD2027 rule differs from the California Air Resources Board ("CARB") approach, and CARB and opt-in states under Clean Air Act Section 177 continue implementation of the California standard, there will be two different NOx programs in play across the country – a proposition that is unworkable and problematic. For example, manufacturers would not only face the prospect of two different product lines but also two different sets of engine certification requirements and two different review and approval processes for these products. This will undoubtedly add to the cost of bringing new engines to market and create duplication in the administrative approval process. [EPA-HQ-OAR-2019-0055-1326-A1, pp. 5 - 6]

ATA does not define "harmonization" as federal standards mirroring those of a single state such as California. California has unique air quality issues given its large population and unique geographical features. Their regulation should not automatically become the template in establishing the next national low-NOx standard. Our definition of "harmonization" is the setting of one federal standard that will reduce NOx emissions nation-wide, not impede trucking operations or purchase plans across the country, and is both technologically and economically achievable. Option 1 is the CARB standard and ATA does not support California's extreme and unattainable approach as the next national standard for diesel freight trucks for the rest of the country. [EPA-HQ-OAR-2019-0055-1326-A1, p. 6]

If one national standard across the country is not established, fleets will become creative in where, when, and what type of equipment to purchase if patchwork standards are to remain in effect and expand. For example, while states such as California will not allow you to register a new truck purchased outside the state that does not meet CARB's low-NOx and warranty requirements, such vehicle can be purchased and operated outside the state and then be registered in California once its odometer hits 7,500 miles. Other states may have similar registration provisions. [EPA-HQ-OAR-2019-0055-1326-A1, p. 6]

While California has its unique topography and associated air quality issues, it is imperative that the state and EPA find common ground in plotting a path forward. Putting differences aside, ATA encourages EPA and CARB to ultimately unify their approaches. Fleets have choices and if one harmonized national standard cannot be achieved, fleets may be forced to change their business models and purchasing decisions. [EPA-HQ-OAR-2019-0055-1326-A1, p. 6]

Organization: *California Air Pollution Control Officers Association (CAPCOA)*

CAPCOA supports proposed Option 1, with modifications that would align the proposal with the California Air Resources Board's (CARB) recently adopted Heavy-Duty Omnibus Regulation. This technology forcing regulation will reduce in-use nitrogen oxide (NOx) emissions from new heavy-duty engines and trucks sold in California by 90% beginning in 2027. Such a federal standard would ensure that model year 2027 and later trucks operating in California would meet the most stringent standards achievable regardless of their origin. [EPA-HQ-OAR-2019-0055-1253-A1, p.1]

Despite these significant efforts by air districts and CARB, federal action to reduce emissions is critical if we are to attain the National Ambient Air Quality Standards. For example, data shows that in the South Coast air basin, considering only emissions from ships, locomotives, and aircraft which are under federal authority, the region needs an additional 46 tons per day of NOx reductions by 2023 to attain standards in a timely manner. When also considering the emissions from on-road heavy-duty trucks that are subject to federal authority, the region needs a total of 67 – 69 tons per day of NOx reductions from federal sources. Extrapolating this example to the rest of California, it is clear that without significant progress in reducing mobile source emissions, especially at the federal level, it will be extremely difficult if not impossible to meet our air quality mandates. Absent strong federal action, extreme nonattainment areas such as the South Coast and San Joaquin Valley air basins face Clean Air Act penalties and sanctions due to mobile source emissions under federal jurisdiction. Such air districts will be forced to implement additional stationary source regulations that are much less cost effective than federal mobile source measures and in regions that already impose the most stringent regulations in the nation. To this end, CAPCOA strongly encourage U.S. EPA to promulgate technology forcing regulations in the mobile sector that are directly and solely under U.S. EPA authority that yield as much emissions reductions as possible as quickly as possible. The health of our residents depends on it. [EPA-HQ-OAR-2019-0055-1253-A1, p.2]

Organization: *California Air Resources Board (CARB)*

U.S. EPA should align its standards with those that CARB has already demonstrated are feasible. CARB adopted major revisions to our heavy-duty requirements, known as the 'Heavy-Duty Omnibus Low NOx Regulation' (HD Omnibus Regulation), in 2021. CARB's HD Omnibus Regulation includes a comprehensive set of revisions designed to ensure that NOx emissions from heavy-duty engines are significantly reduced from the time the vehicle/engine is first sold until the end of its useful life. During the development of the Omnibus Regulation over seven years, CARB coordinated closely with U.S. EPA staff. In fact, U.S. EPA contributed significant funding to California's Low NOx heavy-duty engine demonstration work at the Southwest Research Institute, which demonstrated NOx levels on order of 90 percent lower than today's standards with no greenhouse gas impact. U.S. EPA's CTP NPRM contains almost identical programmatic elements to the HD Omnibus Regulation but offers a range of possible stringencies. Option 1, as U.S. EPA notes, is the more stringent option and reflects alignment with the HD Omnibus Regulation. [EPA-HQ-OAR-2019-0055-1186-A1, p.2]

Accordingly, it is absolutely crucial that U.S. EPA finalize standards in line with Option 1 in the CTP NPRM – and strengthen Option 1 to eliminate undue loopholes that could weaken its ability to ensure in-use compliance with its standards. The Option 1 proposal is technologically feasible and cost-effective and closely aligned with CARB's HD Omnibus Regulation. Some of the flexibilities discussed in the NPRM would effectively set higher, less stringent standards for compliance. Such flexibility would allow standards to appear more stringent and health protective than they actually are, thereby providing a 'backdoor' method to set looser standards. For example, such flexibilities could make the regulation's 35 milligrams per brake-horsepower hour (mg/bhp-hr) standard effectively a 70 mg/bhp-hr standard. Option 2 is too weak to be considered as reasonably, especially regarding the proposed emissions standards, useful life, and warranty period requirements. Option 2 would forego desperately needed emission reductions and fail to meet U.S. EPA's statutory requirements under the Clean Air Act. [EPA-HQ-OAR-2019-0055-1186-A1, p.2]

- CARB recommends that U.S. EPA consider only the Option 1 standards, with modifications to the 2027 through 2030 standards that would align with CARB's heavy-duty Omnibus standards. [EPA-HQ-OAR-2019-0055-1186-A1, p.2]

U.S. EPA has proposed a 20 mg/hp-hr NOx standards on the FTP and SET duty cycles and a 50 mg/hp-hr NOx on the LLC for MY 2031 and later light and medium HDEs for full UL and heavy HDEs through IUL of 435,000 miles. These standards are technically feasible and align with the Omnibus 2031 MY standards. [EPA-HQ-OAR-2019-0055-1186-A2, p.40]

However, for MY 2027, the proposed Option 1 FTP, SET, and LLC NOx standards are less stringent than is technically feasible. CARB staff recommends that U.S. EPA align with the 2027 MY Omnibus NOx standards by adopting a 20 mg/hp-hr NOx on the FTP and SET and a 50 mg/hp-hr NOx on the LLC for light and medium HDEs through UL and heavy HDEs through IUL. As discussed below, these standards are technically feasible for MY 2027. [EPA-HQ-OAR-2019-0055-1186-A2, p.40]

The proposed Alternative standards are the most stringent compared to both proposed Options 1 and 2. Although the Alternative has the potential to provide much needed NOx emission reductions, CARB staff understand that U.S. EPA believes that currently no data exists to unequivocally establish the feasibility of the Alternative 20 mg/hp-hr standard over the proposed longer 850,000 mile UL for MY 2027. However, CARB staff strongly supports that U.S. EPA adopt in its final rulemaking the proposed Option 1 standards with CARB staff recommended modifications that would align it with the Omnibus standards as well as strengthen the LLC and idling NOx standards to reflect recently demonstrated emissions performance in the CARB Stage 3 and U.S. EPA Stage 3 RW engine testing as well as the On-Road PEMS demonstration and further engine testing results from the Achates 10.6L Class 8 engine project. Ongoing work is expected this summer from both a second EPA low NOx engine configuration at SwRI and from a CARB and South Coast Air Quality Management District sponsored 800,000 mile aging follow-on emissions demonstration utilizing the second generation Achates engine and simplified aftertreatment. [EPA-HQ-OAR-2019-0055-1186-A2, p.47]

Organization: *Coalition for Clean Air*

Because a significant percentage of the trucks on California roads are based in other states, we rely on USEPA to set a health-protective ultra-low NOx standard. [EPA-HQ-OAR-2019-0055-1139-A1, p.1]

EPA proposes two options for cutting NOx emissions – the biggest cause of smog and soot -- from heavy-duty vehicles. Under Option 1, EPA's plan would work in two phases, reaching 0.035 grams per brake horsepower-hour (g/bhp-hr) in model year (MY) 2027 and 0.02 g/bhp-hr in MY31. This would represent a tenfold increase in stringency over the existing federal standard of 0.2 g/bhp-hr. EPA's weaker "Option 2" would cut NOx to 0.05 g/bhp-hr in a single-step starting in MY27. Option 2 is completely inadequate to address truck pollution. [EPA-HQ-OAR-2019-0055-1139-A1, p.1]

EPA should adopt Option 1, which would produce far deeper NOx cuts than 'Option 2,' but EPA also needs to tighten the plan further to align with California's 'omnibus' heavy-duty truck rule. California's rule reaches the same emissions limit of 0.02 g/bhp-hr of NOx as EPA's 'Option 1,' but does so faster, in MY27. Furthermore, EPA's rule should emulate California's improvements to test procedures, regulatory useful life, emission-related warranty, and other requirements that will meaningfully reduce actual on-road emissions. [EPA-HQ-OAR-2019-0055-1139-A1, pp.1-2]

Organization: *Colorado Energy Office, et al.*

Our agencies strongly support EPA's development of NOx and GHG emission standards. Colorado is planning to initiate a rulemaking at the state Air Quality Control Commission in late 2022 to consider adoption of both the Advanced Clean Trucks rule and the Low NOx Omnibus rule to help address state air quality challenges. Nevertheless, our agencies are highly supportive of a national standard that is as robust as possible to ensure strong progress nationwide on air pollution and equity. A strong national standard is particularly important for trucks because they frequently travel between states supporting interstate commerce, so greater consistency across the country is better for clean air and business. [EPA-HQ-OAR-2019-0055-1297-A1, p.1]

Organization: *Eaton Vehicle Group (Eaton)*

1. **Implementing one national standard is critical for the transportation industry**. The EPA has an opportunity to create a single regulatory approach to emissions. In our assessment, <u>Option 1 of the NPRM is close enough to the California Air Resource Board (CARB) Omnibus</u>, and we believe convergence is both feasible and desirable [EPA-HQ-OAR-2019-0055-1252-A1, p.1]

The absence of a single national standard carries serious risks and introduces uncertainties and confusion in the market, ultimately stifling innovation, investment and the potential for economies-of-scale. This possibility is realistic, as a similar situation happened over the past five years in the light-duty space, when part of the market decided to adopt more stringent CARB CO_2 standards, while another part followed less stringent federal standards, which introduced significant uncertainty in investment strategies of suppliers like Eaton. [EPA-HQ-OAR-2019-0055-1252-A1, p.1]

Besides the uncertainty in the supplier base investments, different emissions levels in some parts of the nation creates the risk of a patchwork of local rules that in effect will lead to disruption in freight with unpredictable effects on the economy. (CARB Omnibus certification represent 20% of the market, with a strong potential that many of the other NESCAUM MOU states would adopt those standards, covering up to 40% of the market). [EPA-HQ-OAR-2019-0055-1252-A1, p.2]

Agency Request / Topic: We are requesting comment on the proposed Options 1 and 2, as well as the Alternative, standards for each duty cycle, as well as the one and two-step approaches in proposed Options 1 and 2, respectively, and the implementation dates of MYs 2027 and 2031 [EPA-HQ-OAR-2019-0055-1252-A1, p.7]

Eaton Comment Strategy / Materials: As explained, Eaton believes that Option 1 is very close to the CARB omnibus (20 mg FTP and 50mg LLC at IUL), there are multiple technology packages that can already achieve these limits, with 40% or better compliance margin, at reasonable costs and based on life-long components. Thus, according to the overriding interest of a single national standard, we believe it is best to harmonize Option 1 with the Omnibus rule. [EPA-HQ-OAR-2019-0055-1252-A1, p.7]

Agency Request / Topic: Throughout Sections III and IV, we discuss areas where our proposal differs from the California Air Resources Board (CARB) Heavy-Duty Omnibus Rulemaking, and request comment on our proposal, including whether it is appropriate to harmonize the federal and CARB regulatory programs more in light of the authority and requirements of CAA section 202, and the benefits or challenges if EPA were to finalize particular aspects of its program that are or are not fully aligned with the Omnibus. [EPA-HQ-OAR-2019-0055-1252-A1, p.9]

Eaton Comment Strategy / Materials: We believe that a single national standard is paramount to the health of the transportation sector. Furthermore, we believe Option 1 is close to the Omnibus. We also believe there are validated technologies that achieve the Option 1 and Omnibus limits with significant compliance margin, at reasonable cost, with truck-life durability. Therefore, we strongly recommend the EPA takes the opportunity to implement a single national standard, in accord with CARB [EPA-HQ-OAR-2019-0055-1252-A1, p.9]

Organization: *Hyliion, Inc.*

The majority of these comments will request cohesiveness between both the California and Federal standards to allow for predictability in the industry. In both warranty and testing cycles we would recommend following the established standards set by California's Air Resource Board. Many in the industry have taken steps to be compliant with these standards and we recommend a unified and certain approach. [EPA-HQ-OAR-2019-0055-1238-A1, p. 2]

Organization: *International Council on Clean Transportation (ICCT)*

Several differences exist between state HDV omnibus regulations first adopted by CARB nearly two years ago and EPA's proposed regulation. These differences could result in engine manufacturers producing different engines depending on whether trucks are being sold in California and Section 177 states, or sold elsewhere, resulting in unnecessary costs. Our view is that a single national program, reflecting even closer alignment between federal standards and those adopted by individual states, including not only California but also Massachusetts, Oregon, and other states intending to adopt, would reduce manufacturer compliance risk and production costs. [EPA-HQ-OAR-2019-0055-1211-A1, p. 18]

Testing of the CARB engine at SwRI achieved an emissions level of 23 mg at 435K mi. Testing of an improved system sponsored by EPA reduced NOx emissions to 20 mg. Four years of lead time remain for OEMs to refine solutions they are already expected to deliver in California. A national requirement would justify OEM research and development at greater scales than what they may consider necessary to meet California requirements alone. For these reasons we support the development of a single national program together with California and other states who have adopted an HDV Omnibus program. [EPA-HQ-OAR-2019-0055-1211-A1, p. 18]

Organization: *Maine Department of Environmental Protection (Department)*

Using the CARB Heavy-Duty Omnibus Regulation as a bellwether, the Department requests the following revisions to the federal proposal: [EPA-HQ-OAR-2019-0055-1288-A1, p.6]

NOx emission limits. Option 1 should be revised to require a 20mg/bhp-hr NOx limit beginning in model year 2027 at intermediate useful life and a 0.035 gram NOx standard at full useful life. A 20mg/bhp-hr NOx limit is technically feasible and consistent with requirements under the CARB Heavy-Duty Omnibus Regulation. [EPA-HQ-OAR-2019-0055-1288-A1, p.7]

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

EPA requests comments on whether it is appropriate to harmonize the federal and CARB regulatory programs more in light of the authority and requirements of CAA section 202, and the benefits or challenges if EPA were to finalize particular aspects of its program that are or are not fully aligned with the Omnibus. [EPA-HQ-OAR-2019-0055-1322-A1, p. 8]

MEMA strongly discourages any technology mandates (i.e., avoid ZEV mandates). In addition, it would be helpful for the EPA to use broader, more flexible definitions of emissions reducing technology. Then the industry can design to performance-based standards and users' unique requirements. As we have advocated in the past, it would also be beneficial to look at the entire lifecycle rather than just "tailpipe" emissions. As vehicles become significantly more fuel efficient, both upstream and downstream emissions become much more important when attempting to truly compare them. Significant infrastructure requirements would also come along with these rules, so if EPA were to try to match CARB there would need to be significant coordination with DOE in terms of planning for the national electric grid. [EPA-HQ-OAR-2019-0055-1322-A1, p. 8]

Organization: *Moving Forward Network (MFN)*

Option 1 should immediately harmonize with state action in model year (MY) 2027. Instead of allowing a four-year delay in matching state-level stringency, Option 1 should immediately impose a NOx emission standard of 0.02 g/bhp-hr for spark ignition, light-, medium-, and heavy-duty engines through intermediate useful life and a 0.035 g/bhp-hr for heavy heavy-duty engines from intermediate useful life to full useful life. [EPA-HQ-OAR-2019-0055-1277-A1, p. 21]

Delaying alignment with the cost-effective Omnibus rule unnecessarily allows dirtier engines to continue to be sold, knowing they will stay on our roads for decades, denying life saving emissions reductions. The most stringent standard – already adopted by three states and being pursued by several more – must be immediately phased-in at the start. [EPA-HQ-OAR-2019-0055-1277-A1, p. 21]

EPA has not adequately explained its deviation from the standards of the Omnibus rule. While disparity between the rules may pose some challenge for manufacturers, central import is that EPA upholds its requirements under Section 202(a) of the Clean Air Act, to promulgate "standards which reflect the greatest degree of emission reduction achievable." In deviating from the Omnibus program, EPA has deviated from years of studies providing robust evidence supporting stronger standards. [EPA-HQ-OAR-2019-0055-1277-A1, p. 22]

Organization: *Ozone Transport Commission (OTC) and Mid-Atlantic/Northeast Visibility Union (MANE-VU)*

Heavy-Duty Engine NOx Standards in 2027: Given the urgent need to reduce NOx emissions from heavy-duty vehicles to improve public health and air quality, we strongly encourage EPA to finalize NOx emission limits equivalent to those in the CARB Heavy-Duty Omnibus Regulation. Specifically, OTC supports the adoption of a 0.020 gram NOx engine standard in 2027 at intermediate useful life and a 0.035 gram NOx standard at full useful life, as specified in CARB's Omnibus regulation. There is ample data from CARB, EPA, and other research programs that support the feasibility of introducing a 0.020 gram NOx standard at intermediate useful life in 2027. 22,23,24,25,26,27 [This comment copied in 3.1.2] [EPA-HQ-OAR-2019-0055-1250-A1, p.13]

> 22 Manufacturers of Emission Controls Association, 'Technology Feasibility for Heavy-Duty Diesel Trucks in Achieving 90% Lower NOx Standards in 2027,' February, 2020. Available at https://www.meca.org/wp-content/uploads/resources/MECA_2027_Low_NOx_White_Paper_FINAL.pdf. Accessed May 4, 2022.
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> 23 Southwest Research Institute, 'Update on Heavy-Duty Low NOx Demonstration Programs at SwRI,' November 2019. Available at https://ww3.arb.ca.gov/msprog/hdlownox/files/workgroup_20190926/guest/swri_hd_low_nox_demo_programs.pdf. Accessed May 12, 2022.

24 Sharp, C.; Neely, G.; Rao, S.; Zaval, B., ‘An Update on Continuing Progress Towards Heavy-Duty Low NOx and CO2 in 2027 and Beyond,’ Southwest Research Institute, WCX, Detroit, Michigan, April 5-7, 2022.

25 U.S. EPA, ‘Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards Draft Regulatory Impact Analysis,’ EPA-420-D-22-001, March 2022. Available at https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10144K0.pdf. Accessed May 12, 2022.

26 Achates Power, ‘Heavy Duty Opposed Piston Engine Demonstration,’ CRC Real World Emissions Workshop, March 15, 2022.

27 Mendoza Villafuerte, P.; Demuynck, J.; Bosteels, D., ‘Ultra-Low NOx Emissions with a Close-Coupled Emission Control System on a Heavy-Duty Truck Application,’ Society of Automotive Engineers, September 21, 2021. Available at https://www.aecc.eu/wp-content/uploads/2021/09/2021-01-1228.pdf. Accessed April 25, 2022.

Organization: *Retail Industry Leaders Association (RILA)*

Certain areas of EPA's proposed rule relating to the reduction of criteria pollutant emissions align substantially with existing rules in California, introduced by the California Air Resources Board (CARB) in December 2021 as the 'Heavy-Duty Omnibus Regulation'. This proposed rule will therefore harmonize several important federal and state policies for the regulation of heavy-duty engines. Such policy alignment would ensure consistency across the United States and avoid creating bifurcated regulatory frameworks for stakeholders to navigate that would introduce additional compliance costs.[EPA-HQ-OAR-2019-0055-1189-A2, p.5]

Alignment benefits retailers, who operate or rely on complex nationwide freight logistics as a core component of their business. The harmonization of policies would mitigate the complexities that fleet operators might face in managing the availability of vehicles that meet the emissions standards to be registered in most of the country, but not in certain states (e.g., California).[EPA-HQ-OAR-2019-0055-1189-A2, p.5]

Since the trucks that transport freight for retailers often travel across jurisdictions, such as California, it would be beneficial to harmonize where possible. EPA is therefore encouraged to maintain its proposed alignment with CARB's 'Heavy-Duty Omnibus Regulation' where economically justifiable, in order to avoid inducing unnecessary complexity to fleet logistics operations. [EPA-HQ-OAR-2019-0055-1189-A2, p.6]

Organization: *San Joaquin Valley Air Pollution Control District (District)*

On August 27, 2020, the California Air Resources Board (CARB) adopted the Heavy- Duty Engine and Vehicle Omnibus Regulation. This regulation will have significant, and highly important, impacts in reducing NOx emissions in the Valley, and will play an important role in the District’s efforts to attain the federal NAAQS. However, the regulation only applies to engines and vehicles purchased in the state, and many vehicles in use in the Valley are out-of-state vehicles. In fact, CARB's mobile source emissions model, EMFAC, projects that 44% of vehicle miles traveled and 47% of NOx from heavy heavy-duty diesel trucks operated within the District boundaries in 2037 will be due to out-of-state trucks. That single category of mobile sources alone represents 27% of the District's total 2037 NOx emissions from all anthropogenic sources. Given the significance of heavy duty trucking emissions, on June 22, 2016, the District submitted a petition requesting that the U.S. EPA consider adopting new national heavy-duty truck engine emissions standards. [EPA-HQ-OAR-2019-0055-1291-A1, p.2]

Given the need for emissions reductions in the Valley, and the significance of this category within the total emissions inventory, the District strongly supports EPA adopting the most stringent controls possible and recommends adoption of Option 1. Given the challenges faced by the San Joaquin Valley, and the durability of trucks, selecting a less stringent option would burden our residents with unnecessary emissions for decades. Additionally, the District urges EPA to consider modifications to Option 1 to align with the CARB Omnibus Regulation to make nationwide compliance simpler, lead to less confusion nationally, and improve the overall emissions benefit of the regulation. [EPA-HQ-OAR-2019-0055-1291-A1, p.2]

Organization: *Southern Environmental Law Center (SELC)*

The standards should also be fully aligned with the California Heavy-Duty Omnibus Regulation in 2027, establish minimum ZEV production requirements, and preserve the stringency of GHG emissions requirements for internal combustion engine vehicles. [EPA-HQ-OAR-2019-0055-1247-A1, p.1]

As currently proposed, Option 1 does not harmonize with the Omnibus Regulation until model year 2031. This delay in alignment is projected to result in almost 72,000 more tons of NOx emissions through 2045.33 [EPA-HQ-OAR-2019-0055-1247-A1, p.5]

> 33 U.S. ENV'T PROT. AGENCY, Control of Air Pollution from New Motor vehicles: Heavy-Duty Engine and Vehicle Standards Draft Regulatory Impact Analysis, EPA-420-D-22-001, at app. 5, tbl. 5-49 (Mar. 2022).

Given the localized nature of many of the impacts of tailpipe pollution—which, as discussed above, can seriously affect public health and disproportionately impact communities of color and low-income communities—any delay in adopting the strongest possible standards will harm communities nationwide. This is especially true in the near-term, when failure to align with the Omnibus Regulation starting in model year 2027 will result in over 4 percent less NOx reduction each year from model years 2027 through 2030.34 Less stringent standards will also continue to make it difficult for many state and Tribal governments to meet their obligations under the NAAQS. [EPA-HQ-OAR-2019-0055-1247-A1, pp.5-6]

> 34 Id.

As noted by commenters during the public hearing on this proposed rule, localities have limited authority to address criteria pollutant emissions from mobile sources and strong federal tailpipe emissions standards are one of the most important tools available to address this type of pollution. Moreover, a single-step alignment would create a single national standard for medium- and heavy-duty engine and vehicle manufacturers, making planning and compliance easier.35 [EPA-HQ-OAR-2019-0055-1247-A1, p.6]

35 'The heavy-duty engine and vehicle manufacturing industry has consistently maintained a strong preference for harmonized regulations across the U.S. and Canada, given the highly integrated nature of the North American market and the desire to avoid the additional costs associated with having to develop specialized products.' INT'L COUNCIL ON CLEAN TRANSP., California's Heavy-Duty Omnibus Regulation: Updates to Emission Standards, Testing Requirements, and Compliance Procedures 10 (Jan. 2022), https://theicct.org/publication/california-us-hdvomnibus-reg-jan22/.

Organization: *Truck Renting and Leasing Association (TRALA)*

TRALA supports the efforts to reduce emissions and to increase the development of cleaner trucks onto our nation's highways. [EPA-HQ-OAR-2019-0055-1180-A1, p. 1]

TRALA believes that there is a desire in the trucking industry to incorporate newer and cleaner trucks into the marketplace, especially as the cost comes down. However, TRALA remains concerned that government mandates to adopt these technologies on shortened timelines will only slow the process of getting newer trucks onto the road. [EPA-HQ-OAR-2019-0055-1180-A1, p. 2]

TRALA remains determined that the EPA needs to set a national standard for emissions. For too long, the trucking industry has dealt with two manufacturing standards when purchasing new trucks, a truck that meets the EPA's standard, and a truck that meets CARB's standard. In its comments to the EPA on their Greenhouse Gas Phase 2 rule, TRALA urged the EPA to work with CARB to adopt a national standard for NOx that was not an ultra-low standard. These competing standards increase manufacturing costs and add complexity to the operation of national fleets. As we are seeing now, the requirements on manufacturing set by CARB and the EPA are diverging even further. [EPA-HQ-OAR-2019-0055-1180-A1, p. 3]

This growing divergence between CARB and EPA regulations will continue to create a chaotic regulatory patchwork of state requirements that EPA regulations are meant to avoid. Several states have already indicated that they will adopt CARB standards as well. By permitting CARB to supersede EPA's standard for NOx, the EPA is shirking its responsibility to take the lead in setting national standards for clean air. TRALA strongly encourages EPA to make Option 2 the basis for nationwide standards, and to work to ensure that California and other states align their NOx requirements with the Option 2-based standards that EPA establishes through a final rule. [EPA-HQ-OAR-2019-0055-1180-A1, p. 3]

TRALA has significant concerns with how the dual standard model would impact the new and secondary truck markets. As previously stated, TRALA members purchase vehicles, but they do not operate them, nor do they choose where their customers domicile these vehicles. If additional non-attainment states choose to adopt CARB's standard over EPA's, it will create major interstate commerce concerns for TRALA customers who operate in states that have competing

NOx standards. The decisions on where to operate will be constrained by the OEM's ability to meet the demands for EPA and CARB trucks. For instance, the timeline to acquire an EPA truck may be much longer than the timeline to acquire a CARB truck, forcing a business to either wait longer for the truck they need, or pay a premium to receive the CARB truck they don't want. Furthermore, TRALA members are concerned that the dual standards will significantly harm the secondary market as non-CARB trucks will not be able to be sold in certain states. That will leave smaller motor carriers in CARB states with the option to buy older trucks or used CARB trucks which are vastly more expensive due to the NOx rule's impacts on product availability and price. It is unlikely that smaller motor carriers that are the most price-sensitive would be able to absorb those cost increases and remain competitive in the trucking industry. [EPA-HQ-OAR-2019-0055-1180-A1, p. 3]

Accordingly, TRALA supports the Option 2 certification standard of .05. That said, we urge EPA to work with CARB and the other states who have pledged to adopt CARBs standards for NOx, to persuade those states not to proceed with regulations that would exceed the EPA's standard. TRALA urges the EPA to adopt regulations based on Option 2 and to work with every state including California to agree to a new national low-NOx certification standard of .05. TRALA believes that a national standard would reduce the regulatory burden on the OEMs that would not have to meet multiple standards in a shortened time period. A national standard of .05 would reduce the catastrophic disruption these rules could have on the new and used truck markets. [EPA-HQ-OAR-2019-0055-1180-A1, p. 4]

Organization: *Valero Energy Corporation*

There are several critical deficiencies in the data and analysis on which the proposed rule revisions rely. In addition to these specific deficiencies identified below, Valero incorporates as part of these comments a report prepared by Ramboll U.S. Consulting, Inc. for Western States Petroleum Association that evaluates CARB's Heavy Duty Truck strategy1 and concludes that CARB's approach does not deliver results as early and as cost-effectively as an approach that incorporates low-nitrogen oxides ('NOx') emission vehicles coupled with increased introduction of renewable liquid and gaseous fuels. Since EPA's proposal relies heavily on analysis performed by CARB, the conclusions in the Ramboll study are relevant to EPA's proposal. EPA must not blindly follow CARB, but should take these comments, including the Ramboll study, into account. [EPA-HQ-OAR-2019-0055-1328-A2, p.3]

> 1 'Multi-Technology Pathways to Achieve California's Air Quality and Greenhouse Gas Goals: Heavy-Heavy-Duty Truck Case Study,' prepared for Western States Petroleum Association by Ramboll U.S. Consulting, Inc. (February 1, 2021).

Organization: *Wisconsin Department of Natural Resources (WDNR)*

Option 1 includes program elements such as low load cycle NOx standard, full useful life standard and emission warranty (miles) identical to California Air Resources Board's (CARB) heavy-duty engine and vehicle omnibus regulation for both MY 2027 and 2031. EPA should consider revising remaining Option 1 program elements to fully align with CARB omnibus regulation beginning in MY 2027. Having to comply with different federal and California standards may impose unnecessary burden on engine manufacturers. [EPA-HQ-OAR-2019-0055-1162-A1, pp. 2 - 3]

EPA should work with CARB to evaluate the technical elements of the proposal that are not as stringent as those required in CARB's omnibus rule. For example, EPA's proposed durability demonstration program is weaker than that required by CARB's rule and may not adequately simulate real-world engine aging. Should EPA finalize any program elements that are less stringent than those in CARB's omnibus rule, it must ensure they do not result in an overall decrease in program stringency. [EPA-HQ-OAR-2019-0055-1162-A1, p. 3

EPA Summary and Response

Several commenters provided input on whether and how EPA should align the standards and requirements in the final Federal program with the standards and requirements in the California Air Resources Board (CARB) Heavy-Duty Omnibus Low NOx Regulation (HD Omnibus). Many state organizations, some suppliers of heavy-duty emissions control technologies, and environmental justice organizations support a Federal program that fully aligns with the HD Omnibus starting in MY 2027. In contrast, other heavy-duty emission control technology suppliers and retail organizations support a Federal program that only partially aligns with the HD Omnibus (i.e., commenters support a Federal program that aligns with some parts, but not other parts, of the HD Omnibus program); for instance, one commenter suggested EPA align with the HD Omnibus test procedures, but not the numeric stringency. Finally, the trade organization for large heavy-duty fleets support a Federal program that fully aligns with a California program, but does not support the level of stringency in the HD Omnibus, rather they encourage EPA and CARB to ultimately unify approaches such that a single federal standard "reduces NOx emissions nation-wide while not impede trucking operations or purchase plans across the country". In this Section 3.1.2 of the Response to Comments document, we briefly discuss the perspectives of each of these commenter groups, and then provide the EPA response to these comments.

Commenters who support a Federal program that fully aligns with the HD Omnibus starting in MY 2027 provide several points of discussion. First, these commenters stress the importance of full alignment with the level of stringency in the HD Omnibus because trucks frequently travel between states. Commenters note that out-of-state trucks contribute significantly to emissions in CA, and potentially to other states that may adopt the HD Omnibus program, and thus a national program is important for reducing emissions from all trucks; commenters also point to the importance of reducing emissions from all trucks in areas working to achieve or maintain National Ambient Air Quality Standards. Given the significant contribution of emissions from heavy-duty trucks, some of these commenters petitioned EPA in 2016 to consider adopting new national heavy-duty truck engine emissions standards. Second, commenters note that full alignment with the HD Omnibus would allow both engine manufacturers and suppliers to streamline their development processes, as well as provide certainty in their investments in the next generation of vehicle technologies. Third, commenters state that a Federal program fully aligned with the HD Omnibus would simplify nationwide compliance, lead to less confusion nationally, and improve the overall emissions benefit of the Federal regulation. They further note that full alignment between Federal and California standards could avoid the risk of a patchwork of local rules that could then disrupt freight transport, with unpredictable effects on the economy.

One commenter further stated that EPA did not adequately explain the deviation in the proposed standards from the HD Omnibus; stating that under Section 202(a) of the Clean Air Act, EPA is required to promulgate “standards which reflect the greatest degree of emission reduction achievable,” and noting that deviating from the HD Omnibus program deviates from studies providing evidence that support stronger standards than proposed. In addition, another commenter stated that if EPA finalizes any program elements that are less stringent than those in the HD Omnibus, then EPA should ensure the overall program maintains the same level of stringency. This commenter pointed specifically to the proposed durability demonstration program and raised a concern that it may not adequately simulate real-world engine aging. Finally, one commenter noted that Executive Order (EO) 14037 explicitly instructed EPA to coordinate its Heavy-duty NOx standards with California.[10]

Commenters supporting a Federal program that only partially aligns with the HD Omnibus also provide several lines of discussion. For instance, one commenter states that there is significant value in EPA coordinating with CARB on requirements for testing, certification, recordkeeping, reporting procedures, as well as compliance and enforcement provisions; however, they do not support harmonization on all areas of the standards. Another commenter stated that EPA should seek to have CARB’s requirements become more consistent with EPA’s approach to regulating criteria and GHG emission, rather than adopting the CARB requirements. Another commenter supports EPA adopting proposed Option 1, which they characterize as very close to the HD Omnibus program. The commenter notes that there are multiple technology packages that can already achieve the proposed Option 1 standards with 40% or better compliance margin over the useful life periods, and at what the commenters states are reasonable costs. Some commenters further urged EPA to promulgate standards that may be achieved by a variety of different technological approaches (i.e., avoid a mandate of any one technology) and, consistent with its CAA authority, only promulgate standards that appropriately consider costs as well as allow for a sufficient timeframe for necessary research, development and demonstration. Commenters further noted that there are a different set of considerations and challenges that need to be considered when promulgating regulations for products that will serve diverse applications in commercial vehicle markets across the country (e.g., fueling infrastructure, electric grid capacity). Another commenter stated that it would be beneficial to align with the HD Omnibus where economically justifiable, in order to avoid inducing unnecessary complexity to fleet logistics operations.

The trade organization for large heavy-duty fleets similarly stated that a lack of a unified national program could result in fleets changing their business models and purchasing decisions. They support full alignment of a Federal program with a CARB program, but do not support the stringency of the HD Omnibus. Rather, this commenter encouraged EPA and CARB to ultimately unify approaches for a single federal standard that does not disrupt the business operations of fleets. Similarly, another commenter stated that EPA should not simply follow CARB, but rather should take into account additional information, including information submitted in their comments that they state shows the HD Omnibus does not deliver results as early and as cost-effectively as an approach that incorporates low-nitrogen oxides ('NOx') emission vehicles coupled with increased introduction of renewable liquid and gaseous fuels.

[10] President Joseph Biden. Executive Order on Strengthening American Leadership in Clean Cars and Trucks. 86 FR 43583, August 10, 2021.

Response:

As discussed in preamble Section III.A.3, our evaluation of available information and data shows that the final standards and useful life periods are technologically feasible and will result in the greatest degree of emission reduction achievable for MY 2027, pursuant to our authority under CAA section 202(a)(3) that applies to setting this final rule's standards, giving appropriate consideration to cost, lead time, and other statutory factors.[11] We acknowledge that several commenters urged EPA to finalize proposed Option 1 since it closely aligned with the HD Omnibus; while we are not finalizing proposed Option 1, as further explained in preamble Section III our independent evaluation of the greatest degree of emission reduction achievable for a national program includes consideration of the points the commenters raised. For example, EPA determined an appropriate compliance margin for manufacturers within the context of this rule's low numeric emission standards and long regulatory useful life mileages and included compliance flexibilities like the in-use compliance margin in our assessment of the projected emission reductions from the final rule. In addition, we have considered one commenter's concern that the proposed durability demonstration program did not align with the HD Omnibus and may not adequately simulate real-world engine aging; as discussed in preamble Section IV and section 10 of this document, the final durability demonstration program includes updates from the proposal, which allow for closer alignment with the HD Omnibus. In our assessment the final durability demonstration program will account for real-world aging while providing a significantly shortened aging time for demonstration out to useful life.

We disagree with the commenter who stated that "deviating" from the HD Omnibus program "deviates" from available evidence supporting stronger standards. As discussed immediately above, our evaluation of available information and data shows that the final standards and useful life periods will result in the greatest degree of emission reduction achievable for MY 2027, giving appropriate consideration in EPA's judgment to the statutory factors.[12] Further, California has submitted a waiver of preemption under CAA section 209(b) for the HD Omnibus program; a waiver of preemption enables California to enforce its own standards that would otherwise be preempted under section 209(a). EPA's decision on that waiver proceeding is still pending, and until EPA grants the waiver, the HD Omnibus program is not enforceable.

Even assuming that EPA subsequently grants the waiver, however, that does not mean that EPA must issue the same standards as California or otherwise suggest any defect with this final rule.

[11] We note that CAA section 202(a)(3) neither requires that EPA consider all the statutory factors equally nor mandates a specific method of cost analysis; rather EPA has discretion in determining the appropriate consideration to give such factors. See, e.g., Sierra Club v. EPA, 325 F.3d 374, 378 (D.C. Cir. 2003) (explaining that similar technology forcing language in CAA section 202(l)(2) ''does not resolve how the Administrator should weigh all [the statutory] factors in the process of finding the 'greatest emission reduction achievable' ''); Husqvarna AB v. EPA, 254 F.3d 195, 200 (D.C. Cir. 2001) (explaining that under CAA section 213's similar technology-forcing authority that ''EPA did not deviate from its statutory mandate or frustrate congressional will by placing primary significance on the 'greatest degree of emission reduction achievable' '' or by considering cost and other statutory factors as important but secondary).

[12] We note that the commenter did not explicitly state which studies they were referring to in their statement regarding "years of studies"; however, our response includes consideration of the CARB engine demonstration program.

Rather, the statute directs EPA to establish standards under 202(a)(3) and there is a separate review process under 209(b) for waiving preemption of California's standards, which are established under state law. Congress developed these two entirely different administrative proceedings, and Congress also intended that California have the authority to adopt and enforce its own motor vehicle program, subject to the limited waiver criteria in section 209(b), to address its compelling and extraordinary conditions. Thus, the statute contemplates that California and EPA may adopt different motor vehicle programs. And while EPA and California have aligned programs in the past, that result is plainly not required by statute. Accordingly, in this final rule, we are focused on achieving the greatest emission reductions achievable in the MY 2027 timeframe under our authority in 202(a)(3), and have applied our judgment in determining the appropriate standards starting in MY 2027 under this authority for a national program. We further note that, while, as one commenter noted, EO 14037 states that EPA should coordinate with California on heavy-duty NO_X standards, the EO also directs EPA to do so in a manner that is appropriate and consistent with applicable law; as discussed in this section of the Response to Comments document and further detailed in the preamble, this is the approach that we have taken in developing this final rule.

Moreover, the HD Omnibus program differs from the federal program in multiple aspects, such that a facile comparison is not appropriate. These differences result in part from there being different considerations for a national regulation compared to a state or regional program, as some commenters note. For instance, we acknowledge one commenter's perspective that there are several factors that distinguish California's efforts from Federal efforts (e.g., California has undertaken several state actions to accelerate ZEV adoption, including providing funding and support for ZEV charging and re-fueling infrastructure).[13] In addition, as noted immediately above, the factors for establishing standards under 202(a)(3) are separate from the process under 209(b) for waiving preemption of California's standards.

Some commenters urged EPA to take ZEVs into account when setting the final standards, while other commenters urged EPA to set standards that may be achieved by a variety of different technological approaches. As explained in preamble Section III, the final standards in this rule are not based on the projected utilization of ZEV technology, though manufacturers may choose to comply with the standards through using ZEV technologies.

Regarding the study one commenter points to that they state shows the HD Omnibus does not deliver results as early and as cost-effectively as an approach that incorporates low-nitrogen oxides ('NOx') emission vehicles coupled with increased introduction of renewable liquid and gaseous fuels, EPA is setting performance-based standards that EPA has demonstrated to be technology-forcing, feasible, and appropriate under our CAA section 202(a)(3)(A) authority and that do not require a certain technology be applied to comply with the standards; thus, the comment and cited study generally support the feasibility of the final standards to the extent the

[13] While we note that the Inflation Reduction Act (IRA) has many incentives for promoting zero-emission vehicles, including support for refueling infrastructure (e.g., Section 13404 Alternative Fuel Refueling Property Credit), we intend to consider the implications of the IRA and other Federal actions in future rulemakings focused on heavy-duty vehicle standards for the heavy-duty sector. We further note that, as discussed in preamble Section IV, the final ABT program does not allow manufacturers to generate NO_X emissions credits from ZEVs because we are concerned that allowing NO_X emissions credits from ZEVs would result in fewer emissions reductions than intended from this rule.

application of such technology may be used in the future to meet these standards. As noted immediately above, manufacturers may elect to comply through alternate pathways, such as renewable liquid or gaseous fuels, if they find them more cost-effective or otherwise more preferable.

We acknowledge the concerns that some commenters raised that differences between the Federal program and CARB HD Omnibus could lead to business and/or logistical challenges for fleets and other members of the heavy-duty industry. As an initial matter, we note that these same kinds of concerns — regarding additional costs and implementation challenges associated with developing and producing vehicles to meet multiple standards — were raised to Congress during the development of the Clean Air Act. Nonetheless, Congress enacted section 209(b), which authorizes California to adopt and enforce its own motor vehicle emissions program, clearly contemplating the possibility for two different motor vehicle regulatory programs in the United States.

As explained further in the final rule preamble Sections III and IV, and this section 3 of this document, in setting the final standards EPA considered the required statutory factors, including giving appropriate consideration to the cost associated with the application of technology that can achieve the emission reduction of the final standards. To the extent consistent with our authority and within the scope of this rulemaking, we have aligned with testing and other requirements in the HD Omnibus. For instance, we are adopting the same LLC duty cycle procedure and incorporating by reference the 2019 CARB OBD regulations (see preamble Section III for details on the idle standard in the final rule and preamble Section IV for details on the OBD requirements in the final rule). EPA staff intend to continue working closely with CARB staff and other stakeholders where possible to ensure as smooth an implementation of the Federal program as possible.

3.2 Criteria pollutant standards for FTP and SET testing

3.2.1 FTP and SET standards and testing for compression-ignition engines

Comments by Organizations

Organization: *Alliance for Vehicle Efficiency (AVE)*

AVE supports additional modifications to Option 1 to provide the best opportunity for driving more rapid adoption of advanced engine and emission control technologies. These additional modifications include:

- Considering a stricter PM standard than what is being proposed to prevent backsliding under the proposed lower NOx limits. [EPA-HQ-OAR-2019-0055-1280-A1, p. 3]

Organization: *Allison Transmission, Inc. (Allison)*

- Allison also believes that finalizing a 50 mg/hp-hr NOx standard, as measured on the Federal Test Procedure ("FTP") and Supplemental Emission Test ("SET") cycles, offers a much better chance of programmatic and environmental success across medium- and heavy-duty vehicle fleet. Conversely, imposing a 20mg /hp-hr NOx standard, with limited validation of the necessary technology and longer useful life periods, carries with it a considerable risk of failure and disruption to the HDV market. Allison does not believe that the 20 mg/hp-hr standard has been validated in the vocational vehicle market to degree that would be required by Option 1 or any more stringent Alternative under consideration.[EPA-HQ-OAR-2019-0055-1231-A1, p.5]

Organization: *American Trucking Associations (ATA)*

Technology Issues Present Hurdles to Achieving Overly Stringent NOx Standards

ATA and fleets are concerned that manufacturers will not be capable of producing Option 1-compliant products that meet 0.02 g/bhp-hr in 2031. As shown in Figure 1, meeting a 0.02 g/bhp-hr standard under the FTP through 435,000 miles was not demonstrated as part of laboratory testing preceding the rulemaking. To reach such stringency levels, the requisite compliance margins could, hypothetically, have to dip into the "negative emission" compliance range. Stringency levels teetering a notch above zero cause great hesitation for fleets that can ill afford more false-positive NOx sensor readings and greater potential for manufacturer recalls. After all, a truck in a service bay is an unproductive truck – even if such truck is still under a warranty for repairs. [EPA-HQ-OAR-2019-0055-1326-A1, p. 7]

While it is true that CARB has certified a limited number of natural gas and liquefied petroleum gas heavy-duty engine families that can achieve a 0.02 g/bhp-hr NOx limit, these engines do not incorporate NOx sensors (See Table 1). Whereas there are limited niche markets for certain natural gas vehicles, natural gas technologies are largely being used by school and municipal buses and the refuse industry – not the freight sector. The fact remains that trucking is and will be for the foreseeable future a diesel-driven industry. [EPA-HQ-OAR-2019-0055-1326-A1, p. 8]

More importantly, according to manufacturers, current NOx sensors are incapable of accurately sensing 0-5 ppm tailpipe NOx concentrations that are typical at 0.02 g/bhp-hr NOx certification levels, especially because current NOx sensors have a nearly 1:1 cross-sensitivity to ammonia slip. Given there are also no accurate ammonia sensors either, separately sensing and subtracting ammonia to correct for the NOx sensor's ammonia cross-sensitivity doesn't work either. OEMs have already tried such an approach to no avail. [EPA-HQ-OAR-2019-0055-1326-A1, p. 9]

Organization: *California Air Resources Board (CARB)*

U.S. EPA's Stage 3 RW engine platform at 435,000 equivalent miles of accelerated aging resulted in tailpipe NOx emissions of 20, 17, and 29 mg/hp-hr respectively on the FTP, Ramped-modal cycle (RMC), and LLC duty cycles. Since the proposed useful lives for MY 2027 light and medium HDEs are much less than 435,000 miles, it can be concluded that, with application of emission control technologies similar to the Stage 3 RW, these engine classes could meet CARB staff recommended standards of 20 mg/hp-hr NOx on the FTP and SET and a 50 mg/hp-hr NOx on the LLC. [EPA-HQ-OAR-2019-0055-1186-A2, pp.40-41]

On page 17471 of the NPRM, U.S. EPA asks for comments regarding the issue of certification compliance margins. Specifically: '… if a margin between the demonstrated emissions performance and the proposed standards should be included and if so, we request comment on if a specific margin should be used and what that value should be. Commenters requesting a specific margin are encouraged to provide data and analysis to support the numeric value of the margin(s)'. [EPA-HQ-OAR-2019-0055-1186-A2, p.50]

> Compliance margin (CM) is defined as CM = Applicable Standard - Certification emission level / Applicaple Standard x 100%, where the certification emission level represents the highest NOx emission level for all production engines within the engine family at the end of UL and includes the infrequent regeneration adjustment factors. [EPA-HQ-OAR-2019-0055-1186-A2, p.50]

At the time of certification, manufacturers sign a statement of compliance for each engine family certifying that all production engines within the engine family are in all material respects described in the certification application and comply with all regulatory requirements (including the emission standards). Adding CMs to the adopted standards effectively sets higher, less stringent standards for compliance. Such CMs in effect allow standards to appear more stringent and health protective than they actually are, thereby providing a 'backdoor' method to set looser standards. CARB strongly opposes applying such CMs. The standards should be set at the attainable levels and measured against those levels when compliance determinations are made by regulatory agencies. [EPA-HQ-OAR-2019-0055-1186-A2, pp.50-51]

CARB staff has performed an exhaustive study124 of CMs for diesel-fueled engines covering all California certified on-road HDEs from 2010 through 2020 MYs. The result from this study is shown in Figure 5-3. As shown, four percent of the engine families were certified with no CM, while another 10 percent of the engine families were certified with less than a 5 percent CM. It should also be noted that only 19 percent of the certified engine families had CMs between 50-75 percent. [EPA-HQ-OAR-2019-0055-1186-A2, p.51]

> 124 CARB certification data. https://ww2.arb.ca.gov/new-vehicle-and-engine-certification-executive-orders-compression-ignition-and-heavy-duty-engines

The data in Fig. 5-3 indicates that engine manufacturers do not have a universal, one-size fits all approach when it comes to certifying their product portfolio with a built-in compliance margin. In fact, for the referenced period, seven out of eight on-road HD diesel engine manufacturers had certified engine families with a 15 percent compliance margin or less as shown in Fig 5-4. [EPA-HQ-OAR-2019-0055-1186-A2, pp.51-52]

For HHDD engines a similar analysis is shown in Fig. 5-5. As shown, three percent of the HHDD engine families were certified with no compliance margin, while another seven percent of the engine families were certified with less than a five percent CM. [EPA-HQ-OAR-2019-0055-1186-A2, p.52]

Based on analysis of historical certification data in Fig. 5-3, 5-4 and 5-5, CARB staff strongly believes that U.S. EPA should not consider the inclusion of any compliance margins in establishing new emissions standards. In other words, the standard should be set based on the demonstrated emission rates achievable with the anticipated technology, without adding some margin on top of that. The manufacturers determination as to what margin they desire when meeting emission standards is an aftertreatment design consideration and a business decision. U.S. EPA should not set minimum or maximum margin considerations when establishing standards. [EPA-HQ-OAR-2019-0055-1186-A2, p.53]

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

Finally, Commenters support EPA's proposals to adopt a revised PM standard and to require closed crankcase ventilation systems for compression-ignition engines, both of which will achieve important reductions in PM pollution. 87 Fed. Reg. at 17,461–62, 17,466–67. The proposed PM standard of 5 mg/hp-hr is unquestionably feasible (even allowing for measurement variability), as manufacturers are already certifying engines well below this level. Id. at 17,462. Finalizing a PM standard at least that low will preserve these gains by preventing backsliding in the future.

Organization: *Coach USA, Inc. (Coach USA)*

Further, the proposed rule leaves major open questions about its impact on engine size and weight. Any significant increase in either the size or weight of engines could counter-productively serve to reduce the number of passengers that could be transported on a motorcoach. For example, both under federal and state laws buses are subject to strict weight limits. See, e.g., 23 U.S.C. 127. However, the proposed rule contains no useful analysis of its bus weight implications. [EPA-HQ-OAR-2019-0055-1307-A1, p. 3]

Finally, Coach USA urges EPA to obtain information from engine manufacturers to assess implications from the added weight and increased temperatures associated with SCR and derate-related equipment. As noted above, interstate buses are subject, throughout the country, to heavily-enforced weight restrictions; any exceedance caused by SCR or derate-related equipment that causes a bus to be overweight would be unacceptable to sustaining interstate bus operations. Likewise, any increased temperatures caused by such equipment – which may cause buses to be less reliable or otherwise potentially impair driver/passenger safety – would also be unacceptable to Coach USA. [EPA-HQ-OAR-2019-0055-1307-A1, p. 7]

Organization: *Cummins Inc. (Cummins)*

Analysis of the compliance margin needed for robust compliance also shows the Option 2 NOx standard of 50 mg/hp-hr to be challenging but achievable, assuming current emission useful life periods. (Our concerns with EPA's longer proposed Option 2 useful life periods are described below.) EPA should finalize the Option 2 NOx FTP/ SET standard of 50 mg/hp-hr, at appropriate useful life, across all spark-ignition (SI) and compression-ignition (CI) primary intended service classes. [EPA-HQ-OAR-2019-0055-1325-A1, p. 4]

1036.505(d)(4) - Figure 1

Figure 1 seems to indicate SET 5 cycle would be cold cycle. This is not equivalent to engine SET where engine and aftertreatment are pre-conditioned before running the emission test. Cummins suggests skipping the cycle where engine starts for first time and use the following cycle to report criteria emissions. For example, skip SET 5 and 6, report result from SET 7 (not shown in the picture). A similar approach should be considered for cycle average fuel map process. [EPA-HQ-OAR-2019-0055-1325-A1, p. 24]

1036.505(h)

This requirement forces to capture PM on the two separate idle modes of the SET duty cycle which may require additional PM system. Additionally, the PM during the idle modes will be similar to background levels and this could lead to negative brake-specific PM data due to measurement uncertainty. Subsequently, these negative brake-specific PM will serve as emission standards for clean idle test. Therefore, this paragraph should allow a manufacturer to use other methods to ensure that the emissions of PM, HC, and CO are not adversely affected by meeting clean idle requirements. [EPA-HQ-OAR-2019-0055-1325-A1, p. 24]

1036.510(g)

This requirement forces to capture PM on the idle modes of the FTP duty cycle which may require additional PM system. Additionally, the PM during the idle modes will be similar to background levels and this could lead to negative brake-specific PM data due to measurement uncertainty. Subsequently, these negative brake-specific PM will serve as emission standards for clean idle test. Therefore, this paragraph should allow a manufacturer to use other methods to ensure that the emissions of PM, HC, and CO are not adversely affected by meeting clean idle requirements. [EPA-HQ-OAR-2019-0055-1325-A1, p. 25]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

While we fully endorse EMA's comments on this topic and encourage EPA to consider them carefully, we also highlight and recommend herein a few important design margin parameters for incorporation into EPA's next-tier NOx standards. EMA's industry-wide analysis of all HD engines shows that design margins of ~ 40% are appropriate for meeting the EPA 2010 0.2 g/hp-hr standard on composite FTP (below is the chart presented in EMA's technical feasibility document illustrating the margin). This margin is the difference between the emission standard and the lower 'as-designed' emissions performance that diesel OEMs target for their products. Daimler Truck designs and calibrates its products to provide sufficient margin to ensure robust compliance after accounting for numerous factors that can compromise real-world emissions performance. As emission standards become more stringent, these design margins become more and more important and carry significant weight in the design of new technologies to meet future low-NOx standards. The following Figure 2, adopted from the EMA comments, shows that

>60% margins are needed for any future NOx reduction regulations: [EPA-HQ-OAR-2019-0055-1168-A1, pp.24-25]

To meet the current EPA 2010 0.2 g/hp-hr NOx emission standard, the 40% design margin from the standards that OEMs are taking is driven by field degradation concerns, production components variability, and in-use testing standards (due to fuel contaminants), and not from FTP or RMC-based test cell demonstrations (as demonstrated during the EPA Stage 3 research studies). In the Proposed Rule, it is apparent that EPA has failed to perform any field demonstration of the new technology on the vehicle. In our experience, even the most sophisticated test cell-based thermal aging procedures fail to account for real world chemical degradation due to the variability of field fuel quality. Below are examples of key design margins that an OEM considers during the design of aftertreatment technologies, which are not addressed in the Proposed Rule:

1. Catalyst aging impact due to field fuel quality and NOx increase due to biodiesel.
2. Different configurations (ratings, exhaust length configurations, etc.) not considered by EPA in demonstration.
3. Components, sensor variability and test-to-test variabilities that are not considered by EPA in the proposal. [EPA-HQ-OAR-2019-0055-1168-A1, p.25] Apart from the above design margins not considered in the Proposed Rule, there are a number of overarching issues that EPA did not consider as a part of its low-NOx technology feasibility demonstration:
4. EPA’s demonstrated technology is not available.
5. The Stage 3 / RW system demonstrated in Proposed Rule cannot be packaged on a vehicle.
6. EPA’s Stage 3 / RW demonstration system doesn’t meet GHG Phase 2 standards for MY 2027.
7. In-use 3B-MAW issues.
8. SWRI test data does not demonstrate the feasibility of the standards proposed by EPA. [EPA-HQ-OAR-2019-0055-1168-A1, pp.25-26]

EPA’s low-NOx demonstration failed to account for the full range of expected engine configurations. [EPA-HQ-OAR-2019-0055-1168-A1, p.32]

EPA low-NOx test cell demonstration work at SWRI was performed on a Cummins MY2017 X15 and considered only one engine rating, 500HP/1850 lb-ft, and only one exhaust configuration. The parent rating combination along with the short exhaust pipe is likely the best case scenario for tailpipe low-NOx emissions. When an OEM certifies an engine family with EPA and CARB, there are multiple engine ratings and configurations represented by the certified engine family. The parent test engine configuration selection for criteria pollutants is defined in 40 CFR 86.096-24. When certifying the parent engine test configuration, an OEM also has to ensure all the lower engine ratings within the engine family will meet the relevant criteria pollutant and GHG standards with adequate margins to account for the various field deterioration variables (e.g., range of field fuels, field aging, production components and sensors variability, cold ambient conditions etc.). [EPA-HQ-OAR-2019-0055-1168-A1, p.32]

These various engine ratings within an engine family cover a wide variety of customer applications. A few examples of various customer chassis applications are shown in Figure 6 below, including line haul/regional distribution, crane, dump truck, logging, snow plow, construction, bulk haul, tanker, refuse, food and beverage hauler etc. In these various customer chassis applications, there is no space in the engine compartment (near the engine exhaust) to package the aftertreatment devices that would be required, due to the positioning of the various engine components and interferences with the structural frame rails. [EPA-HQ-OAR-2019-0055-1168-A1, pp.32-33]

For these reasons, the main aftertreatment devices (DOC, DPF, SCR) are packaged downstream from the engine where space is available for packaging aftertreatment components while accounting for vehicle safety and application needs. In the various chassis applications, connecting exhaust pipe lengths from the engine exhaust to the aftertreatment varies, depending on the type of vehicle chassis. In Figure 6 below, Daimler Truck also highlights an example of two such exhaust pipe length configurations. Configuration (2) in the chassis application has a significantly longer exhaust pipe when compared to a sleeper cab, which is configuration (I). Various lengths of exhaust pipe configurations exist to cover various customer chassis applications: [EPA-HQ-OAR-2019-0055-1168-A1, p.33]

In the EPA demonstration of the Stage 3 engine investigations at test cell, only one exhaust configuration and only one parent rating were tested. The worst case scenarios of longer exhaust pipe configurations and other ratings were not tested in any of the EPA Stage 3 investigations, which were the basis for the Proposed Rule. These worst case scenarios are expected to have lower exhaust temperatures, and higher temperature losses between the engine and the aftertreatment, leading to lower exhaust gas temperatures entering into the aftertreatment and consequently lower SCR performance. Consequently, these scenarios will result in higher tailpipe NOx emissions compared to those demonstrated in the EPA Stage 3 test results. To ensure robust emissions compliance, during certification an OEM absorbs the effect of exhaust pipe lengths and engine ratings within the engine family by ensuring during development testing and validation that all configurations meet the desired standard. EPA has not done so for its demonstration engine-and it is unlikely such configurations would pass. [EPA-HQ-OAR-2019-0055-1168-A1, pp.33-34]

SCR conversion efficiency is reduced at lower temperatures. This is well explained and acknowledged by EPA in the draft RIA. 71 Since the introduction of SCR technologies in the U.S. HD market in 2010, catalyst suppliers have been working to improve low-temperature SCR kinetics for over a decade, but there are only minor improvements in the low temperature zones. No such quantum leap in the low temperature SCR conversion efficiency improvements has been seen till date. [EPA-HQ-OAR-2019-0055-1168-A1, p.34]

> 71 See Draft RIA at 11 ('SCR functionality is particularly reduced at lower exhaust temperatures due to difficulties with low-temperature urea decomposition and due to slower SCR reaction kinetics (Figure 1-3). ').

As explained in the draft RIA and shown in Figure 7 below, SCR fast reactions are dominated by temperature, and in temperatures below 320 degrees Celsius (at the SCR Inlet), SCR conversion efficiency is significantly reduced, as shown by arrows in the figure. When comparing longer and shorter exhaust pipes, longer exhaust pipes configurations tend to have higher heat loss, thereby leading to lower SCR Inlet temperature. Accordingly, SCR reaction kinetics move towards lower conversion efficiencies, hence higher tailpipe NOx emissions. In addition to effects from longer exhaust systems for some applications, lower engine horsepower ratings reduce cycle temperature, causing the net SCR reaction kinetics to reduce conversion efficiency, as shown on the arow on Figure 7. Although EPA understood the SCR reaction kinetics issues in the draft RIA, no such combinations of testing was conducted by EPA for low-NOx feasibility in support of the Proposed Rule. [EPA-HQ-OAR-2019-0055-1168-A1, p.34]

Under EPA's proposed 40 C.F.R. 1036.235(a), OEMs would need to demonstrate on a worst case scenario, as EPA proposes to require manufacturer demonstrations with 'the engine configuration most likely to exceed (or have emissions nearer to) an applicable emission standard or FEL.'73 EPA has not done this demonstration with the SWRI system. If EPA were to follow its own proposed standards, the Agency would still need to demonstrate low-NOx feasibility with the longest possible exhaust pipe and the worst possible engine rating. In the Agency's feasibility study, EPA has not performed this analysis using the parameters proposed in Section 1036.235(a). Rather, EPA's feasibility study is performed on the best-case engine rating and shortest possible exhaust pipe configuration. Effectively, EPA has tested the 'best-of-the-best' and declared it representative for all possible configurations. EPA must demonstrate compliance with other configurations and ratings to adequately demonstrate feasibility. [EPA-HQ-OAR-2019-0055-1168-A1, p.35]

73 See Proposed Rule, 87 Fed. Reg. at 17,680.

EPA's proposed NOx standards fail to account for component, sensor, and test-to-test variability. [EPA-HQ-OAR-2019-0055-1168-A1, p.35]

EMA's study submitted in support of its comments on the Proposed Rule reflects that, to protect 97.7% of production population, a design margin of 0.026 g/hp-hr is needed for low-NOx 'dyno based standards.'74 These margins, reflected in Figure 8 below, are necessary to account for variability induced by production variability, soot and sulfur accumulation, ash accumulation, field deterioration, and more. Similarly, to account for additional sources of variability that may be experienced in-use, EMA calculates that a design margin of 0.036 g/hp-hr is necessary. In-use testing requires higher margin levels due to the broad range of test conditions that are not accounted for on the dyno, including altitude operation, cold temperature operation, fuel quality, DEF quality, and field deterioration due the various parameters listed in the sections above. EPA and SWRI did not attempt to account for any of these sources of variability in their study, and accordingly, have not demonstrated that their proposed standards are feasible. [EPA-HQ-OAR-2019-0055-1168-A1, p.35]

74 See EMA Proposed Rule Comments, 'EMA Assessment of Technical Feasibility,' Table II.B.3.3.1 incorporated herein by reference.

Daimler Truck continues to collaborate with catalyst suppliers for developing coating technologies that are more effective at controlling emissions and more durable for extended full-useful life. However, after extensive product screenings, the Company has observed only minor improvements in the 2027 catalyst formulations offered compared to current production offerings. [EPA-HQ-OAR-2019-0055-1168-A1, p.36]

As demonstrated in Figure 9 above, catalysts offered by suppliers for MY 2027 have not shown improved durability, as compared to current production catalysts, to suppo1t extended full useful life. Catalyst suppliers are unwilling to accept additional durability requirements. One of the three major heavy duty coaters declined to bid on a 2027 Daimler Truck product, citing unreasonably onerous durability requirements. The Company does not believe the catalyst products commercially offered support EPA's proposed NOx stringency at extended full useful life, and does not believe that technologies likely to be on offer for MY 2027 will fundamentally change the assumptions about catalyst aging and degradation that unde1pin our analysis of EPA's proposed standards and their infeasibility. [EPA-HQ-OAR-2019-0055-1168-A1, p.36]

Daimler Truck continues to investigate the DEF doser supplier landscape and has identified only one supplier that is actively developing a heavy-duty heated-DEF doser technology. However, availability of an adequately-validated heated-DEF doser is not feasible in the MY 2027 timeframe due to insufficient maturity of the technology. Daimler Truck is also investigating other heated-DEF technologies, which may provide production-feasible timing at the expense of cost, complexity and reliability. Based upon our investigation, the EPA-demonstrated heated-DEF doser technology will not be production-feasible for the 2027 timeframe. [EPA-HQ-OAR-2019-0055-1168-A1, p.37]

Daimler Truck sees very little development of future sensors technology considered necessary to maintain adequate control of UL NOx systems. Sensor suppliers are rapidly moving towards electrification technology, rather than continuing to invest in diesel technology. In fact, we see no evidence of NOx sensor improvement in the necessary timeframe. To adequately control a system to 90% less NOx with the same accuracy as today’s systems, a 90% improvement in NOx sensor accuracy would be necessary, but no such improvements are planned. Today’s NOx sensors have variability of +/- 10 ppm below 100 ppm, which is greater than the absolute values of the proposed NOx emission limits. Similarly, EPA considers NH3 sensors as necessary inputs to an UL NOx control system, but no supplier today offers an NH3 sensor capable of the accuracy needed for required useful life. Daimler Truck’s understanding is that sensor manufacturers will not invest significantly in developing new technology for combustion engines in this timeframe, as suppliers dedicate resources to future ZEV technologies and divest from expensive combustion technology development. Given the anticipated lack of necessary sensor technology, EPA’s standards will likely be infeasible. [EPA-HQ-OAR-2019-0055-1168-A1, p.37]

SWRI has provided the dimensions of the close-coupled SCR (also known as LO-SCR) system and the associated hardware as tested by EPA in the Stage 3 test cell demonstration. The dimensions obtained from SWRI for the EPA Stage 3 rework testing are for the following components:

1. Turbine to DEF tube elbow
2. DEF injector mounting tube

3. Inlet LO-SCR Cone
4. LO-SCR Catalyst
5. Outlet LO-SCR Cone [EPA-HQ-OAR-2019-0055-1168-A1, p.37]

A photograph of the SWRI LO-SCR system is provided above in Figure 10. This photograph demonstrates the infeasibility of the system tested by the EPA—the LO-SCR is mounted extremely closely to the engine, in a manner infeasible in commercial vehicles. Daimler Truck took all the new hardware boundary dimensions (as mentioned above) of the EPA technology demonstrator at SWRI and performed in-depth packaging feasibility studies in all vehicle chassis configurations. [EPA-HQ-OAR-2019-0055-1168-A1, p.38]

The results of the packaging study in our highest-volume chassis, the Freightliner Cascadia, is shown in Figures 11 (side view) and 12 (top view) below. LO-SCR and associated hardware packaging studies illustrates significant interferences with the cab floor, structure, and frame rails. The Company's packaging study on a high volume chassis clearly shows only two options: first is to redesign the whole cab (Option 1); and the second is to move the LO-SCR downstream of the exhaust flow where space is available (Option 2). Under Option 1, a cab redesign is not a feasible option, due to inferences of the aftertreatment system package with the frame rails, a major structural component of a vehicle. The only feasible option is Option 2, which would entail packaging the LO-SCR further downstream, further away from the engine outlet. Moving the LOSCR to this downstream location introduces longer exhaust pipes from turbocharger outlet to the LO-SCR catalyst. As described in Figure 6, longer exhaust pipes will have higher temperature loss and hence worse tailpipe NOx emission performance when compared EPA's demonstration in support of the Proposed Rule. If EPA's proposed system were packaged in such a way as to fit on a truck, the LO-SCR effectiveness would be significantly reduced since it would operate at colder temperatures, which runs contrary to its designed purpose.[EPA-HQ-OAR-2019-0055-1168-A1, p.38]

EPA also requests comments on issues with low-volume applications. In response, Daimler Truck refers EPA to the industry-wide study submitted with EMA's comments.76 A notable finding of the EMA study is that ''[p]ackaging' requirements (i.e., fitting emission systems under the hood or cab) to 'close-couple' the new light-off SCR ('LO-SCR') to the turbocharger turbine exit will be extremely difficult, and/or will require cab retooling. Such retooling costs come at a very high cost (on the order of $500M) for low-volume products with potentially abbreviated amortization schedules, especially as those same vehicles transition to battery-electric and other 'zero-emissions' technologies driven, at least in part, by other regulations.'77 [EPA-HQ-OAR-2019-0055-1168-A1, p.39]

> 76 See EMA Proposed Rule Comments, 'EMA Assessment of Technical Feasibility of Complying with a 0.020 g/bhp-hr NOx Standard for Heavy-Duty Diesel Engines.'
> 77 Id.

In the draft RIA, EPA notes with regard to its low-NOx demonstration program that 'the under-cab EAS will also be installed in a MY2018 Navistar Daycab Class 8 Tractor equipped with a second EPA developmental X15 engine. The engine and cab are instrumented to allow evaluation of NVH characteristics during truck operation when using CDA.'78 EPA has not, however, shared corresponding results of its vehicle testing investigations to date. Daimler Truck understands that this is because no such vehicle testing has been performed by EPA to substantiate that real-world test results are similar to the Agency's low-NOx test cell demonstration results.[EPA-HQ-OAR-2019-0055-1168-A1, p.39]

78 Draft RIA at 122.

We expect that, if such testing were performed, the in-use tailpipe results would be significantly higher on the aftertreatment demonstration technology considered for this evaluation. This is because, due to packaging and other constraints, the proposed technology for vehicle demonstration is significantly less capable than what EPA has demonstrated in the test cell. We would also expect this result because:

- The LO-SCR volume considered for vehicle demonstration is 25% lower than what is demonstrated by EPA in its test cell program.
- The main SCR/ASC considered for vehicle demonstration is 37% lower than what is demonstrated by EPA in its test cell program.
- Even the Diesel Particulate Filter (DPF) considered for vehicle demonstration is 13% lower than what is demonstrated by EPA in its test cell program.
- The vehicle exhaust pipe length is not documented by EPA in the draft RIA, but, as evidenced in our packaging study, above, must necessarily be significantly longer than what EPA used for its test cell program. [EPA-HQ-OAR-2019-0055-1168-A1, pp.39-40]

EPA and SWRI make these design compromises specifically to have 'minimal impact on existing EPA Class 8 day cab tractors'-because they are concerned that the Stage 3 system will not fit in a truck. [EPA-HQ-OAR-2019-0055-1168-A1, p.40]

The reduced volume of LO-SCR (-25%), reduced volume of SCR/ASC (-37%), along with the longer exhaust pipes would be expected to yield lower SCR perfo1mance results on real-world vehicle testing as compared to EPA's demonstration in a test cell with Stage 3 technology. [EPA-HQ-OAR-2019-0055-1168-A1, p.40]

These reduced volumes will likely have significant impact on tailpipe emissions, if EPA performs back-to-back emissions testing in a test cell for the two systems configurations when adequately aged to represent end of useful life. Tailpipe NOx test results for the system considered for vehicle testing with 'aged' reduced SCR catalyst volumes are expected to exceed the proposed NOx standards. EPA's demonstration with the larger, more capable system does not show compliance with all of EPA's proposed standards and provides no margin to others—as the composite FTP test results are 0.038 g/hp-hr, barely meeting 0.040 g/hp-hr standard before accounting for the Infrequent Regeneration Adjustment Factor (IRAF). Substantially reduced catalyst volumes (as considered by EPA for in-vehicle testing) after aging would further worsen these results and will exceed the proposed low-NOx standards. [EPA-HQ-OAR-2019-0055-1168-A1, pp.40-41]

Figure 14 shows initial test cell results at SWRI of EPA's proposed candidate system for installation in a vehicle. Even before aging, this system was determined to have unacceptable performance by SWRI and EPA, as follows:

> 1. System backpressure was 40kpa, significantly higher versus 28kpa with Stage 3 system;
>
> 2. Significant impact noted on RMC CO2;
>
> 3. Turbomachinery and air-handling component design limits (and Peak Cylinder Pressure limits) prevent much re-tuning to recover high load CO2 impact, even at higher NOx levels. [EPA-HQ-OAR-2019-0055-1168-A1, p.41]

EPA itself noted that it 'did not proceed due to CO2 impact.' [EPA-HQ-OAR-2019-0055-1168-A1, p.41]

These technology considerations are prime examples of real-world technical challenges and compromises that an OEM will face when placing low-NOx technology on a vehicle. This further shows that EPA's technology demonstration does not support the proposed low-NOx standards, because it cannot be successfully packaged on a vehicle—and a system that can be packaged would not meet EPA's proposed standards. [EPA-HQ-OAR-2019-0055-1168-A1, p.41]

Additionally, as noted in Figure 14, the demonstration engine meets only the MY 2017 GHG standards and will have to achieve 7.2% fuel efficiency measures to meet the MY 2027 GHG Phase 2 standard without margin. As shown in Figure 14, the addition of NOx-reduction technology reduced GHG performance by up to 2% in a few cycles, as compared to the baseline engine. This further proves that additional GHG technologies are needed to offset the GHG deficit produced by low-NOx technology on a tractor (RMC Standard), which EPA did not envision in the GHG Phase 2 rulemaking. EPA has never demonstrated an engine that meets the existing GHG standards for MY 2027 and even approaches meeting their proposed NOx standards. [EPA-HQ-OAR-2019-0055-1168-A1, p.41]

In summary, EPA recognizes the technical challenges that manufactures have repeatedly raised, e.g., vehicle installation challenges, CO2 emission increases, hardware component limitations, NVH issues, and more. EPA also recognizes the need to demonstrate any proposed new hardware in a vehicle. However, due to these very technical challenges, EPA has not demonstrated any ultra-low NOx engine in a vehicle. The candidate system that the Agency evaluated for vehicle installation will not meet the proposed low-NOx standards, and even this system has been abandoned due to real world technical challenges. [EPA-HQ-OAR-2019-0055-1168-A1, p.41]

The Proposed Rule creates a number of contradictions, gaps, and conflicts that will make compliance exceedingly difficult. One such area is the infeasibility of meeting Phase 2 MY 2027 GHG emission standards while simultaneously implementing the low-NOx technology needed to achieve the proposed NOx standards. EPA appears to assume that OEMs will simply make required engine efficiency changes to meet Phase 2 standards in addition to adding low-NOx aftertreatment systems (e.g., SCR and associated hardware technologies), and that no changes will be needed on the engine side. This assumption is flawed for the following reasons:

- None of the EPA test demonstration data shows that the SWRI Stage 3 engine can meet EPA Phase 2 GHG standards for MY 2027. All of EPA's test cell research demonstration work was done on a Cummins MY 2017 engine that would need ~ 6% more CO2 reduction to meet the MY 2027 GHG RMC standard without margin. The Stage 3 engine does not meet the MY 2021 or 2024 CO2 standards. If we apply 6% engine fuel efficiency measures to EPA's low-NOx demonstration engine to meet MY 2027 standards (e.g., better in-cylinder fuel burn, mixing, and other measures), the result will be a colder exhaust – all fuel economy improvements to an engine are achieved by extracting more work from the fuel, leaving less energy to be delivered to the exhaust. This would mean that more and more thermal exhaust measures (i.e., heated exhaust measures) will be needed beyond what was used in EPA's demonstration. In other words, an engine that met EPA's MY 2027 GHG standards would have an even harder time complying with EPA's proposed NOx standards, since, according to first principles of combustion physics, it will run colder than EPA's demonstration engine.
- Not only do EPA's low-NOx demonstration and investigations at SWRI testing ignore the complexities of CO2-NOx emission trade-offs, they also ignore the increased backpressure from low-NOx demonstration-related hardware, which will further harm GHG performance.
- As seen in EPA's low-NOx demonstration data at SWRI, the Stage 3 / RW system had slightly higher tailpipe GHG results over the baseline production configuration. Overcoming this additional CO2 to bring the Stage 3 / RW system into GHG compliance (with margin) will require additional CO2-reducing technology over and above what EPA included in their feasibility demonstration. [EPA-HQ-OAR-2019-0055-1168-A1, p.43]

The tradeoff between NOx emissions and CO2 emissions are well understood by the industry; EPA cannot claim that the Agency has demonstrated the feasibility of its proposed standards without demonstrating an engine that can meet the relevant NOx and CO2 standards simultaneously. In some vehicle classes, EPA's proposed NOx regulations will be so at odds with existing GHG regulations that they may generate perverse incentives to sacrifice GHG performance for the sake of improved NOx performance. A key example may unfold in the MHD truck market, which is sensitive to initial purchase cost, while being less sensitive to fuel consumption. It is also worth noting that under EPA GHG Phase 2 regulations, vocational vehicles powered by SI-gasoline engines are allowed 17% higher CO2 emissions than their diesel-fueled counterparts. Due to this conflict between GHG Phase 2 and the proposed NOx standards, it may be expected that medium duty market shifts to SI-gasoline, which can more easily meet EPA's proposed standards. Such a shift in the market will significantly increase CO2 emissions from the national fleet, and minimize the efforts of the commercial vehicle sector to combat global warming. [EPA-HQ-OAR-2019-0055-1168-A1, pp.43-44]

EPA must consider the tradeoff between NOx and CO2 emissions performance, and must not set NOx standards that are so stringent that they have unintended consequences for CO2 emissions compliance. [EPA-HQ-OAR-2019-0055-1168-A1, p.44]

EPA has not demonstrated that its proposed FTP emissions standards are feasible. Daimler Truck believes that an FTP NOx standard of 50 mg/hp-hr is appropriate, in combination with further changes to the FTP to better represent the real world contribution of cold-start operations. Additionally, the PM standard should be set to 7.5 mg/hp-hr to reflect the state of available technology. [EPA-HQ-OAR-2019-0055-1168-A1, p.54]

Daimler Truck provides in these comments exhaustive evidence to show that EPA has not demonstrated the feasibility of the FTP standards set forth in the Proposed Rule (see Section II.B.3 of these comments). Notably, *no vehicle* has been demonstrated that can meet EPA's proposed standards when considered in their totality (including GHG standard compliance, exposure to real world maintenance and fueling practices, installation on a real vehicle with acceptable Noise, Vibration and Harshness (NVH) profiles, drivability characteristics etc.). EPA attempts to demonstrate feasibility with the technical demonstrator system that the Agency has developed in collaboration with SWRI, but the Agency's feasibility analysis does not adequately consider the following key factors: [EPA-HQ-OAR-2019-0055-1168-A1, p.54]

Adequate emissions margin to the certification standard. Manufacturers must develop and certify systems with an adequate level of margin to account for a number of factors. EMA has developed an analysis concluding that manufacturers require margin between the certification emissions of their UL NOx systems and any reasonable UL NOx standard of at least 0.026 g/hp-hr NOx.83 By contrast, EPA's results from SWRI do not provide for any margin from the standard—with NOx results at the proposed standard in SWRI's latest testing of the EPA Stage 3 rework system (the EPA Stage 3/RW System).84 [EPA-HQ-OAR-2019-0055-1168-A1, p.54]

83 See EMA Proposed Rule Comments, 'EMA Assessment of Technical Feasibility.'

84 See Sharp, C. et al., 'An Update on Continuing Progress Towards Heavy-Duty Low NOx and CO2 in 2027 and Beyond – SAE Detroit' (April 5-7, 2022).

Further, EMA includes in its sources of variability aging impacts from fuel contamination, production variability, measurement variability, packaging limitations, accumulation of sulfur, soot, and ash, maintenance variability, and the direct impact of biodiesel on NOx emissions. EPA does not adequately account for any of these limitations. [EPA-HQ-OAR-2019-0055-1168-A1, p.54]

Additionally, SWRI data shows that in some conditions, PM values exceed the proposed emissions standards (even before the IRAF is applied). Although SWRI points out that this data occurs immediately after ash cleaning, and eventually returns below the threshold, manufacturers are required to meet the threshold in all conditions. [EPA-HQ-OAR-2019-0055-1168-A1, p.54]

Real-world application of proposed low NOx technologies. The proposed system demonstrated in the 'Stage 3' technical solution has never been installed and operated in a truck, and has never been demonstrated to be acceptable in terms of impact on NVH, drivability, or durability, especially in the broad range of custom-tailored vehicles and duty cycles in the heavy-duty industry. [EPA-HQ-OAR-2019-0055-1168-A1, p.54]

The EPA Stage 3/RW System cannot be adequately packaged in a heavy-duty vehicle; specifically, its CCSCR cannot be placed as close to the engine as SWRI uses in its demonstrator. Placing the system further away, which will be necessary in commercial vehicles, will further degrade its emissions performance, which EPA does not consider. [EPA-HQ-OAR-2019-0055-1168-A1, p.55]

EPA does not consider the wide range of applications, ratings, and other criteria that force design compromises and reduced emissions control performance. EPA's demonstration only covers one configuration, with one rating. EPA proposes that manufactures must demonstrate emissions compliance with the worst-case rating; however, in its feasibility study, the Agency has not accounted for the worst case configuration for emissions performance. Indeed, it has only one configuration, with one rating—which is likely to be favorable. [EPA-HQ-OAR-2019-0055-1168-A1, p.55]

Competing need for CO2 reductions. The EPA Stage 3/RW System does not meet EPA's 2027 CO2 emissions standards. While EPA has demonstrated low-NOx performance without dramatically increasing CO2 emissions, the Stage 3 engine does not meet these requirements. The changes necessary to improve CO2 performance will necessarily reduce the system's NOx control effectiveness, as CO2 improvements will reduce the engine's exhaust temperatures, which are critical to SCR performance. There is an unavoidable trade-off between NOx and CO2 that the EPA does not consider in their study. [EPA-HQ-OAR-2019-0055-1168-A1,p.55]

In light of the above challenges, summarized in more detail elsewhere in these comments, and in the EMA Proposed Rule Comments, Daimler Truck believes that EPA has not demonstrated the feasibility of the proposed FTP emission standards for NOx and PM. [EPA-HQ-OAR-2019-0055-1168-A1, p.55]

CAA Section 202(a)(3)(A) requires that EPA's heavy-duty criteria pollutant standards 'reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology.'85 Since the EPA has not demonstrated that its proposed NOx or PM emission standards reflect the greatest degree of emission reduction achievable, they would not be enforceable under the CAA. [EPA-HQ-OAR-2019-0055-1168-A1, p.55]

85 42 U.S.C. 7521(a)(3)(A)(i).

Daimler Truck submits that an FTP NOx standard of **50 mg/hp-hr, or 0.05 g/hp-hr** better reflects the greatest degree of emissions reduction achievable. This standard accounts for the real world emissions contributions of various operating conditions and gives appropriate consideration to the cost factors associated with the application of available technology. [EPA-HQ-OAR-2019-0055-1168-A1, p.55]

Similarly, in light of SWRI's post DPF ash cleaning procedure data, Daimler Truck believes that EPA has not demonstrated feasibility for its proposed PM standard. DTNA recommends a PM standard of **7.5 mg/hp-hr on the FTP**, for the reasons provided above. [EPA-HQ-OAR-2019-0055-1168-A1, p.55]

Daimler Truck believes that the current weighting methodology of the composite FTP— namely, 1/7 contribution from emissions from the Cold FTP, weighted with 6/7 contribution from the emissions from the Hot FTP—over-represents the emissions from the initial cold-start drive off of the vehicle compared to real world operation. [EPA-HQ-OAR-2019-0055-1168-A1, p.56]

In fact, nearly all of the NOx released in the composite FTP is emitted during the first several minutes of the Cold FTP. Once the aftertreatment reaches proper operating temperatures, NOx emission contributions to the overall composite FTP are nearly inconsequential. Daimler Truck provides an example in the below Figure 21. [EPA-HQ-OAR-2019-0055-1168-A1, p.56]

In this example, Daimler Truck provides the cold FTP emissions trace of a candidate emissions control system designed to provide as much emissions reduction as possible. For the purposes of this evaluation, Daimler Truck will consider 'Cold Start' as all operation before the engine has accumulated 4.72 bhp-hr of work. This threshold was selected to differentiate operation during which the system had reached appropriate light-off temperature for adequate emissions control, and when it had not. The appropriate threshold of accumulated work to differentiate 'Cold Start' operation would necessarily vary from engine to engine, or could be determined via other proxies, such as coolant temperature (approximately 63 degrees Celsius in this case). All other operation in the remainder of the Cold Start FTP, and in the subsequent Hot Start FTP is classified as 'Hot' operation. [EPA-HQ-OAR-2019-0055-1168-A1, p.56]

Using this differentiation, it is possible to apply the current Cold/Hot weighting factor (1/7th and 6/7th, respectively) to determine, on a work-weighted basis and on a time-weighted basis, how this section of duty cycle is weighted in the composite FTP. [[See Table 9 on p. 57 for Daimler's Work-based and Time-based estimates of the contribution of the 'Cold Start' operation portion of the Cold FTP to the overall duty cycle of a Cold/Hot weighted FTP.]] [EPA-HQ-OAR-2019-0055-1168-A1, p.56]

So, although the 'Cold Start' operation of the FTP in this example represents only 5% of the time of a weighted FTP, and only 2.1 % of the work in a weighted FTP, it accounts for >95% of the NOx emissions ultimately compared to the standard for a weighted FTP. Daimler Truck believes that this significantly over-weights the relevance of these emissions compared to the impact of these 'Cold Start' operations on real world emissions inventories. [EPA-HQ-OAR-2019-0055-1168-A1, p.57]

To illustrate this over-weighting of Cold Start emissions, Daimler Truck has analyzed real-world data captured in a joint project between West Virginia University (WVU) and the EMA. Details of Data Analyzed:

- Daimler Truck Data acquired from EMA-WVU 100-vehicle study
- Vehicle Type: Day Cab

- Engine MY 2013-2019
- Application: Customer operation of goods movement in southern California
- Sample Size: 16 vehicles
- Approximately 1 month of data collection for each vehicle
- 202 total shift-day trips analyzed [EPA-HQ-OAR-2019-0055-1168-A1, p.57]

Daimler Truck believes that a larger data set, containing more applications, manufacturers, and duty cycles could prove more instructive. However, since this dataset specifically analyzes the operation of day-cab tractors performing goods movement, it is illustrative. Other applications, such as sleeper-cab, long-haul tractors are dominated by operation represented by the Hot FTP and the RMC, and the Hot FTP best represents pickup-and-delivery applications, with frequent starts and stops. [EPA-HQ-OAR-2019-0055-1168-A1, p.57]

Daimler Truck analyzed each shift-day using the same metrics presented above for the Cold FTP contribution of 'Cold Start' operation versus 'Hot' operation, using the same differentiation of a cumulative 4.72 bhp-hr of work. The analysis was performed to calculate both the 'Time Weighted' and 'Work Weighted' contribution percentage for each shift-day. The statistical analysis for each approach is presented below in Figures 22 and 23, respectively. [EPA-HQ-OAR-2019-0055-1168-A1, p.58]

This analysis shows that current FTP weighting, comparatively, over-represents the 'Cold Start' operation in its evaluation of emissions. For example, the 'Work Weighted' analysis of vehicles shows that for nearly 75% of trips, 'Cold Start' operation contributes *less than half* of the work during the shift-day (1.1%) than an FTP assumes (2.1%). Daimler Truck summarizes this analysis below in Table 10. [EPA-HQ-OAR-2019-0055-1168-A1, p.58]

Daimler Truck's data demonstrates that the current Cold/Hot weighting factor (1/7th cold, 6/7th hot) inappropriately over-weights the contribution of vehicle operation before the aftertreatment system has reached operating temperatures. This implies that a more appropriate weighting factor for the Cold FTP may be approximately 1/12th to 1/18th. Daimler Truck believes EPA should reevaluate the Cold FTP weighting factors in light of this information, and determine if the current test procedures and weighting factors are appropriate. [EPA-HQ-OAR-2019-0055-1168-A1, p.59]

EPA should add a 300-second idle warm-up period to the beginning of the Cold FTP, to reflect the way that trucks are operated in the real world. [EPA-HQ-OAR-2019-0055-1168-A1, p.59]

As explained above, Daimler Truck believes that the current Cold FTP test procedure and weighting protocol inappropriately weights the emissions performance during the period of engine operation before the emissions controls can be employed effectively. This procedure most obviously diverges from real world operation in the way it treats start and the first acceleration events of the test. [EPA-HQ-OAR-2019-0055-1168-A1, p.59]

In the Cold FTP, during the first New York Non-Freeway segment of the test, the engine is started, and is accelerated to represent vehicle movement within 25 seconds of engine start.

Figure 24 shows the profile of an FTP the first acceleration after vehicle start. [EPA-HQ-OAR-2019-0055-1168-A1, p.59]

These first early acceleration events, before the emissions control system are fully effective, are responsible for most of the emissions measured as part of the Cold FTP, as demonstrated in Figure 25: [EPA-HQ-OAR-2019-0055-1168-A1, p.60]

The Cold FTP has the first acceleration event 25 seconds after engine start, and the first three major cold start events contribute the great majority of the emissions captured during the FTP. As Daimler Truck discusses above, these events are overweighted in terms of real-world contribution to the emissions inventory. Additionally, they stand in stark contrast to the way vehicles are operated in the real world. [EPA-HQ-OAR-2019-0055-1168-A1, p.60-61]

Most drivers idle their vehicles for some extended period of time before driving off for the first time of the day. The driver is required to complete a pre-trip inspection and fill out their log books and work instructions for the day, all of which might be completed while the vehicle is idling. Additionally, the system must be allowed to accumulate pressurized air for operation of the air brakes, parking brake, and more, again, all of which requires the vehicle to idle before it can be driven for the first time. [EPA-HQ-OAR-2019-0055-1168-A1, p.61]

Daimler Truck analyzed the data from the EMA-WVU dataset, described above, and found that most shift-days start with a significantly longer idle period than represented by the Cold FTP. The distribution of data is provided below in Figure 26: [EPA-HQ-OAR-2019-0055-1168-A1, p.61]

Daimler Truck's analysis shows that the average idle period for a day-cab vehicle in California is 227 seconds, in contrast with the 25 seconds provided in the Cold FTP. Daimler Truck believes that other application types, such as long-haul sleeper trucks, or trucks operating outside of California (which actively discourages idling) would be likely to see even longer idle operation before the first acceleration event. In this manner, the Cold FTP significantly misrepresents the way vehicles are actually operated, and accordingly, misrepresents the emissions impacts of early acceleration events. Combined with the mis-weighting of cold operation previously discussed, Daimler Truck believes that the current FTP significantly penalizes early, cold-engine operation compared to real world emissions impact. [EPA-HQ-OAR-2019-0055-1168-A1, p.61]

Daimler Truck believes that the EPA should add a 300-second idle period to the beginning of the Cold FTP to better reflect real-world operational profiles. This would allow the full application of emissions controls technologies to be adequately represented in the FTP emissions evaluation. The emissions during this idle period should be measured as part of the Cold FTP emissions and weighted accordingly. [EPA-HQ-OAR-2019-0055-1168-A1, p.61]

If the Agency is concerned about any vehicles that regularly drive off immediately after their cold start, it could address this with a requirement to prevent such operation. For example, EPA could require manufacturers implement an emissions control, which prevents significant engine work until the emissions system is active and effective—such as a vehicle speed limit until the aftertreatment system reaches operating temperature. Such limits on vehicle operation, and customer acceptance of said limits, has precedence in the world of diesel engines, with Wait-to-Start lamps being common emissions controls. [EPA-HQ-OAR-2019-0055-1168-A1, p.62]

EPA could also consider addressing this issue by further de-weighting the first minutes of the cold FTP, or by otherwise introducing a warm-up protocol which would make the composite FTP emissions represent real-world emissions profiles more accurately. [EPA-HQ-OAR-2019-0055-1168-A1, p.62]

In any case, if EPA does not adequately adjust the Cold/Hot FTP to accurately reflect real world operation, manufacturers will be forced to optimize their systems to target these initial FTP acceleration events. Since temperature is the most critical factor to these emissions, manufacturers will be forced to select systems with less thermal inertia to maximize warmup, including smaller CCSCRs, reduced SCR substrate volume or wall thickness, lighter, less durable materials, and implement control technologies that increase system temperature, which necessarily come at the cost of CO_2 emissions. Manufacturers may be able to optimize systems for these early Cold FTP emissions to reduce on-cycle NOx, but it will come at the cost of real world emissions reductions, in terms of CO_2 and NOx over the rest of the vehicle's operation. [EPA-HQ-OAR-2019-0055-1168-A1, p.62]

EPA has not demonstrated that the proposed RMC emissions standards are feasible, in particular that the NOx limits proposed under Option 1 are appropriate. Additionally, the PM standard should be set to 7.5 mg/hp-hr to reflect the state of available technology. [EPA-HQ-OAR-2019-0055-1168-A1, p.62]

Similar to the FTP standards, EPA has not adequately demonstrated feasibility of a 20 mg/hp-hr NOx standard for the RMC, when considering the totality of the Agency's proposal. While there are new emission control systems that can be used to improve emissions characteristics by improving SCR temperature, such new control systems do not provide any emissions benefit in operations best represented by the RMC. RMC operations are intended to represent warmed-up, steady-state duty cycles, where SCR technology is already being fully leveraged. [EPA-HQ-OAR-2019-0055-1168-A1, p.62]

Proposed catalyst candidates for potential UL NOx systems do not show any benefit compared to existing catalyst systems in the area best represented by the RMC. In Figure 27 below, Daimler Truck compares current SCR technology to a proposed UL NOx system, demonstrating that in areas of high temperature, little to no improvement is possible beyond today's performance. Similarly, the proposed catalysts do not show any significantly improved aging behavior compared to the catalysts in production today. [EPA-HQ-OAR-2019-0055-1168-A1, p.62]

Since RMC emissions performance is dominated by high-temperature SCR conversion efficiency, and since the high NOx flux experienced in the RMC makes systems particularly susceptible to aging behavior, Daimler Truck finds that new technology offers no improvement to RMC emissions potential. While EPA offers that manufacturers could select larger catalysts to improve conversion efficiency or aging, doing so would come at the cost of increased thermal inertia, and accordingly, reduced cold start and low-load emissions perfo1mance. EPA also does not consider the impact of such increased catalyst size on packaging the proposed system on the many vehicle configurations offered today. [EPA-HQ-OAR-2019-0055-1168-A1, p.63]

Accordingly, Daimler Truck recommends that EPA set the RMC NOx threshold to **50 mg/hp-hr, or 0.05 g/hp-hr,** to reflect the greatest degree of emission reduction achievable through the application of technology that will be available. [EPA-HQ-OAR-2019-0055-1168-A1, p.63]

Similarly, in light of SWRI's post DPF ash cleaning procedure data, Daimler Truck believes that EPA has not demonstrated feasibility for the proposed PM standard. Daimler Truck submits that a PM standard of **7.5 mg/hp-hr** on the RMC would be the greatest degree of emission reduction achievable, given the state of current technology. [EPA-HQ-OAR-2019-0055-1168-A1, p.63]

Organization: *Manufacturers of Emission Controls Association (MECA)*

In addition, MECA supports EPA's proposed PM standard of 0.005 g/bhp-hr on the FTP and RMC cycles for MY 2027 and later engines. This PM standard is technologically feasible with currently available DPF technology as supported by the certification data of current heavy-duty diesel engines that implement DPFs, which report substantially lower PM measurements. This more stringent standard will prevent backsliding by ensuring the best available DPFs remain an integral component in aftertreatment systems. In response to tighter PM limits signaled by the EU and CARB's Omnibus, DPF suppliers are delivering improved filter substrates that have smaller mean pore size and more uniform pore size distribution, resulting in higher filtration efficiency and reduced pressure drop as the filter loads with soot. These improvements result in reduced particle number and mass emissions by up to 50%, even on a clean or freshly regenerated filter, better light-off performance necessary for soot regeneration and potential fuel economy benefits [7]. [EPA-HQ-OAR-2019-0055-1320-A1, pp.5-6]

> [7] Y. Kurimoto, R. Mishina, K. Kato, T. Aoki, K. Tanaka, T. Honda, A. Kaneda and C. Vogt, 'Next Generation Diesel Particulate Filter for Future Tighter HDV/NRMM Emission Regulations (SAE 2022-01-0545),' SAE WCX, April 2022.

The proposed emission limits have been derived from years of technology demonstration and testing at Southwest Research Institute under CARB and EPA contracts that began in 2014 and have been enhanced under multiple phases to expand duty cycles, technologies and engines. MECA and our members have committed millions of dollars in cash and in-kind contribution to provide hardware and funding into this program to demonstrate multiple pathways for meeting a 90% reduction in NOx while not increasing GHG emissions and controlling other regulated and unregulated pollutants. This seminal demonstration program also benefited from in-kind contribution from Volvo and Cummins who provided engines and calibration assistance, funding from South Coast AQMD and the Port of Los Angeles, among others, to deliver a robust technology feasibility demonstration through partnership between industry and regulators. [EPA-HQ-OAR-2019-0055-1320-A1, p.6]

The first stage of the program that concluded in 2016 relied on an advanced MY 2014 diesel engine that included turbo-compounding technology for meeting future 2017 Phase 1 GHG limits. Although this engine provides impressive fuel saving at highway speeds, it posed thermal management challenges at cold start and low load operation. This could be overcome through the use of active heating based either on electric or fuel burner components. In spite of these challenges, this first ever demonstration of ultra-low NOx emissions served as a great learning opportunity through screening of thirty-three different aftertreatment configurations and advanced calibration to demonstrate that future 0.02 g/bhp-hr emission limits are feasible. The learning from this stage of the program served as the starting point for technology selection in future stages of this multi-year program. This work was published in 2017 in a number of SAE technical papers [8] [9] [10]. [EPA-HQ-OAR-2019-0055-1320-A1, p.6]

> [8] C. Sharp, C. C. Webb, G. Neely, M. Carter, S. Yoon and C. Henry, 'Achieving Ultra Low NOx Emissions Levels with a 2017 Heavy-Duty On-Highway TC Diesel Engine and an Advanced Technology Emissions System - Thermal Management Strategies (SAE 2017-01-0954),' SAE International Journal of Engines, vol. 10, no. 4, pp. 1697-1712, 2017.
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> [9] C. Sharp, C. C. Webb, S. Yoon, M. Carter and C. Henry, 'Achieving Ultra Low NOx Emissions Levels with a 2017 Heavy-Duty On-Highway TC Diesel Engine - Comparison of Advanced Technology Approaches (SAE 2017-01-0956),' SAE International Journal of Engines, vol. 10, no. 4, pp. 1722-1735, 2017.
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> [10] C. Sharp, C. C. Webb, G. Neely, J. V. Sarlashkar, S. B. Rengarajan, S. Yoon, C. Henry and B. Zavala, 'Achieving Ultra Low NOx Emissions Levels with a 2017 Heavy-Duty On-Highway TC Diesel Engine and an Advanced Technology Emissions System - NOx Management Strategies (SAE 2017-01-0958),' SAE International Journal of Engines, vol. 10, no. 4, pp. 1736-1748, 2017.

The primary objective of stage two of the program was to develop a low load certification cycle based on real world truck operation derived from duty cycles collected by the National Renewable Energy Lab (NREL) and UC-Riverside on over 800 trucks operating in California and across the U.S. The methodology developed under this program by NREL and SwRI was a completely original approach to certification cycle development and will serve as a model for future regulations around the world for years to come. The stage 1 engine and aftertreatment system was operated over the newly developed certification cycle and demonstrated that when engine calibration and aftertreatment are optimized for real world operation, it is possible to achieve NOx reductions over 95% from the baseline system under the most challenging conditions. Although overcoming the thermal mass of the turbo-compound unit at low loads required active thermal management at a fuel penalty of about 2%, we did learn about aftertreatment architecture and design optimization to reduce emissions from both cold-start and low load operation, and this knowhow was carried into stage 3 of the program. [EPA-HQ-OAR-2019-0055-1320-A1, p.6]

Stage 3 of the program began in 2017 and employed a different state-of-the-art 15L engine that met the 2017 Phase 2 GHG limits without the use of turbo-compounding. The aftertreatment system options were narrowed down based on all of the learning in stages 1 and 2. Furthermore, replacing the use of active burner thermal management, we applied cylinder deactivation (CDA) on this engine and further calibration to get rapid heat-up of the aftertreatment from cold-start as well as maintaining SCR temperature during coasting, idling and low speed operation. The CDA was further able to provide thermal management while reducing fuel consumption and CO2 emissions. Other technology options for simultaneous thermal management and GHG reductions were also evaluated and are discussed below. These include driven turbochargers among others that OEMs could employ to build additional compliance margin against tighter NOx limits and future Phase 2 standards. This stage of the program was another first of its kind demonstration of achieving both ultra-low NOx emissions and simultaneous GHG reductions that have long been considered a challenging trade-off by engine developers. [EPA-HQ-OAR-2019-0055-1320-A1, pp.6-7]

It should also be noted that technology demonstration on a vehicle has been conducted to support the European Union ongoing process of considering more stringent heavy-duty criteria emission standards in a Euro VII rulemaking. This work, conducted by the Association for Emission Controls by Catalyst (AECC) is showing that stringent NOx emission limits can be met on a vehicle in real world driving conditions by employing similar technologies demonstrated in the program at SwRI [11]. The integration onto an existing truck chassis required a slightly modified close-coupled catalyst architecture and demonstrates yet another pathway to achieving low NOx emissions. Further work by AECC demonstrated that integrating an electrically heated catalyst (EHC) with the close-coupled DOC yielded an additional 60-77% reduced NOx during cold start in an urban delivery drive cycle [12]. [EPA-HQ-OAR-2019-0055-1320-A1, p.7]

[11] Mendoza Villafuerte, Pablo; Demuynck, Joachim; Bosteels, Dirk; Gioria, R; Selleri, T; Melas, A; Suarez-Bertoa, R; Perujo, A; Wilkes, T; Robb, L; Recker, P, 'Ultra-Low NOx Emissions with Close-Coupled Emission Control System on a Heavy-duty Truck Application,' in 30th Aachen Colloquium, 2021.

[12] J. Demuynck, P. Mendoza Villafuerte and D. Bosteels, 'Ultra-low pollutant and CO2 emissions on demonstrator vehicles with advanced emission controls and sustainable renewable fuels,' in 10th International Conference on Fuel Science, Aachen, 2022.

Over the course of this multi-year program, the technology innovation was not static, and in fact new technologies came on midstream as they became commercially viable. Even the aftertreatment components that remained fundamentally unchanged from today’s systems on trucks benefitted from multiple generations of substrate improvements and new catalyst formulations that occurred over the 8 years of testing under this program. Further improvements in catalysts and architectures have been tested in the latest EPA-led portion of the test program that built on the learnings of the CARB funded portion of the program. [EPA-HQ-OAR-2019-0055-1320-A1, p.7]

Catalyst suppliers have already developed a next generation of SCR catalysts with higher NOx reduction efficiency and better durability compared to the Stage 3 parts tested in the SwRI demonstration program. Through the use of sophisticated models that incorporate the latest learnings on both thermal and chemical aging effects, it is possible to project the gains in efficiency provided by these new materials. A similar methodology was used to that discussed in the MECA 2027 white paper, incorporating exhaust information from the latest engine calibration from SwRI and an optimized dosing calibration for the new downstream SCR catalyst. The catalysts were laboratory aged both thermally and chemically using sulfur containing simulated exhaust gas to represent 435,000 miles of equivalent engine aging. The catalysts were modeled over the FTP, RMC and LLC certification cycles and demonstrated lower emissions than the Stage 3 system at SwRI. The not yet published results suggest that the latest generation SCR catalyst would provide OEMs with additional margin to a 0.02 g/bhp-hr standard. [EPA-HQ-OAR-2019-0055-1320-A1, pp.7-8]

Furthermore, even in the short time since the latest emission control system was provided to SwRI for the demonstration program, improvements continue to be made to substrates and catalysts. For example, a recent paper published at the 2022 SAE WCX conference describes development of high-porosity honeycomb substrates with thinner wall thickness and high cell density that can be coated with SCR catalyst. The combination of developments on this substrate enables higher surface area and lower thermal mass, which improves coating efficiency, reduces catalyst heat-up time, and reduces pressure drop. These result in performance improvements that are especially prominent at low temperature operation. At engine exhaust temperatures of 175â„ƒ, the NOx conversion efficiency improved by 14% compared to earlier generation substrates [13]. [EPA-HQ-OAR-2019-0055-1320-A1, p.8]

> [13] Y. Ido, K. Kinoshita, C. Goto, H. Toyoshima, S. Hirose, E. Ohara, T. Honda, A. Kaneda, A. Wells and C. Vogt, ‘High-Porosity Honeycomb Substrate with Thin-Wall and High Cell Density Using for SCR Coating to Meet Worldwide Tighter Emission Regulations (SAE 2022-01-0550),’ in SAE WCX, Detroit, MI, 2022.

This example of continual improvement and optimization is a testament to the ongoing innovative technology development occurring in the industry between suppliers and their OEM customers. Each time a test is run, new information is obtained and applied to the next iteration. This has been going on continually over the past 15 years of advanced emission controls on trucks. In fact, over the life of the SwRI program, catalyst suppliers have deployed new catalyst formulations and coating techniques to continually improve the durability and performance of the SCR system in order to build greater compliance margin relative to the program targets. Our industry has seen a tremendous amount of innovation on both engines and aftertreatment since the U.S. 2010 on-road diesel standards were implemented. This learning has been applied to improve manufacturing and reduce variability that has allowed systems to be downsized by about 60% and reducing their costs by about 30% (costs will be further addressed later). [EPA-HQ-OAR-2019-0055-1320-A1, p.8]

This regulation will complement CARB’s Omnibus to set the goals for engineers at OEMs and suppliers who will work together to make these systems more robust and durable as they are integrated on trucks and tested in the field. This collaboration is only possible once new standards are set and our industry is motivated to work with our OEM customers to meet them. As part of this process, over the next several years, a number of observations from the SwRI program will be evaluated and applied to make further improvements to the engine-out and tailpipe NOx limits. This partnership between suppliers and their customers will lead to improvements in durability while delivering the compliance margins that OEMs rely upon when certifying engines and emission control systems. Some of the areas for improvement that have been identified include:

1) Applying improved substrates and catalyst formulations that target poisoning resistance at low temperatures while retaining high temperature ammonia selectivity.
2) Adjustments in catalyst volume and engine calibration to accommodate catalyst aging for longer useful life.
3) Packaging improvements for passive thermal management and ammonia mixing and distribution for optimal urea utilization.
4) Modified catalyst component architectures that take advantage of passive thermal management, NO oxidation capability and further reduced fuel consumption.
5) Close attention to engine and urea dosing calibration over all duty-cycles to ensure optimal ammonia surface coverage of the upstream and downstream SCR to optimize catalyst utilization.
6) Improvements in NOx and ammonia sensor accuracy and detection. [EPA-HQ-OAR-2019-0055-1320-A1, p.9]

Over the past 12 years of diesel aftertreatment experience, our industry has learned a great deal about the design and operation of advanced diesel aftertreatment systems based on a DOC, DPF and SCR and the use of liquid urea to reduce NOx. The next 5 years will build on that learning to essentially use the same fundamental components to achieve a further 90% reduction in NOx. Passenger cars have had the benefit of 45 years of engine and aftertreatment development to achieve SULEV emissions. The SwRI program has demonstrated that near SULEV emissions are also achievable from heavy-duty engines to match the NOx emissions from natural gas engines that have operated at 0.02 g/bhp-hr levels for years. A more detailed discussion of the multiple technology pathways to achieving the emission limits proposed in this rule is provided below. [EPA-HQ-OAR-2019-0055-1320-A1, pp.9-10]

Commercially available technologies have been demonstrated to meet a 0.035 g/bhp-hr FTP NOx standard at 600,000 miles full useful life by 2027. These technologies can also enable a 0.02 g/bhp-hr intermediate FTP NOx standard at 435,000 miles. [EPA-HQ-OAR-2019-0055-1320-A1, p.10]

Engine technologies, advancements in engine calibration, thermal management, and catalysts can be combined to enable engines plus aftertreatment systems to achieve FTP and RMC emissions below 0.02 g/bhp-hr NOx [15]. Ongoing work by MECA members is aimed at demonstrating emission levels that will provide sufficient compliance margins that OEMs need for full useful life durability. Recent testing funded by EPA further optimized the engine and aftertreatment system based on lessons learned during Stage 3 of the CARB Low-NOx Demonstration Project. During cold-start and low-load operation, which are challenging conditions for emission control, engine technologies can be combined with calibration and thermal management to reduce engine-out NOx emissions and achieve real-world NOx reductions. Engine calibration and thermal management combined with advanced catalysts and substrates have improved to the point where a current technology engine plus aftertreatment system can achieve FTP emissions below 0.05 g/bhp-hr NOx by 2024 to meet the CARB stage 1 standards. [EPA-HQ-OAR-2019-0055-1320-A1, p.10]

[15] MECA, 'Technology Feasibility for Heavy-Duty Diesel Trucks in Achieving 90% Lower NOx Standards in 2027,' 2020. Online at https://www.meca.org/wp-content/uploads/resources/MECA_2027_Low_NOx_White_Paper_FINAL.pdf.

New aftertreatment architectures, that employ a close-coupled selective catalytic reduction (SCR) catalyst before the diesel oxidation catalyst (DOC) and diesel particulate filter (DPF) in a twin SCR system arrangement with dual urea dosing, can meet future FTP/RMC NOx limits of 0.02 g/bhp-hr after 435,000 miles by 2027. Several potential future aftertreatment layouts have been demonstrated in the SwRI test program. MECA has published two white papers that outline the technologies and models used to design catalyst, substrate and architectures to meet ultra-low NOx levels [16] [15]. Over the past 8 years of demonstration work at SwRI, testing has confirmed MECA's modeled results while also showing the need for modest enhancement of emissions control durability to provide margin for the FTP and RMC cycles over extended useful life. Over the next five years, industry will embrace any remaining challenges as suppliers continue to optimize their components and engine manufacturers hone their calibrations to exceed what has been demonstrated to date. This continued improvement work is why MECA believes that an intermediate limit of 0.02 g/bhp-hr is a technologically achievable up to 435,000 miles for a national program by 2027. [EPA-HQ-OAR-2019-0055-1320-A1, p.10]

> [15] MECA, 'Technology Feasibility for Heavy-Duty Diesel Trucks in Achieving 90% Lower NOx Standards in 2027,' 2020. Online at https://www.meca.org/wp-content/uploads/resources/MECA_2027_Low_NOx_White_Paper_FINAL.pdf.
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> [16] MECA, 'Technology Feasibility for Model Year 2024 Heavy-Duty Diesel Vehicles in Meeting Lower NOx Standards,' 2019. Online at https://www.meca.org/wp-content/uploads/resources/MECA_MY_2024_HD_Low_NOx_Report_061019.pdf.

PM and particle number emissions from MD and HD gasoline engines can be reduced further. [EPA-HQ-OAR-2019-0055-1320-A1, p.32]

EPA is proposing to tighten PM by 50% to 0.005 g/bhp-hr for diesel engines and MECA believes that would not require any change in technology but only serve as a backstop to prevent backsliding under a tighter NOx limit. As fuel efficiency standards tighten and GDI injection technology becomes more common on commercial vehicle engines, the PM emissions from medium and heavy-duty gasoline engines are likely to increase dramatically. The European Commission, China and India have adopted a particle number emission standard for light-duty vehicles powered by gasoline direct injection (GDI) engines as a part of their Version 6 light-duty emission standards. These standards were set at a stringency to require best available controls at the time being GPFs. Since 2019 high pressure fuel injection technology has further advanced to a point that it too can meet these stringent particle number limits. Europe implemented the PN limit for all vehicles in 2019, and China in 2020. India will implement it in 2023. China will require all vehicles to meet this limit in 2023, including gasoline port fuel injected vehicles. This PN standard established a more stringent particle emission limit for GDI vehicles in the same timeframe as EPA's 3 mg/mile PM standard that will complete phase-in with the 2021 model year. The Euro 6 GDI particle number limit has been set at 6 X 1011 particles/km, measured using the European PMP particle measurement protocol and is approximately equivalent to 0.5 mg/mile. This European particle number limit combined with Euro 6d Real Driving Emission testing has motivated auto manufacturers to introduce these cleaner technologies on vehicles. Nearly all auto manufacturers that sell into the European or

Chinese markets are using particulate filters on gasoline direct injection vehicles as well as some PFI vehicles. [EPA-HQ-OAR-2019-0055-1320-A1, pp.32-33]

MECA funded a study at the National Renewable Energy Laboratory (NREL) that summarized statistics of real world operation from two major data sources: NREL's Fleet DNA database that includes 435 conventional, diesel-powered trucks from 25 different vocations and from 24 fleets across the U.S. and University of California Riverside's CE-CERT database that consists of 79 diesel-powered vehicles from 10 different vocations and from 23 fleets operating in California [22]. Results from this report provide some insights into the causes for NOx emission reduction challenges due to real world operation. [EPA-HQ-OAR-2019-0055-1320-A1, p.17]

> [22] C. Zhang, E. Miller, A. Kotz, K. Kelly and M. Thornton, 'Characterization of Medium- and Heavy-Duty Vehicle Operations from In-Use Data: An Analysis of Starts, Soak Time, and Warm-Up Duration,' Golden, CO, 2019.

Some observations from this work are shown in Figure 4 and include:

- Cold starts represent approximately 12% of total real-world starts, and this is appropriately reflected by the FTP composite weighting of 14.3%.
- Cold operation time is also well captured by the FTP certification cycle (1.5%) versus 1.3% in the real-world.
- Current cold and hot start definitions are based on coolant temperature, which does not often correlate with SCR inlet temperature and thus SCR performance.
- Much of real-world operation (30-70%) involves restarting a hot engine (based on coolant temperature), but the aftertreatment has cooled off below the optimal operating temperature and must be warmed back-up quickly to minimize NOx emissions.

Engines idle much more in the real world than captured by inventory emission models or certification cycles. [EPA-HQ-OAR-2019-0055-1320-A1, pp.17-18]

Impacts of fuel quality on future aftertreatment systems: In order to achieve reductions in harmful emissions from heavy-duty diesel engines, federal regulations were designed to allow for an engineered systems approach that combines advanced engine designs, advanced exhaust control technologies, and improved diesel fuel quality. In current diesel engine regulations, fuel quality requirements set a limit on the amount of sulfur allowed in fuel. The reason for this is two-fold; first, when sulfur is present in fuel that participates in combustion, the resulting emissions contain sulfur oxides (SOx) as well as sulfate particulate matter. Second, sulfur oxides are known compounds that reversibly affect the performance of precious metal and SCR catalysts found in diesel emission control components through a number of deactivation mechanisms. The current limit of 15 ppm sulfur in ultra-low sulfur diesel was established based on precious metal (PGM) in diesel catalyst. The PGM oxidizing function of the DOC and DPF can reversibly deactivate over time in the presence of sulfur. The DOC serves to oxidize NO2 from the engine so it is in the proper oxidation state to be reduced by the SCR using ammonia as the reductant. Similarly, the PGM on the DOC, upstream of the SCR, oxidizes SO2 to SO3 which is a stronger poison for the SCR. Because it is positioned upstream of the DOC/DPF, the front SCR in a close-coupled dual-SCR aftertreatment architecture is primarily exposed to SO2, which is a less severe poison for the zeolite SCR catalyst. [EPA-HQ-OAR-2019-0055-1320-A1, p.23]

Well established thermal sulfur removal strategies are employed to reverse the negative impacts of sulfur on these catalysts. Commercial DOCs begin to recover from sulfur poisoning between 350-600°C, depending on the catalyst design. SCR catalysts are generally tolerant to sulfur found in today's fuels; however, long term exposure may cause gradual deactivation via two potential poisoning mechanisms. A less often occurring mechanism is the irreversible reaction of sulfuric acid with the zeolite catalyst washcoat. More often, sulfur can chemisorb onto catalyst active sites and block further NOx reduction reaction from occurring at the active site. If recovery is necessary, copper zeolite SCRs show nearly full recovery at 500°C. The SCR catalyst downstream of the DPF is typically regenerated during the periodic high temperature excursion used to regenerate soot from the DPF. [EPA-HQ-OAR-2019-0055-1320-A1, p.23]

An aftertreatment architecture likely to be employed to meet the Proposed Option 1 standards may include a twin SCR arrangement with a close-coupled SCR that is upstream of today's aftertreatment systems. In the absence of an upstream DOC, the close-coupled SCR will be mainly exposed to SO2 rather than SO3, the latter being a more severe poison. Research suggests that sulfur effects on the close-coupled SCR can be reversed by heating the catalyst to 500°C, which can be achieved through late post injection or other engine thermal management strategies, including cylinder deactivation and variable valve actuation (VVA) strategies. The SwRI Low-NOx Test Program has demonstrated that upstream SCRs in a dual SCR system can be brought up to temperature for desulfation via engine calibration to optimize short periods of higher temperature operation without incurring a fuel penalty or significant catalyst deterioration. The strategy employed by SwRI successfully removed sulfur from the SCR catalyst and reversed the marginal performance loss experienced due to sulfur deposition. [EPA-HQ-OAR-2019-0055-1320-A1, pp.23-24]

EPA has funded a continuation of the SwRI program with accelerated aging and durability demonstration out to 800,000 mile equivalent useful life using a new aging protocol being developed with industry partners and MECA. The results of this program are helping to inform about the long-term impacts of fuel sulfur on SCR catalysts. Aging experience from catalyst manufacturers suggests that the greatest impact may be on the close-coupled SCR since this is closest to the engine and sees the highest temperature and the major portion of lube oil metal exposure. The downstream, underfloor SCR is somewhat protected from fuel metals by the DOC and DPF. However, it will see higher temperatures during DPF regeneration. Results of the aging demonstration conducted at SwRI have confirmed some loss of performance from 435,000 miles to 800,000 miles. However, the rate of performance loss was cycle specific. For example, the SwRI program results showed minimal loss of performance over the LLC (0.029 g/bhp-hr to 0.032 g/bhp-hr) from 435,000 miles to 800,000 miles for the latest system ('Stage3 RW') tested as of April 2022. The same deterioration over the FTP cycle test resulted in a 0.020 g/bhp-hr level at 435,000 miles compared to 0.037 g/bhp-hr at 800,000 miles. It should be noted that all of these results are under the Proposed Option 1 standards at 800,000 miles for MY 2031 engines. [EPA-HQ-OAR-2019-0055-1320-A1, p.24]

Organization: *Moving Forward Network (MFN)*

EPA has erroneously set a standard of 35 mg/bhp-hr NOx on the FTP/SET cycle for light-heavy- and medium-heavy-duty diesel (LHDD and MHDD) and heavy-duty Otto-cycle (HDO) engines. This standard is inconsistent with EPA's own data on the capability of these engines, in addition to the requirements of the Omnibus. [EPA-HQ-OAR-2019-0055-1277-A1, p. 22]

California engaged in an extensive, multi-year process with significant stakeholder engagement to justify its Omnibus standards. Much of this work was done in collaboration with EPA—as such, the agency should be well apprised of the latest available technologies to reduce emissions from diesel engines. Generally, we find the agency's Draft RIA to reflect up-to-date information on technical potential. Unfortunately, not all of that work appears to be reflected in its feasibility analysis. Below, we assess some deficiencies in the agency's analysis and include additional references to support stronger emissions reductions requirements from conventionally powered trucks. [EPA-HQ-OAR-2019-0055-1277-A1, p. 23]

> 128. https://ww2.arb.ca.gov/sites/default/files/classic/research/apr/past/13-312.pdf
>
> 129. https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hdomnibuslownox/appi.pdf

EPA is proposing two changes which have the potential to significantly reduce particulate matter emissions: 1) a reduced PM standard and 2) requiring closed crankcase emissions. Our support for these changes is discussed below. [EPA-HQ-OAR-2019-0055-1277-A1, p. 35]

EPA's certification program as well as its in-use test data both confirm that today's diesel trucks emit significantly less particulate pollution than pre-2007/2010 vehicles. In fact, every 2021-2022 certified diesel engine achieves an FTP/SET standard below EPA's proposed standard for 2027,145 indicating that there is currently more than a 50 percent compliance margin. Furthermore, the most recent data on EPA's Stage 3RW system indicates PM values below 5 mg/bhp-hr on all test cycles, all the way up to 800,000 miles.146 On the FTP and SET test cycles, in particular, the SwRI data exhibit more than a 70 percent margin at the 2031 FUL, indicating that diesel technology can meet a standard well below the proposed 5 mg/bhp-hr on the FTP and SET cycles. [EPA-HQ-OAR-2019-0055-1277-A1, pp. 35 - 36]

> 145 EPA. 2022. Heavy-duty highway gasoline and diesel certification data (Model years: 2015-present), updated February 2022. https://www.epa.gov/system/files/documents/2022-02/heavy-duty-gas-and-diesel-engines-2015-present.xlsx.

It is critical that EPA eliminate any potential for backsliding on the progress made to date on direct particulate matter emissions and encourage even further gains by setting mandatory PM standards for heavy-duty engines that are at least as stringent as the proposed Option 1 standards. [EPA-HQ-OAR-2019-0055-1277-A1, p. 36]

The proposed full useful life (FUL) of LHDD engines is 190,000 miles in 2027 and 270,000 miles in 2031. The proposed FUL of MHDD engines is 270,000 miles in 2027 and 350,000 miles in 2031. At 435,000 miles of accelerated aging, the SwRI demonstration of the Phase 3 RW system achieved a 20 mg/bhp-hr level of NOx emissions on the FTP cycle, 17 mg/bhp-hr on the SET, and just 29 mg/bhp-hr on the LLC (Draft RIA Table 3-8). This level of aging (435,000 miles) exceeds the level of deterioration of even the 2031 FUL for either engine. [EPA-HQ-OAR-2019-0055-1277-A1, p. 22]

EPA's proposed stringency for LHDD and MHDD engines exceeds the feasibility demonstrated at SwRI by 75 percent on the FTP cycle (35 compared to 20 mg/bhp-hr), 106 percent on the SET cycle (35 compared to 17 mg/bhp-hr), and 210 percent on the LLC cycle (90 compared to 29 mg/bhp-hr). Such levels well exceed any reasonable compliance margin, and the agency has not explained anywhere its rationale for such gross differences. Perhaps even more evidence of its error is that its proposed 2031 standards are much more consistent with the available data, aligning with the Omnibus standards of 20 (FTP), 20 (SET), and 50 (LLC) mg/bhp-hr. This discrepancy between the 2027 and 2031 capabilities for LHDD and MHDD engines, is unaccounted for in both the Draft RIA or NPRM and is particularly surprising given the extended FULs in 2031 for these engines. [EPA-HQ-OAR-2019-0055-1277-A1, p. 22]

While the demonstration engine was a heavy-heavy-duty diesel (HHDD) engine, this cannot explain the gross error in EPA's proposal. Other demonstration projects on an MHDD engine were able to achieve the 20 mg/bhp-hr FTP standard.87 Moreover, EPA's data shows relatively similar behavior across engine sizes when appropriately normalized.88 [EPA-HQ-OAR-2019-0055-1277-A1, p. 22]

87. Dhanraj, F., Dahodwala, M., Joshi, S., Koehler, E. et al., "Evaluation of 48V Technologies to Meet Future CO2 and Low NOx Emission Regulations for Medium Heavy-Duty Diesel Engines," SAE Technical Paper 2022-01-0555, 2022, doi:10.4271/2022-01-0555.

88. Draft RIA, Table 3-21

Given the proposed FUL schedule, EPA should align its numerical stringency in 2027 with its values in 2031, which would thus align with the Omnibus and the available evidence. [EPA-HQ-OAR-2019-0055-1277-A1, p. 22]

As noted by EPA, variable valve actuation (VVA) has been used for decades in light-duty vehicles (LDVs) to reduce fuel use, but recent advances in controls now allow for new efficiency strategies like part-time Atkinson and Miller cycles. VVA strategies for heavy-duty vehicles can build on those controls advancements to develop novel diesel valve control that can fine-tune intake/exhaust valve timing to reduce emissions and fuel use at the same time. [EPA-HQ-OAR-2019-0055-1277-A1, p. 23]

Early exhaust valve opening (EEVO) is one example of a strategy to utilize VVA in an effort to reduce emissions.90 In this case, the exhaust valve is opened before completing the power stroke, which can thus significantly increase exhaust temperature, albeit at the expense of increased fuel use, and in some cases with trade-offs on other pollutants (HC, CO, PM2.5). EPA notes these trade-offs in its Draft RIA (16). Careful optimization is key to EEVO, and these trade-offs can be managed through more advanced controls.91 With such advanced controls in place, VVA can be used to compensate for any fuel penalty from EEVO through improved efficiency, such as early and late intake valve closing (EIVC, LIVC)—such strategy can even be used to implement Miller cycle operation in the diesel engine. A forthcoming analysis as part of the Volvo SuperTruck program shows that Miller cycle operation can enable reduced NOx emissions without compromising on efficiency.92 [EPA-HQ-OAR-2019-0055-1277-A1, pp. 23 - 24]

90. See, for example, Honardar, S., H. Busch, T. Schnorbus, C. Severin, A.F. Kolbeck, and T. Korfer. 2011. "Exhaust temperature management for diesel engines assessment of engine concepts and calibration strategies with regard to fuel penalty." SAE Technical Paper 2011-24 0176. Online at https://doi.org/10.4271/2011-24-0176 and Roberts, L., M. Magee, G. Shaver, A. Garg, J. McCarthy, E. Koeberlein, E. Holloway, R. Shute, D. Koeberlein, and D. Nielsen. 2015. "Modeling the impact of early exhaust valve opening on exhaust aftertreatment thermal management and efficiency for compression ignition engines." Int. J. Eng. Res. 16 (6), 773-794. Online at https://doi.org/10.1177%2F1468087414551616.

91. Salehi, R., and A.G. Stefanopoulou. 2018. "Optimal exhaust valve opening control for fast aftertreatment warm up in diesel engines." Proceedings of ASME 2018 Dynamic Systems and Control Conference, Vol. 2. DSCC2018-9178, V002T26A003. Online at https://doi.org/10.1115/DSCC2018-9178.

92. Garcia, E., V. Triantopoulos, A. Boehman, A., M. Taylor, and J. Li. 2020. "Impact of Miller Cycle Strategies on Combustion Characteristics, Emissions and Efficiency in Heavy-Duty Diesel Engines." SAE Technical Paper 2020-01-1127. Online at https://saemobilus.sae.org/content/2020-01-1127/.

One particular VVA strategy which helps both reduce fuel consumption and address low-load emissions is cylinder deactivation (CDA), which EPA and CARB have incorporated into their heavy-duty engine demonstration work with SwRI. CDA has already been proven effective and durable in light-duty vehicles, but recent research shows the strong benefits of CDA in heavy-duty diesel vehicles as well. CDA essentially allows the engine to be downsized in real time—this has the effect of dramatically increasing the temperature of low load operation (about 100°C in an MHD engine) while improving overall fuel efficiency.93 Importantly, this study found fuel savings (3.2 to 7.8 percent) and NOx reduction (33 to 86 percent) over a range of real-world driving cycles emphasizing low load operation, without any modification to the production aftertreatment system. Even at low-load operation and idle conditions, heavy-duty CDA saw increases of 60-80°C with fuel savings of 8 to 28 percent.94 EPA's own data, which was for some reason not cited in the Draft RIA, shows similar behavior, reducing tailpipe NOx on the low-load cycle (LLC) by 77 percent, thanks to an average increase in temperature at the SCR inlet by 38°C.95 Data on a third VVA system shows the same behavior but extends the applicability to medium-duty engines.96 While this study was only a simulation, it shows tailpipe NOx reductions of 29 to 49 percent while reducing CO2 emissions by 1.6 to 3.5 percent over a range of representative cycles. A follow-up bench study by the same company on a heavy-heavy-duty engine saw a similar range of behavior, suggesting robustness of the original findings.97 [EPA-HQ-OAR-2019-0055-1277-A1, p. 24]

93. McCarthy, J. 2019a. Simultaneous CO2 and NOx Reduction for Medium & Heavy-Duty Diesel Engines Using Cylinder Deactivation. (Presentation). 16th SAE Brasil forum on diesel and alternative technologies for commercial and off-road vehicles, September 4, 2019.

94. McCarthy, J. 2019b. Meeting Future Low Load Emissions Using Cylinder Deactivation and EGR Pumps to Achieve Simultaneous NOx and CO2 Reduction. (Presentation). Emissions 2019 Conference, Livonia, MI, June 5, 2019.

95. Matheaus, A., Singh, J., Sanchez, L., Evans, D. et al., “Evaluation of Cylinder Deactivation on a Class 8 Truck over Light Load Cycles,” SAE Technical Paper 2020-01-0800, 2020, doi:10.4271/2020-01-0800.

96. Scassa, M., Körfer, T., Chen, S.K., Fuerst, J. et al., “Smart Cylinder Deactivation Strategies to Improve Fuel Economy and Pollutant Emissions for Diesel-Powered Applications,” SAE Technical Paper 2019-24-0055, 2019, doi:10.4271/2019-24-0055.

97. Srinivasan, V., Wolk, B., Cai, X., Henrichsen, L. et al., “Application of Dynamic Skip Fire for NOx and CO2 Emissions Reduction of Diesel Powertrains,” SAE Int. J. Advances & Curr. Prac. in Mobility 4(1):225-235, 2022, doi:10.4271/2021-01-0450.

EPA seems to have determined that there is a significant amount of certainty needed in the selection of VVA as an emissions reductions tool.98 However, recent work shows that the same turbocharger can be used with and without CDA, and that there are multiple calibration strategies that can be deployed to keep the aftertreatment system warm while simultaneously reducing fuel use.99 [EPA-HQ-OAR-2019-0055-1277-A1, p. 24]

98. Draft RIA, p. 16.

99. Morris, A. and McCarthy, J., “The Effect of Heavy-Duty Diesel Cylinder Deactivation on Exhaust Temperature, Fuel Consumption, and Turbocharger Performance up to 3 bar BMEP,” SAE Technical Paper 2020-01-1407, 2020, doi:10.4271/2020-01-1407.

EPA additionally noted concerns about noise, vibration, and harshness (NVH) with CDA; however, recent data from Eaton shows that relatively simple adjustments in mounting and damping can dramatically reduce such NVH issues.100 Tula used a flywheel setup to reduce oscillations but showed that such a design could be accomplished without any additional modifications to packaging.101 [EPA-HQ-OAR-2019-0055-1277-A1, pp. 24 - 25]

100. Pieczko, M., McCarthy, Jr., J., and Hamler, J., “Mitigating Vibration for a Heavy-Duty Diesel Cylinder Deactivation Truck,” SAE Technical Paper 2021-01-0661, 2021, doi:10.4271/2021-01-0661.

101. Srinivasan et al. 2021

EPA suggested that vocational vehicles in particular may not be able to take full advantage of CDA,102 but these data on NVH and the applicability to reduced engine sizes suggests that CDA is broadly applicable to all heavy-duty applications and must be considered as a viable strategy to simultaneously reduce fuel consumption and both CO2 and NOx emissions across a broad range of heavy-duty vehicle categories. [EPA-HQ-OAR-2019-0055-1277-A1, p. 25]

102. Draft RIA pp. 16-17

Organization: *National Association of Chemical Distributors (NACD)*

This rule is being considered under a backdrop of severe supply chain disruptions that are forcing goods to reach their end destinations late or not at all. These disruptions have also contributed to record high inflation as the cost to transport goods has risen dramatically — costs being passed on to the average American. While the general cause of these disruptions can be traced to the COVID-19 pandemic, the current crisis we are facing exposed how fragile the supply chain was originally. [EPA-HQ-OAR-2019-0055-1279-A1, pp. 2 - 3]

The supply chain as presently constructed lacks resilience, as each piece of the puzzle had just been barely working until the added demand and workforce disruptions sparked by the pandemic caused it to fall apart. The Biden administration’s Council of Economic Advisors’ Economic Report of the President, published in April 2022, supports this as it concludes that modern supply chains have become more fragile and 'supply chain fragility will continue to be a problem.' [EPA-HQ-OAR-2019-0055-1279-A1, p. 3]

Adding increased regulations to heavy-duty vehicles will make it more difficult for necessary resilience to be built into the trucking side of the supply chain. When another surge in demand or some other added strain is put on the supply chain, each link must be able to withstand it. With this proposed rule, trucks would be less affordable making it more difficult for fleet owners to add additional trucks and accommodate an already unpredictable and unstable supply chain. [EPA-HQ-OAR-2019-0055-1279-A1, p. 3]

Furthermore, the proposed rule would add several new requirements to heavy-duty vehicles and engines that would require more parts to be added into their production and detection systems, creating additional possible chokepoints in heavy-duty vehicle manufacturing. Currently, an NACD member company has been awaiting a shipment of new power units that has been 8-9 months delayed and is still without a delivery date. Data referenced by The Wall Street Journal also shows 55% fewer orders being complete from manufacturers in 2022 compared to early 2021 due to equipment struggles.2 NACD fears that difficulties getting new trucks and components assembled and on the road would worsen under this proposed rule. [EPA-HQ-OAR-2019-0055-1279-A1, p. 3]

2. The Wall Street Journal, 'Truckers Want More Trucks Than Industry Can Build,' WSJ.com, WSJ https://www.wsj.com/articles/truckers-want-more-trucks-than-industry-can-build-at-the-moment-11652094004?mod=pls_whats_news_us_business_f

Lastly, during the public testimony on this proposed rule, several stakeholders raised concerns that increased emission requirements could result in lower truck reliability. Decreased truck reliability would further exacerbate future supply chain challenges. [EPA-HQ-OAR-2019-0055-1279-A1, p. 3]

Organization: *National Association of Clean Air Agencies (NACAA)*

NACAA also notes the potent toxicity and impact of diesel PM and welcomes EPA’s proposal of a PM anti-backsliding standard, based on use of a DPF, of 5 mg/hp-hr, down from the current level of 10 mg/hp-hr. EPA should finalize this standard. [EPA-HQ-OAR-2019-0055-1232-A1, p. 16]

Organization: *Navistar, Inc. (Navistar)*

The NOx certification standards proposed under Option 1 do not provide room for adequate compliance margins and are therefore infeasible and unworkable. The foundation of proposed Option 1 is based on the CARB SWRI Stage 3 proof of concept engine, which is based on one of the highest ratings for the Cummins X-15 engine family 500hp/1850ft-lbs. This rating is not reflective of greater than 97% of the Class 7-8 tractors and severe service applications sold by Navistar over the last 4 years. This engine would not comply with either the current engine selection criteria under 40 CFR 86.096-24(b)(3)(ii) or proposed 40 CFR 1036.235(a). If adopted by EPA, Option 1 will likely have the effect of preventing manufacturers from developing new and cleaner HDOH diesel engines by MY 2027. [EPA-HQ-OAR-2019-0055-1318-A1, p. 3]

Emission reductions are driven by trade-offs. The current CARB/SWRI Stage 3 engine is no different. The demonstration illustrates these same tradeoffs when attempting to reduce NOx to 20 mg/hp-hr, which has resulted in increases to CO2. Currently the Stage 3 engine has been specifically configured to operate at a 500hp/1850 ft-lb. power rating that should provide higher brake specific fuel economy, as well as provide the greatest enthalpy to the aftertreatment, which aids NOx conversions efficiency. However, the Stage 3 engine does not meet any of the 2021, 2024 or 2027 CO2 standards for line haul or vocational trucks. [EPA-HQ-OAR-2019-0055-1318-A1, p. 5]

Selecting a more representative power rating would likely increase NOx levels due to the lower enthalpy and fuel economy either would remain the same or be reduced. Base engine trade-offs would also extend to vehicle aerodynamics losses. The current SWRI configuration will not fit in the current space allotted for production aftertreatment. This would require increasing the width or height of the hood and cab to accommodate the changes, resulting in increased aerodynamic drag and loss of fuel economy. [EPA-HQ-OAR-2019-0055-1318-A1, p. 5]

Organization: *Northeast States for Coordinated Air Use Management (NESCAUM)*

Should EPA instead promulgate Option 1, we urge the Agency to make the following changes to the proposed standards: NESCAUM notes the potent toxicity and impact of diesel particulate (PM2.5) and welcomes EPA's proposal of a PM anti-backsliding standard, based on use of a diesel particulate filter, of 5 mg/hp-hr, down from the current level of 10 mg/hp-hr. We encourage EPA to finalize this standard. [EPA-HQ-OAR-2019-0055-1249-A1, p. 15]

Organization: *Belli, Mike and Cheryl (OOIDA)*

I'm not gonna mince words with you at the EPA. If you want these standards met, you need to give engine manufacturers time to design a prototype first. Allow them to build 10-20 engines and put them out for testing allowing a million miles each. Allow the manufacturers time to compile data with things that worked and things that failed so they can produce an engine that will not be so problematic as the engines you all forced to be built before they could be adequately tested. You all have made a disaster out of engine designs being forced to adhere to your time frames. No one can properly do what you are requiring without causing major issues. As an owner operator, the EGR, DPF, DEF engines have cost me in excess of $35k over the last several years. You have created problems that will never go away, as engines today are like a cancer that will never go away. Your ideas are killing engines because none of you has any idea what the hell you doing. Just another government agency imposing their will at the cost of those who will suffer from your decisions. There ya have it. You don't like it, well neither do I having to continually put my hard earned money fixing the same issues over and over and over. [EPA-HQ-OAR-2019-0055-1266-A2, p.5]

Organization: *Imhausen, Jim (OOIDA)*

"Cummins 2010 after treatment system on a 2012 Kenworth cost me $50,000 by the time I gave up and sold the truck. All of the estimated life of service and maintenance intervals were phony. Field service technicians weren't trained. Government forced the manufacturers and the manufacturers misrepresented the capabilities of the products. Big companies had spare trucks in place and could deal with the situation, but I couldn't." [EPA-HQ-OAR-2019_0055-1266-A2, p.2]

Organization: *Dudek, Nick (OOIDA)*

"I stand behind you guys 100%, the government continuing to put their unproven technology on our backs will continue to put people out of business especially the little guy, I have had to dig very deep in my pockets because of emission issues on my semi-truck, had I not had some extra money put away it would've buried me and put me out of business." [EPA-HQ-OAR-2019_0055-1266-A2, p.2]

Organization: *Elison, Doyle (OOIDA)*

Please allow enough time for technology to become reliable before it is required. What is already required is barely there now after 10 years. It is still too expensive to repair when some little sensor fails. Thank you. [EPA-HQ-OAR-2019-0055-1266-A2, p.5]

Organization: *PACCAR, Inc (PACCAR)*

Proposed 1036.522 additionally requires manufacturers to determine the regeneration frequency for each duty cycle. However, identifying specific in-use regeneration intervals per individual certification cycle (FTP, RMC or LLC) is complicated due to the generally wide-ranging duty cycles between regeneration intervals, e.g., if a vehicle runs 50 hours in city conditions and 50 hours in motorway conditions during a 100 hour regeneration interval, it is not possible to determine whether the data should be used in the overall calculation of the RMC, the FTP or the LLC frequency. Using back-to-back dynamometer emission cycles to determine regeneration intervals does not lead to representative in-use regeneration frequencies and durations. Customers are unlikely to drive the same or similar duty-cycles during their complete regeneration interval, which is the main factor that determines a regeneration frequency. Finally, effects of cold-starts and ambient conditions are not accurately simulated in back-to-back dyno cycles. EPA should therefore retain the option to determine a single regeneration frequency and duration that is used to calculate the IRAF for all emission cycles based on the average regeneration frequency of customer vehicles over all duty cycles. PACCAR respectfully submits that using average customer in-use data is a more appropriate method to determine regeneration frequencies and durations. [EPA-HQ-OAR-2019-0055-1346-A1, pp.50-51]

The Southwest Research Institute's ('SwRI's') system is the principal basis for the purported feasibility of the 0.020 g/bhp-hr NOx standard. CARB's assertion that the new low-NOx requirements are technically feasible is based on a system demonstrated by SwRI over accelerated laboratory aging. To support its low-NOx rulemaking, EPA also contracted with SwRI to perform an aged emissions demonstration with a technical solution very similar to the CARB 'Stage 3' technology package. [EPA-HQ-OAR-2019-0055-1346-A1, pp.4-5]

PACCAR concurs with EMA – which has been engaging with EPA and CARB on HDOH low-NOx rulemakings from the outset, including on the underlying SwRI demonstration projects – that the Omnibus/Option 1 low-NOx standards have not been demonstrated to be technically feasible, and are in fact infeasible, for the following reasons:

- a. The aged-engine 'Stage 3' NOx emissions results neither meet the proposed future 0.020 g/bhp-hr NOx standard across all required certification cycles, nor consistently meet the in-use NOx standards when laboratory tested on 'road cycles' that mimic real-world operation, which shows that the SwRI program was a demonstration of technical infeasibility. CARB and EPA have not considered real-world conditions and other factors that increase NOx emissions, or the accelerated aftertreatment deterioration that will occur in the field. Those real-world conditions and other factors, which were not 'in scope' in the SwRI demonstration program, will require significant additional development effort, and likely additional NOx and CO_2 emissions control hardware.

'Getting close' to meeting extremely stringent emissions requirements, as SwRI did, is inadequate and an unreasonable basis for setting the Option 1 emissions standards at issue, especially when the agencies have not considered critical and significant emissions-increasing factors.

- b. 'Packaging' requirements (i.e., fitting emission systems under the hood or cab) to 'close-couple' the new light-off SCR ('LO-SCR') to the turbocharger turbine exit will be extremely difficult, and/or will require cab retooling. Such retooling costs are expensive (on the order of $500 million) for low-volume products with potentially abbreviated amortization schedules, especially as those same vehicles transition to battery-electric and other 'zero-emissions' technologies driven, at least in part, by other regulations. [EPA-HQ-OAR-2019-0055-1346-A1, pp.5-6]

Diesel engine manufacturers often use the term 'margin' when talking about the headroom they must design into their emissions control strategies. Margin is the difference between the underlying emissions standard and the lower 'as-designed' emissions performance that diesel engine manufacturers target for their products. Manufacturers must design and calibrate to provide for sufficient margin to ensure robust compliance after accounting for the myriad factors that can compromise real-world emissions performance, thereby protecting themselves from recall and/or enforcement actions, fines, damaged reputations, etc. With this background, PACCAR explains its additional concerns regarding the demonstration testing and its inability to represent real-world, in-commerce applications:

- The demonstration testing on which EPA relies was conducted on a single engine with the calibration adjusted multiple times to perform in an optimal manner for a specific engine.
- Manufacturers must meet the proposed emission limits on tens of thousands of engines per year. These engines are mass-produced and have an inherent spread in emission performance due to natural variation between the mass-produced parts and because they must support multiple configurations, including for various vocational applications.
- In addition, although SwRI's aging protocol may represent the average aging of the emission control system, manufacturers must meet emission limits throughout each engine's useful life under all in-use conditions. Therefore, additional margin must be included to ensure that the emission limits are achieved under worst-case aging conditions.
- The SwRI data shows insufficient margin to be considered a demonstration of feasibility to the standard. [EPA-HQ-OAR-2019-0055-1346-A1, pp.6-7]

Moreover, while a close-coupled Selective Catalytic Reduction ('SCR') application (referred to as 'LO-SCR' or 'light-off SCR' by SwRI) is effective at demonstrating Low NOx in the laboratory, the LO-SCR system must be 'close-coupled' to the turbocharger turbine exit to actually be effective. This close-coupled configuration may not be possible for all current commercial vehicle applications due to packaging constraints and heat load impact on temperature sensitive components (such as the Engine Control Module ('ECM') and AC systems). In some cases, and especially with the smaller range of vehicles in the HD class, packaging constraints will be extremely difficult to overcome. Cab retooling will be necessary in certain instances, as efforts to adequately insulate long runs of exhaust piping will compromise the efficacy of the LO-SCR unit. And, as mentioned above, cab retooling costs can be very high (as much as $500 million), particularly for low-volume products with potentially abbreviated amortization schedules, since those same vehicles will be transitioning to battery-electric and other zero-emissions technologies. [EPA-HQ-OAR-2019-0055-1346-A1, p.7]

With the LO-SCR being larger than the traditional downpipe, additional heat shielding will be required to protect proximate components. That is particularly problematic since the proximate components include much of the Heating, Ventilation and Air Cooling ('HVAC') hardware, such as heater/evaporator coils, fan air intake, as well as electrical junctions, fuse panel, Powertrain Control Module ('PCM'), relays and other temperature sensitive components. Those thermal issues are exacerbated by the transition to low-GHG HVAC refrigerant HFO 1234yf, where there are additional flammability concerns. Adding length or height to the vehicle hood to 'make room' to mitigate the packaging challenges will compromise bumper-to-back-of-cab limitations, or will increase GHG emissions due to increased aerodynamic drag, or both. Reducing the substrate frontal area to improve packaging will increase backpressure and CO2 emissions. [EPA-HQ-OAR-2019-0055-1346-A1, pp.7-8]

Due to these constraints, some applications may require vehicle cab redesign to facilitate integration, and other applications may not be able to support this catalyst volume and would therefore be eliminated from commerce. The redesign expense is significant and not included in EPA's current economic impact analysis. A 'first-in-box' application modification or placing a portion of SCR first in a catalyst array currently located under the vehicle is more viable. However, this application results in additional heat loss and further delays the catalyst system's light off, leading to slightly higher emissions than the laboratory close coupled SCR configuration. [EPA-HQ-OAR-2019-0055-1346-A1, p.8]

In short, commercial vehicles are exposed to a number of variables that are not present in laboratory demonstrations that lead to intrinsic emissions variation and do not necessarily indicate a failed system. Any regulatory proposal must provide flexibility for this variation; if not, systems that have not failed but are simply demonstrating normal variation may be subject to unnecessary recalls, which would be untenable. [EPA-HQ-OAR-2019-0055-1346-A1, p.8] EPA has failed to address real-world, in-commerce variation in its feasibility demonstration efforts. [EPA-HQ-OAR-2019-0055-1346-A1, p.8]

A large number of real-world variables can affect Low NOx system performance, such as fuel sulfur (S), biodiesel metals, oil consumption differences, application variation that leads to aging variation, and sensor errors. Major improvements in NOx sensors accuracy are not foreseen in the proposed low-NOx standards timeframe. NOx sensors (three of which are used in the Stage 3 solutions) play a critical role in Diesel Exhaust Fluid ('DEF') dosing strategies and long-term trim functions. In addition, there are normal variations due to lab-to-lab differences and test-to-test variations. [EPA-HQ-OAR-2019-0055-1346-A1, p.9]

These data demonstrate that although a proposed emissions standard may be met in a laboratory-controlled environment under DF, there must be a 'variance allowance' for production engines tested from vehicles in commerce. This approach would establish a stringent emissions standard while providing a regulated Variance Allowance that enables compliance under real-world variation and would mitigate the unintended consequence of subjecting normally-functioning systems (i.e., those that have not failed) to recall actions by acknowledging the intrinsic variation of emissions due to real-world variables. Setting a tailpipe emissions standard for durability demonstration, and then providing an ‘in-commerce’ variability allowance, aligns with EPA’s proposed Option 1. In Preamble Section IV(K) titled ‘Other Flexibilities Under Consideration’, EPA acknowledges: ‘We understand that manufacturers generally aim to design and build vehicles not only with a sufficient margin to ensure the emissions control technology is meeting the applicable standards throughout the full useful life, but also an additional margin to reflect the fact that not every vehicle manufactured and every vehicle application will perform identically to the laboratory tests. This is particularly important, and challenging for manufacturers, when new technologies and test procedures are being implemented.’ 87 FR at 17564. [EPA-HQ-OAR-2019-0055-1346-A1, p.15]

PACCAR respectfully requests that EPA separate the variance allowance from the standard – based on observed standard deviation caused by real world variables – and then add that variance allowance to the standard for in-production performance. This could be accomplished, for example, using the proposed equation below:

In Production Standard = NOx FEL + VA

Where:

- NOx FEL = the standard, including any credit adjustments
- VA= variance allowance [EPA-HQ-OAR-2019-0055-1346-A1, pp.15-16]

In sum, PACCAR supports the regulatory levels of Option 2 as feasible under a laboratory controlled scenario, such as DF program durability demonstration, with the addition of a ‘variability allowance’ applied to in-commerce engine testing to account for real-world emission variations. PACCAR respectfully requests that EPA propose a FTP/RMC emission standard in alignment with Option 2 and a variance allowance of **30 mg** for in-commerce testing compliance. Because it is unclear how these variables would diminish over time, EPA should not propose phasing out the variance allowance. The variance allowance should be included for in-commerce engine testing including:

- SEA · Conformity Testing
- Verification of DF; and
- Heavy-Duty In-Use Testing (‘HDIUT’). [EPA-HQ-OAR-2019-0055-1346-A1, p.16]

Organization: *South Coast Air Quality Management District*

CARB staff has further indicated that the proposed MY 2024 standards are in fact feasible without requiring significant changes to the current engine and aftertreatment system architecture with thermal management strategies and improved aftertreatment systems, including advanced catalyst substrates and heated dosing.29 As an example, CARB notes that the SwRI Stage 1 program aftertreatment screening process has demonstrated 0.04 g/bhp-hr NOx on the FTP using a 2014 model conventional SCR system and heated dosing.30 CARB’s 2019 white paper provides further evidence of technological feasibility. By way of example, Stage 1 of SwRI's low NOx research program involved development work on both a 2012 MY 12-liter Cummins natural gas engine and 2014 MY 13-liter Volvo diesel engine with a target NOx emission rate of 0.02 g/bhp-hr on the FTP and RMC-SET test cycles.31 This phase achieved a 0.01 g/bhp-hr NOx over the FTP and a 0.001 g/bhp-hr NOx level over the RMC-SET on the Cummins natural gas engine.32 [EPA-HQ-OAR-2019-0055-1201-A1, p.8]

29 CARB, Omnibus Regulation, Final Statement of Reasons for Rulemaking (FSOR) (2020), available at https://ww2.arb.ca.gov/sites/default/files/barcu/board/rulemaking/hdomnibuslownox/fsor.pdf, pg. 17.

30 Id.

31 CARB, Assessment of the Technical Feasibility of Lower NOx Standards and Associated Test Procedure 2022 and Subsequent Model Year Medium-Duty and Heavy-Duty Diesel Engines, Staff White Paper (April 18, 2019), available at https://ww2.arb.ca.gov/sites/default/files/classic/msprog/hdlownox/white_paper_04182019a.pdf?_ga=2.68986130.2008336815.1651111319-1848774752.1595968774, pg. 11.

32 Id.

Additionally, a Volvo diesel engine achieved a 0.034 g/bhp-hr NOx level over the FTP and a 0.038 g/bhp-hr NOx level over the RMC-SET.33 [EPA-HQ-OAR-2019-0055-1201-A1, p.9]

33 Id.

Per EPA's own analysis, a nationwide Omnibus scenario in MY 2027 would bring significant NOx reductions over the baseline, similar to those that would be achieved via implementation of the Alternative Option.34 Numerous past and on-going studies also support the notion that a 0.02 g/bhp-hr standard for MY 2027 is feasible. For instance, as part of the CARB funded SwRI Stage 3 program, the final test results at the end of the useful life of 435,000 miles were 0.023 g/bhp-hr NOx on the composite FTP, 0.020 g/bhp-hr NOx on the RMC-SET, and 0.047 g/bhp-hr NOx on the LLC. While the results of CARB Stage 3 did not reach below 0.02 g/bhp-hr for FTP/RMC-SET, SwRI has identified a number of additional improvements that could ultimately reach the 0.02 level including new catalyst architecture, better DEF mixing, larger downstream catalyst volume, improvements to SCR formulation as well as trim/calibration improvements.35 With respect to the EPA funded SwRI Stage 3 'Rework' program, SwRI was able to incorporate what it learned from its Stage 3 program, changing the zone coated catalyzed soot filter with traditional DOC+DPF architecture and achieving 0.020 g/bhp-hr NOx on the composite FTP, 0.017 g/bhp-hr NOx on the RMC-SET, and 0.029 g/bhp-hr NOx on the LLC at 435,000 miles. [EPA-HQ-OAR-2019-0055-1201-A1, p.9]

34 RIA at pg. 27, Table 5-49 (National Heavy-duty Vehicle NOx Emission Reductions Relative to the Baseline Case for Omnibus Nationwide Scenario (Reductions Relative to EPA Proposed Option 1 Shown for Comparison)).

35 FSOR at pg. 66.

Aside from the lab demonstration work, other work has shown the feasibility of 0.02 g/bhp-hr. In April 2022, Achates Power announced in-use NOx test results from the Heavy-Duty Diesel Demonstration program showing the opposed piston engine reaching 0.02 g/bhp-hr level in real world conditions, 50% below the proposed EPA in-use limit. To quote Achates, '[t]he engine showed a comfortable compliance margin to the NAAQS requirements on all cycles, even in the fully aged case.'36 Importantly, an Achates/FEV study concluded that Achates opposed-piston engine architecture complies with 2027 ultra-low NOx regulations and provides an 11% cost savings compared to a current production four-stroke, inline six cylinder engine and 6% savings excluding exhaust aftertreatment hardware.37 In summary, even though commercialized pathways to 0.02 g/bhp-hr have not yet been fully achieved at the time of this proposal, the past and ongoing work provides a fully convincing case that it can be done. The Clean Air Act does not require regulations to incorporate currently commercially available technology. What the Act requires are standards that reflect the greatest degree of reductions available with technology that will be available for the applicable model year.38 [EPA-HQ-OAR-2019-0055-1201-A1, p.9]

36 Day 2 Testimony at pg. 213, lines 2-4.

37 Achates Power, Opposed-Piston Engine Cost Comparison, available at http://achatespower.com/wp-content/uploads/2020/03/Achates-Power-Cost-Study-White-Paper_March-2020.pdf

38 42 U.S.C. Section 7521(a)(3)(A)(i).

Organization: *Truck and Engine Manufacturers Association (EMA)*

Broadly speaking, EPA’s assumption that its proposed Option 1 standards and requirements are fully feasible is a fallacy. Moreover, that fallacy is premised on only one set of data — in some instances just one data point — from one still-evolving prototype engine used in one not-fully-successful experiment. That is the sum and substance of the basis for EPA’s incorrect assumption that manufacturers can design and build engine systems to meet a NOx standard starting at 0.02 g/bhp-hr, and ending at 0.04 g/bhp-hr at the 800,000 mile mark, without the need to replace any emissions-related components. As explained in great detail below, a rulemaking of this magnitude based on such scant data and such fallacious assumptions will not stand. Instead, an Option 2-like program will need to serve as the foundation for a sustainable final rule. [EPA-HQ-OAR-2019-0055-1203-A1, p. 16]

In order to ensure the adoption of fully achievable and cost-effective HDOH low-NOx regulations, and notwithstanding our broader agreement, the Agency should revise the proposed standards in the following manner:

(iii) Manufacturers will not produce Option 1-compliant products because the Option 1 standards are not feasible. Accordingly, the FTP/RMC certification standards for NOx must be set at Option 2-like levels, not 0.02 g/bhp-hr. Otherwise, the standards will fail to provide the requisite compliance margins, which will render them infeasible in practice, and will cause unacceptable compliance and recall risks for manufacturers. In addition, a program centered around Option 2-like levels will be more beneficial from an emissions-inventory perspective, once potential fleet turnover market responses, including pre-buy/no-buy responses, are taken into account. [EPA-HQ-OAR-2019-0055-1203-A1, p. 6]

EPA proposes to apply the GHG version of the RMC to the certification testing process for criteria emissions. The effective weighting factors at each steady-state data point for the GHG RMC were developed based on a robust dataset reflective of modern engines. The industry recognizes the importance of representativeness in the certification tests, and agrees it is illogical to make different assumptions about operational activity depending on the emissions constituents measured. EMA supports EPA's proposal to use this improved, more representative test for criteria emissions testing. [EPA-HQ-OAR-2019-0055-1203-A1, p. 115]

EMA supports that EPA proposes to allow a stop-start function to be active during the FTP and LLC cycles (§1036.501(f)). Stop-start could be an effective tool for reducing NOx, and having the ability to demonstrate NOx control over the LLC and RMC will be beneficial. More detail will be necessary, such as whether operator over-ride functions will influence whether stop-start can be active during certification testing. Also, there are concerns about deploying conventional starters to support restart, because the inertia of the dyno may cause unforeseen problems. EMA appreciates that EPA is providing for stop-start to be active in the certification tests, and is ready to work with EPA to iron out the details for the final rule. [EPA-HQ-OAR-2019-0055-1203-A1, p. 116]

Our conclusion is that the Omnibus/Option 1 low-NOx standards have not been demonstrated to be technically feasible, and are in fact infeasible, for the following reasons:

1) The aged-engine "Stage 3" NOx emissions results do not meet the proposed future 0.020 g/bhp-hr NOx standard across all required certification cycles, nor do they consistently meet the in-use NOx standards when laboratory tested using "road cycles" that mimic real world operation (which, practically speaking, makes the case that the SwRI program was a demonstration of technical infeasibility.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 18]
2) CARB and EPA have not considered the impacts of the real-world conditions and other factors that increase NOx emissions, or the accelerated aftertreatment deterioration that will occur in the field, all factors for which diesel engine manufacturers will be held accountable. Those real-world conditions and other factors, which were not "in scope" in the SwRI demonstration program, will require significant additional development effort, and likely additional NOx and CO2 emissions control hardware. "Getting close" to meeting extremely stringent emissions requirements, which is all that SwRI has done, is inadequate and unreasonable as a basis for setting the Option 1 emissions standards at issue,

especially when critical and significant emissions-increasing factors have not been considered. [EPA-HQ-OAR-2019-0055-1203-A1, p. 18]

3) The “Stage 3” technical solutions used as the basis for the EPA and CARB rulemakings include technologies such as individually-controlled cylinder deactivation systems that have never-before been used on HDOH production engines subject to the durability requirements of the medium heavy- (“MHD”) or heavy heavy-duty (“HHD”) diesel engine markets, and that also require an unknown scale of effort to address the “noise, vibration and harshness” (NVH) challenges that arise in the context of the multiple custom-tailored vehicle specifications of HD trucks. [EPA-HQ-OAR-2019-0055-1203-A1, p. 18]
4) “Packaging” requirements (i.e., fitting emission systems under the hood or cab) to “close couple” the new light-off SCR (“LO-SCR”) to the turbocharger turbine exit will be extremely difficult, and/or will require cab retooling. Such retooling costs come at a very high cost (on the order of $500M) for low-volume products with potentially abbreviated amortization schedules, especially as those same vehicles transition to battery-electric and other “zero-emissions” technologies driven, at least in part, by other regulations. EPA has done nothing to assess the feasibility of the multiple packaging challenges at issue. [EPA-HQ-OAR-2019-0055-1203-A1, p. 18]
5) Heavy-duty diesel engines also are regulated to control CO2 emissions. The “Stage 3” technical solutions for NOx have not been demonstrated in combination with the requisite improvements that will be needed to comply with the 2027 CO2 emissions standards. The Stage 3 engine does not even meet the 2021 or 2024 CO2 standards, for that matter. The well-established NOx/CO2 tradeoff that has challenged diesel engine manufacturers for decades has not been given adequate consideration in EPA’s Option 1 proposal. [EPA-HQ-OAR-2019-0055-1203-A1, p. 18]

As noted, the SwRI demonstration project is the source of the data behind EPA’s assumption that the low-NOx standards at issue are feasible for HDOH diesel engines. SwRI conducted baseline tests of a production configuration 15L Cummins HD diesel engine calibrated for certification to the US10 HDOH emission standards. SwRI outfitted the engine and its aftertreatment system with additional emissions control systems for the purpose of the demonstration project. Features of the “Stage 3” solution include cylinder deactivation (CDA) to increase light-load exhaust temperatures, and an EGR cooler bypass, as depicted below: [EPA-HQ-OAR-2019-0055-1203-A1, p. 19]

The aftertreatment system that CARB used in its low-NOx demonstration added several new components to the US10 DOC/DPF/SCR/ASC configuration, including a second SCR catalyst closely coupled to the turbocharger outlet (a light-off SCR, or “LO-SCR”) with its own independent heated DEF injector, a zone-coated soot filter (“zCSF”), and other refinements intended to improve DEF mixing in the downstream SCR. A third NOx sensor was added after the LO-SCR to calculate and activate DEF dosing rates for the downstream SCR, and an NH3 sensor was installed at the midpoint of the downstream SCR bricks to monitor and correct those dosing rates. Thermal management routines were structured to optimize cold-start and light load emissions control. A diagram of the CARB Stage 3 prototype aftertreatment system is included here: [EPA-HQ-OAR-2019-0055-1203-A1, pp. 19 - 20]

EPA is using the SwRI-developed Stage 3 solution as the backbone of its own technical feasibility demonstration, but with one primary modification. EPA's technical solution (which SwRI calls the Stage 3 Reworked system, or "Stage 3 RW") uses a conventional DOC/DPF rather than a zCSF to improve regeneration robustness and to sustain more consistent NO-NO2oxidation over time. The EPA Stage 3 RW system also includes minor sizing and control calibration differences compared to the CARB Stage 3 solution, but otherwise the technical packages are very similar. A schematic of the "RW" aftertreatment system is shown here: [EPA-HQ-OAR-2019-0055-1203-A1, p. 20]

In that regard, and as an initial matter, EPA's proposed Option 1 proposal is fundamentally infeasible because, among other things, EPA has not and cannot fully demonstrate the feasibility of the Option 1 NOx standards through testing with the "Stage 3" prototypes at SwRI, especially when adjustments for infrequent regeneration adjustment factors ("IRAFs") and other emission impacting factors are accounted for. In particular, EPA has failed to demonstrate the feasibility of maintaining compliance with the Option 1 NOx standards through the proposed extended useful life periods, and has not even completed the analysis of the Stage 3 protypes' emission results out to 800,000 miles. In addition, EPA has conducted no in-vehicle testing whatsoever, has not demonstrated that the Stage 3 prototype can meet the Option 1 NOx standards while also meeting the current Phase 2 GHG requirements, and has done no testing to show that the Stage 3 prototype is capable of meeting the 2027 MY GHG standards. Indeed, in some testing, the CO2 emissions from the Stage 3 prototype were up to 1.3% higher than the 2017 MY baseline engine. (87 FR at p. 17469) [EPA-HQ-OAR-2019-0055-1203-A1, p. 8]

Equally important, the ultra-low level of EPA's proposed standards (if set based on a 0.02 g/bhp-hr FTP/RMC NOx standard) would leave no room for any compliance margins that are necessary to account for production, fuel and emissions-testing variabilities, real-world operating conditions, or for the expected emissions deterioration over the proposed lengthened FULs of HDOH engines and vehicles. Simply stated, a program based on a 0.02 g/bhp-hr NOx standard, as opposed to Option 2-like requirements, will leave no room for manufacturers to ensure and certify full in-use emissions compliance over the proposed extended useful life periods, and so is fundamentally infeasible. As a result, manufacturers cannot commit to building Option 1 compliant diesel engines. Stated differently, if EPA finalizes Option 1, the Agency will, in effect, prohibit HDOH diesel engines as of 2027. That would have enormous ramifications for the economy and security of this country. [EPA-HQ-OAR-2019-0055-1203-A1, p. 9]

In light of those core infeasibility issues, the inconsequential incremental NOx emissions inventory differences between a 0.02 g/bhp-hr-centric program and an Option 2-like program do not outweigh the risks of not being able to implement the type of viable comprehensive HDOH low-NOx program that all stakeholders support. [EPA-HQ-OAR-2019-0055-1203-A1, p. 9]

Since the Agency's Option 1 proposal is not feasible, as detailed below, it necessarily follows that the more stringent "Alternative" concept is even more so. Accordingly, EMA fully agrees with the Agency that the Alternative alluded to in the NPRM is fundamentally unworkable and, as such, warrants no further discussion in these comments. Instead, EMA's comments will focus on the potentially implementable elements of Option 2, and, by comparison, the non-implementable elements of Option 1. [EPA-HQ-OAR-2019-0055-1203-A1, p. 9]

As noted above, a critical shortcoming of the Option 1 proposal, and to a certain extent the Option 2 proposal as well, is that the Agency has neither accounted nor provided for the compliance margins that manufacturers need to factor-in when designing and producing engine and aftertreatment systems capable of meeting the prescribed emission standards over the applicable useful life period. To the contrary, the "Stage 3" prototype systems that serve as the foundation for the NPRM just barely meet (or in some instances fail to meet) the new Option 1 NOx standards over the new test cycles without any margin at all. The lack of allowing for sufficient compliance margins is especially evident from the emissions-test results of the aged Stage 3 systems, and has been specifically noted by SwRI as an area of concern. The Agency's failure to provide for the needed compliance margins must be remedied in the final rule. [EPA-HQ-OAR-2019-0055-1203-A1, p. 9]

Significantly, EPA acknowledges the fundamental importance of this issue, notwithstanding the Agency's failure to account for it. For example, EPA notes that, "to account for variability in emission measurements, as well as production variability, manufacturers typically add margin between the DF and infrequent regeneration adjustment factor (IRAF)-adjusted test result, and the family emission limit (FEL)." (87 FR at p. 17460.) Similarly, the Agency states that "manufacturers design their engines to perform significantly better than the standards when first sold to ensure that the emissions are below the standard throughout useful life, even as the emissions controls deteriorate." (87 FR at p. 17467.) The NPRM also acknowledges that "manufacturer margins can range from less than 25 percent to 100 percent of the FEL." (Id.) Finally, the Agency summarizes this critical issue, as follows: We understand that manufacturers generally aim to design and build vehicles not only with a sufficient margin to ensure the emissions control technology is meeting the applicable standards throughout the full useful life, but also an additional margin to reflect the fact that not every vehicle manufactured and every vehicle application will perform identically to the laboratory tests. This is particularly important, and challenging for manufacturers, when new technologies and test procedures are being implemented. (87 FR at p. 17564.) [EPA-HQ-OAR-2019-0055-1203-A1, pp. 9 - 10]

Yet even with those express acknowledgements, the Agency did not attempt to quantify or provide for the compliance margins that manufacturers will need to meet NOx standards that are 90 percent lower than today's standards. As explained more fully below, that failure completely undermines the feasibility of the Option 1 proposal, and will require revisions to the Option 2 proposal to make it fully implementable. Accordingly, EMA appreciates the Agency's request for comments on whether "a margin between the demonstrated emissions performance and the proposed standards should be included, and, if so, what that value should be." (87 FR at p. 17471.) EMA's comments specifically respond to that request, and quantify the necessary margins at issue. [EPA-HQ-OAR-2019-0055-1203-A1, p. 10]

Given all the significant issues and concerns regarding EPA's Option 1 proposal, EMA appreciates that EPA is still "considering the degree to which there is uncertainty in how the [Stage 3] technologies deteriorate when the engine is installed in a wide variety of heavy-duty vehicle applications that exist in the marketplace, and how to address such uncertainty." (87 FR at p. 17563.) In that regard, EMA agrees that the feasibility issues and related uncertainties are significant, and we fully support the Agency's suggestion that higher interim NOx standards may be warranted, perhaps extending out for five or more MYs, to allow manufacturers "to gain experience with the additional [Stage 3] emission control technologies needed to meet the proposed NOx standards while these technologies are operating in the field." (Id.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 14]

Section 202 of the federal Clean Air Act ("CAA"), 42 U.S.C. §7521, governs the Agency's establishment of emission standards for new mobile sources, including HDOH engines and vehicles. CAA section 202(a)(3)(B) specifically governs the Agency's establishment of "revised standards for heavy-duty trucks." Unlike the general standard-setting provisions contained in section 202(a)(3)(A) – which call for the establishment of emission standards that "reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply" – section 202(a)(3)(B), the specific provision that applies here, simply states that the Administrator may set revised emissions standards "taking costs into account." [EPA-HQ-OAR-2019-0055-1203-A1, pp. 15 - 16]

Consequently, in assessing the details for the proposed revised low-NOx regulations at issue, costs, not the absolute limits of potential technological feasibility, are a paramount consideration. In this case, a full and fair consideration of costs and benefits leads to the conclusion that a low-NOx program centered around an Option 2-like program will yield an optimized final rule, while a program centered around the Option 1 proposal is simply not workable. [EPA-HQ-OAR-2019-0055-1203-A1, p. 16]

EMA has multiple concerns with the capabilities of the Stage 3 prototype systems to consistently achieve NOx results compliant with the Option 1 proposal. EMA similarly has concerns regarding manufacturers' ability to design, produce and deliver similar prototype engines and aftertreatment systems capable of meeting all of the Option 1 requirements over the extended useful life and emission warranty periods at issue. Indeed, the Option 1 standards are not feasible. [EPA-HQ-OAR-2019-0055-1203-A1, p. 16]

By way of background, it is important to understand the rigor of the current HDOH NOx standards. To comply with EPA and CARB's "US10" heavy-duty emissions standards, HDOH diesel engine manufacturers have deployed elaborate exhaust aftertreatment systems supported by complex control strategies downstream of advanced NOx-reducing exhaust gas recirculation ("EGR") systems, which were introduced earlier to meet the prior "US04" emissions-reduction step. Wall-flow diesel particulate filters ("DPF") were introduced in 2007 to meet the 0.01 g/bhphr particulate matter ("PM") standard. Those DPFs have required either a "7th" diesel fuel injector or in-cylinder dosing to periodically inject fuel into the exhaust stream over a diesel oxidation catalyst ("DOC"), elevating exhaust temperatures to oxidize soot that accumulates on the filter. By 2013, all major HDOH diesel engine manufacturers also had deployed Selective Catalytic Reduction ("SCR") systems with an ammonia slip catalyst ("ASC") downstream of the DPF to meet the fully-implemented US10 NOx standard of 0.20 g/bhp-hr. SCR systems require Diesel Exhaust Fluid ("DEF") stored on-board (and replenished at approximately every second refueling event), which is injected at carefully controlled rates, dynamically adjusted in response to operating parameters and ambient conditions. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 16 - 17]

Despite the fact that the NOx conversion efficiency of SCR varies with exhaust temperatures commonly encountered during HD diesel vehicle operation, comprehensive testing by West Virginia University ("WVU") of 100 HDOH diesel vehicles in various highway and vocational applications operating in Southern California has demonstrated that US10-compliant emissions-control systems reduce total NOx emissions from in-use vehicles at levels proportional to the change in the certification standards. DPFs are even more effective, reducing PM emissions to a fraction of the certification standard. Overall, NOx emissions from HD diesel vehicles compared to pre-regulation levels have been reduced by some 98%, and PM emissions by 99%. [EPA-HQ-OAR-2019-0055-1203-A1, p. 17]

One of the key enabling technologies in the Stage 3 prototype's suite of engine and aftertreatment solutions is cylinder deactivation ("CDA"). CDA permits an engine to selectively deactivate certain cylinders from the combustion process, thereby meeting the power demand with fewer cylinders in operation, which in turn elevates exhaust temperatures while decreasing CO2 emissions. [EPA-HQ-OAR-2019-0055-1203-A1, p. 21]

A critical challenge for manufacturers, however, is to implement CDA on a heavy-duty diesel engine, and have it deliver consistent, reliable, durable performance over 800,000 miles, without creating truck and cab "noise, vibration, and harshness" ("NVH") issues or driveline torsional problems. Implementing CDA with individual independent cylinder deactivation control has never been achieved before on MHD or HHD diesel engines,3 but this technology is a fundamental element of EPA's attempted technical feasibility demonstration, applicable to every HDOH diesel engine sold in the US from and after 2027. [EPA-HQ-OAR-2019-0055-1203-A1, p. 21]

> 3. One manufacturer of heavy heavy-duty engines has industrialized a system capable of deactivating all three front cylinders as a group (without individual cylinder control).

It is instructive first to consider the design aspects of CDA. CDA is not a bolt-on, one-size fits-all system that an OEM can purchase off-the-shelf from a component supplier. Each diesel HDOH engine valvetrain design will require a unique CDA design integration. CDA also will introduce new and potentially catastrophic failure modes, such as failures to open the exhaust valve on the exhaust stroke of a firing cylinder, and subsequent intake valve and valvetrain failures as the intake valve attempts to open under extremely high pressures. [EPA-HQ-OAR-2019-0055-1203-A1, p. 21]

In addition, CDA presents complex challenges for the multiple applicable HD OBD requirements, strategies and calibrations. OBD threshold diagnostic determinations become very difficult when CDA is factored-in, since multiple valves individually or in concert may experience either partial or complete failures. In such a case, separate failure modes would require separate diagnostic validation for each failure mode permutation. The OBD challenges would not be limited to diagnostics of the CDA system itself. CDA can significantly alter the required strategies and calibrations of multiple system diagnostics. For example, CDA greatly complicates the ability to diagnose misfire, a detection issue that already is among the more challenging under the HD OBD regulations. [EPA-HQ-OAR-2019-0055-1203-A1, p. 21]

Another major concern associated with CDA, as mentioned above, relates to NVH. The inline six-cylinder engine configuration that dominates the HDOH diesel engine market has inherent torsional balance advantages over other configurations. When individual cylinders are deactivated, that natural torsional and harmonic balance is disturbed, so the engine vibration levels are increased and torsionals in the engine and driveline systems are elevated. The result is increased noise levels and cab vibration levels that can be uncomfortable to the driver, and that can cause increased wear and stress on cranktrain and drivetrain components, and vibration levels throughout the vehicle that can cause performance and fatigue issues for on-board systems. [EPA-HQ-OAR-2019-0055-1203-A1, p. 21]

While SwRI performed some computer-based modeling to assess possible cylinder deactivation combination schemes to reduce simulated vibration as assessed in the test cell, there is a vast difference between vibration characteristics “as modeled” in an emissions laboratory, and those experienced in an actual HD vehicle on the road. That fact was duly noted by Neely, et al., of SwRI in their related SAE article, where they stated, “Acceptability standards to linear vibration (e.g. measured at the seat, steering wheel, foot pedal, frame rails, etc.) are better understood in a vehicle environment. The system driveline in a vehicle will differ from that in a dyno (test cell) as well, and it is recommended to evaluate driveline response in a typical vehicle setting.”4 EPA and SwRI have not done that. [EPA-HQ-OAR-2019-0055-1203-A1, p. 22]

> 4. Simultaneous NOx and CO2 Reduction for Meeting Future California Air Resources Board Standards Using a Heavy-Duty Diesel Cylinder Deactivation-NVH Strategy, Neely et al., Southwest Research Institute, SAE article 03-13-02-0014.

Indeed, one OEM’s experience with a prototype CDA system in a Class 8 vehicle has found that, at the lowest loads and speeds, drivers’ responses to the experienced NVH issues are not favorable, especially when the minimum number of cylinders are active. Depending on the extent of CDA at a given load and speed, NVH can vary from mildly perceptible to very significant and fatiguing. The concern for manufacturers and fleet operators then becomes whether CDA would adversely impact driver attentiveness, fatigue, and, ultimately, driver retention. While increasing the number of active cylinders and engine speed can result in a more positive driver response, that reduces the benefits derived from the elevated temperature of CDA. Passive or active engine mounts can help improve those negative responses, but there is insufficient data on the broad range of truck powertrain configurations to know whether those issues can be addressed in a sufficiently effective manner. [EPA-HQ-OAR-2019-0055-1203-A1, p. 22]

Manufacturers of Class 2b-3 vehicles (14,000 lbs. and less), where gasoline engines of smaller displacements have been fitted with CDA, are very familiar with the magnitude of the engineering challenges to overcome NVH issues. Each engine installation on each unique vehicle model is its own development project, requiring significant resources, multiple technical solutions, and substantial verification time. The technical solution, depending on the vehicle model, can include engine-mount tuning, active noise-cancellation systems, exhaust butterfly valves and pipe geometry modifications, active-tuned dampers, and high-torque-convertor slip settings. HDOH diesel vehicle and engine manufacturers do not have a sufficient body of knowledge regarding the range of heavy-duty truck powertrain configurations to know how effective those potential technical solutions might (or might not) be in larger engines and vehicles. Moreover, some of those solutions will have negative fuel efficiency impacts. [EPA-HQ-OAR-2019-0055-1203-A1, p. 22]

As noted, the CDA engineering challenge is multiplied in this case by the fact that each CDA installation requires an engineering investigation and a unique combination of solutions. Given the multiple significant differences among heavy-duty truck configurations and applications, the resultant number of those technical challenges could be insurmountable. When the level of customization that occurs with each customer’s purchase in the HD vehicle market is taken into account, the level of effort, resources and time it could take to implement CDA effectively could quickly become overwhelming. [EPA-HQ-OAR-2019-0055-1203-A1, p. 22]

The addition of a LO-SCR system is another key component of the Stage 3 RW aftertreatment control strategy, although one manufacturer evaluating its benefits is finding that the extra catalyst mass of the LO-SCR is increasing hot FTP results, to the point of increasing the composite FTP results. [EPA-HQ-OAR-2019-0055-1203-A1, p. 23]

A LO-SCR will be subjected not only to fuel-based contaminants such as metals commonly found in the biofuels promoted by EPA and CARB, but also oil poisoning will occur at a rate higher than experienced by today’s SCR systems (which benefit from the protection of an upstream DPF). Oil-derived contaminants are known to deposit heavily on the first catalyst brick encountered in the aftertreatment array, which acts to delay catalyst light-off under cold conditions and light load.5 Oil-derived poisonings are not reversible under any engine-based regeneration strategy, and they also can act to reduce the catalyst channel size. More desulfation activity will be required than today because the LO-SCR will not benefit from the elevated thermal conditions that now will be associated with downstream DPF regeneration events. Moreover, the interaction of DEF deposits with oil deposits is unknown (particularly under cold-start, and low-load operation), but may lead to a further reduction of the catalyst channel size, leading to increased backpressure and associated CO2 penalties.6 EMA is working with the Coordinating Research Council (CRC) to measure tailpipe emissions impacts when the Stage 3 system is run with a range of market-available fuels and biofuels. The results of that study should be considered before the Agency finalizes this rulemaking. [EPA-HQ-OAR-2019-0055-1203-A1, p. 23]

5. See A Case Study of a CuSSZ-13-SCR Catalyst Poisoned by Real-World High Sulfur Diesel Fuel, Yuanzhou Xi (Cummins) et al, SAE 2020-01-1319, April 14, 2020.

6. That poisoning effect would be exacerbated by the “thin wall, high-cell density” substrates proposed as a potential low-NOx technology solution by the Manufacturers of Emissions Controls Association (MECA). Oil poisoning is linear with exposure. In that regard, the accelerated catalyst aging demonstration performed at SwRI exposed the catalyst to only 1/3 of the expected “intermediate UL” (435k mile) oil quantities. No

consideration was given to the level of oil exposure expected under the proposed extended FUL of 800k miles (nearly double). That is an inadequate demonstration of the durability of the close-coupled SCR due to oil-derived poisoning.

Further complicating the issues associated with the LO-SCR system are packaging requirements. To be effective, the LO-SCR system must be "close-coupled" to the turbocharger turbine exit. In some cases, and especially with the smaller range of vehicles in the HD class, packaging constraints will be extremely difficult to overcome. Cab retooling will be necessary in some cases, as efforts to adequately insulate long runs of exhaust piping will compromise the efficacy of the LO-SCR unit. Cab retooling costs can be very high (as much as $500M), particularly for low-volume products with potentially abbreviated amortization schedules, since those same vehicles will be transitioning to battery-electric and other "zero-emissions" technologies due, at least in part, to additional anticipated GHG regulations and zero-emissions vehicle sales and purchase mandates. [EPA-HQ-OAR-2019-0055-1203-A1, p. 23]

An examination of packaging challenges on a single vehicle model as performed by one manufacturer has determined that the "hot side" of the engine compartment will require a complete redesign. With the LO-SCR being larger than the traditional downpipe, additional heat shielding will be required to protect proximate components. That is particularly problematic since the proximate components include much of the HVAC hardware, such as heater/evaporator coils, fan air intake and similar, as well as electrical junctions, fuse panel, PCM, relays and other temperature sensitive components. Those thermal issues are exacerbated by the transition to low-GHG HVAC refrigerant HFO 1234yf, where there are additional flammability concerns. Adding length or height to the vehicle hood to "make room" to mitigate the packaging challenges will compromise bumper-to-back of cab limitations, or will increase GHG emissions due to increased aerodynamic drag, or both. Reducing the substrate frontal area to improve packaging will increase backpressure and CO2 emissions. None of these challenges has an obvious solution. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 23 - 24]

Major improvements in the accuracy of NOx sensors are not foreseen in the timeframe of the proposed low-NOx standards. NOx sensors (three of them are used in the Stage 3 solutions) play a critical role in DEF dosing strategies and long-term trim functions. In addition, the NH3 sensor used to monitor ammonia levels for the mid-SCR catalyst bed is known to be highly inaccurate. EMA is working with SwRI to conduct tailpipe NOx sensitivity tests on the Stage 3 RW configuration in response to the installation of NOx and NH3 sensors with measurement bias representative of field-aged sensors. EMA is seeking to quantify with real data the tailpipe NOx impacts from those (and other) sensor inaccuracies. Significantly, however, that testing will reveal only a limited view of the production real-world variability that will be discussed later as part of EMA's "margin stackup" analysis. It is important to note that EPA has not addressed this issue at all in its feasibility-demonstration efforts. [EPA-HQ-OAR-2019-0055-1203-A1, p. 24]

The actual results from SwRI's testing of the Stage 3 prototype are not compliant with the proposed Option 1 low-NOx standards. This demonstrates that the Option 1 standards are not feasible. Focusing specifically on the results of the EPA Stage 3 RW system (which are slightly lower than the CARB Stage 3 engine results), set forth below are the lab-measured NOx emission data points at 435,000, 600,000 and 800,000 mile-equivalent aging, as reported by SwRI: [EPA-HQ-OAR-2019-0055-1203-A1, p. 24]

Stage 3 RW Tailpipe NO_x Emissions (*and proposed standard*) (g/bhp-hr)

Certification test cycle	**435k mile7**	**600k mile7**	**800k mile7**
Composite FTP (transient)	0.022 (*0.020*)	0.029 (*0.040*)	0.040 (*0.040*)
Ramped Modal Cycle (steady-state)	0.019 (*0.020*)	0.026 (*0.040*)	0.031 (*0.040*)
Low Load Cycle	0.034 (*0.050*)	0.038 (*0.100*)	0.037 (*0.100*)

7. Figures are mileage equivalents, achieved by aftertreatment bench-aging methods. The engine, however, including cylinder deactivation and EGR cooler bypass systems, was not aged to determine deterioration effects.

Recall that, for heavy heavy-duty engines, the interval from 435,000 miles to 800,000 miles will be held to a 0.040 g/bhp-hr FTP and RMC NOx standard under EPA's Option 1 proposal. As the test results above show, EPA's Stage 3 prototype does not meet the 0.020 g/bhp-hr NOx standard at 435,000 miles over the FTP certification cycle, and it generated results exactly equal to the "second stage" standard of 0.040 g/bhp-hr when tested to 800,000 miles. (The CARB Stage 3 engine generated a composite FTP result of 0.031 g/bhp-hr at just 290,000 miles equivalent aging before the engine was recalibrated mid-testing to reduce the tailpipe NOx to 0.023 g/bhp-hr at the expense of an almost 1% CO2 emissions penalty. CARB terminated its testing at 435,000 miles equivalent aging.) The emissions results reported by SwRI are, therefore, not fully compliant. Moreover, they are not even complete, since they only include the IRAFs that SwRI generated when the system was degreened, not when the system was aged. It is also clear that the SwRI results fail to account in any way for the necessary compliance margins. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 24 - 25]

Just as important, the Stage 3 RW CO2 emissions, as measured by SwRI, are 2.3% above the HHD 2027 FTP CO2 emissions standard for vocational engines, and 5.2% above the HHD 2027 RMC standard for tractor engines, an issue that EPA has attempted to downplay as immaterial to engine manufacturers' ability to comply with those future requirements, despite the well-established NOx/CO2 tradeoff that continues to challenge the diesel engine industry. More will be discussed on this significant point later. [EPA-HQ-OAR-2019-0055-1203-A1, p. 25]

There are two types of in-use real-world factors that need to be considered, since they can be detrimental to tailpipe NOx emissions over and above the Stage 3 demonstrated performance. The first set of factors includes those that cause temporary increases, or increased variability of NOx emissions, such as accumulated sulfur on aftertreatment systems (prior to a desulfation regeneration event), variable ambient conditions, and production variability. The second set of factors includes those that cause engine and aftertreatment systems to degrade to a greater degree than the "nominal" or "typical" degradation assessed through a test cell demonstration, whether that be a feasibility demonstration conducted on behalf of regulators, or a manufacturer's "deterioration factor" test run for certification purposes. Three examples are SCR poisoning due to fuel impurities, operation under more severe in-use duty-cycles, and inadequate maintenance practices. (A more comprehensive list of the various factors of concern will be provided later in these comments in the section related to EMA's efforts to quantify the additional NOx reductions needed relative to Stage 3 NOx emissions – i.e., the additional "margin" that is necessary to ensure robust emissions compliance in the field.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 26]

Those short-term and long-term emissions-impacting factors are risks that manufacturers will be held accountable for in designing their diesel engine products for robust emissions compliance, but which EPA has not considered in its "technical feasibility" demonstration. As explained below, the NOx increases in response to those factors are far from trivial. Yet EPA has not presented any kind of technical analysis that even attempts to quantify the emissions increases that can result from those in-use real-world impacts. Thus, while it may be good enough for EPA that the Stage 3 engine "came close" to complying with a 0.020 g/bhp-hr verification standard (recall that actual compliance was not achieved over the FTP test cycle or over the EU ISC in-use road cycle), that is in fact not good enough to sustain a rulemaking of this significance. [EPA-HQ-OAR-2019-0055-1203-A1, p. 26]

Diesel engine manufacturers often use the term "margin" when talking about the headroom they must design into their emissions control strategies. Margin is the difference between the underlying emissions standard and the lower "as-designed" emissions performance that diesel engine manufacturers target for their products. Manufacturers must design and calibrate to provide for sufficient margin to ensure robust compliance after accounting for the myriad factors that can compromise real-world emissions performance, and thereby to protect themselves from recall actions, fines, and damaged reputations. The next section details how NOx compliance margins have grown to become a larger and larger percentage of the emissions standards as those standards have been reduced, and what that could mean for the Agency's proposed low-NOx standards. [EPA-HQ-OAR-2019-0055-1203-A1, p. 26]

At a fundamental level, it appears that EPA has simply failed to take into account the inherent technical challenges that lean-burn engines present as compared to spark-ignited, stoichiometric burn engines, as well as the degree to which all of the real-world in-use variabilities impact NOx emissions from lean-burn engines. [EPA-HQ-OAR-2019-0055-1203-A1, p. 36]

Lean-burn engines are inherently more efficient than stoichiometric-burn engines, largely due to the "free-breathing" unthrottled air intake system, higher compression ratios, and the higher energy density of diesel fuel (15% higher than gasoline). This superior efficiency, and therefore more environmentally favorable CO2 emissions profile, coupled with exceptional durability, is what makes lean-burn diesel engines the powertrain of choice for the heavy-duty truck market. Lean-burn engines, and their low-CO2 emissions performance, however, do come with significant technical challenges when it comes to controlling emissions, especially with respect to aftertreatment controls. Those technical challenges, coupled with the sensitivity of aftertreatment to real-world factors, compel the manufacturers of these engines to certify their products with much higher compliance margins than their spark-ignited counterparts in order to ensure their continuing in-use emissions compliance. [EPA-HQ-OAR-2019-0055-1203-A1, p. 36]

In that regard, there are a number of inescapable physical and chemical differences between diesel and spark-ignition engines and their aftertreatment systems that result in the different requisite compliance margins at issue, including the following: [EPA-HQ-OAR-2019-0055-1203-A1, p. 36]

In that regard, there are a number of inescapable physical and chemical differences between diesel and spark-ignition engines and their aftertreatment systems that result in the different requisite compliance margins at issue, including the following: Part of what makes a lean-burn diesel engine more efficient is also what makes its real world in-use NOx emissions much more variable. More specifically, a diesel engine's unthrottled, variable air-to-fuel ratio combustion process leads to highly variable exhaust compositions and temperatures, which create many unique challenges for the engine's SCR-based NOx emissions aftertreatment system. In contrast, a stoichiometric natural gas (or gasoline or propane) spark-ignition engine's exhaust has a nearly constant composition and its temperature is stable under nearly all operating conditions after initial warmup. Spark-ignition engine exhaust is simply less variable, so it takes less effort to control those emissions. Diesel exhaust also experiences more extreme fluctuations between high temperature and low temperature operations where the catalyst is more susceptible to degradation. [EPA-HQ-OAR-2019-0055-1203-A1, p. 36]

In that regard, there are a number of inescapable physical and chemical differences between diesel and spark-ignition engines and their aftertreatment systems that result in the different requisite compliance margins at issue, including the following: Because of those inherent exhaust stream differences, a diesel engine requires a more complex diesel particulate filter and selective catalytic reduction aftertreatment system, which is comprised of at least four different temperature-sensitive catalysts. It also requires precise, real-time thermal management and dosing of ammonia-forming Diesel Exhaust Fluid ("DEF") into the exhaust. SCR requires sophisticated electronics and fast and accurate wide-range sensors to actively control the entire system. The particulate filter requires periodic high temperature regeneration to remove its accumulated soot, temporarily interrupting the SCR's NOx reduction performance. In sum, a diesel engine's emissions control system is much more complex than a spark-ignition engine's three-way catalyst(s) and single "on-off" (switching) oxygen-sensor-based control system. Unlike diesel engines, spark-ignition engines inherently maintain exhaust temperatures suitable for high efficiency catalyst performance over all operating conditions shortly after engine start. Diesel engine controls, however, must modulate DEF injection according to many factors, including variable exhaust temperatures to which NOx conversion efficiency is very sensitive. EPA acknowledges the complexity behind the DEF dosing-control function, which it described in the Agency's RIA, as follows: [EPA-HQ-OAR-2019-0055-1203-A1, pp. 36 - 37]

In that regard, there are a number of inescapable physical and chemical differences between diesel and spark-ignition engines and their aftertreatment systems that result in the different requisite compliance margins at issue, including the following: Small errors in dosing can lead to significant variability in tailpipe NOx. Underdosing causes inadequate NOx conversion, while overdosing causes ammonia slip which is converted to NOx in the ammonia slip catalyst. Either case increases tailpipe NOx. [EPA-HQ-OAR-2019-0055-1203-A1, p. 37] In that regard, there are a number of inescapable physical and chemical differences between diesel and spark-ignition engines and their aftertreatment systems that result in the different requisite compliance margins at issue, including the following: More generally, the number of emissions-related components used in diesel engines is significantly greater than for spark-ignited engines. That simple fact, coupled with the greater complexity of a diesel engine's aftertreatment system and related control algorithms, inevitably leads to greater emissions variability, especially under the broad range of real-world in-use operating conditions that heavy-duty diesel vehicles encounter. [EPA-HQ-OAR-2019-0055-1203-A1, p. 37]

In that regard, there are a number of inescapable physical and chemical differences between diesel and spark-ignition engines and their aftertreatment systems that result in the different requisite compliance margins at issue, including the following: As mentioned, diesel aftertreatment systems operate across a wide range of exhaust temperatures with associated variable NOx conversion efficiency, and lean-burn exhaust chemical compositions. Because of this, tailpipe emissions are sensitive to small reductions in catalytic activity caused by thermal and chemical aging effects. Spark-ignited applications with three-way catalysts, however, are more tolerant of thermal and chemical aging effects because the "starting point" (the degreened system) has more NOx compliance headroom. Moreover, the diesel fuel supply is more likely to contain contaminants than the gasoline supply, such as the metals commonly found in biodiesel blends. Long-term degradation of aftertreatment in compression-ignition diesel applications is further exacerbated by significantly longer useful life requirements than most spark-ignited applications and stoichiometric exhaust composition conditions. Of note, those already-longer useful life requirements are proposed to be extended even further – almost doubled - under EPA's proposed Option 1. [EPA-HQ-OAR-2019-0055-1203-A1, p. 38]

Spark-ignited gasoline engines have a strong advantage over diesel engines when it comes to the ability to robustly and consistently reduce engine-out NOx to near-zero tailpipe emissions, but that advantage does not extend to CO2 emissions. Forcing diesel products out of the market through the adoption of infeasible low-NOx emissions standards would force vehicle owners into higher CO2-emitting spark-ignited solutions, a highly counter-productive outcome. [EPA-HQ-OAR-2019-0055-1203-A1, p. 38]

The high-efficiency lean-burn engine's necessarily complex emissions control system, and the several other factors raised in this section, increase the in-use emissions-variability of diesel engines in ways that EPA has not accounted for. All of these factors necessitate compliance margins that make a 0.020 g/bhp-hr NOx standard inherently infeasible for HDOH diesel engines. [EPA-HQ-OAR-2019-0055-1203-A1, p. 38]

As noted, EPA has overlooked the gap between the proposed 0.020 g/bhp-hr HD NOx standard and the actual results of the Stage 3 and Stage 3 RW "feasibility demonstration" by claiming that manufacturers will continue to work on control strategy optimization and final calibration to overcome the exceedance (and one must assume, the required compliance margin). That claim, however, is simply not reasonable when assessed against the reality of what is, and what is not, technically feasible. [EPA-HQ-OAR-2019-0055-1203-A1, p. 38]

At the macro-level, there are three technology paths to consider for reducing tailpipe NOx emissions over and above that demonstrated by the Stage 3 solutions:

Reduce engine-out emissions: In theory, a reduction in engine-out NOx emissions could result in a reduction in tailpipe NOx. That could be achieved with higher EGR rates, adjustments to injection timing, or other strategies. However, those techniques necessarily would increase CO2 emissions, another regulated emission. The Stage 3 RW engine, as demonstrated, has 5.3% higher CO2 emissions than the 2027 HHD tractor CO2 emissions standard, and 2.3% higher than the vocational engine CO2 standard. In fact, the final SwRI calibration does not even meet the 2021 GHG standards, and has CO2 emissions slightly higher than the baseline Cummins X15 production configuration from which the Stage 3 RW system was developed. Overcoming an additional CO2 deficit caused by reducing engine-out NOx further to bring the Stage 3 RW system into compliance (with margin) will require additional CO2-reducing technology over and above what EPA has included in its feasibility demonstrations, rendering any related cost analysis inherently deficient. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 38 - 39]

Increasing exhaust temperatures: Increasing exhaust temperatures at light loads to improve SCR NOx conversion efficiency over a broader range of operating conditions would decrease tailpipe NOx emissions. That could be achieved through actions to decrease engine combustion efficiency, more frequent dosing of diesel fuel across the DOC, or by adding a spark-ignited burner system or electrically-heated catalyst upstream of one or both of the SCR units. Any of those actions also would increase CO2 emissions, thereby requiring additional CO2-control technology to comply with CO2 emissions standards that will be taking effect along with the future NOx standards. Such methods to overcome the Stage 3 system deficiencies will likewise require additional technology over and above what EPA has included in its feasibility demonstrations, again rendering any related cost analysis inherently deficient. [EPA-HQ-OAR-2019-0055-1203-A1, p. 39]

Improved SCR efficiency: If manufacturers were able to develop SCR NOx conversion efficiencies superior to the capability of the systems included in the Stage 3 demonstrations, that could be an effective means to overcome the deficiency of the Stage 3 solution. That is not a viable solution, however. The SCR conversion efficiencies observed with the Stage 3 RW engine are already unrealistically high when compared to manufacturers' experience with high mileage systems in the field. The Stage 3 RW engine at the 435,000 mile intermediate UL equivalent aging had a 99.3% overall conversion efficiency on the composite FTP transient test, and still produced a failing 0.022 g/bhp-hr result. The RMC barely passed at 0.019 g/bhp-hr despite having a 99.6% cycle SCR conversion efficiency. If a field sample were to degrade a mere 0.3% more, that RMC result would escalate to a badly failing 0.026 g/bhp-hr! While SCR manufacturers have made strides to improve the long-term durability of SCR catalysts, for example with the introduction of FeZe/CuZe "hybrid" catalysts, manufacturers with three or more years' experience with those systems in production have found that they offer only marginal improvements, at best, compared to their predecessor configurations The following graph compares test results from aged systems, comparing this new generation hybrid SCR (labeled "2027 SCR", though the manufacturer has had it in production for 3 years) to the former technical solution (labeled "current"). The manufacturer is reporting that the aging characteristics of the new hybrid SCR configurations are not proving to be superior to the old configuration. [EPA-HQ-OAR-2019-0055-1203-A1, p. 39]

The conversion efficiencies achieved in the laboratory aging process, while producing barely compliant or even non-compliant results, are unrealistic to expect consistently in the field. This issue is even further exacerbated by the growing prevalence of biofuels in the marketplace, with known aftertreatment degrading characteristics. Significant increases in aftertreatment sizing could be considered, but not without backpressure increases driving higher CO_2 emissions, increased heat demand from the same exhaust flow, and a significant increase in cost. Once again, overcoming those CO_2-increasing measures would require additional technology over and above what EPA has included in its feasibility demonstrations, rendering any related cost analysis for Option 1 inherently deficient. [EPA-HQ-OAR-2019-0055-1203-A1, p. 40]

In summary, while one might expect that additional work on system optimization may be available to achieve minor NOx reductions over and above the performance of the Stage 3 RW system, the levels of improvement required to comply with the Option 1 standards are simply not achievable without significant additional hardware and accompanying control strategies, including new CO_2-mitigation measures. Manufacturers are, in effect, "boxed in" by all of the constraints explained above. As with any development project to industrialize new emissions control concepts, there will be many other emissions-compromising technical challenges to overcome that have not yet even been imagined. Thus, the Agency's claim that manufacturers can simply calibrate the Stage 3 system into a robust compliance solution, given all that we know about aggravating factors and substantial margin requirements, is simply unreasonable. [EPA-HQ-OAR-2019-0055-1203-A1, p. 40]

Based on the foregoing analysis of margin requirements, and given the inherent technological constraints, the case could easily be made that it would be incumbent upon manufacturers to design for a compliance margin greater than 50%, and a margin as high as 75% could be necessary in the end. Under such assumptions, manufacturers would be forced to reduce Stage 3 RW FTP results by 55% to 75%, respectively. Reductions of that scale cannot be achieved with mere calibration efforts. The Agency's claim to the contrary has no sufficient basis in fact. [EPA-HQ-OAR-2019-0055-1203-A1, p. 40]

From all of the foregoing, it is clear that the Agency has failed to (and cannot) demonstrate the technical feasibility of a 0.020 g/bhp-hr FTP/RMC NOx standard for HDOH diesel engines. The proposed technology set, some components of which present serious technical risks to product reliability and durability, has proven incapable of achieving compliant results in dyno-based certification tests and when tested using in-use road-cycles replicated on the engine dynamometer. More than that, the variety of short-term and long-term NOx emissions-increasing factors that can impact field-sampled engines have been given no consideration in those attempted demonstrations. Recent trends of increasing compliance margins (when examined as percentage of prevailing standard) as represented in manufacturers' certification test results clearly demonstrate manufacturers' consistent need to over-comply in certification demonstrations, so that they can manage the additional and significant emissions-compromising influences under all real-world operating conditions. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 40 - 41]

Without a more robust demonstration that an improved technology package is capable of consistently complying with the proposed Option 1 standards, it is apparent that such standards, along with their related in-use emissions requirements, are not technically feasible. Accordingly, it would be manifestly unreasonable for the Agency to proceed with the adoption of Option 1. In fact, doing so likely would drive diesel engines from the HDOH market, which would significantly jeopardize the nation's economy and security. EPA is not authorized to do that. [EPA-HQ-OAR-2019-0055-1203-A1, p. 41]

SwRI presented the initial 800,000 mile aging results for PM from the Stage 3 prototype engine at the April 2022 SAE World Congress Exposition. Those results showed multiple RMC and LLC test results exceeding the proposed 0.005 g/bhp-hr PM standard when tested after ash cleaning of the DPF. SwRI reported that it took 10 to 15 hours of operation before the emissions was reduced from PM levels as high as 0.007 g/bhp-hr, 40% above the proposed standard. EPA has provided no exception for PM standard compliance for any period after ash cleaning. EPA therefore requires compliance over all certification test cycles under any conditions (with proper pre-conditioning). Here again, the demonstration that EPA is relying on actually demonstrates that the proposed emissions standard is not technologically feasible. The current PM standard of 0.01g/bhp-hr should therefore be retained in the final rule. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 43 - 44]

EPA also should consider the possibility that the proposed standards could compel new engine oil formulations. Engine lubricants perform critical functions, including reducing engine wear, enhancing fuel efficiency, and providing protection for the engine and its emissions control systems. The proposed low-NOx standards and extended useful life and warranty periods could have significant impacts on those functions. New oil formulations have been required in response to reduced emissions standards in the past. EPA should account for this possibility in its implementation schedule for the proposed regulations. [EPA-HQ-OAR-2019-0055-1203-A1, p. 143]

In the process of determining what emissions thresholds are achievable given the proposed substantial reductions in PM and NOx, EPA and industry may determine that the state of the art for monitoring key components such as catalytic converters, particulate filters, aftertreatment system sensors, or EGR components will require intrusive monitors. Intrusive monitors temporarily increase tailpipe criteria and GHG emissions when executed. EPA requires the average emissions impact of an intrusive monitor to be included in a manufacturer's certification results (much like IRAFs). As such, the applicable standards either will need to be adjusted even more to reflect those necessary temporary increases, or the OBD thresholds will have to be maintained at levels high enough to not require intrusive monitoring. Without such measures, the current OBD provisions would make the proposed standards even more stringent and infeasible. [EPA-HQ-OAR-2019-0055-1203-A1, p. 95]

EPA Summary and Response

Summary:

Additional comments on the FTP and SET NO_x standards stringency can be found in section 3.1.1 of this document, as well as EPA's summary of and responses to those comments. In general, some commentors stated that proposed Option 1 is feasible, some commenters stated that standards that are more stringent than Option 1 are feasible, and some commenters stated that only proposed Option 2 is feasible with changes to further account for the uncertainty of laboratory and in-use emissions levels. MECA commented that there are additional demos beyond the Stage 3 engine to support the ongoing process in the European Union of considering more stringent heavy-duty criteria emission standards. MECA referenced improvements to emissions control systems beyond what was used for the EPA demo and stated that they expect continued improvements to the emission control systems in the coming years. DTNA commented that there are no benefits to new catalyst designs compared to existing catalyst designs with respect to catalyst activity and durability. ATA commented that EPA hasn't demonstrated Option 1 is feasible.

A couple commenters stated that EPA has not demonstrated the feasibility of the proposed FTP and SET emission standards for NO_x, stating that EPA did not consider key design margins such as different configurations (ratings, exhaust length configurations, etc.), that demonstrated technologies are not commercially available, and that the EPA Stage 3 system doesn't meet GHG Phase 2 standards for MY 2027. DTNA commented that there are concerns with catalyst durability at the high miles and that effectively, EPA has tested the 'best-of-the-best' and declared it representative for all possible configurations. DTNA also commented that if EPA's proposed system were packaged to fit on a truck, the low temperature SCR catalyst effectiveness would be significantly reduced as it would operate at colder temperatures. DTNA stated that EPA made design compromises to minimize packaging impact on existing Class 8-day cab tractors because EPA is concerned that the Stage 3 system will not fit in a truck, and that the composite FTP test results are 0.038 g/hp-hr, which is just below the 0.040 g/hp-hr standard without IRAF. DTNA commented that EPA did not move forward with testing of its first candidate system as the system was determined to have unacceptable performance by SwRI due to high system backpressure, significant impact on RMC CO_2 emissions, and design limitations on turbomachinery, air-handling, and peak cylinder pressure limits.

DTNA commented that the EPA GHG Phase 2 vocational vehicle SI standard is 17% higher for CO_2 than the CI standard. They are concerned that the medium duty market could shift to SI engines that will significantly increase CO_2 emissions from the national fleet. They also commented that that the engine fails to comply with EPA's proposed PM standards and raises questions about N_2O compliance feasibility.

DTNA, ATA, and PACCAR also commented that current NO_x sensor technology is unable to adequately maintain control of SCR systems at the proposed standards. Some commenters stated that the proposed criteria pollutant standards could negatively impact GHG emissions and the ability to meet the GHG standards for the applicable MYs.

Some commenters stated that EPA must set standards that include margin to account for fuel contamination, production variability, measurement variability, packaging limitations, accumulation of sulfur, soot, and ash, maintenance variability, lower engine power ratings, and the impact of biodiesel. CARB commented that EPA should not set standards with margin. Allison recommended subcategory specific standards like those for HD GHG vehicle standards.

MFN commented that EPA's proposed stringency for LHDD and MHDD engines exceeds the feasibility demonstrated at SwRI by 75 percent on the FTP cycle (35 compared to 20 mg/bhp-hr), 106 percent on the SET cycle (35 compared to 17 mg/bhp-hr), and 210 percent on the LLC cycle

(90 compared to 29 mg/bhp-hr), negating any reasonable compliance margin, noting that the Agency has not explained the reason for such gross differences.

PACCAR commented that retooling costs are expensive (on the order of $500 million) for low-volume products with potentially abbreviated amortization schedules. They stated that close-coupled catalyst configurations may not be possible for all current commercial vehicle applications due to packaging constraints and heat load impact on temperature sensitive components, as the close coupled SCR catalyst is larger than the traditional downpipe requiring additional heat shielding. They commented that this is problematic as HVAC hardware, electrical junctions, fuse panels, Powertrain Control Module, relays and other temperature sensitive components could be affected. They commented that they also have flammability concerns with the transition to refrigerant HFO 1234yf. They also stated that cab redesign will compromise bumper-to-back-of-cab limitations or increase GHG emissions due to increased aerodynamic drag. They also commented that redesign expense is significant and not included in EPA's current economic impact analysis. They stated that under vehicle location for aftertreatment is more viable, but results in additional heat loss and further delays the catalyst system's light off. They requested a variance allowance of 30 mg/hp-hr for in-commerce testing compliance and that it include SEA, DF, and in-use testing.

Coach USA commented that interstate buses are subject, throughout the country, to heavily-enforced weight restrictions and any exceedance caused by SCR or derate-related equipment that causes a bus to be overweight would be unacceptable to sustaining interstate bus operations, as would any increased temperatures which could cause buses to be less reliable or otherwise potentially impair driver/passenger safety.

National Association of Chemical Distributors commented with concerns that the additional parts for the technologies needed to meet the standards could exacerbate current supply chain issues.

Multiple members of OIDA commented that standards should be set at a level that doesn't decrease the reliability of heavy-duty engines.

<u>Response:</u>

The final FTP and SET standards and test procedures, as well as the basis for those standards and test procedures, are explained in Section III of the preamble. As discussed in preamble Sections I.D and III.A, EPA is promulgating the new heavy-duty engine criteria pollutant standards under our authority in CAA section 202(a)(3)(A) and the final standards reflect the greatest degree of emission reduction achievable through the application of technology that we have determined will be available for MY 2027, giving appropriate consideration to the statutory factors. EPA's assessment of the statutory factors in CAA section 202(a)(3)(A) justify the final emission standards, and the final standards are appropriately based on further consideration of the data included in the proposed rule, as well as additional supporting data from our own test programs, and consideration of the extensive public input EPA received in response to the proposed rule. Preamble Sections III and IV, and RIA Chapter 3 include additional details on our assessment of the final standards, including our consideration of the technologies available to achieve the greatest degree of emission reduction in MY 2027, meeting the final standards over the useful life periods in the final rule, emission control performance over multiple test cycles, packaging constraints, impacts on CO_2 emissions, compliance margin, and lead time in the final rule. See also our responses to general comments on NO_x standards stringency in section 3.1.1 of this document. Our cost analysis of the final standards (i.e., cost of compliance for manufacturer associated with the application of such technology) is included in preamble Sections III and V, with additional detail in RIA Chapters 3 and 7 and section 18 of this document. In response to commenters who discuss the importance of fleet turnover for reducing emissions, we point to discussion in preamble Section X and section 25 of this Response to Comments document.

In setting the final standards, EPA in part considered the data, including the NOx and GHG emissions levels, from testing the Stage 3 demonstration engine with aftertreatment that was aged to the equivalent of 800,000 miles using today's commercially available NO_x sensors for aftertreatment control. Regarding comments on NO_x sensors, this demonstration supports that the final standards can be met with the current commercially available NO_x and NH_3 sensors. We have also considered all of the concerns and supporting information brought forward by the commentors that effect emission control system performance, as discussed in Section III of the preamble. The final standards, as summarized in Section III of the preamble, were demonstrated with margin and without increasing GHG emissions over the baseline engine. Regarding the comment about a portion of the test program that EPA did not move forward with, we note that the System B up front SCR catalyst diameter was too small and resulted in increased backpressure on the engine, as explained in RIA Chapter 3. Due to the inadequate size, we did not move forward with aging and testing this system, but that system does not impact our feasibility assessment based on the overall demonstration program. As discussed in RIA Chapter 3, the technologies we expect to be used to meet the final standards build upon the technologies used in today's light- and heavy-duty engines. Our final standards are based on our projection of the future performance improvements of the emission control technologies (e.g. cylinder deactivation, heated DEF dosers, dual-SCR aftertreatment, and NO_x sensors) like those applied in the Stage 3 engine for model year 2027, which in some cases are technologies that are currently available as prototypes but are not necessarily in production yet. MECA stated in their comments, and we agree based on the improvements we have seen in recent years, that it is reasonable to expect there will be additional improvements beyond what was demonstrated with the Stage 3 engine. For example, we have seen a reduction in catalyst volume over the last 10 years due to improvements in aftertreatment technology. Another example of this is the NO_x reduction improvements of EPA System A as compared to the CARB and EPA Stage 3 engine. As covered in RIA Chapter 3, the NO_x emissions from the EPA System A are lower than the CARB Stage 3 after degreening the aftertreatment. We acknowledge, however, that there are some uncertainties on the magnitude of possible additional improvement to aftertreatment beyond those included in the Stage 3 engine and we are finalizing standards that are higher than what was demonstrated to account for these uncertainties, as further detailed in Section III of the preamble. We project that the current state of development in conjunction with anticipated improvements make the final standards technologically feasible starting in MY 2027, consistent with our authority to set technology-forcing HD engine criteria pollutant standards under CAA section 202(a)(3)(A). Regarding comments on compliance margin, see also our response to comments in section 3.4 of this document regarding the interim in-use testing allowance for Medium HDE and Heavy HDE in the final rule.

Regarding the comment on meeting the Phase 2 GHG standards, the NO_X standards are incremental to the GHG standards, and the technology required to achieve both standards simultaneously can be independently applied to the engine. The Stage 3 engine was a MY 2017 engine that did not include the technology needed to meet the Phase 2 MY 2027 GHG standards. The demonstrated NO_x emissions were achieved without increasing GHG emissions from the base engine, and thus would have no adverse effect on GHG reductions achieved through the introduction of additional technology. See also discussion in preamble Section III. As explained above, EPA expects that the four-year lead time will provide sufficient time for all of the technologies for the final standards to become commercially available.

Regarding DTNA's comment regarding the medium duty market shifting to SI engines, to the extent this comment may be within the scope of this rulemaking, the commenter did not provide information to support their concern such that it would impact decisions in this final rule.

DTNA commented on the availability of heated DEF dosers and the evaluation of "noise, vibration, and harshness" (NVH) from CDA. EPA believes that setting the final standards with a least 4 years of lead time will allow enough time for suppliers to increase production of heated DEF dosers. The supplier of the heated DEF doser for the EPA Stage 3 system has provided EPA with dosers at various stages of their product development and their hardware is approaching production readiness. Regarding the comment on considering NVH when setting the standards, as outlined in RIA Chapter 3, we have conducted NVH testing with CDA active. EPA's assessment based on this testing is that there are several ways to reduce NVH to acceptable levels through design of the complete system, including, where CDA is used, engine mounts, cab mounts, and seat calibration. Based on consideration of this testing and the other data discussed in the RIA, we have determined that the final standards are achievable without increasing NVH outside of the acceptable range. EPA disagrees with DTNA's concern regarding N_2O compliance feasibility, as the N_2O emissions from the EPA and CARB Stage 3 engine were below the FTP N_2O standard, even after the aftertreatment was aged to the equivalent of 800,000 miles, which is beyond the final useful life for Heavy HDEs.

We received several comments on the FTP and SET test procedures. MECA provided data to support the current cold/hot start FTP weighting factors. DTNA commented that EPA should change the weighting factor for the FTP duty cycle and add 300 seconds of idle before the cold FTP. PACCAR commented that EPA should retain the option to determine a single IRAF based on the average regeneration frequency of customer vehicles over all duty cycles. See preamble Section III.B.2 for EPA's full response to comments requesting changes to the weighting factors for the FTP or adding 300 seconds to the beginning of the cold FTP. We neither proposed these changes nor requested comment on them in the NPRM, and for the reasons explained in preamble III.B.2 are not adopting the requested changes. We note that we requested comment on alteration to the FTP duty-cycle in the ANPR and only received comments in support of the current FTP duty-cycle, including weighting factors. DTNA analyzed the data from the EMA-WVU data set and stated that their analysis showed that the average idle period for a day-cab vehicle in California is 227 seconds. DTNA did not provide the data used in this analysis to EPA, so we are not able to independently verify the conclusions of their analysis or how broadly it applies to all heavy-duty engines. The current structure of the FTP duty-cycle with its weighting factors ensures that engine control strategies cover in-use operation where the vehicle is not idled for an extended period of time, thus the worst-case scenario is covered ensuring that quick catalyst light off strategies are employed.

Regarding the comment from PACCAR, 40 CFR 1065.680 states that “For engines subject to standards over more than one duty cycle, you must develop adjustment factors under this section for each separate duty cycle”. There is nothing in 40 CFR 1065.680 that prevents a manufacturer from developing a single IRAF that represents the average of, and can be applied to, all duty cycles. The IRAF determination procedure in 40 CFR 1065.680 provides flexibilities with respect to the method of IRAF determination.

Cummins commented that for PHEV testing, 40 CFR 1036.505 Figure 1 seems to indicate SET 5 cycle would be a cold cycle. This is not equivalent to engine SET where engine and aftertreatment are pre-conditioned before running the emission test. Cummins suggests skipping the cycle where engine starts for first time and use the following cycle to report criteria emissions. EPA disagrees with Cummins regarding 40 CFR 1036.505 Figure 1. We note that this is the same approach used for light duty PHEV testing, but in conjunction with the charge sustaining criteria for HD vehicles in SAE J2711. While it is true that the engine will start from a “cold” condition, the powertrain test procedure allows for powertrain operation over the duty-cycle utilizing hybrid propulsion where the ECU can activate heating of the aftertreatment prior to engine start. Thus, if aftertreatment heating is needed to ensure emission control under engine start, there is opportunity within the duty-cycle to achieve that heating. For example, this could be addressed with an electrically heated catalyst warming up the aftertreatment before the engine starts. The starting of the engine is representative of how the engine would start under this type of operation in-use. We would also like to point out that when determining the brake specific emission results from SET 5 in 40 CFR 1036.505 Figure 1, the emission results are determined using the work performed over the entire duty-cycle and not just the portion where the engine is operating. Thus, the emission results from SET 5 could be lower than the emission results from SET 6 where the engine is operating the entire time.

Cummins commented that potential test cell upgrades are needed to conduct PM testing to meet the requirements of the clean idle test in 40 CFR 1036.505(h) and 40 CFR 1036.510(g) and that there will be additional measurement uncertainty with the test procedure due to tailpipe emissions at a level similar to background. We discussed in Section III of the preamble and Section 3.5 of this document why we are not finalizing PM, HC, and CO standards for the clean idle duty cycle. Therefore, for the final rule, we are not including the PM, HC, and CO measurement requirements in 40 CFR 1036.505(h) and 40 CFR 1036.510(g) that would have required the measurement of PM during the idle portions of the FTP and SET under the proposed rule.

Regarding the comments on the selection of the engine rating for the Cummins X15 engine used for the EPA Stage 3 demonstration, we disagree that the rating is not representative since it is an available rating for the Cummins X15 engine. As explained further in the documents referenced in our response above regarding feasibility, the final NO_x standards include margin above the emissions levels demonstrated with the EPA Stage 3 engine to account for variability in emissions from engine ratings within the same engine family.

EPA agrees with EMA that clarifications are needed on how to restart the engine when stop-start systems are active on the engine due to dynamometer effects and additional specifics are needed on what type of stop-start systems can be considered for certification testing. EPA has updated 1036.501(d) to reflect that good engineering judgment should be used to restart the engine, including for example decoupling the dynamometer from the engine during the restart or using a bigger start motor. EPA has already considered the implications of user selectable stop-start systems for HD vehicles in 40 CFR 1037.660. We have made modifications to 40 CFR 1036.501(d) to provide clarification for what types of stop-start systems can be considered for use during engine certification. Specifically, we reference 40 CFR 1037.660 for limitations on its use during certification. In addition, we have added a new paragraph 40 CFR 1036.415(g) to address the use of stop-start during in-use testing. This new paragraph references 40 CFR 1037.601, linking the off-cycle testing stop-start requirements to the laboratory certification requirements.

We disagree with EMA's comment that the final standards will require a new lube oil, since the EPA Stage 3 demonstration was conducted with commercially available lube oil. To the extent that a new lube oil is developed, the final standards include four years of lead time for this development.

All commenters supported EPA promulgating lower than the current PM standards for the FTP and SET duty cycles. While many supported the proposed standard of 5 mg/hp-hr, some commenters stated that 7.5 mg/hp-hr would reflect the state of available technology today. See preamble Section III.B for further discussion of the basis of our final PM standards and our response to these comments. We note that most DPF equipped HD engines today emit PM at less than 1 mg/hp-hr. We also note that it has been shown that soot buildup in the DPF improves filtration efficiency and, as with ammonia storage on SCR catalysts, EPA allows for preconditioning prior to manufacturers carrying out their test of record for certification. This preconditioning not only establishes baseline ammonia storage on the SCR catalyst but reestablishes the DPF soot cake layer that was removed during the initial forced DPF regeneration that occurs prior to the preconditioning sequence.

Many commentors raised concerns regarding system packaging and its effect on emission performance, as well as weight and heat load as to effects on safety. In regard to system packaging, as described in preamble Section III, we have set final standards with margin to cover consideration of applications-specific design to meet the packaging requirements of those vehicles. In regard to weight, our assessment is that the addition of an upfront SCR catalyst to the aftertreatment system will not contribute significantly to the overall engine weight. See the FEV teardown study referenced in RIA Chapter 3 for details on our assessment of the increased mass of the aftertreatment system.[14] In regard to safety, the comments received have not provided any supporting data showing that there is a valid concern with increased heat load from the potential packaging constraints of the upfront SCR catalyst. Our assessment is that the upfront SCR catalyst can be packaged with proper heat shielding to mitigate any of the potential associated safety due to heat load concerns.

[14] Mamidanna, S. 2021. Heavy-Duty Vehicles Aftertreatment Systems Cost Assessment. Submitted to the Docket.

Regarding the comments from National Association of Chemical Distributors on standards potentially exacerbate supply issues, we do not have data supporting this conclusion. The final standards will go into effect for MY 2027 engines which is at least 4 years from now, which we believe will provide manufacturers enough time to supply the needed technologies to meet the standards. Additional, EPA hopes, as everyone does, that the current economic conditions – inflation, the pandemic, etc. – are alleviated by the time the final program is being implemented.

Regarding the comments on setting standards that don't decrease the reliability of heavy-duty engines, we believe that the standards will not reduce the reliability of heavy-duty engines. As discussed in RIA Chapter 3, the technologies we expect to be used to meet the final standards build upon the technologies used in today's light- and heavy-duty engines.

3.2.2 FTP and SET standards and testing for spark-ignition engines

Comments by Organizations

Organization: *American Automotive Policy Council (AAPC)*

EPA has proposed reductions in NOx and PM FTP emissions for gasoline spark-ignited emissions to the same level as diesel engines. In addition to the California Low NOx Regulation, the EPA also is proposing to reduce hydrocarbon (HC) emissions by 57-71% and Carbon Monoxide (CO) emissions by 58% versus the current standards. The proposed HC and CO emission standards are challenging and technology-forcing for spark-ignition engines, particularly when coupled with the new requirement to certify to a Supplemental Emissions Test (SET) standard. Given the stringency of the new standards and test procedures, we believe that an averaging, banking, and trading (ABT) requirement should also apply for HC and CO emissions. Having an HC and CO ABT program will allow additional compliance flexibility as manufacturer engineer new solutions for these stringent standards. [EPA-HQ-OAR-2019-0055-1293-A1, p. 3]

Organization: *California Air Resources Board (CARB)*

The proposed Option 1 NOx standards for MY 2031 SI engines on the FTP duty cycle are aligned with the corresponding Omnibus standards. However, they are less stringent than Omnibus for MY 2027 SI engines. U.S. EPA's own demonstration testing shows a 20 mg/hp-hr NOx on the FTP and SET duty cycles to be technically feasible for 2027 MY SI engines.118 Additionally, manufacturers are currently certifying SI engines to CARB's most stringent optional low NOx standard of 20 mg/hp-hr while also meeting the proposed Option 1 criteria pollutant standards for both FTP and SET (Appendix II) [Appendix II can be found at EPA-HQ-OAR-2019-0055-1186-A2, p.143-145]. Analysis of CARB optional low NOx engine certification data for MYs 2020 and 2021 shows that all of the 20 mg/hp-hr NOx certified engines meet the proposed Option 1 FTP standards for non-methane hydrocarbon (NMHC) and CO and 80 percent meet the proposed 5 mg/hp-hr FTP PM standard. In addition, the diesel-cycle derived SI engines certified to the optional 20 mg/hp-hr NOx standard also meet the proposed SET standards for NOx, PM, NMHC, and CO. Furthermore, the diesel cycle derived optional low NOx engines are subject to the CI engine certification procedures including durability demonstration and UL periods (e.g., 435,000 miles for heavy HDEs), again, indicating that SI engines can meet the 20 mg/hp-hr NOx for the proposed Option 1 UL periods.119,120 CARB staff urges U.S. EPA to align the proposed MY 2027 NOx standards for SI engines with the MY 2027 Omnibus standards. CARB staff supports the adoption of the proposed Option 1 standards for PM, HC, and CO. [EPA-HQ-OAR-2019-0055-1186-A2, p.48]

118 Tables III-25 and III-28 of NPRM (pages 17485-17486).

119 CARB certification webpage: New Vehicle and Engine Certification: Executive Orders for Compression-Ignition and Heavy-Duty Engines and Vehicles. Accessed 4/8/2022.

120 Appendix II: Model Years 2020 and 2021 Optional Low NOx Certified SI Engines

CARB staff also supports requiring SI engines to certify on the SET test procedures to ensure emissions are controlled under high load and speed conditions. [EPA-HQ-OAR-2019-0055-1186-A2, p.48]

Organization: *Cummins Inc. (Cummins)*

In Option 2, EPA proposes to lower the hydrocarbon (HC) emissions standard for all primary intended service classes from today's 140 mg/hp-hr level down to 40 mg/hp-hr, starting MY 2027. EPA cited the measured non-methane hydrocarbon (NMHC) test results from six MY 2019 gasoline engine certifications, ranging from 42 to 80 mg/hp-hr, as an indication of technological feasibility. However, all those NMHC values that EPA cited did not include the manufacturers' EPA-required deterioration factors (DFs) or the manufacturers' required compliance margins. EPA's online certification spreadsheet is incomplete with respect to those manufacturers' reported deterioration factors. However, for one of the certification engines for which EPA reported a 42 mg/hp-hr test result, that manufacturer reported a 1.9 multiplicative DF, which means that EPA prohibits that manufacturer from declaring a Family Emission Limit (FEL) below 80 mg/hp-hr. In any case, no manufacturer to date is shown in EPA's online certification spreadsheet to have declared a heavy-duty SI FEL below 140 mg/hp-hr. That is an indication that manufacturers are factoring in a compliance margin between the minimum FELs they are allowed by EPA to declare and the 140 mg/hp-hr standard. Otherwise, those manufacturers could have generated HC emissions credits by declaring FELs below the standard. [EPA-HQ-OAR-2019-0055-1325-A1, p. 6]

We urge EPA to carefully review its analysis of certification data, and we urge EPA to reach out to manufacturers to discuss HC deterioration factors—particularly at EPA's proposed longer useful life, and also discuss manufacturer-required compliance margins and minimum design targets (similar to our comments on NOx stringency). Additionally, EPA should consider a wider range of fuels. EPA appears only to have considered gasoline SI engines, not alternative-fuel SI engines, in setting the standard. A single-step standard of 80 mg/hr in MY 2027 could be more appropriate considering all these factors. Such a standard would still deliver over a 40% reduction, while ensuring a wide range of fuels could be used. [EPA-HQ-OAR-2019-0055-1325-A1, p. 6]

Furthermore, Cummins does not support EPA justifying the feasibility of a HC standard based on the projected availability of HC emissions credits. That approach to standard-setting could lead to competitive disruptions between manufacturers, based on the mix of technologies different manufacturers are able to sell into various market subsegments. [EPA-HQ-OAR-2019-0055-1325-A1, p. 6]

Organization: *Eaton Vehicle Group (Eaton)*

Agency Request / Topic: In addition, we are requesting input on several aspects of the proposed new LLC duty cycle for heavy-duty CI engines and applying the SET duty cycle to heavy-duty SI engines (see Section III) [EPA-HQ-OAR-2019-0055-1252-A1, p.7]

Eaton Comment Strategy / Materials: We also support adding the SET option for SI engines, especially as we prognosticate an increase in market share of such engines. [EPA-HQ-OAR-2019-0055-1252-A1, p.7]

Organization: *Ford Motor Company (Ford)*

Ford supports EPA's effort to increase the stringency of the heavy-duty emission and greenhouse gas standards, starting in 2027 model year. We believe that the Option 1 alternative, along with the recommendations outlined in our attached comments, represents the appropriate level of stringency. [EPA-HQ-OAR-2019-0055-1300-A1, p. 2]

Ford supports the criteria emission standards in Option 1. The standards proposed in Option 1 would reduce NOx and particulate matter (PM) standards to the same level as the California Low NOx regulation by 2031 MY. In addition, the EPA proposal would reduce hydrocarbon (HC) emissions by 71% and Carbon Monoxide (CO) emissions by 60% versus the current standards. [EPA-HQ-OAR-2019-0055-1300-A1, p. 3]

Ford believes that complying with the 2031 model year and later 20 mg/bhp-hr NOx standard will require the same robust and durable technological solutions as are needed to comply with the CARB requirements in 2027 model year. [EPA-HQ-OAR-2019-0055-1300-A1, p. 3]

Organization: *General Motors LLC (GM)*

GM supports EPA's effort to finalize more stringent criteria emissions regulations than today's standards for medium- and heavy-duty engines and vehicles, in 2027 and beyond. [EPA-HQ-OAR-2019-0055-1246-A1, p.2]

In Option 1, the EPA proposes to decrease NOx emissions from the current standard by 82.5% in 2027, and 90% In 2031. At the same time, the agency proposed to revise upwards the useful life and warranty of new equipment in 2027, and then again in 2031. Different technology packages may be necessary to achieve these different requirements.7 Proposed restrictions to averaging, banking, and trading credits decrease a manufacturer's ability to respond to these stepped changes. [EPA-HQ-OAR-2019-0055-1246-A1, p.4]

7 Engine hardware, emissions systems, on-board diagnostic software, electrification, etc.

GM encourages the agency to consider a one-step standard that considers technological feasibility, and the air quality goals of the standard. A program with a straightforward one-step structure, with full ABT, that includes ZEVs is preferred. [EPA-HQ-OAR-2019-0055-1246-A1, p.4]

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

With regard to EPA's request for comments on several aspects of the proposed new LLC duty cycle for heavy-duty CI engines and applying the SET duty cycle to heavy-duty SI engines, much of the impact of this is on the engine certifier. MEMA would like to highlight the fact that accessory loads are very impactful to thermal management systems - especially during low load cycle conditions. New certification cycles should accurately quantify and reward contributions of technologies to fuel efficiency improvements and NOx emissions reductions. MEMA recommends that EPA develop unique considerations for vocational vehicles with regard to correct accessory loading to reflect real-world use. [EPA-HQ-OAR-2019-0055-1322-A1, p. 6] [Also included in Section 3.3 of this document]

Organization: *Moving Forward Network (MFN)*

Option 1 should immediately harmonize with state action in model year (MY) 2027. Instead of allowing a four-year delay in matching state-level stringency, Option 1 should immediately impose a NOx emission standard of 0.02 g/bhp-hr for spark ignition, light-, medium-, and heavy-duty engines through intermediate useful life and a 0.035 g/bhp-hr for heavy heavy-duty engines from intermediate useful life to full useful life. [EPA-HQ-OAR-2019-0055-1277-A1, p. 21]

EPA's data on HDO engines shows that the best-performing 2019 gasoline-powered engines are already certified below the proposed Option 1 standard, with significant room for improvement according to the agency itself.89 [EPA-HQ-OAR-2019-0055-1277-A1, p. 22]

89. Draft RIA, Tables 3-35 and 3-40 (Demonstration Program).

Organization: *National Propane Gas Association (NPGA) and Propane Education & Research Council (PERC)*

We suggest the following modifications to the Proposed Option 1:

- 2. **Supplemental Emission Test (SET):** We discourage the agency from implementing SET requirements for spark ignited engines.9 We believe these are being considered for spark ignited engines to alleviate concerns specifically pertaining to power enrichment and engine/aftertreatment protection. As an alternative, we suggest that EPA monitor in-use compliance of vehicles to identify the outliers and work with pertinent manufacturers directly rather than including unnecessary and onerous additional requirements, which would increase the cost of engineering, testing and hence the product. Further, the agency's proposal deviates from current practice in that SET certification is not required under CARB's 2027 Ultra-Low NOx standards for spark ignited engines.10 [EPA-HQ-OAR-2019-0055-1263-A1, p.3]

9 Id., at 17429.

10 Heavy-Duty Low NOx, California Air Resources Board, https://ww2.arb.ca.gov/our-work/programs/heavy-duty-low-nox

Organization: *Roush CleanTech (Roush)*

Roush is in favor of the Option 1 proposed FTP standards and useful life periods for SI engines as listed in Table III-22. We believe these standards are highly challenging to achieve on gasoline, but likely feasible when combined with the ABT and OBD threshold flexibilities proposed. We believe that the use of clean alternative fuels such as LPG and CNG will provide an attractive alternative path for compliance due to their proven advantages in heavy-duty NOx emissions, but that this is simply one of several technical approaches that could be adopted under the regulation. We believe that the proposed implementation dates of 2027 and 2031 are reasonable, although we are concerned that given the broad scope of questions and preliminary content included in the NPRM, it will be difficult to finalize the rule in time to achieve 2027MY implementation. We encourage EPA to focus on the core provisions relating to NOx, useful life, and warranty, with primary concern being achieving a single national program with ARB, even if that means some of the other areas under consideration may need to be delayed for a future program. We recognize that NOx FEL timeline may be different between EPA and ARB, and that EPA and ARB warranty provisions may vary, but we would hope these would be the only substantive difference between the programs. [EPA-HQ-OAR-2019-0055-1276-A1, p.2]

Organization: *Truck and Engine Manufacturers (EMA)*

EPA has requested comment on the proposed SET test cycle and standards for SI HDEs, and whether any modifications should be considered when adapting the current CI-based SET duty cycle to SI HDEs. Application of the SET test to gasoline SI engines will require significant engine and aftertreatment investments far beyond the scope of what EPA has considered in the NPRM. The higher-load operating points of the SET test are challenging for gasoline SI engines where engine and aftertreatment components can be damaged by the associated high exhaust temperatures. Fuel enrichment is commonly used to cool those components under high-load conditions. EPA's gasoline SI demonstration of SET compliance employed down-speeding to avoid fuel enrichment. While down-speeding could be used in these applications, there will be a significant loss in the engine performance that customers demand. EPA states in the preamble that down-speeding would have to be combined with enhanced emissions controls and improved catalyst formulations to meet the proposed standards. EMA believes the hardware and software changes required to comply with the proposed SET standard, while also maintaining the customer's performance requirements, would be far more extensive than that. Indeed, those applications would have to be transitioned to higher displacement engines, requiring potentially significant vehicle modifications to package both engine and aftertreatment systems. An undesired consequence of using higher displacement engines in those applications would be an increase to GHG emissions. Additionally, manufacturers would be required to achieve greater engineering margin to account for the multiple sources of variability present in real-world applications beyond that provided in EPA's test results. [EPA-HQ-OAR-2019-0055-1203-A1, p. 116 - 117]

Considering the foregoing, EMA recommends that the SET test requirement be delayed until MY 2031 to provide manufacturers of gasoline SI engines the time needed to develop and install the larger engines that would be required for those applications. Alternatively, the SET test could be introduced with MY 2027 as proposed, but with exclusions to criteria emissions requirements needed during fuel enrichment-supported operation under high-load. Those exclusions could be sunset in MY 2031. [EPA-HQ-OAR-2019-0055-1203-A1, p. 117]

EPA Summary and Response

The summary and response for this section includes a listing of the topics raised, then the comments are summarized by category and the responses follow each summary.

Comments relating to FTP and SET testing for spark-ignition engines fell into the following general categories:

- Broad support for or opposition to the proposed options
- Specific comments on the proposed duty cycles and standards
- Credits and flexibilities
- Analysis of alternative fuels

Broad support for or opposition to the proposed options

Ford commented with general support for EPA's proposed Option 1. CARB supported Option 1 for PM, HC, and CO, but recommended EPA align more closely with CARB's Omnibus program by pulling ahead the 20 mg/hp-hr NOx standard that was proposed for MY 2031 to apply in MY 2027. CARB provided certification data for SI engines currently certifying to their optional low NOx standard of 20 mg/hp-hr and noted that 100% of those certified engines met EPA's proposed HC and CO standards as well. Roush also commented in support of Option 1 and requested a "single national program with ARB" specifically for NOx standards, useful life, and warranty. MFN commented that they believed Option 1 was feasible to implement in MY 2027, citing EPA's demonstration program results and the compliance numbers for MY 2019 SI engines. GM commented in support for lowering the standards from today's levels, but recommended a "straightforward" single step program instead of proposed Option 1. Cummins requested that EPA adopt an HC standard of 80 mg/hp-hr that they believe more appropriately accounts for the deterioration factors and compliance margins that manufacturers are expected to use. Cummins also noted that EPA did not appropriately account for the DF values in the MY 2019 certification data used in justifying the standards.

Response:

We are finalizing new FTP standards and new SET standards for Spark-ignition HDE subject to the final 40 CFR part 1036, which includes all spark-ignition engines installed in vehicles above 14,000 lb GVWR and incomplete heavy-duty vehicles at or below 14,000 lb GVWR that are not subject to or otherwise certified under 40 CFR part 86, subpart S.

We acknowledge the support from Ford and Roush for the proposed Option 1 standards and from CARB and MFN for pulling ahead the proposed Option 1 standards to MY 2027. As described in section III of the preamble, we are finalizing standards of 35 mg/hp-hr NOx, 5 mg/hp-hr PM, 60 mg/hp-hr HC, and 6.0 g/hp-hr CO over the FTP duty cycle for MY 2027 and later engines. The NOx and HC standards match the MY 2027 step of proposed Option 1; the PM and CO standards match the MY 2031 step of Option 1. All of these standards were demonstrated to be technologically feasible in EPA's SI engine test program.

In response to Cummins, we clarify that we included the MY 2019 certification data as one indicator that the proposed emission standard levels were achievable by today's engines. The certification data was added as supporting information; our primary technical basis for the numeric levels of the standards was and continues to be the SI engine demonstration program. It is true that our proposed analysis of the supporting certification data presented test values that did not include the DF. In RIA Chapter 3, we have updated our analysis of this certification data to account for DF.

We thank CARB for sharing the certification data from their optional low NOx program. We agree that the data also support the proposed Option 1 NOx levels for some current engines, but most of the engines in the dataset are alternative-fueled engines, including the natural gas-fueled engines certified using the CI duty cycles. As discussed in preamble Section III.A.3 and section 3.10 of this document, while we have referenced a technology pathway for complying with our final heavy-duty engine criteria pollutant standards (Chapter 3 of the RIA), which is consistent with CAA section 202(a)(3), there are other technology pathways, including alternative-fueled engines, that manufacturers may choose in order to comply with the final performance-based standards.

We are not finalizing an HC standard of 80 mg/hp-hr as requested by Cummins. For Spark-ignition HDE over the FTP duty cycle, we are finalizing an HC standard of 60 mg/hp-hr (which matches the MY 2027 HC standards for proposed Option 1). As explained further in preamble Section III, we demonstrated HC levels below 40 mg/hp-hr over the FTP in EPA's SI engine testing program and for the reasons explained in the preamble we believe a 60 mg/hp-hr standard is the appropriate level for a HC standard starting in MY 2027.

We respond to comments regarding alignment with the CARB Omnibus program in the preamble for this rule and Section 3.1 of this document.

Specific comments on the proposed duty cycles and standards

CARB and Eaton specifically expressed support for EPA's proposal to include a new SET duty cycle and standards for Spark-ignition HDE. MEMA commented that the impact of the new duty cycle is largely on the engine certifier, but that EPA should ensure that accessory loads are well-represented in the duty cycle due to their impact on thermal management systems. NPGA/PERC opposed the new SET standards, indicating that the new test would increase costs and isn't in line with the CARB Omnibus program. NPGA/PERC suggested enrichment for SI engines was best addressed through in-use monitoring. EMA suggested EPA underestimated the investment and time needed for manufacturers to adapt their engines to comply with standards over the SET duty cycle. EMA commented that the high load points of the SET duty cycle will result in high exhaust temperatures for SI engines, and the high temperatures could damage aftertreatment systems if manufacturers needed to avoid engine protection enrichment strategies in order to meet the standards. EMA suggests that, while EPA demonstrated the standards could be met with downspeeding, a downsped engine may not meet the performance requirements of HD customers in the range of applications for SI engines. Additionally, EMA commented that utilizing increased displacement engines would have the unintended consequence of higher GHG emissions as well as necessitating increase engineering margins to account for multiple sources of variability. EMA requested that EPA delay the SET requirement until MY 2031 to provide manufacturers more lead time. Alternatively, EMA suggested EPA could provide additional lead time by introducing SET in MY 2027 with an exclusion that sunsets in MY 2031 for operation in the high load points that would currently require fuel enrichment.

Response:

We appreciate the support for new SET standards from CARB and Eaton. We also acknowledge the adverse comments from NPGA/PERC and EMA and agree that the new duty cycle would present some new challenges for the industry. We disagree with the suggestion from NPGA/PERC that EPA monitor in-use vehicles to address enrichment in lieu of establishing SET duty cycle standards. We prefer EPA's long-standing approach of requiring manufacturers to demonstrate that their engines meet standards to ensure engines are designed to achieve the lowest possible levels of emissions before they enter commerce.

While lead time is necessary for SET duty cycle standards for Spark-ignition HDE, we disagree with EMA's comment that additional lead time may be needed for manufacturers to reevaluate their engine protection enrichment strategies over the higher load conditions of a SET duty cycle due to higher exhaust temperatures. We also disagree with EMA's request for EPA to delay implementation of the SET or provide exclusions for high load operating points on the duty cycle to provide additional lead time. Instead, as explained in preamble Section III, we are finalizing new SET standards starting in MY 2027, which we demonstrated are feasible and appropriate starting in that MY. By applying SET standards that start in MY 2027, we can ensure manufacturers take the quickest action to address the high load operation and minimize enrichment for SI engines.

As explained further in preamble Section III, we are finalizing SET standards of 35 mg/hp-hr NOx, 5 mg/hp-hr PM, and 40 g/hp-hr HC. For CO, we are finalizing a SET standard of 14.4 g/hp-hr. As shown in our SI engine test program and described in the RIA for this rule, CO is the most challenging emission to control under enrichment conditions for gasoline-fueled engines, but we demonstrated our final CO standard is technically feasible. We believe an SET CO standard, at the level of today's FTP CO standard, will sufficiently ensure manufacturers are assessing the performance of their engines at high load conditions as soon possible, yet the final stringency would not require the flexibilities or additional lead time that was suggested by commenters. Since the SET cycle is not currently required, manufacturers are not currently held to any standards at sustained high load and we expect a standard of 14.4 g/hp-hr will significantly reduce emissions compared to levels emitted under that unregulated operation.

EMA's claim that meeting the CO standard of SI SET by downspeeding would result in deterioration of vehicle performance was not substantiated with data to indicate the magnitude of the anticipated performance deterioration. Our SI SET demonstration engine maintained performance that we believe is acceptable in the commercial vehicle sector. Furthermore, our performance-based standards do not require manufacturers to adopt a specific technology (e.g., downspeeding or larger displacement) and manufacturers are expected to adopt the technology that is most appropriate for their compliance strategies for the range of applicable standards. Finally, manufacturers have readily adopted increased engine displacement with downspeeding as their engineering solution to achieve the current GHG standards. Agency review of recent certified engines indicates a 10% or more increase the engine displacements of all new HD engine designs combined with a reduction in rated engine speed following the implementation of GHG emission standards.

We requested comment on modifications we should consider to adapt the current CI-based SET duty cycle to Spark-ignition HDEs. MEMA suggested that accessory loads were especially important to consider for vocational vehicles, but did not provide data or specific suggestions for accessory loads in vocational applications. We may consider amendments to the SET duty cycle in a future rulemaking as more information becomes available for testing Spark-ignition HDE over the SET.

Credits and flexibilities

Roush and AAPC commented that the proposed standards are challenging and noted the need for the flexibility of an ABT program. Specifically, AAPC requested that manufacturers be able to generate credits for HC and CO. GM requested "full ABT". Cummins recommended that EPA set the final HC standard without assuming manufacturers would use credits to comply, citing the potential for competitive disruptions.

Response:

The final standards are not based on the use of emissions credits for any pollutant and our analyses show that manufacturers can meet the final standards without the use of credits. See preamble Section III for the feasibility of the final standards and preamble Section IV for the final ABT program.

Consistent with the proposal for this rule, we are finalizing an ABT program for NOx credits only and are discontinuing the current options for manufacturers to generate HC and PM credits. We did not request comment on and are not finalizing an option for manufacturers to generate credits for CO. See Section IV of the preamble to this rule and section 12 of this document for a discussion of the final ABT provisions.

Analysis of alternative fuels

Roush noted that LPG and CNG are alternative fuel options that could achieve the proposed standards. Cummins commented that EPA did not appropriately consider the feasibility of the proposed standards for alternative-fueled vehicles.

Response:

We agree with Roush's comment that LPG and CNG fuels may be viable methods to achieve the proposed standards and we note that, consistent with our current heavy duty engine standards compliance program, manufacturers can pursue alternative fuels as a technology pathway to comply with the final standards. Regarding Cummins' comment, we have updated our feasibility analysis from proposal to include compliance data from alternative-fueled and gasoline-fueled engines in RIA Chapter 3.

3.3 Criteria pollutant standards for LLC testing

Comments by Organizations

Organization: *Alliance for Vehicle Efficiency (AVE)*

AVE supports additional modifications to Option 1 to provide the best opportunity for driving more rapid adoption of advanced engine and emission control technologies. These additional modifications include:

- Adoption of a lower limit of a Low Load Cycle (LLC) for engine certification.
- Considering a tighter than proposed in-use compliance standard to meet a lower LLC limit. [EPA-HQ-OAR-2019-0055-1280-A1, p 3]

Organization: *Allison Transmission, Inc. (Allison)*

- Allison supports EPA's proposal of a Low Load Cycle but believes that EPA should determine accessory loads in a manner that better represents real-world operations. [EPA-HQ-OAR-2019-0055-1231-A1, p.6]

EPA has proposed new test procedures for Low Load Cycle62 and proposed corresponding low load cycle emission standards.63 These standards are significantly higher than standards that apply for NOx and HC as measured under FTP and SET testing. Allison has reviewed the proposed Low Load Cycle and agrees that this cycle measures operations where aftertreatment thermal management strategy is a significant factor to maintaining emissions control. Therefore, we agree that Low Load Cycle would measure emissions across a broader range of engine operating conditions aligned with EPA's objectives in proposing the new requirements. [EPA-HQ-OAR-2019-0055-1231-A1, p.30]

62 Proposed 40 C.F.R. §1036.512.

63 Proposed 40 C.F.R. §1036.104(a)(3)

Allison notes that, as proposed, the Low Load Cycle would apply accessory loads of 1.5kw, 2.5kw, and 3.5kw for LHDEs, MHDEs, and HHDEs. Allison experience with eGen Flex hybrid system testing indicates accessory loads are a significant factor for thermal management, as hybrid systems moving from engine off all electric range operation to resumed engine operation exiting geofenced green zones, were able to more quickly recover thermal management compared to test vehicles run with lower accessory loads. This is a reason that hybrid technology with all electric range is a better fit for applications with higher accessory loads like transit bus. [EPA-HQ-OAR-2019-0055-1231-A1, p.30]

Based on these observations, Allison believes that EPA should determine accessory loads in a manner that better matches real-world operation and consider different assumptions for different vocations. Allison was unable to compile data to provide EPA within this comment period timeframe, but we will offer suggestions how EPA could consider accessory load assumptions or gather data via customer survey leading to final rule: [EPA-HQ-OAR-2019-0055-1231-A1, p.30]

- Allison would suggest EPA survey commercial vehicle customers (fleet and OEM) across segments of both tractor and vocational applications to gather this data because accessory loads are vehicle and application specific
- Allison would recommend EPA seek a range of worst case to best case accessory loads from customers because, for each vehicle or application type, accessory loads can vary seasonally based on ambient temperatures, particularly for applications that have more complex climate control (air conditioning/heating) systems like transit bus.
- Allison suggests EPA define different assumptions for accessory loads for tractor and vocational application because Allison would expect accessory loads to be higher on average for vocational applications compared to tractor applications. Any vehicle with complex accessories including climate control, air compressor loads, power-take-off is more likely to have higher accessory loads. For example, another application known to have higher-than-average accessory loads would be a reefer truck. [EPA-HQ-OAR-2019-0055-1231-A1, p.30]

Organization: *American Trucking Associations (ATA)*

While ATA cannot address every aspect of HD2027, we are supportive of the underlying environmental objectives and several of the elements being proposed. ATA's areas of support include: Low-load cycle NOx emissions standards are necessary to reduce overall NOx profiles from the trucking sector. [EPA-HQ-OAR-2019-0055-1326-A1, p. 3]

Organization: *California Air Resources Board (CARB)*

U.S. EPA's Stage 3 RW engine platform at 435,000 equivalent miles of accelerated aging resulted in tailpipe NOx emissions of 20, 17, and 29 mg/hp-hr respectively on the FTP, Ramped-modal cycle (RMC), and LLC duty cycles. Since the proposed useful lives for MY 2027 light and medium HDEs are much less than 435,000 miles, it can be concluded that, with application of emission control technologies similar to the Stage 3 RW, these engine classes could meet CARB staff recommended standards of 20 mg/hp-hr NOx on the FTP and SET and a 50 mg/hp-hr NOx on the LLC. [EPA-HQ-OAR-2019-0055-1186-A2, pp.40-41]

96 NPRM 17461

97 Sanchez, James. 'Test Results from EPA Diesel Demonstration'. Memorandum to Docket: EPA-HQ-OAR-2019-0055. February 10, 2022.

The Omnibus LLC standards for NOx were based on test data from the CARB Stage 3 engine, which used a zone-coated catalyzed soot filter (ZCSF) upstream of the downstream underfloor SCR system. Testing on the LLC of the CARB Stage 3 engine with ZCSF after accelerated aging to 435,000 miles was at 47 mg/hp-hr, and it provided the basis for CARB's Omnibus LLC standards of 50 mg/hp-hr through IUL. However, in the Stage 3 RW engine testing, the ZCSF was replaced with a separate diesel oxidation catalyst (DOC) and diesel particulate filter (DPF) aftertreatment system. These improvements resulted in lower NOx emissions on the FTP, SET, and LLC compared to corresponding NOx emissions from the CARB Stage 3 engine on which the Omnibus standards were based. In particular, LLC NOx emissions from the Stage 3 RW engine, which measured emissions at 435,000, 600,000, and 800,000 equivalent miles of accelerated aging, were significantly reduced and stable with no significant variations in the deterioration through the UL of 800,000 miles (see Figure 5-2 above). Thus, the technology and the demonstration results justify NOx standards on the LLC duty cycle that are more stringent than those in the proposed Option 1 or Omnibus. In fact, CARB's adopted 50 mg/hp-hr IUL standard for LLC could have been adopted for heavy HDE's at 600,000 and 800,000 mile UL. Adopting CARB's IUL LLC NOx standard of 50 mg/hp-hr out to full UL of 800,000 miles is feasible and would provide around a 50 percent compliance margin when looking at the Stage 3 RW test results at the equivalent mileage of 800,000 miles. CARB staff recommends that U.S. EPA adopt in its final rulemaking NOx standards that are more stringent than the proposed Option 1 or Omnibus LLC standards. [EPA-HQ-OAR-2019-0055-1186-A2, p.45]

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

Commenters support changes to duty cycle and in-use testing to curtail the extremely high emissions that occur when HDVs are idling or traveling at low speeds. Selective catalytic reduction (SCR)-based emissions control systems, typically used on diesel engines, work best when the engine's exhaust is at a high temperature, i.e., when trucks are traveling at higher speeds or when engines are working at 'higher load.' 87 Fed. Reg. at 17,418. This means that when trucks and buses are moving at lower speeds on congested highways through urban areas, on city streets, pulling into and out of logistics facilities and warehouses, or idling—the times when these vehicles are closest to pedestrians and cyclists and closest to people's homes, schools, and workplaces—they are emitting the highest levels of dangerous pollution.233 [EPA-HQ-OAR-2019-0055-1302-A1, p.55]

233 Huzeifa Badshah et al., Current State of NOx Emissions from In-Use Heavy-Duty Diesel Vehicles in the United States 17, ICCT (Nov. 2019), https://theicct.org/publication/current-state-of-nox-emissions-from-in-use-heavy-duty-diesel-vehicles-in-the-united-states/.

EPA proposes improving its duty cycle testing by adding a new low-load cycle to its current Federal Test Procedure (FTP) and Supplemental Emission Test (SET) duty cycles. 87 Fed. Reg. at 17,460. The new low-load cycle (LLC) would be identical to the Omnibus LLC, and would be subject to a different (higher) set of emissions limitations than the FTP and SET cycles. 87 Fed. Reg. at 17,463–64. Commenters support adoption of a low-load duty cycle to better limit the higher emissions that occur at low loads, though, as discussed below, we believe EPA should set more stringent emissions limits on this cycle. [EPA-HQ-OAR-2019-0055-1302-A1, p.56]

Organization: *Consumer Reports (CR)*

EPA is proposing to add a new low-load cycle (LLC) standard for CI engines. CR supports the addition of the LLC standard, and encourages EPA to extend this test to SI engines. The proposed LLC standard is needed to capture NOx emissions in urban areas where heavy duty vehicles operate in stop-and-start, and other low-load conditions. [EPA-HQ-OAR-2019-0055-1285-A1, p.7]

Studies by both CARB and ICCT show that NOx emissions in urban driving settings exceed emission rates certified by manufacturers.43 As the ICCT study states 'a disproportionate amount of NOx emissions from heavy-duty [diesel] vehicles is emitted during the low-speed operation characteristic of urban driving,' and that 'vehicle operation at speeds of less than 35 mph results in NOx emissions of more than five times the certification limit for the average heavy-duty vehicle in the study.'44 For this reason the LLC is necessary to ensure that NOx emission standards apply not only to driving conditions seen on highways, but also to emissions that occur during cold start warm-up, idling, low-load driving, and transient operations. Such a requirement is needed for both SI and CI engines. EPA must adopt the Option 1 LLC standards that reflect CARB's Heavy-Duty Omnibus Rule.45 Compared to Option 2, Option 1 reflects the greatest degree of emission reduction achievable, as required by the CAA. [EPA-HQ-OAR-2019-0055-1285-A1, p.7]

43 Thomas Durbin, Certification an in-use compliance testing for heavy-duty diesel engines to understand high in-use NOx emissions: 2018 final report, California Air Resources Board (November 2018). Available at: https://www.arb.ca.gov/research/single-project.php?row_id=65254

44 Huzeifa Badshah, Francisco Posada, Rachel Muncrief, Current State of NOx Emissions from in-use heavy duty diesel vehicles in the United States, International Council on Clean Transportation (November 2019). Available at: https://theicct.org/sites/default/files/publications/NOx_Emissions_In_Use_HDV_US_20191125.pdf

45 California Air Resources Board, California Air Resources Board Staff Current Assessment of the Technical Feasibility of Lower NOx Standards and Associated Test Procedures for 2022 and Subsequent Model Year
Medium-Duty and Heavy-Duty Diesel Engines, (April 18, 2019). Available at: https://ww2.arb.ca.gov/sites/default/files/classic/msprog/hdlownox/white_paper_04182019a.pdf

Organization: *Cummins Inc. (Cummins)*

1036.512(b)(3)

For LLC cycle, it was previously agreed to have slightly relaxed statistical criteria which was also adopted in the CARB Omnibus rule. See below for CARB criteria from 1065.514.A.3.(f)(4): [EPA-HQ-OAR-2019-0055-1325-A1, p. 25]

Organization: *District of Columbia Department of Energy and the Environment (DOEE)*

DOEE supports the inclusion of performance requirements to ensure achievement of emission standards across all duty cycles, including idle and low load in the final rule. [EPA-HQ-OAR-2019-0055-1299-A1, p. 5]

Due to the high level of heavy-duty engine NOx emissions that come from operation at low loads, we support EPA's proposal to adopt a low-load test that would provide a procedure for assessing emissions at low loads and allow for better control of NOx emissions in urban driving environments. For MY 2027-2030 engines, EPA has proposed a low-load cycle (LLC) standard of 90 mg/hp-hr, which is the same as that in the California Heavy-duty NOx Omnibus Regulation. However, several recent research initiatives – including EPA's Low NOx Stage 3 Research Program conducted by SwRI and a program conducted by Achates – provide clear evidence that a tighter standard is feasible. Based on this research, EPA should evaluate how much lower the LLC standard can be and improve the proposed standard in the final rule. [EPA-HQ-OAR-2019-0055-1299-A1, p. 5]

Organization: *Eaton Vehicle Group (Eaton)*

Agency Request / Topic: In addition, we are requesting input on several aspects of the proposed new LLC duty cycle for heavy-duty CI engines and applying the SET duty cycle to heavy-duty SI engines (see Section III) [EPA-HQ-OAR-2019-0055-1252-A1, p.7]

Eaton Comment Strategy / Materials: We believe the LLC cycle represents the real emissions in urban-like applications that currently generate significant NOx exactly where many people live and in environmentally disadvantaged communities. Furthermore, the technologies today already allow a significant compliance margin versus the proposed 50 mg standard. We believe the EPA should consider maintaining or possibly improving that limit. [EPA-HQ-OAR-2019-0055-1252-A1, p.7]

Organization: *International Council on Clean Transportation (ICCT)*

LLC compliance is also achieved with even larger margins. The LLC standard under EPA Option 1 calls for 90 mg/bhp-hr at 600k miles for MY2027-2030. The latest results from SwRI show 33 mg/bhp-hr or a 60% compliance margin. For MY 2031 and beyond the LLC Option 1 standard is listed as 50 mg/bhp-hr @ 435k miles and 100 mg/bhp-hr at 800k miles. SwRI results show LLC emissions at 30-40 mg/bhphr at 435k miles, at least a 20% margin, and 30mg/bh-hr

@800k miles, which provides a 70% compliance margin. [EPA-HQ-OAR-2019-0055-1211-A1, p. 10]

The industry has many years to improve the first-ever emission compliance design to reach the final level of emissions of the proposed Option 1 standards, and 8 years to assure its performance at 800k miles. These results also indicate that LLC standards can be tightened even further. [EPA-HQ-OAR-2019-0055-1211-A1, p. 10]

Organization: *Manufacturers of Emission Controls Association (MECA)*

MECA suggests that EPA consider tightening two categories of the Proposed Option 1 standards such that they are more stringent than those finalized in CARB's Omnibus. This recommendation is based on new, previously unavailable test results that have been released since the adoption of the Omnibus. Further testing on certification and real-world field cycles suggest that tighter standards are possible while retaining sufficient compliance margin that engine manufacturers need to account for manufacturing and field variability. We strongly encourage CARB to review this new test information and harmonize with EPA on more stringent standards. The two standards that can be tightened are the LLC standard and the idle standard. Similar to CARB's Omnibus, the idle standard should also be required for certification rather than an optional standard as currently proposed. There is significantly more data available from the SwRI demonstration program since CARB developed its Omnibus regulation. These data show that the LLC and idle standards finalized by CARB and proposed by EPA in Proposed Option 1 can be achieved with significant margin. The NOx level achieved over the LLC with systems fully aged to 800,000 equivalent miles is 0.037 g/bhp-hr, which includes the infrequent regeneration adjustment factor (IRAF) [6]. [EPA-HQ-OAR-2019-0055-1320-A1, p.5]

> [6] EPA, 'Test Results from EPA Diesel Engine Demonstration,' 10 May 2022. [Online]. Available: https://www.regulations.gov/document/EPA-HQ-OAR-2019-0055-1082.

MECA supports the inclusion of a low load cycle and standard to certification requirements that achieve low NOx emissions during low load operation. [EPA-HQ-OAR-2019-0055-1320-A1, p.17]

One challenge with diesel engine emission control is maintaining high NOx conversion during low load operation, due to insufficient temperature in the exhaust to support efficient catalyst conversion in the SCR. Diesel vehicles used in drayage, delivery operations, and other activities that result in high periods of idle, creep, and/or stop-and-go operation are examples of challenging duty-cycles. [EPA-HQ-OAR-2019-0055-1320-A1, p.17]

MECA supports EPA adopting, similar to CARB's Omnibus, revised regulatory requirements that aim to best control emissions at times of low load engine operation. During certification, the engines and aftertreatment systems would need to meet low emissions over the newly proposed low-load certification (LLC) cycle that targets average engine power of about 7%. MECA supports the addition of the LLC cycle in 2027 for engine certification. However, as stated in our comments on page 3-4 above, we believe the LLC standards at full useful life should be tightened for both MY 2027 and 2031. Testing at SwRI has shown that the Proposed Option 1

LLC standards can be achieved with significant margin at the proposed limits and may result in emissions backsliding over time in these operating modes that are the most critical to urban operation.[EPA-HQ-OAR-2019-0055-1320-A1, p.18]

Inclusion of the LLC is a very important part of this rule as it ensures that during certification, dynamometer testing evaluates the ability of technology to meet real-world emissions in an accurate test cell environment before they are deployed on the road. As discussed above, the cycle was derived from real truck data operated over actual duty cycles from many different truck vocations ranging from delivery to busses to line-haul tractors. The proposed LLC cycle is a robust approximation of all types of truck operation at low load. The approach used by NREL and SwRI to develop a real-world cycle stands as an example of how future certification cycles can be developed. MECA supports the inclusion of the proposed LLC cycle to give EPA the confidence, at time of certification, that the technology will be able to meet the requirements of the revised in-use compliance program proposed by staff based on a moving average window analysis. MECA members have developed and are offering a number of technology solutions (discussed previously) that can enable OEMs to meet the tighter-than-proposed LLC limits. Testing of the Stage 3 engine and aftertreatment systems have exceeded the proposed LLC emission limits with significant margin based on the same technology solutions that achieved ultra-low NOx emissions over the FTP, including over 98% conversion efficiency over the cold-start phase of the FTP. [EPA-HQ-OAR-2019-0055-1320-A1, p.19]

We support Proposed Option 1 slight increase to the emission standards at the final longer durability periods to account for possible deterioration beyond the current FUL of 435,000 equivalent miles. Results from the SwRI demonstration program support the NOx limits at the FUL requirements in Proposed Option 1. [EPA-HQ-OAR-2019-0055-1320-A1, p.20]

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

With regard to EPA's request for comments on several aspects of the proposed new LLC duty cycle for heavy-duty CI engines and applying the SET duty cycle to heavy-duty SI engines, much of the impact of this is on the engine certifier. MEMA would like to highlight the fact that accessory loads are very impactful to thermal management systems - especially during low load cycle conditions. New certification cycles should accurately quantify and reward contributions of technologies to fuel efficiency improvements and NOx emissions reductions. MEMA recommends that EPA develop unique considerations for vocational vehicles with regard to correct accessory loading to reflect real-world use. [EPA-HQ-OAR-2019-0055-1322-A1, p. 6]

Organization: *National Association of Clean Air Agencies (NACAA)*

NACAA supports inclusion in the final rule of performance requirements to ensure achievement of emission standards across all duty cycles, including idle and low load. [EPA-HQ-OAR-2019-0055-1232-A1, p. 11.]

Due to the high level of heavy-duty engine NOx emissions that come from operation at low load we support EPA's proposal to adopt a low-load test that would provide a procedure for assessing emissions at low loads and allow for better control of NOx emissions in urban driving environments. For MY 2027-2030 engines, EPA has proposed a low-load cycle (LLC) standard of 90 mg/hp-hr, which is the same as that in the Omnibus. However, several recent research initiatives – including EPA's Low NOx Stage 3 Research Program conducted by SwRI29 and a program conducted by Achates – provide clear evidence that a tighter standard is feasible. Based on this research, EPA should evaluate how much lower the LLC standard can be and, in the final rule, improve upon the proposed standard. [EPA-HQ-OAR-2019-0055-1232-A1, p. 11]

29. https://www.regulations.gov/document/EPA-HQ-OAR-2019-0055-1082

Organization: National Waste & Recycling Association (NWRA)

NWRA commends EPA on beginning to break out short-haul and long-haul trucking as in terms of effective pollution controls. EPA's recognition that the start-stop and short distances traversed by short-haul drivers between stops potentially limits the ability of some pollution control devices to work effectively since they would not get to a high enough temperature. NWRA asks that EPA work with short-haul companies and manufacturers to find viable alternatives. [EPA-HQ-OAR-2019-0055-1242-A1, p. 2]

Organization: *Northeast States for Coordinated Air Use Management (NESCAUM)*

Should EPA instead promulgate Option 1, we urge the Agency to make the following changes to the proposed standards: We strongly support the establishment of EPA's proposed low load certification cycle and the inclusion of auxiliary load in the cycle. Test data collected by EPA, CARB, the International Council on Clean Transportation (ICCT), NESCAUM, and others demonstrate the substantial contribution to overall heavy-duty engine emissions from low load operation.27,28,29,30 In the Northeast and mid-Atlantic regions, recent data logging of on-road tractor trailers over 100 days of travel found that 10 percent to 40 percent of tractor trailer NOx was emitted at low load.31 Taken together, these studies strongly point to the need for additional NOx controls at low load cycles. Figure 6 shows the NOx mass emissions for idle (bin 1), low load (bin 2), and high load (bin 3) over 100 days of data logging of truck tractors in the NESCAUM study. The green bar shows the contribution of NOx emissions at low load as a fraction of total NOx emissions. [EPA-HQ-OAR-2019-0055-1249-A1, p. 10]

27 U.S. EPA, "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, Draft Regulatory Impact Analysis," March 2022, see page 84.

28 Badshah, H.; Posada, F.; Muncrief, R., "Current State of NOx Emissions from In-Use Heavy-Duty Diesel Vehicles in the United States," 26 November 2019. Available at https://theicct.org/publications/nox-emissions-us-hdv-diesel-vehicles (accessed May 12, 2022).

29 Sharp, C., "Update on Heavy-Duty Low NOx Demonstration Program at SwRI," Southwest Research Institute, September 26, 2019. Available at Update on Heavy-Duty Low NOx Demonstration Programs at SwRI (accessed April 25, 2022).

30 NESCAUM and Environment and Climate Change Canada, “Heavy-Duty Vehicle In-Use NOx Testing Report, Interim Results, July 2021, submitted for publication, available upon request.

31 Ibid.

Even with this important contribution, the green bar understates total low load NOx emissions because the NOx sensors were not active at exhaust temperatures below 190 degrees Celsius. The right-hand graph in Figure 6 shows the percent of time the NOx sensor was active for each truck at low load conditions. On average, NOx sensors were inactive for 31 percent of the time. Not shown in the graph is NOx sensor activity at idle. NOx sensors were inactive for 67 percent of the time at idle. A proper accounting of NOx emissions when the NOx sensors were inactive would increase the amount of NOx emitted at low load and idle. It is important to note that these trucks are tractor trailers that spend a significant portion of the time at speeds above 60 miles per hour. For delivery trucks, buses, and other vocational vehicles, low load emissions comprise an even larger share of total emissions. [EPA-HQ-OAR-2019-0055-1249-A1, pp. 10 - 11]

Low load cycles and excess NOx emissions are of particular concern in Overburdened Communities located near busy truck routes and where trucks operate in stop and go conditions where exhaust temperatures are potentially too low to enable selective catalytic reduction (SCR) emissions control function. The truck data logging study found that for current engines, cold ambient temperatures reduce the amount of time NOx sensors are active, indicating potentially greater NOx emissions at low load in the wintertime. In addition to exacerbating localized heavy-duty truck emissions, lack of NOx sensor activity and SCR performance in cold weather are a concern for regional haze. [EPA-HQ-OAR-2019-0055-1249-A1, p. 11] [Also in Section 23 of this document]

While we support the low load certification test cycle proposed by EPA, we request that EPA finalize a more stringent low load NOx standard for model year 2027-2030 engines. The proposed standard in Option 1 of 90 milligrams/hp-hour is significantly higher than data show is achievable in 2027. For example, an upgraded Cummins engine with cylinder deactivation, improved engine calibration, and advanced aftertreatment had low load cycle (LLC) NOx emissions of 0.036 and 0.053 g/bhp-hr.[32,33] Results from EPA’s Heavy-duty Low NOx Stage 3 Research Program show the proposed Option 1 LLC standards are well above what the test data demonstrate are feasible at 435,000, 600,000, and 800,000 miles.[34,35] EPA’s test data indicate a 35 to 40 mg/bhp-hr standard is feasible in 2027. NESCAUM supports a more stringent low load certification standard beginning in model year 2027. Achieving the greatest technically feasible NOx reductions in 2027 and subsequent model year heavy-duty vehicles is essential to the Northeast to meet air quality requirements and to improve public health. [EPA-HQ-OAR-2019-0055-1249-A1, p. 11 - 12]

32 CARB, “Heavy-Duty Low NOx Program Low Load Cycle,” Public Workshop, September 26, 2019. Available at https://ww3.arb.ca.gov/msprog/hdlownox/files/workgroup_20190926/staff/03_llc.pdf (accessed April 25, 2022).

33 Sharp, C., “Update on Heavy-Duty Low NOx Demonstration Program at SwRI,” Southwest Research Institute, September 26, 2019. Available at Update on Heavy-Duty Low NOx Demonstration Programs at SwRI (accessed April 25, 2022).

34 U.S. EPA, “Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards Draft Regulatory Impact Analysis,” March 2022. Available at Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards – Draft Regulatory Impact Analysis (EPA-420-D-22-001, March 2022).

35 U.S. EPA, “Test Results from EPA Diesel Engine Demonstration,” Memorandum from J. Sanchez, OAR/OTAQ/ASD, to Docket EPA-HQ-OAR-2019-0055, May 3, 2022. Available at https://www.regulations.gov/document/EPA-HQ-OAR-2019-0055-1082 (accessed May 12, 2022).

Organization: *Ozone Transport Commission (OTC) and Mid-Atlantic/Northeast Visibility Union (MANE-VU)*

Low Load Cycle (LLC): We strongly support the establishment of EPA’s proposed low load certification cycle and the inclusion of auxiliary load in the cycle. Test data evaluated by the International Council on Clean Transportation (ICCT), NESCAUM, CARB, and others demonstrate the substantial contribution to overall heavy-duty engine emissions due to low load operation.28,29,30,31 In the Northeast and mid-Atlantic, recent data logging of onroad tractor trailers over 100 days of travel found that up to 40 percent of tractor trailer NOx was emitted at low load.32 Taken together, these studies strongly point to the need for additional NOx controls at low load cycles. [EPA-HQ-OAR-2019-0055-1250-A1, pp.13-14]

28 U.S. EPA, ‘Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards Draft Regulatory Impact Analysis,’ EPA-420-D-22-001, March 2022. Available at https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10144K0.pdf. See page 84.

29 Badshah, H.; Posada, F.; Muncrief, R., ‘Current State of NOx Emissions from In-Use Heavy-Duty Diesel Vehicles in the United States,’ 26 November 2019. Available at https://theicct.org/publications/nox-emissions-us-hdv-diesel-vehicles. Accessed May 12, 2022.

30 Sharp, C., Southwest Research Institute, ‘Update on Heavy-Duty Low NOx Demonstration Programs at SwRI,’ September 26, 2019. Available at https://ww2.arb.ca.gov/sites/default/files/classic/msprog/hdlownox/files/workgroup_20190926/guest/swri_hd_low_nox_demo_programs.pdf?_ga=2.85472537.1256936515.1649334668-1678718972.1597669978. Accessed May 12, 2022.

31 NESCAUM and Environment and Climate Change Canada, ‘Heavy-Duty Vehicle In-Use NOx Testing Report, Interim Results, July 2021, submitted for publication, available upon request.

32 Ibid.

Low load cycles and excess NOx emissions are of particular concern in Overburdened Communities located near busy truck routes and where trucks operate in stop and go conditions. [EPA-HQ-OAR-2019-0055-1250-A1, p.14] [Also in Section 23 of this document]

While we support the certification test cycle proposed by EPA, we request that EPA finalize a more stringent low load NOx standard for model year 2027-2030 engines. The proposed standard in Option 1 of 90 milligrams/hp-hour is significantly higher than CARB and EPA data show is achievable for MY 2027. For example, an upgraded Cummins engine with cylinder deactivation, improved engine calibration, and advanced aftertreatment had LLC NOx emissions of 0.036 and 0.053 g/bhp-hr.33,34 Results from EPA's Heavy-duty Low NOx Stage 3 Research Program show the proposed Option 1 LLC standards are well above what the test data demonstrate are feasible at 435,000 miles, 600,000 miles, and 800,000 miles.35,36 EPA's test data indicate a 35 to 40 mg/bhp-hr standard is feasible in 2027. OTC supports a more stringent low load certification standard beginning in model year 2027. Given that 2027 to 2030 model year heavy-duty vehicles will be in service for many years to come, it is essential we realize the greatest NOx reductions possible with the implementation of new emissions standards. [EPA-HQ-OAR-2019-0055-1250-A1, p.14]

33 CARB 'Heavy Duty Low NOx Program, Low Load Cycle,' Public Workshop, September 26, 2019. Available at https://ww3.arb.ca.gov/msprog/hdlownox/files/workgroup_20190926/staff/03_llc.pdf. Accessed April 25, 2022.

34 Sharp, C., Southwest Research Institute, 'Update on Heavy-Duty Low NOx Demonstration Programs at SwRI,' September 26, 2019. Available at https://ww2.arb.ca.gov/sites/default/files/classic/msprog/hdlownox/files/workgroup_20190926/guest/swri_hd_low_nox_demo_programs.pdf?_ga=2.85472537.1256936515.1649334668-1678718972.1597669978. Accessed May 12, 2022.

35 U.S. EPA, 'Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards Draft Regulatory Impact Analysis,' EPA-420-D-22-001, March 2022. Available at https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10144K0.pdf. Accessed May 12, 2022.

36 U.S. EPA, 'Test Results from EPA Diesel Engine Demonstration,' Memorandum from J. Sanchez, OAR/OTAQ/ASD, to Docket EPA-HQ-OAR-2019-0055, May 3, 2022. Available at https://www.regulations.gov/document/EPA-HQ-OAR-2019-0055-1082. Accessed May 12, 2022.

Organization: *PACCAR, Inc (PACCAR)*

Proposed 1036.522 addresses infrequently regenerating aftertreatment devices. As an initial matter, operation in the Low Load Cycle conditions may not trigger regeneration events under real-world conditions, especially in extreme low-load conditions. Manufacturers must therefore be afforded additional flexibility to address this issue, by, for example, being able to use FTP-derived IRAF values, or by omitting IRAF values if manufacturers can demonstrate that regenerations are unlikely to occur under real-world, low-load conditions. [EPA-HQ-OAR-2019-0055-1346-A1, p.50]

Organization: *Public Citizen and Healthy Port Communities Coalition (HPCC)*

The Proposal recommends three laboratory tests to better ensure that trucks meet emissions reduction criteria: (1) the Federal Test Procedure, (2) the Supplemental Emission Test, and (3) the Low-Load Cycle test. Both (1) and (2) are currently used to demonstrate emission control efficacy when a vehicle transitions from low to high loads or under a sustained load. But these tests fail to demonstrate emissions reduction efficiency under low load. The Proposal would add (3) as a way to ensure that engines retain the capacity for emissions reductions at lower speeds and operating temperatures. Controlling emissions over a broader range of conditions would be a welcome relief for communities adjacent to ports and freight corridors where currently even using the newest equipment cannot guarantee emissions reductions. [EPA-HQ-OAR-2019-0055-1417-A2, p. 2]

Organization: *Retail Industry Leaders Association (RILA)*

Large vehicles that use heavy-duty engines operate under a wide range of load conditions and speeds during day-to-day operation, including sustained low-load and idle. However, these load conditions are not currently included in the existing federal standards for criteria pollutant emissions, such as NO_x and PM. The absence of such standards has left these emissions largely unregulated during common low-load operations such as waiting at a traffic light or driving at low-speed. [EPA-HQ-OAR-2019-0055-1189-A2, p.3]

The medium- and heavy-duty trucks that use engines covered by this proposed rule are commonly used to transport freight and deliver goods to retailers. These trucks will often operate in low-load and idle modes during deliveries to retail facilities as they arrive, unload, and depart. Reductions to the pollution emitted by trucks during low-load operations will reduce exposure to pollutants experienced at these retail facilities by both employees that work near areas where trucks unload (e.g., around loading docks), as well as customers who might be exposed to the emissions of idling trucks when they enter or leave the facility. [EPA-HQ-OAR-2019-0055-1189-A2, p.3]

The inclusion of testing that covers low-load and idle operation in EPA's proposed rule is therefore seen as a logical update by RILA that can reduce exposure to criteria pollutant emissions faced by communities, including the retail community, across the country. [EPA-HQ-OAR-2019-0055-1189-A2, p.3]

Organization: *South Coast Air Quality Management District*

Additionally, there is no reason to believe a 0.05 g/bhp-hr LLC limit in MY 2027 is not possible. The Southwest Research Institute's (SwRI's) Stage 3 'Rework' system, funded by EPA itself, includes final test results on thermally aged development parts demonstrating 0.034 g/bhp-hr

NOx on the LLC at 800,000 miles, which is significantly lower than a proposed 0.05 g/bhp-hr standard.27 As CARB notes in its Initial Statement of Reasons for the Omnibus Regulation, a 0.05 g/bhp-hr standard on the LLC is feasible for MY 2027 and subsequent MY engines so long as manufacturers employ engine software and hardware technologies that accelerate catalyst light-off and keep the aftertreatment warm under sustained low load operations as well as remain neutral or provide GHG emission reductions.28 [EPA-HQ-OAR-2019-0055-1201-A1, pp.7-8]

26 87 Fed. Reg. at 17488

27 CARB, Omnibus Regulation, Initial Statement of Reasons for Rulemaking (ISOR) (2020), available at https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hdomnibuslownox/isor.pdf, pgs. III-22 – III-23.

28 Id. at pg. III-26.

Organization: *Truck and Engine Manufacturers Association (EMA)*

It is important to highlight from the outset that while there are various details of EPA's rulemaking proposal (particularly with respect to Option 1) that EMA and its members fundamentally disagree with, there are multiple major points of substantial agreement. In that regard, EMA agrees with EPA that:

(v) A new low-load cycle and related emission standards should apply to the certification of HDOH engines starting in MY 2027; [EPA-HQ-OAR-2019-0055-1203-A1, p. 5]

EPA also proposes to add a new low-load certification test cell cycle ("LLC") to the certification requirements for HDOH engines. The new LLC, first developed and applied to HD HDOH engine requirements by CARB, is a 92- minute test cycle that includes approximately 30 minutes of idle operation, a significant portion of high-to-low load operation with extreme airflow-induced cooling (i.e., downhill operation), and a significant portion of low-to-high load transient operation (i.e., drayage work). The selected LLC also has an average power that is approximately 6% of maximum power, and an average vehicle speed that is approximately 10 mph. It is an extreme cycle, especially as applied to every HDOH engine, regardless of the vehicle type and application in which the engine might be installed. [EPA-HQ-OAR-2019-0055-1203-A1, p. 115]

EMA has repeatedly questioned the analyses that CARB, SwRI, and NREL relied on to develop the LLC. One concern relates to the portion of the LLC that has been dubbed, "v11660_5." That portion's combination of engine, transmission, 6x4 axle configuration, and 4.20 axle ratio appears to be a heavy-haul configuration, which should mean heavier parts all around. However, the mass—after SwRI's mass reduction and after EMA subtracts a hypothetical 15,000-pound empty trailer—is 11,333 pounds for a GEM-simulated tractor. That tractor weight is not at all realistic. Even a heavy-haul single unit vehicle, like a dump truck, typically is heavier than 26,333 pounds (i.e., without subtracting an empty trailer). For reference, Navistar's regional-haul day-cab with a roof deflector and a 12-liter engine is about 15,000 pounds, and a Daimler Cascadia daycab with no roof deflector and a 13-liter engine is 16,300 lbs. Those day-cab configurations are among the lighter Class 8 vehicles, yet they are thousands of pounds heavier than the vehicle simulated to generate LLC portion "v11660_5." Thus, it would seem that the proposed LLC is not representative of the actual operation of any actual HDOH vehicle. EMA recommends that EPA work (with CARB) to modify the LLC to include only representative engine behavior drawn from representative vehicle operation. [EPA-HQ-OAR-2019-0055-1203-A1, p. 115 - 116]

Similarly unrepresentative is the LLC auxiliary load that EPA proposes to apply. EPA should increase the LLC auxiliary load for HHD engines from 3.5 kW to a value in the range of 5.0 to 5.5 kW, so that it is more representative of real-world auxiliary loads. [EPA-HQ-OAR-2019-0055-1203-A1, p. 116]

EMA supports that EPA proposes to allow a stop-start function to be active during the FTP and LLC cycles (§1036.501(f)). Stop-start could be an effective tool for reducing NOx, and having the ability to demonstrate NOx control over the LLC and RMC will be beneficial. More detail will be necessary, such as whether operator over-ride functions will influence whether stop-start can be active during certification testing. Also, there are concerns about deploying conventional starters to support restart, because the inertia of the dyno may cause unforeseen problems. EMA appreciates that EPA is providing for stop-start to be active in the certification tests, and is ready to work with EPA to iron out the details for the final rule. [EPA-HQ-OAR-2019-0055-1203-A1, p. 116]

EPA Summary and Response

Summary:

Multiple commenters provided perspectives on the proposed low-load cycle (LLC) standard and test procedure. Most commenters expressed general support for including the LLC. Stakeholders agree that the LLC would measure emissions across a broader range of engine operating conditions, and is aligned with EPA's objectives to reduce NO_X across different modes of operation and duty-cycles, including urban driving environments. One stakeholder provided data showing the need for additional NO_X emission controls at low load cycles. Several stakeholders emphasized that emission control under low-load operation is particularly important in overburdened communities located near busy truck routes and where trucks operate in stop and go conditions. One stakeholder also stated that emission control in low-load operation is also important to reduce exposure at retail facilities both for employees that work near areas where trucks unload (e.g., around loading docks), as well as customers who might be exposed to the emissions of idling trucks when they enter or leave the facility. One stakeholder encouraged EPA to work with CARB to revise the LLC such that it includes only representative engine behavior drawn from representative vehicle operation.

Several commenters provided additional input on the numeric level of the LLC. The majority of stakeholders urged EPA to lower the numeric level of LLC engine certification test standard. One commenter also urged EPA to lower the numeric level of the LLC standard for in-use compliance. In contrast, three stakeholders stated EPA needed to better account for accessory loads when setting the final LLC standard. Another stakeholder stated EPA should adopt relaxed statistical criteria which was also adopted in the CARB Omnibus rule. Finally, one stakeholder stated that manufacturers needed flexibilities for determining infrequent regeneration adjustment factors for the LLC (e.g., allow the use of FTP-derived IRAF values, or by omitting IRAF if the manufacturer can demonstrate regeneration is unlikely to occur during low-load operations in the real-world).

Several of the stakeholders who urged EPA to lower the LLC standard pointed to recent data from SwRI and Achates as providing clear evidence that a standard lower than 75 mg/hp-hr is feasible. One stakeholder suggested that EPA's test data indicate a 35 to 40 mg/bhp-hr standard is feasible in 2027. Another commenter stated that EPA should set the LLC to 50 mg/hp-hr for all engine classes. Finally, one stakeholder noted that not lowering the proposed numeric standard for the LLC could result in emissions backsliding over time in these operating modes.

Multiple stakeholders who stated that EPA should evaluate accessory loads when setting the LLC encouraged EPA to determine accessory loads in a manner that better matches real-world operation when finalizing the LLC standard. They further stated that EPA should consider different assumptions for different vocations and conduct a survey of fleets and vehicle manufacturers to gather data on accessory loads in tractor and vocational applications. They further stated that EPA should define different assumptions for accessory loads for tractor and vocational application because they expect accessory loads to be higher on average for vocational applications compared to tractor applications. One stakeholder stated EPA should increase the LLC auxiliary load for HHD engines from 3.5 kW to a value in the range of 5.0 to 5.5 kW, so that it is more representative of real-world auxiliary loads.

One commenter stated that the regression criteria should be relaxed for the LLC.

One commenter proposed to allow a stop-start function to be active during the FTP and LLC cycles (40 CFR 1036.501(f)).

Finally, three commenters stated that EPA should extend the LLC to SI engines.

Response:

EPA agrees with many of the commenters that the LLC is an important measure to accurately account for and control emissions across a broader range of engine operation, including urban driving conditions and other operation that could impact overburdened communities. As further detailed in preamble Section III, the final program includes new emission standards for the LLC duty cycle. The LLC duty cycle was developed by SwRI and NREL with average power and duration characteristics intended to test current diesel engine emission controls under three low-load operating conditions: transition from high- to low-load, sustained low-load, and transition from low- to high-load and its development, taking into account representative vehicle operation, and is fully described in Chapter 2.2.2 of the RIA. We disagree with the comment that the vehicle mass of 26,333 pounds used for profile v11660 is unrealistic, since 26,333 pounds is in the range of a class 8 tractor without a trailer. The operation included in profile v11660 was from a drayage tractor, which can spend a significant amount of time without a trailer connected. For the reasons described in this section and preamble Section III, we are finalizing the LLC test cycle as proposed.

Regarding the comment regarding flexibilities for IRAF determination, 40 CFR 1065.680 states that "For engines subject to standards over more than one duty cycle, you must develop adjustment factors under this section for each separate duty cycle." There is nothing in 40 CFR 1065.680 that prevents a manufacturer from developing a single IRAF that represents the average of, and can be applied to, all duty cycles. Nor does 40 CFR 1065.680 prevent you from determining that your IRAF is zero. The IRAF determination procedure in 40 CFR 1065.680 provides flexibilities with respect to the method of IRAF determination.

See preamble Section III for the basis for the final LLC standards. We agree with some commenters that data support a lower numeric value of the LLC standard than what we proposed for certain LLC standards in Option 1 (e.g. at the useful life value of 800,000 miles for Heavy HDE). We noted in the NPRM that the margin between the proposed Option 1 MY 2031 standards and the Stage 3 engine data is the largest on the LLC, suggesting that a lower numeric NO_X standard may be feasible than what we proposed. The final LLC numeric standard, as further discussed in preamble Section III, is the consistent with the most stringent proposed option, pulled forward to MY 2027.

The commenters who urged EPA to further consider accessory loads in finalizing the LLC did not provide data for accessory load, but EMA provided specific suggestions of 5.0 and 5.5 kW for tractor applications. They did not provide a basis for how they arrived at these specific loads. Based on data available, we considered accessory loads when setting the final numeric value of the LLC standard. Additional discussion on how we considered accessory loads is available in preamble Section III.

We did not propose and are not finalizing standards over the LLC to apply for Spark-ignition HDE. As we explained at proposal and as we describe in Section III.D.2 of the preamble, we are finalizing other provisions to ensure emissions are controlled under lower load operation for Spark-ignition HDE (see also section 3.6.1 of this document).

With respect to EMA's comment on stop-start technologies as it applies to the LLC, see EPA's response to a similar comment regarding the FTP in section 3.2.1 of this document.

With respect to National Waste & Recycling Association comment on working with engine and short-haul manufacturers to ensure emissions control technology works in stop-start operation, we have finalized standards with the new LLC to ensure that the emissions control technology performs under these conditions. In addition, we have evaluated technologies that enable emissions control under this operation (e.g., CDA and closed-couple SCRs).

We agree with the comment from Cummins that for gaseous-fueled engine testing with a single-point fuel injection system, the cycle regression criteria should be revised from the proposal in the final provision to address the slow response of the fuel system to changes in operator demand. As such we are finalizing the allowance for the use of the statistical criteria in 40 CFR 1036.540(d)(3) to validate the LLC for these engines.

3.4 Criteria pollutant interim in-use standards

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

U.S. EPA is soliciting comment on providing manufacturers with higher (numerical) standards for an interim period to gain experience with the additional emission control technologies needed to meet the proposed heavy HDE NOx standards. [EPA-HQ-OAR-2019-0055-1186-A2, p.54]

Verification testing of both new and in-use engines helps to ensure that production engines comply with applicable emissions standards when they are initially produced (i.e., as they leave the production lines) and as they are operated in-use. As U.S. EPA notes, it generally establishes in-use test standards that are equivalent to certification standards, but has occasionally established temporary higher in-use standards when it believes that manufacturers both need to utilize new technologies to comply with proposed standards, and need additional time to evaluate the capabilities of such new technologies to control emissions as engines and vehicles operate in-use, during the time period such new standards are first implemented. [EPA-HQ-OAR-2019-0055-1186-A2, p.54]

CARB staff strongly opposes the flexibilities that U.S. EPA is considering, which would allow temporary higher numerical values when regulatory agencies perform verification testing of new or in-use engines for MY 2027 through 2033 heavy HDEs, such as during confirmatory testing, Selective Enforcement Audit (SEA) testing, and in-use off-cycle testing. [EPA-HQ-OAR-2019-0055-1186-A2, p.54]

The interim in-use standards for new engines that U.S. EPA is considering are extremely high (i.e., loose), and further margin allowance would make the standards even higher and looser. These interim in-use standards lie somewhere between 1.4 to 2 times the certification standards for confirmatory and SEA testing, and 1.4 to 2 times the off-cycle standards for in-use testing. For off-cycle standards, this allowance is on top of the in-use thresholds which, depending on MY, are already 2 times or 1.5 times the certification standard and also include an additional proposed 10 percent measurement allowance. U.S. EPA's justification for providing these extremely high in-use standards is an asserted need to take into account '…the degree to which there is uncertainty in how the emissions control technologies deteriorate when the engine is installed in the wide variety of HD vehicle applications that exist in the marketplace and how to address such uncertainty.' [EPA-HQ-OAR-2019-0055-1186-A2, p.54]

However, the confirmatory and SEA tests are laboratory tests on certification duty cycles and not in field testing, and hence there is no reason why the test results should not be as close as possible to the certification levels the manufacturer submitted during certification. In fact, new engines tested under SEA should have no deterioration effects and should have lower emissions than their certification test results, similar to the zero-hour (de-green) test results in the Stage 3 and Stage 3 RW demonstration programs. [EPA-HQ-OAR-2019-0055-1186-A2, p.54]

U.S. EPA's rationale for the verification test standards for new engines is therefore inconsistent with the evidence, and U.S. EPA has also failed to articulate a rational connection between the facts and its proposal. State Farm, 463 U.S. at 43. [EPA-HQ-OAR-2019-0055-1186-A2, p.55]

CARB staff is especially concerned that U.S. EPA has not fully considered the adverse emissions consequences of this proposal. The proposed increased allowances will apparently at least double the allowable levels of pollutants emitted by heavy HDEs for a period of seven years, thereby effectively diluting the stringency of the Option 1 standards for heavy HDEs to Option 2 standards, which CARB has previously explained in Section 5 are impermissibly inconsistent with the statutory mandate of CAA section 202(a), and making it difficult for California and other states with air quality issues to meet their air quality goals. CARB staff strongly urges U.S. EPA not to include the interim in-use standard in its final rule. [EPA-HQ-OAR-2019-0055-1186-A2, p.55]

U.S. EPA's failure to analyze the scope and extent of the increased emissions resulting from this proposal, and their impacts on the public's health and welfare constitutes a failure to consider an important aspect of this proposal, State Farm, 463 U.S. at 43, and an impermissible abdication of U.S. EPA's duty to ensure affected heavy-duty engines and vehicles mandates of CAA section 202(a) to ensure heavy-duty vehicles and engines comply with applicable emissions standards throughout applicable useful lives. CAA sections 202(a)(1), 202(a)(3), Chevron, 467 U.S. at 842-843. (See CARB comment at Section 5.a, infra) [EPA-HQ-OAR-2019-0055-1186-A2, p.55]

CARB staff suggests that U.S. EPA consider how early reduction credits (i.e., producing lower FEL engines to generate credits) could provide any needed relief if manufacturers determine that they need to provide additional compliance margin during the introduction of compliant engines at a higher FEL (i.e., by producing credit consuming engines). Manufacturers will be producing cleaner FEL engines meeting the Omnibus more stringent standards starting with MY 2022, and those engines would produce significantly more credits under the federal HD program between 2022 through 2026 MYs. If manufacturers determine they need more margin, they can plan accordingly. By encouraging early action, this flexibility approach would also provide earlier emission reduction in our most vulnerable communities impacted by heavy HDE emissions. [EPA-HQ-OAR-2019-0055-1186-A2, p.56]

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

As part of Option 1, EPA proposes several changes to its laboratory-based duty cycle tests, in-use (sometimes called 'off-cycle') testing procedures, and verification testing. The current regulations must be revised to better regulate low load emissions and protect public health in communities overburdened by vehicle pollution. Commenters generally support making changes to close gaps in the current duty cycle and in-use testing procedures to reduce the amount of dangerous air pollution breathed by individuals living, working, and attending school in near-road communities. But Commenters oppose EPA's proposed 'flexibilities' that would weaken verification testing. [Comment also included in Chapter 11.6.1] [EPA-HQ-OAR-2019-0055-1302-A1, p.54]

Among the Option 1 'flexibilities' on which EPA requests comment is a drastic weakening of the standards' verification testing for Heavy Heavy-Duty Engines (HHDEs)—one that would permit emissions that vastly exceed EPA's proposed standards. The three types of verification testing include: confirmatory testing, in which EPA verifies a manufacturer's test results before an engine is certified; selective enforcement audit, in which EPA conducts testing of engines that come off the production line; and in-use testing of engines that have already entered commerce. 87 Fed. Reg. at 17,563. EPA's proposed 'interim in-use [NOx] standard[s]' for HHDEs would be based on purported 'uncertainty in how the emissions control technologies deteriorate.' 87 Fed. Reg. at 17,563–65. The proposed flexibility is discussed in terms that suggest that it would apply not just to in-use testing, but also to confirmatory and selective enforcement audits. But EPA's justification—the possibility of deterioration in control technologies' performance—has no bearing on confirmatory testing or selective enforcement audits, which apply to new engines that have not deteriorated. There is no basis for applying the proposed interim in-use standards during either confirmatory testing or selective enforcement audits. [EPA-HQ-OAR-2019-0055-1302-A1, pp.56-57]

As for in-use testing, EPA's standards already incorporate a margin for deterioration over time; providing an additional allowance for deterioration in EPA's in-use testing effectively double-counts that anticipated decrease in effectiveness. To the extent any further residual uncertainties remain, EPA's proposed rule—through its crediting and averaging provisions, as well as its generous scaling and measurement allowances—provides ample allowance for them. Id. at 17,467, 17,469, 17,474, 17,553. There is consequently no reasonable basis for the inflated testing standards—even at the low end of the suggested range of alternative standards, let alone the high end—for which EPA has requested comment. Id. at 17,564. Including the proposed interim in-use standards would establish a substantial incentive for manufacturers to design engines to the weaker standards, after certification, or to avoid the cost of long-lasting components that would ensure sustained emissions performance. See, e.g., Notices of Filing Consent Decrees, 63 Fed. Reg. 59,330–34 (Nov. 3, 1998) (describing enforcement actions against manufacturers over defeat-devices that relaxed emissions controls after certification testing). The record fully demonstrates the feasibility of meeting Option 1's standards without an additional allowance for deterioration. See DRIA at 108–30 (describing feasibility testing from Southwest Research Institute).238 [EPA-HQ-OAR-2019-0055-1302-A1, p.57]

> 238 See also Achates Power, Heavy-Duty Diesel Engine In-Use Testing (last accessed May 12, 2022), https://achatespower.com/wp-content/uploads/2022/04/Achates-Power-Heavy-Duty-Diesel-In-Use-Testing-Results.p df (testing of opposed-piston design, in fleet service with Walmart Corporation, achieving emissions well below Option 1 standards throughout life).

Organization: *Cummins Inc. (Cummins)*

EMA's comments and associated reports describe those issues and many others in detail, pointing to the need for continued work by both EPA and industry to evaluate improvements that should be implemented for the final rule, not just in the test and analysis protocols, but also with respect to compliance measures and stringency. As stated before, Option 1 is not feasible, including the proposed Option 1 off-cycle standards. For Option 2, a higher interim in-use conformity factor should be considered while manufacturers gain experience with new technologies and new 3B-MAW protocol. Also mentioned before, if EPA does finalize increases to today's useful life periods, it will need to account for additional uncertainty and variability in the deterioration of engines operated in the field by prescribing additional in-use margins to the off-cycle standards. [EPA-HQ-OAR-2019-0055-1325-A1, p. 13]

Organization: *International Council on Clean Transportation (ICCT)*

The technical concerns expressed by the manufacturers that the proposed standards cannot be met, in part due to a lack of compliance margin, are not warranted as the latest research by SwRI shows that with the remaining lead time the proposed emission standards can be met. [EPA-HQ-OAR-2019-0055-1211-A1, p. 9]

SwRI provides an example of compliance for both the traditional FTP cycle as well as the much-needed LLC, with ample compliance margin for an 800,000-mile useful life. The past manufacturer comments present an incomplete picture of the technical analysis performed by SwRI to evaluate the EPA proposal, specifically at the extended UL requirements. Manufacturers claim that the basis of the current evaluation was the previous research work for ARB's Low NOx omnibus rule, which included the technical package known as "Stage 3" aged to 435k miles. They claim that EPA contracted with SwRI to "perform an aged demonstration with a technical solution very similar to the CARB "Stage 3" technology package. Thus, the SwRI system is the principal basis for the purported feasibility of the 0.02 g/bhp-hr NOx standard". [EPA-HQ-OAR-2019-0055-1211-A1, p. 9]

What the manufacturer comments fail to mention is that aftertreatment aging was extended by SwRI to cover the 800,000 miles for the proposed UL. Moreover, the Stage 3 demonstration is only one potential pathway to meet the standards. European manufacturers are exploring other technology options (e.g., heated catalysts) to meet planned Euro VII standards. [EPA-HQ-OAR-2019-0055-1211-A1, p. 9]

The manufacturers claim that EPA has not demonstrated the technical feasibility of the standards, however, their claims are unfounded. [EPA-HQ-OAR-2019-0055-1211-A1, p. 10]

First, manufacturers claim that the Stage 3 aged-engine NOx emissions results do not demonstrate feasibility across all required certification cycles and extended UL. This is not up to date with the latest information. The latest SwRI update from April 2022 demonstrated composite FTP results of 27 mg/bhp-hr at 600k miles, which demonstrates feasibility for the 2027-2030 proposal with a margin of 23%; and 37 mg/bhp-hr at 800k, which demonstrates feasibility for the MY2031 and beyond with 8% margin.13 [EPA-HQ-OAR-2019-0055-1211-A1, p. 10]

13. Chris Sharpe et al. (2022). An Update on Continuing Progress Towards Heavy-Duty Low NOx and CO2 in 2027 and Beyond. Southwest Research institute. SAE World Congress Experience (April 5-6 2022).

Another consideration that supports the feasibility of the proposed NOx standards is that once the engine begins in-use operation, off-cycle, in-use compliance standards become numerically less stringent than the certification standards. The in-use standards provide extra margin to account for unexpected emission deterioration and engine-to-engine variability, compared to the certification standards. The proposed off-cycle in-use emission standards for non-idle Bins 2 and 3 are two times the certification standards for 2027-30, and 1.5 times the certification standards for 2031+. The 150 mg in-use standard for the 2031 LLC cycle for HHD engines between 435K and 800K miles is particularly generous, when compared to the projected SWRI data indicating less than 50 mg at full useful life (see EPA's Figure 3-17 from the TSD, reproduced above). These generous in-use standards support the feasibility of the proposed standards by reducing in the initial years the compliance risk that engines have higher emissions than anticipated. [EPA-HQ-OAR-2019-0055-1211-A1, p. 9]

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

Most of the agency's laboratory work concentrated on aftertreatment aging rather than full engine aging. As a result, data regarding the impact of engine aging on components such as exhaust gas recirculation, camshafts, fuel injectors, turbochargers, piston rings, sensors, and electronics is lacking. [EPA-HQ-OAR-2019-0055-1322-A1, p. 4]

EPA also requested comment on whether they should finalize interim standards for testing used to verify that the engine meets the standards through its useful life. Unfortunately, significant additional testing is required. Much of SWRI's recent research focused on aftertreatment aging, and therefore was not as focused on full engine aging. As a result, not as much data is available on EGR aging, cam wear, fuel injection holes, turbochargers, oil control rings, etc. In addition, due to the variety and complexities of real-world use, many vocational cycles have very different demands resulting in an unknown statistical performance distribution. Estimating full commercial vehicle impacts based on this limited SWRI testing could be problematic – especially for vocational vehicles. Also, the industry does not have near as much data regarding 2nd and 3rd vehicle owner usage. As a result of these shortcomings, MEMA recommends that EPA include significantly more compliance margin for in-use testing standards. [EPA-HQ-OAR-2019-0055-1322-A1, pp. 6 - 7]

Organization: *National Association of Clean Air Agencies (NACAA)*

NACAA does not support finalizing any interim in-use emission standards. [EPA-HQ-OAR-2019-0055-1232-A1, p. 13]

EPA requests comment on a flexibility to provide manufacturers with higher numeric interim in-use standards for verification testing for heavy HD trucks. In particular, when in-use testing is conducted to verify that an in-use heavy HD truck meets applicable duty cycle or off-cycle emission standards throughout useful life, the vehicle would be held to a much less stringent standard from MY 2027 through MY 2033 (the "interim period"). According to the scenario on which EPA seeks comment, the interim in-use standard could be up to 100 percent of (or double) the actual standard. EPA says the reason for this provision would be to allow manufacturers time to gain experience with the emission control technologies while they are operating in the field. EPA also says that depending on what it observes as part of its engine demonstration study it may consider adopting even more lenient interim in-use standards in the final rule. [EPA-HQ-OAR-2019-0055-1232-A1, p. 13]

Under this scheme, it appears EPA would also forfeit its own authority to verify manufacturer-provided data as even EPA's testing of new Selective Enforcement Audit engines or the manufacturer's certification engine itself could not be held to the regular emissions standard. Beyond the likely emissions consequences of not pursuing corrective action on engines emitting at up to twice the standard, such so-called in-use standards set up a perverse motivation for manufacturers, who would be on notice that their certification submissions effectively could not be audited. This is not theoretical as there is a recent incident of fraudulent certification submissions by a heavy-duty engine manufacturer, resulting in loss of engine customers, truck and construction equipment manufacturing jobs and even permanent plant closure.30,31,32,33 [EPA-HQ-OAR-2019-0055-1232-A1, p. 13]

30 https://wvmetronews.com/2020/12/28/hino-engine-certification-issues-the-reason-for-production-suspension-in-wood-county-through-much-of-2021/

31 https://www.equipmentworld.com/equipment/article/15065118/yanmar-isuzu-to-supply-kobelco-engines-in-the-us

32 https://www.kobelcocm-global.com/news/2022/220225.html

33 https://www.reuters.com/world/asia-pacific/japan-revoke-hinos-engine-certification-over-false-emissions-data-2022-03-18/

EPA should not finalize any interim in-use standards. Such "flexibility" is inappropriate and would weaken the rule's effectiveness in reducing emissions and protecting public health. Gaining experience with emission control technologies should be addressed by manufacturers during product development, not after vehicles are sold. [EPA-HQ-OAR-2019-0055-1232-A1, p. 14]

Organization: *Navistar, Inc. (Navistar)*

In setting higher interim in-use NOx standards in the final rule, EPA should take into account the inherent variability of in-use testing. For example, any factor that deviates from the original test cell environment and reference methods must be assumed to contribute to in service test variability including temperature, humidity, elevation, PEMS measurement allowance, test route, vehicle maintenance history, fuel temperature, and fuel usage history. These are all aspects of the in service fleet specific operation that are largely out of control of the OEM. The addition of the LLC test cycle, while designed to capture low load emissions, relies on engine broadcast load (torque), which does not provide the same level of precision and accuracy as the engine dyno reference method. As a result, we believe that EPA should provide a significant compliance margin initially to account for all of the various new requirements. Manufacturers need sufficient time to develop and validate a robust compliant calibration. Lessons learned from the 2010 emissions standard highlighted weaknesses in both the hardware and software strategy of every OEM. Early examples of SCR-equipped trucks experienced a range of technical issues as fleets and OEMs struggled to adapt to the new technology. By 2013, the design shortcomings were resolved and fleets learned how to operate and maintain the trucks properly. We believe that a similar or longer transition period, 3-5 years, may be necessary, given the simultaneous change in the standard, technology, testing, and customer acceptance. [EPA-HQ-OAR-2019-0055-1318-A1, p. 4]

Organization: *Northeast States for Coordinated Air Use Management (NESCAUM)*

Should EPA instead promulgate Option 1, we urge the Agency to make the following changes to the proposed standards: EPA is considering finalizing higher temporary in-use standards for all the proposed duty cycle and off-cycle heavy-duty engines and requests comment on whether the Agency should consider including in the final rule interim in-use standards to account for potential variabilities in performance during the early years of implementing new technology. Tables IV-16 and IV-17 of the preamble list potential low-end and high-end ranges for the proposed in-use standards. NESCAUM requests that EPA not finalize the proposed interim in-use standards, or if interim standards are finalized, that they be significantly more stringent than the ones proposed. With regard to the proposed low load interim in-use standards, test data show that NOx emissions of 0.036 to 0.053 g/bhp-hr on the CARB low load cycle are technically feasible. Manufacturers will have five years to prepare for commercial application of technologies to reduce low load emissions and finalizing NOx emissions standards in-use between 0.07 to 0.20 g/bhp-hr (70 mg/bhp-hr to 200 mg/bhp-hr) would substantially weaken the low load emissions requirements. Similarly, the FTP, SET, and idle interim in-use standards EPA is considering are significantly higher than what has already been demonstrated at intermediate and full useful life.[EPA-HQ-OAR-2019-0055-1249-A1, p. 14]

Organization: *Ozone Transport Commission (OTC) and Mid-Atlantic/Northeast Visibility Union (MANE-VU)*

Interim In-Use Standards: EPA is considering finalizing higher temporary in-use standards for all the proposed duty cycle and off-cycle heavy-duty engines and requested comment on whether the Agency should consider including in the final rule interim in-use standards to account for potential variabilities in performance during the early years of implementing new technology. Tables IV-16 and IV-17 of the preamble list potential low-end and high-end ranges for the potential in-use standards. OTC requests that EPA not finalize the proposed interim in-use standards, or if interim standards are finalized, that they be significantly more stringent than the ones proposed. With regard to the low load interim in-use standards proposed, test data show that NOx emissions of 0.036 to 0.053 g/bhp-hr on the CARB low load cycle are technically feasible. [EPA-HQ-OAR-2019-0055-1250-A1, p.15]

Manufacturers will have five years to prepare for commercial application of technologies to reduce low load emissions. Therefore, finalizing in-use NOx emissions standards between 0.07 to 0.20 g/bhp-hr (70 mg/bhp-hr to 200 mg/bhp-hr) would substantially weaken the low load emissions requirements. Similarly, the FTP, SET, and idle interim in-use standards EPA is considering are significantly higher than what has already been demonstrated at intermediate and full useful life. [EPA-HQ-OAR-2019-0055-1250-A1, p.15]

Organization: *PACCAR, Inc (PACCAR)*

In particular, PACCAR agrees with the following aspects of EMA's comments: A nationwide program centered around Option 2-like requirements, and including higher interim in-use standards, would be more cost-effective, and would reduce the prospects for further delaying fleet turnover or creating disruptive pre-buy/no-buy responses from the market. [EPA-HQ-OAR-2019-0055-1346-A1, p.2]

Organization: *States of California, et al. (The States)*

The States further recommend that EPA not adopt certain compliance flexibilities in the Proposed Rule, to the extent such flexibilities undermine the emission benefits of Option 1. Most notably, EPA should not adopt the proposed interim "in-use" standards—which are based on emissions from vehicles in operation – that are significantly less stringent than the certification standards that new engines must meet. [EPA-HQ-OAR-2019-0055-1255-A1, p. 3]

EPA should not adopt interim in-use emission standards less stringent than the standards to which manufacturers certify new engines. These proposed interim in-use standards permit 1.4 to 2 times more NOx emissions than the standards to which engines are certified under Option 1,72 effectively turning Option 1 standards into Option 2 standards immediately after certification. As EPA recognizes, this proposal departs from EPA's typical practice, which is to "set[] the same standards for certification testing and in-use testing."73 The industry concerns that EPA cites in support of this departure—"to give manufacturers time to gain experience with the new technology needed to meet the standards and [to] reflect uncertainties about potential variabilities in performance during the early years of implementing new technology"—do not justify such a dramatic relaxation of emission standards vital to protecting the health and welfare of our residents.74 The selective catalytic reduction (SCR) technologies at the heart of the NOx standards are not novel, but are refined technologies that have been used in the heavy-duty sector for more than a decade.75 Moreover, because CARB's Omnibus Rule takes effect three years in advance of model year 2027, the heavy-duty sector will have the benefit of several years of research, development, experimentation, and troubleshooting to ensure engines perform as expected.76 [EPA-HQ-OAR-2019-0055-1255-A1, pp. 17 - 18]

72. Id. at 17,564.

73. Id. at 17,563.

74. Id.

75. Id. at 17,432. See also Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements, 66 Fed. Reg. 5002, 5053 (Jan. 18, 2001) (discussing initial development of SCR technologies for NOx control within the heavy-duty fleet).

76. 87 Fed. Reg. at 14,434.

Furthermore, manufacturers already may protect against "uncertainties about potential variabilities in performance" of this technology through other strategies EPA acknowledges or proposes as flexibilities: most importantly, through (1) compliance margins built into engines by manufacturers; (2) the generous scaling factors and measurement allowances EPA builds into the proposed off-cycle standards; and (3) the use of NOx credits.77 Each of these measures is intended to or can be used to address unexpected performance deficiencies or similar discrepancies between certification standards and real-world performance. Thus, for example, if a manufacturer is concerned that its engines' aftertreatment components will deteriorate over time, and it cannot or chooses not to design its engines with an extra margin, the manufacturer can generate and bank credits in the lead-up to model year 2027 (for example, by introducing HD ZEV models into its fleet) to ensure it remains compliant. [EPA-HQ-OAR-2019-0055-1255-A1, p. 18]

77. Id. at 14,467, 14,469 (describing manufacturer-included margins for deterioration); id. at 17,474 (proposing off-cycle standards 1.5 to 2 times the certification standards and 10 percent allowance for measurement error); id. at 17,553 (discussing five-year credit life to "cover the transition to more stringent standards").

But the proposed interim in-use standards as proposed create a perverse incentive to manufacturers to design their engines to those looser in-use standards, as long as they can pass the certification tests initially. EPA and the States have too much enforcement experience with defeat devices to pretend this incentive will be universally resisted.78 Even a manufacturer not intending to defeat the standards will face cost incentives to use lower-quality components in aftertreatment systems that may degrade shortly after certification, with the same effect of noncompliance.79 In short, this proposal is likely to increase emissions well beyond Option 1 standards in practice. Therefore, EPA should reject this portion of the proposal and design its NOx standards to incentivize against engine component degradation and merely temporary compliance. [EPA-HQ-OAR-2019-0055-1255-A1, pp. 18 - 19]

78. See, e.g., Notices of Filing of Consent Decrees Under the Clean Air Act, 63 Fed. Reg. 59,330-34 (Nov. 3, 1998) (describing consent decrees against Caterpillar, Inc., Cummins Engine Co., Detroit Diesel Corp., Mack Trucks, Inc., Renault Vehicules Industriels, Navistar International Corp., and Volvo Truck Corp. to resolve enforcement actions by USDOJ and CARB over emission-control defeat devices installed by these companies in their heavy-duty diesel engines, which resulted in poorer performance of the engines' NOx control systems in use than in certification testing).

79. Cf. U.S. EPA, "EPA Announces Largest Voluntary Recall of Medium- and Heavy-Duty Trucks" (July 31, 2008) (describing 2018 recall of 500,000 model year 2010-2015 medium- and heavy-duty trucks due to SCR system components that degraded within a few years of operation), EPA-HQ-OAR-2019-0055-0146.

Organization: *Truck and Engine Manufacturers Association (EMA)*

In order to ensure the adoption of fully achievable and cost-effective HDOH low-NOx regulations, and notwithstanding our broader agreement, the Agency should revise the proposed standards in the following manner:

> (vii) As the Agency suggests in the NPRM, the final rule should include higher interim NOx standards for a sufficient number of years to allow manufacturers to gain in-field experience with the additional emission-control technologies that will be required, and to gather real-world data to assess how those systems perform and age under real world operating conditions out to the extended useful life periods. In that regard, higher interim NOx standards to facilitate the implementation of the new stringent low-NOx requirements (including, for example, through higher interim in-use multipliers) are distinct from the type of two-step progressively more stringent standards that EPA has included in Option 1. Those types of two-step emission standards raise fundamental feasibility and resource-constraint issues for manufacturers, including due to the potential need for additional engine hardware and software to comply with the second step, and ultimately would overlap and conflict with the Phase 3 GHG standards that EPA is beginning to develop. [EPA-HQ-OAR-2019-0055-1203-A1, p. 7]

Thus, and as detailed further below, EMA strongly agrees that the Agency should include in the final rule "interim in-use standards to account for uncertainties about potential variabilities in performance during the early years of implementing new technology." (87 FR at p. 17564.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 14]

As mentioned earlier in these comments, EPA and engine manufacturers need time to become familiar with the completely overhauled in-use test protocol and measurement processes, the capabilities and weaknesses of the ultra-low NOx emissions technology packages of the future, the impacts of a diverse and evolving market fuel-mix over newly-extended useful life requirements, and the numerous other factors that drive the uncertainty all stakeholders are faced with during the course of this rulemaking. Applying a conformity factor of 2.0 for the first 7 years following the effective date of these new standards will provide that prove-out time wihout undue risks of noncompliance. This aspect of EMA's proposal is addressed directly in Section 9 of these comments. Failing to provide adequately for a higher inteirm standard would unjustifiably and unnecessarily put engine manufacturers at risk of managing products in the field that were in a state of perpetual recall, simply because the requisite data was not available to set standards in line with the realistic capability of the available technology. [EPA-HQ-OAR-2019-0055-1203-A1, p. 81]

For all of the reasons discussed above, higher interim in-use standards for NOx (i.e., using a 2x conformity factor as opposed to a 1.5x conformity factor) are warranted for the first several model years after the new low-NOx standards take effect in MY 2027. EPA has implicitly conceded as much in "soliciting comment on providing engine manufacturers with higher (numerical) standards for an interim period to gain experience with the additional emissions control technologies needed to meet the proposed Heavy HDE standards (and their rates of deterioration) while those technologies are operating in the field." (87 FR at p. 17563.) EPA further explains the clear justification for higher interim standards, as follows: Manufacturers could use the interim period to collect data from field-aged engines in a range of applications to inform how the engines can be designed to meet the standards throughout useful life for all applications in which the engine is used. In setting the duration of an interim period, we would consider how long it would take manufacturers to collect field data from engines operating out to the full useful life mileage ultimately finalized in this rule. (Id.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 104]

EMA fully agrees with the Agency's assessment of the need for higher interim in-use NOx standards. The known and unknown risks of early model-year product non-compliance are too great without a reasonable phase-in of the final in-use low-NOx standards to allow for a robust assessment of how the new Stage 3-type systems will age and perform out to the new extended UL and warranty periods. To address those risks, EMA recommends setting the interim in-use NOx standards by applying a 2x in-use conformity factor for the first seven model years following the implementation of the new low-NOx standards (i.e., through and including MY 2033). Thereafter, the in-use conformity factor could drop to 1.5. [EPA-HQ-OAR-2019-0055-1203-A1, p. 104]

EPA maintains a publicly available database containing information and test results that manufacturers submit with their annual applications for Certificates of Conformity, a prerequisite to offering engine products for sale in the U.S. Among the data included in those databases are the manufacturers' emissions test results recorded on the engines for which EPA approvals are sought. "Deteriorated" emissions test results (actual test results modified to include emissions deterioration factors) were compared to the underlying standard (or Family Emissions Limit ("FEL") in cases where the manufacturer chose to certify the engine family to a level different from the applicable standard as permitted under credit "averaging, banking and trading" programs). The compliance margin that manufacturers are building-in can be readily determined from this analysis. EMA scanned all relevant data from a single model year for each of the previous four NOx emission reduction steps to calculate the average compliance margin in each case.8 The single model year was specifically selected to represent a "mature" view of the compliance margin to which manufacturers had "settled in" (that is, after compliant engines had been in production for a number of model years). The average FTP transient test margins are presented below in absolute and percent-of-standard terms: [EPA-HQ-OAR-2019-0055-1203-A1, p. 27]

Source	**Model Year**	**No. of Families**	**Standard (g/bhp-hr)**	**Margin (g/bhp-hr)**	**% Margin**
EPA database	2001	45	4.0	0.27	6.5%
EPA database	2006	52	2.5	0.17	6.9%
EPA database	2009	31	1.2	0.12	10.0%
EPA database	2021	26	0.20	0.074	37.1%

8. Certification test results from all heavy-duty diesel on-highway engine families included in the EPA database as manufactured by major manufacturers Cummins, DDC/Daimler, Volvo, Navistar, PACCAR, Hino and Isuzu were used (smaller

manufacturer submissions were excluded). For consistency, and to maintain a view of margin's relationship to the relevant standard, engine families were excluded if they were certified to an FEL less than or greater than 15% of the applicable NOx (or NOx + NMHC) standard. For the NOx "phase-in" period from 2007-2009 the relevant NOx standard was assumed to be the "equally-split family" FEL of 1.2 g/bhp-hr.

It is readily apparent that there has been a decreasing trend in the absolute (g/bhp-hr) margin (NOx standard minus deteriorated certification result) as NOx standards have decreased. That is, of course, necessary – the average margin of 0.27 g/bhphr for the US98 standard would be fundamentally unworkable with a US10 standard of 0.20 g/bhp-hr. More significantly, when examined as a percent of standard, the trend reveals a steadily increasing margin (orange line in graphic above) as NOx standards decrease (from right to left), with the most significant increase associated with the current US10 standard.9 The reason for this trend is simple – the level of variability in production diesel engine emissions control, and long-term degradation, has not decreased linearly with the NOx emissions standards themselves. Thus, the percentage of the standard reflected in those margins has gone up. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 27 - 28]

9. A similar examination shows steady-state cycle (or Ramped Modal Cycle) average US10 certification margins to have increased to 70% of the NOx standard.

This should, in fact, be expected. Today's aftertreatment-based emissions control systems are far more complex than the systems deployed to comply with US98 and US04, and therefore more sensitive to ambient and other external influences, as well as sensor inaccuracies and the expected range of production variability. Furthermore, tailpipe NOx emissions are very sensitive to SCR efficiency, and therefore the "high end" of long-term SCR degradation from fuel impurities, including metals in biofuel blends, or even severe service applications, can compromise NOx control to a significant degree. Additionally, more fundamental factors that influence margin requirements, such as laboratory or field emissions measurement system accuracy, have not improved at levels proportional to the reductions of the underlying standards over the years. All of those factors, and more, have required diesel engine manufacturers to increase the requisite margin relative to the standard to ensure robust post-production compliance. [EPA-HQ-OAR-2019-0055-1203-A1, p. 28]

Further evidence that manufacturers depend on significant compliance margins comes from the fact that, despite the current on-average 37% margins, not a single HD diesel engine manufacturer had certified an engine family to a level below the current 0.20 g/bhp-hr standard until a single manufacturer did so with MY 2022. Certifying engine families to an FEL below the standard would allow a manufacturer to earn emissions credits, which would be extremely valuable as part of a product development plan to transition toward future low-NOx standards. Yet even so, and after more than a decade of experience with the current US10 standards, and despite manufacturers' knowledge that a 75%-90% reduction in the NOx standard is being targeted (making credits that much more valuable), not a single HD highway diesel engine manufacturer had taken the risk to certify products with an FEL less than the current 0.20 g/bhp-hr standard through model year 2021. As noted, one manufacturer has recently submitted model year 2022 applications for FEL-generating families in California, but even in that case, the manufacturer's deteriorated certification test results are much less than 50% of the FEL, yielding a margin greater than 50%. This pervasive reluctance to certify with an FEL below the current 0.20 g/bhp-hr NOx standard, except in cases where unusually high margins can be provided for, highlights how essential significant compliance margins have become to ensure robust real-world emissions compliance. [EPA-HQ-OAR-2019-0055-1203-A1, p. 28]

EPA's failure to consider or provide for the necessary emissions-compliance margins is one of the key factors that establishes the fundamental infeasibility of Option 1. It also is a key factor in the assessment of how the Option 2 proposal will need to be modified. Indeed, without having conducted a careful examination of how the relevant real-world factors will contribute to the necessary margin requirements associated the proposed low-NOx standards, it is clear that EPA's assertions of technical feasibility are deficient and, at best, premature. [EPA-HQ-OAR-2019-0055-1203-A1, p. 28]

In quantifying this issue, the percent of margin is clearly a more compelling metric than the absolute margin. If we return to the graph of progressively increasing emissions margins, the shape of the orange curve indicates that it could be instructive to plot average manufacturer margin on a logarithmic scale. If we do so, and extrapolate the US04-to-US10 trend in a straight-line manner to a proposed 0.020 g/bhp-hr standard, the percent of margin required by this method would be just over 70%, which translates to an absolute margin of 0.014 g/bhp-hr, as depicted below: [EPA-HQ-OAR-2019-0055-1203-A1, pp. 28 - 29]

Including these calculated margin requirements on the original linear-scaled graph yields the following graphic: [EPA-HQ-OAR-2019-0055-1203-A1, p. 29]

The dramatic bend in the absolute margin curve (in blue) is very concerning. EPA's inherent assumption that less margin is needed than the calculated 0.014 g/bhp-hr shown, would only sharpen the bend in the curve, and be even more concerning. The bottom line is that assuming the percentage trends in margin requirements continue to hold – and there is no reason to assume otherwise – in order to meet an Option 1 0.020 g/bhp-hr NOx standard in a manner that could reasonably assure post-production compliance, diesel engine manufacturers would need to target an "as-designed" emissions performance level at or below 0.006 g/bhp-hr. There is no evidence – none – that such a zero-equivalent NOx level is feasible. Indeed, if one considers the trends in absolute margins, manufacturers would need to target negative emissions from their engines, which is, of course, irrational and impossible. Again, the relevant data demonstrate that Option 1 is not feasible and should be abandoned. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 29 - 30]

While EMA concedes that this extrapolation exercise does not provide a complete technical basis for understanding margin requirements in an era of ultra-low HDOH NOx standards, it is nonetheless worthy of consideration. All diesel engine manufacturers will have to determine the level of margin required to comply with future emissions standards based on the capabilities of their emissions control systems. EPA should not gloss over or ignore the significance of this point. Compliance margin is a factor that the regulators – not just manufacturers – should account for in assessing feasibility. Accordingly, EPA simply should not finalize this rulemaking until this issue has been fully and fairly accounted for. [EPA-HQ-OAR-2019-0055-1203-A1, p. 30]

EMA has started to examine in more detail the influence of individual external variables on the stability of tailpipe NOx emissions control. EMA's approach is to combine in a statistical manner the factors that can increase tailpipe NOx variability, while also including those factors that drive a mean offset to tailpipe emissions, in an attempt to calculate how much additional improvement manufacturers will have to achieve relative to the demonstrated performance of the Stage 3 RW solution. The analysis seeks to take into account all those factors for which diesel engine manufacturers will be held accountable for emissions compliance, but that so far have not been considered as part of the Stage 3 RW (or CARB Stage 3) testing to demonstrate "technical feasibility." [EPA-HQ-OAR-2019-0055-1203-A1, p. 30]

Recall that the Stage 3 RW achieved a 0.022 g/bhp-hr tailpipe FTP NOx emissions result at 435,000 miles. (Indeed, the CARB Stage 3 engine generated an FTP result of 0.031 g/bhp-hr at just 290,000 miles equivalent aging (purportedly to justify a 0.020 g/bhp-hr NOx standard), before the engine was recalibrated mid-testing to reduce the tailpipe NOx to 0.023 g/bhp-hr at the expense of an almost 1% CO2 emissions penalty.) EMA has identified multiple factors, not yet considered by EPA, that would increase that demonstrated result by varying amounts. In light of those multiple factors, it is obvious that manufacturers would be left to improve upon the Stage 3 demonstrated result, first to eliminate the 0.002 g/bhp-hr exceedance as measured by SwRI, and second to overcome the multiple real-world emissions-aggravating factors. [EPA-HQ-OAR-2019-0055-1203-A1, p. 30]

The mathematical method applied in this "margin-stackup" analysis is straightforward and typical of multiple variability-source analyses: [EPA-HQ-OAR-2019-0055-1203-A1, p. 30]

The various external sources of emissions-increasing variability and mean offset that EMA has identified have been captured in a spreadsheet set up to calculate the combined effects, as follows: [EPA-HQ-OAR-2019-0055-1203-A1, p. 31]

			Estimated Tailpipe NOx impact g/bhp-hr	
Applies to Dyno	Applies In-Use	Variation/offset driving margin requirement	mean offset	std dev σ_i
		Custom calibration (e.g. SwRI demo project)	reference	
X	X	Nominal result in production	0.0020	
X	X	Production variability		0.0060
	X	Packaging limitations (long exhaust piping to LOSCR)	0.0020	
	X	Without aftertreatment preconditioning	0.0039	
X	X	Sulfur + soot accumulation (N_2O make)	0.0030	
X	X	Ash Accumulation	0.0010	
X	X	Maintenance practices		0
	X	Cold ambient operation	0.0023	
	X	Operation at altitude	0	
X	X	Severe-service duty-cycles	0	
	X	Fuel Quality, DEF quality (short term emissions effects)	0.0020	
X	X	Field deterioration (metals in bio-fuels, etc.)		0.0050
X	X	Lab measurement variability		0.0060
	X	PEMS measurement variability rel to Lab (CARB only)		0.0000
		TOTAL MARGIN REQUIREMENT, DYNO	σ =	0.016
			2σ =	0.026
		TOTAL MARGIN REQUIREMENT, IN-USE	σ =	0.026
			2σ =	0.036

Margin of σ: Protects that 84% of population are below demo reference
Margin of 2σ: Protects that 97.7% of population are below demo reference

The analysis above is a snapshot of work in progress. EMA is striving to identify the most relevant available sources of data to inform the data entries for each line item, and, to that end, we have pulled data from a variety of available sources. Several factors have been “scaled” linearly from reference levels to be reflective of the proposed new low-NOx standards, which is unduly conservative for many of the reasons discussed earlier. For example, lab-to-lab NOx measurement variability does not conveniently decrease by 90% just because the standard (and actual NOx level) is reduced by 90%. A rigorous “round robin” measurement variability test program in which EPA participated demonstrates this point clearly. As depicted below, the coefficient of variability increased as the average measured NOx value decreased: [EPA-HQ-OAR-2019-0055-1203-A1, p. 32]

To give another example of how available data were used to populate the margin stack-up table, consider the item identified in the table as “Fuel quality, DEF quality.” For that element of the necessary variability allowance, EMA acquired information from an OEM reporting a 0.007 g/bhp-hr increase in NOx from a US10-compliant engine fueled with B20 when tested over certification cycles, compared to operation with certification-spec fuel. When those results are scaled down conservatively to the proposed NOx standard of 0.020 g/bhp-hr, the resultant fuel impact increase is 0.0014 g/bhp-hr. A second relevant data source is a 2021 CARB study where the impact of a 35% biofuel blend was assessed on “new technology diesel engines” (“NTDE”).10 In that study, NOx emissions increased over the FTP on a 2019 Cummins HDOH engine, and over the NRTC on a 2018 NTDE non-road Caterpillar engine. The (again, conservatively) scaled-down results from those tests would forecast a fuel-impact increase in NOx emissions of 0.0090 to 0.0178 g/bhp-hr from operation on biofuel. Several stakeholders have expressed concerns regarding the validity of the CARB study. Accordingly, in the margin stack-up table above, EMA has relied mainly on the much lower reported NOx increase from the OEM's fuel-impacts testing. In reality, however, we have no basis to assume the results would scale with the absolute tailpipe emissions, but EMA conservatively makes this preliminary estimate in the absence of other data. [EPA-HQ-OAR-2019-0055-1203-A1, p. 32]

> 10. CARB Low Emission Diesel Study (LED): Low Emission Diesel (LED) Study: Biodiesel and Renewable Diesel Emissions in Legacy and New Technology Diesel Engines - Final Report (ca.gov)

Based on all of this information, and without yet evaluating the NOx increases that may result from off-spec DEF, EMA included only a 0.0020 g/bhp-hr impact in the margin stack-up table. Importantly, the Coordinating Research Council will be evaluating the influences of several fuel formulations, including renewable fuels and biofuels, on tailpipe NOx emissions. That study, to be performed by SwRI on the EPA Stage 3 engine, should be completed by mid-year, and will be directly relevant to the margin analysis at issue. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 32 - 33]

Some factors in the stack-up analysis are more relevant to measurements in a test cell, while others are more relevant to field measurements — or "in-commerce" increments — using portable emissions measurement systems, or "PEMS". For example, cold ambient operation will impact tailpipe NOx emissions in the field, but will not be an issue impacting engine dyno tests in a lab. Several factors can play a role in both dyno-testing and in-use compliance testing. The spreadsheet is setup so that only those factors for which an "x" is entered in the appropriate columns to the left of the chart are included in the corresponding calculated results at the bottom of the chart. [EPA-HQ-OAR-2019-0055-1203-A1, p. 33]

One important aspect of this margin stack-up analysis relates to the first line item in the table, labeled "Custom calibration." This is considered the "starting point" or reference for the analysis, because the work attempts to determine how much better OEM products must be compared with the SwRI Stage 3 RW demonstration to ensure robust compliance in the field. In this case, it is important to recognize that the Stage 3 RW engine was calibrated for optimized emissions control on a single test article. If 1000 production engines were built from the same specifications and using the same controls and calibrations, we should expect the average emissions performance of those 1000 engines to be somewhat higher than the custom-calibrated engine. (Any one of those 1000 engines could then be "custom calibrated" to improve its emissions control, but such a process would not be practical for a production environment.) In the spreadsheet, this delta between the custom-calibrated result and the production average result (not to be confused with production variability), was estimated at 0.002 g/bhp-hr in the line item, "nominal result in production." [EPA-HQ-OAR-2019-0055-1203-A1, p. 33]

Another probable increase to tailpipe NOx emissions that has not yet been included in EMA's margin analysis stems from the fact that the SwRI Stage 3 engine is set up for a 500 HP rating.

That is a rating that would normally be among the higher power ratings within an engine family for an engine the size of the Stage 3 prototype. Lower horsepower ratings would, in general, produce less thermal energy over the certification (and road) cycles, which would trend toward reduced NOx conversion efficiencies from the SCR. A 400 HP rating, for example, would not be atypical for a manufacturer to provide for a Stage 3-like engine, and would likely have higher brake-specific tailpipe NOx emissions. Data showing this effect has been shared with EPA. That emissions-increasing variable is not included in EMA's margin stack-up. Nonetheless, the Agency will need to consider this point when setting the final standards, including sufficient variability allowances, relative to the emissions performance that the Stage 3 demonstration engine was able (and unable) to achieve. [EPA-HQ-OAR-2019-0055-1203-A1, p. 33]

To further illustrate the sensitivity of modern diesel engines and their emissions control systems to minor variability influences, one manufacturer conducted a Monte Carlo analysis to assess the influence of small perturbations in NOx, or NOx control variables on composite FTP results. The analysis involved simulating an array of small NOx concentration perturbations according to the uppermost graph below, coupled with minor exhaust flow measurement error sources. The range of influence to composite FTP results is shown in the graph at right. [EPA-HQ-OAR-2019-0055-1203-A1, p. 33]

This additional Monte Carlo analysis emphasizes the extreme sensitivity of tailpipe NOx emissions to small sources of variability, especially at low absolute tailpipe NOx levels. This is the concern that lies at the heart of the margin stack-up analysis, and the fundamental feasibility issues that necessarily stem from it. [EPA-HQ-OAR-2019-0055-1203-A1, p. 34]

Returning to the margin stack-up analysis, some have questioned the validity of combining several of these factors to quantify the impact on the real emissions development targets that manufacturers must establish, claiming it is unrealistic to expect all of them to occur in combination. The simple fact, however, is that as long as EPA expects manufacturers to design their products to ensure full in-use emissions compliance for all production engines and vehicles without allowing any special procedures to precondition aftertreatment systems — including under conditions just before regenerations are triggered, up to the point of the prescribed DPF ash cleaning maintenance, without regard to marginal maintenance practices, in cold ambient conditions and at high altitudes, regardless of the vehicle's application, and while operating on a wide range of market fuels (EPA's proposal would require compliance with "any commercially available biodiesel fuel blend that meets the specifications for ASTM D975 or ASTM D7467") – – then the combined effect of all of those emissions-impacting factors must be taken into account when establishing the tailpipe NOx design targets that define the requisite compliance margin. In other words, EPA must account for all of those factors when assessing what are and are not achievable standards, just as manufacturers are compelled to do. [EPA-HQ-OAR-2019-0055-1203-A1, p. 34]

Again, this "margin stack-up" analysis remains a work in progress, but the initial results are nonetheless quite striking and concerning. This evaluation, using conservative values in many cases by applying a linear scaling assumption to the proposed low-NOx standard levels, indicates that OEM products must perform 0.016 g/bhp-hr better than the Stage 3 RW engine if protecting for a 1σ compliance level (84% of production engines compliant), and 0.026 g/bhp-hr better if protecting for a 2σ compliance level (97.7% of production engine compliant). There is a clear irrationality from these results when assessed against a 0.020 g/bhp-hr standard. More specifically, the proposed standards are shown to be fundamentally infeasible, since the requisite compliance margin is larger than the standards. (Note that the analysis as shown does not account for the 0.002 g/bhp-hr by which the Stage 3 RW engine exceeded the proposed 0.020 g/bhp-hr proposed FTP transient standard, an exceedance that manufacturers will also have to make up for through improved designs.) [EPA-HQ-OAR-2019-0055-1203-A1, pp. 34 - 35]

Without making allowance for the various factors that contribute to manufacturers' necessary compliance margin requirements, EPA would be setting OEMs up for certain failure. The graph below shows the difference, in terms of NOx emissions distribution for a family population, between what manufacturers may be able to accomplish in a Stage 3 demonstration like laboratory setting (after the still-needed improvements to Stage 3 performance), and how that same engine family could perform in the field. The non-compliant zone in shaded grey, in essence, amounts to a "perpetual recall zone." In that zone, manufacturers would face a continuing series of recall actions, for which there would be no available improved technical solution to resolve the recall. Likely, the only available response from manufacturers would be to recover some level of NOx control by replacing the aftertreatment systems, which would mean that EPA would have failed to achieve one of the goals it set in this rulemaking. Alternatively, if the replacement of aftertreatment systems proved too costly or impractical, the remaining options for OEMs faced with Option 1-like standards would be perpetual recall, or exiting the market. [EPA-HQ-OAR-2019-0055-1203-A1, p. 35]

One way for EPA to account for the emission variabilities that inevitably result from real world operations, as detailed in the margin stack-up above, is to provide for a "variability allowance" that would be applied when assessing in-use emissions compliance of engines in (or from) the field. The variability allowance would be established based on best-available data, akin to that summarized in EMA's margin stack-up, and would be applied as an additive compliance margin during in-use testing, or when in-commerce engines pulled from a vehicle are dyno-tested over the certification cycles. Such an approach would avoid unfair and unwarranted compliance issues for OEMs stemming from variabilities well outside their control, while preserving the integrity of the Option 2-like standards that could be justified based on EPA's limited, and partially unsuccessful, feasibility demonstration. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 35 - 36]

Organization: *Volvo Group*

In response to the following EPA request, the Volvo Group establishes internal Compliance Margins at a fraction of the standard to account for issues such as production variability, maintenance, severe duty cycles, Fuel Quality, DEF quality, and measurement variability. At some level, the variability can exceed the standard itself. This approach is in alignment with the following EPA comment. "We understand that manufacturers generally aim to design and build vehicles not only with a sufficient margin to ensure the emissions control technology is meeting the applicable standards throughout the full useful life, but also an additional margin to reflect the fact that not every vehicle manufactured and every vehicle application will perform identically to the laboratory tests." (87 FR at p. 17564) [EPA-HQ-OAR-2019-0055-1324-A1, p. 7]

In conclusion, the Volvo Group believes the following principles must be reflected in the final regulation: a tailpipe NOx reduction which reasonably addresses in-use performance and expanded useful life requirements so fleets can have confidence in new technology and eschew purchase delays which could lead to devastating layoffs of our production workforce. [EPA-HQ-OAR-2019-0055-1324-A1, p. 10]

EPA Summary and Response

Summary:

In their comments CARB opposes interim in-use standards that would allow temporary numerically higher in-use standards. CARB states that other program elements will help reduce perceived uncertainty regarding deterioration of emissions control technologies, and additional information would be available to manufacturers due to the California Omnibus regulation's application in 2024. CARB states that, thus, there is a limited degree of uncertainty regarding deterioration of emissions control technologies, and no rationale for allowing higher interim standards. CARB further states that the increased temporary allowances would substantially increase allowable emissions, making it difficult for California and other states with air quality issues to meet their air quality goals. CARB suggests, as an alternative, that EPA consider early reduction credits to provide relief for manufacturers who believe they need additional compliance margin to meet MY 2027 and later standards. CARB states that EPA's inventory modeling didn't include the impacts of the interim in-use standard. CARB states that manufacturers will generate significant NO_x credits for engines that they build to meet the Omnibus MY 2024 standards.

With regard to general comments on higher in-use standards, CATF is concerned about additional allowances for deterioration. CATF states that these allowances double-count anticipated decreases in effectiveness and are not necessary because EPA's standards already incorporate a margin for deterioration. CATF states that including the interim in-use standard allows manufactures to design engines to less stringent limits and avoid the cost of more durable components. CATF states that, in addition, existing credit and averaging provisions, as well as scaling and measurement allowances, already address emission uncertainties. Finally, CATF indicates that Option 1 can be met without an additional allowance for deterioration.

Likewise, in their comments, NACAA states that the interim in-use standards are inappropriate and would weaken the rule, and thus should not be finalized. Also, in their comments, OTC/MANE-VU state that the interim standards should not be finalized, or if they are, they should be more stringent than the one proposed.

In their comments, EMA, Cummins, PACCAR, Volvo and Navistar supports higher interim in-use NOx standards in the final rule. These commenters state that manufacturers need time to develop a robust compliant calibration, given the inherent variability of in-use testing. Navistar comments that implementing the 2010 emissions standard highlighted weaknesses in both the hardware and software strategy of every OEM which required time to resolve. Navistar comments that the higher standards are needed for 3-5 years, while EMA states that higher standards should be in place for a sufficient number of years to allow manufacturers to gain in-field experience with the new technology. Navistar supports higher in-use standards to provide margin for temperature, humidity, elevation, PEMS measurement allowance, test route, vehicle maintenance history, fuel temperature, and fuel usage history. Cummins requests the higher standards be considered while manufacturers gain experience with new technologies and new 3B-MAW protocol. MEMA commented that much of SWRI's recent research focused on aftertreatment aging, and therefore was not as focused on full engine aging and not as much data is available on EGR aging, cam wear, fuel injection holes, turbochargers, oil control rings, etc.

EMA cites historic engine emission certification values to show that as the NOx standards have decreased over time, the compliance margin manufacturers have been certifying to have increased as a percentage of the standard. They use this, and the fact that up until MY 2022 no manufacturer has certified with an FEL below the 2010 NOx emission limit, to state that EPA has not considered or provided adequate compliance margin for the proposed Option 1.
After considering the comments and supporting information submitted, historical approaches by EPA to compliance margin in previous heavy-duty criteria pollutant standards rules, the implementation date of MY 2027, and the data collected from the EPA Stage 3 engine and other available data, as further explained in preamble Section III, EPA is finalizing an interim in-use testing allowance for compression ignition Medium and Heavy HDEs. In the preamble for the NPRM, we requested comment on if EPA should finalize higher in-use standards for Heavy HDE and other engine classes (i.e. Light and Medium HDE). Under the final rule, for any in-use testing of Medium and Heavy HDEs a 15 mg/hp-hr compliance allowance is added to the applicable standard, in consideration of the other sources of variability and deterioration of the aftertreatment that can occur once the engine enters the real world. The numeric values for the final emission standards and interim in-use testing allowance, along with how the standards and testing allowance were set, are discussed in Section III of preamble. As explained in Section III of the preamble, we are setting the standards at the level which reflects the greatest degree of emission reduction achievable that we have determined to be feasible starting in MY 2027, giving appropriate consideration to cost and other statutory factors. As discussed in Section III of the preamble, as more data becomes available in the future, we may propose a sunset date for the interim in-use testing allowance in a future rule.

Response:

With regards to comments from Navistar and Cummins on setting higher in-use standards with more margin, as discussed in preamble Section III, we are finalizing standards and test procedures that account for the factors listed. In addition, as detailed in preamble Section III, we are finalizing NOx standards as a function of ambient temperature, and we note that there is an existing NOx humidity correction to address humidity concerns, that an elevation exclusion is included in this final action in 40 CFR 1036.530, and that under the qualification criteria for the HDIUT program engines are required to be well maintained.

We disagree with comments that finalizing the interim in-use testing allowance is inappropriate and will incentivize manufacturers to develop engines that will be less durable. As explained in preamble Section III, in setting the final NO_x emission standards, EPA appropriately assessed the statutory factors specified in CAA section 202(a)(3)(A). As part of that assessment, we determined the numeric levels that are technically feasible starting in MY 2027 and included consideration of compliance margin in that assessment. Given the very long useful life mileages for Heavy HDE and greater amounts of certain aging mechanisms over the long useful life periods of Medium HDE, we determined that an interim in-use testing allowance approach was appropriate for the Medium HDE and Heavy HDE NO_x standards. The final emission standards and demonstration requirements at certification provide assurance at the time of certification that the engines will meet the standards through useful life. We also note that, as discussed further in Section III.B, for Heavy HDE we are also requiring the durability demonstration to show that the emission control system hardware is designed to comply with the NO_X standards out to 750,000 miles, as this demonstration in a controlled laboratory environment ensures that manufacturers are designing Heavy HDE to meet the final standards out to the regulatory useful life of 650,000 miles once the engine is in the real-world.

EPA appreciates the compliance margin analysis provided by EMA and has considered the data showing that the NOx compliance margin built in by manufacturers has increased with the historic increase in stringency of emission standards due to the variability of emission controls at lower NOx levels. EPA has taken this into consideration when setting the stringency for the NOx standards we are finalizing in this action, as described in preamble Section III.C.

See preamble Section III and Section 11 of the response to comments for how EPA is accounting for the portable emissions measurement systems (PEMS) measurement uncertainty.

With regard to CARB's comment on modeling the effects of the interim in-use standards, we note that we did not include higher in-use standards in the proposal but requested detailed comment on such an approach. In this final rule, we have modeled the impacts of the final interim in-use testing allowance on the NOx inventory for the final rule (see RIA Chapter 5 for the details of the emissions inventory modeling).

With regard to CARB's comment on more data being available in 2024, we acknowledge that this may be true, but we are finalizing this rule in 2022 based on the record before us.

With regard to CARB's comment on MY 2024 engines designed to meet CARB Omnibus standards generating credits to the federal NOx standards, see our response in preamble Section IV. With regard to CARB's comment on allowing manufacturers to generate NO_X emissions credits ahead of when they are required to comply with the new standards, rather than providing additional compliance margin, we point to the response in section 12 of this document and additional discussion in preamble Section IV. As described in section 12 of this document and preamble Section IV, we are finalizing a modified from proposal transitional credit program, which will allow manufacturers to generate NO_X emissions credits ahead of MY 2027; however, we are not finalizing the proposed early credit program. As further discussed in preamble Section III and IV, the final standards achieve the greatest emission reductions feasible starting in MY 2027, and do not require participation in an ABT program; the final ABT program is carefully calibrated to provide some flexibility to manufacturers to transition to meeting the final NOx standards while ensuring expected emission reductions of the program are achieved.

We acknowledge that the EPA Stage 3 demonstration conducted at SwRI was focused on the aftertreatment, however we determined that this program is appropriate and the data is relevant to feasibility based on the EMA deterioration study (which fully aged 3 engines and

aftertreatments through the current useful life of each engine) showing that the engine out emissions were relatively flat compared to the tailpipe emissions as the engines aged, see preamble Section IV.F.1. Our assessment is that properly designed engines would show similar emissions through the useful life values we are finalizing, making the aftertreatment demonstration the appropriate demonstration for feasibility of the emission standards.
We disagree with the comment from EMA that a conformity factor of 2.0 is needed for the first 7 years of these new standards. As discussed above, in Section 11 of this document, and in preamble Section III, we have determined that the final off-cycle standards are feasible and that they correspond to a conformity factor of 1.5 starting in MY 2027.

Finally, we are finalizing that the interim in-use testing allowance for Medium and Heavy HDEs only applies for in-use testing (i.e. testing of engines by EPA or the manufacturer that have entered commerce), not certification testing, selective enforcement audit testing or other production line testing prior to the engine entering commerce.

3.5 Criteria pollutant standards for idle testing

Comments by Organizations

Organization: *American Trucking Associations (ATA)*

While ATA cannot address every aspect of HD2027, we are supportive of the underlying environmental objectives and several of the elements being proposed. ATA's areas of support include: A national clean idle program developed as a nation-wide option which supports driver comfort while providing emissions reductions. [EPA-HQ-OAR-2019-0055-1326-A1, p. 3]

EPA proposes to allow engine manufacturers to voluntarily certify to the California Air Resources Board (CARB) clean idle standards by adding to EPA regulations an idle test procedure that is based on an existing CARB procedure. While having a single, uniform idling standard that can be recognized in every state is appealing, this proposal does not ensure that outcome. [EPA-HQ-OAR-2019-0055-1326-A1, p. 19]

Operators that seek to avoid the added expense of purchasing an APU and instead choose to idle their main truck engine for cab comfort in California must have a CARB Certified Clean Idle label on their vehicle. A handful of other states with idling restrictions provide this as a compliance option as well. Today, this label is only available by purchasing a truck with a CARB-certified engine with emissions levels, including emissions levels during idling, which are identical to a truck with an EPA-certified engine. So, while it appears appropriate to provide such an option on a nationwide basis, it is uncertain whether such an option would be recognized by California or other states with idling restrictions. [EPA-HQ-OAR-2019-0055-1326-A1, p. 19]

ATA supports EPA's proposed development of a national clean idle standard program. This program will need to balance the technical feasibility of the standard with the program's implementation and acceptance among the states. We are concerned that a federal idle standard that is recognized by 49 states or 45 states, for instance, will not meet the interstate uniformity needs of trucking companies. Therefore, we ask EPA to not only focus on setting a feasible idle standard but also work with states to recognize the program as an option which supports driver comfort while providing emissions reductions. [EPA-HQ-OAR-2019-0055-1326-A1, p. 19]

Organization: *California Air Resources Board (CARB)*

In the proposed Options 1 and 2, U.S. EPA is proposing that certifying to clean idle standards be voluntary, as currently certified federally today. For the proposed Option 1, the clean idle NOx standards and associated certification test procedures are identical to the Omnibus requirements. CARB staff strongly recommends that the proposed Option 1 clean idle NOx requirements be mandatory rather than optional. In discussions with engine manufacturers, CARB staff learned that most if not all manufacturers currently calibrate their HDEs sold nationally (CARB certified or not) to meet CARB’s optional idle NOx standards. However, vehicle manufacturers could not apply the clean idle sticker on the vehicles they sell unless it is CARB certified. In addition, many fleets have shown interest in having a clean idle sticker on the vehicles they purchase so that they can idle their engines in California and many other states that have adopted California’s idle restriction requirements. Thus, making the proposed Option 1 clean idle requirements mandatory for all HDEs used in vehicles with gross vehicle weight rating greater than 10,000 pounds sold nationally would align with CARB’s Omnibus requirements. Harmonized mandatory requirements in turn would provide significant emissions reductions nationally as well as eliminate the need for a clean idle sticker, thereby saving the customer money that would have been spent for the sticker, each of which is estimated to cost about $100. [EPA-HQ-OAR-2019-0055-1186-A2, pp.45-46]

As mentioned above, the proposed Option 1 voluntary clean idle NOx standards and associated certification test procedures are numerically identical to the mandatory Omnibus requirements. When CARB staff proposed the Omnibus requirements, idling test results from the CARB Stage 3 engine testing were not available and the idle standards in the Omnibus were based on EGR control only. As a result, CARB’s Omnibus idle NOx standards are significantly higher than what was eventually demonstrated from testing of the CARB Stage 3 engine. Testing of the CARB Stage 3 engine on CARB Idle Test Procedure showed significant idle NOx reductions of 0.1 g/hour NOx at low idle and 0.3 g/hour NOx at high idle (i.e., 1100 revolution per minute (rpm)), without impacts on GHG emissions.114 Additional extended 24-hour idle testing to mimic hoteling of sleeper cab tractors, conducted on the Stage 3 engine on behalf of U.S. EPA, also showed very low tailpipe idle NOx emissions of about 1 g/hour.115 These results are well below the 5 g/hour idle NOx standard adopted in the Omnibus or the proposed Option 1 for MY 2027. CARB staff strongly recommends U.S. EPA to evaluate available test data and adopt mandatory clean idle requirements that are at least as stringent as the Omnibus standards. [EPA-HQ-OAR-2019-0055-1186-A2, p.46]

114 Sharp, C. 'Further Development and Validation of Technologies to Lower Oxides of Nitrogen Emissions from Heavy-Duty Vehicles, Low NOx Demonstration Program – Stage 3,' Southwest Research Institute, ARB Contract 16MSC010, SwRI® Project Number 03.23379, Final Report, April 16, 2021. (page 135)

115 Sharp, C., Neely, G., Zavala, B., and Rao, S., 'CARB Low NOx Stage 3 Program - Final Results and Summary,' SAE Technical Paper 2021-01-0589, 2021, doi:10.4271/2021-01-0589.

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

While Commenters prefer the more stringent numerical emissions standards of Option 1 to the unjustifiably lax standards of Option 2, we urge EPA to further strengthen the standards in certain key areas: (1) duty cycle and in-use (off-cycle) standards, (2) idle standards, and (3) the FEL cap. EPA should also reject its proposed two-step approach for Option 1, finalizing the more stringent standards in MY 2027 instead of delaying their application until MY 2031. [EPA-HQ-OAR-2019-0055-1302-A1, p.57]

As one element of duty cycle testing changes included in Option 1, EPA proposes an optional NOx idle standard starting in MY 2023, which by MY 2027 would align with the Omnibus clean idle standard of 5.0 g/hr. 87 Fed. Reg. at 17,464. While manufacturers would not be required to certify compliance with the idle standard, 'once included the idle standard would become mandatory and full compliance would be required.' Id. EPA requests comment on whether the standard should instead be mandatory for MY 2027 and beyond. Id. [EPA-HQ-OAR-2019-0055-1302-A1, p.58]

Commenters support inclusion of a mandatory idle standard for model years 2027 onward, to better protect individuals from the higher emissions that occur during idling, such as when trucks are stopped at city streetlights. EPA should set a mandatory idle standard for MY 2027 onward that is at least as stringent as the 5.0 g/hr standard proposed in Option 1, and should consider setting it at a lower, more protective level. A 5.0 g/hr or lower standard is technologically feasible. Many HDE manufacturers are already planning to comply with a 5.0 g/hr standard in MY 2027 because of the CARB standard. The best-performing current engines are already achieving the 5.0 g/hr requirement, and some are achieving it with a wide compliance margin. See Comments of MFN, to be filed in Docket EPA-HQ-OAR-2019-005 on May 16, 2022. The Omnibus idle standard was proposed before results from CARB’s Stage 3 engine testing were available, and that testing showed NOx emissions far below the 5.0 g/hr adopted in the Omnibus and proposed by EPA as Option 1. See Comments of CARB, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022. [EPA-HQ-OAR-2019-0055-1302-A1, p.58]

Organization: *Consumer Reports (CR)*

EPA is also proposing to include a voluntary idle standard that aligns with CARB’s proposed idle certification standards. Although a number of states, including California, have laws that prevent trucks from idling for extended periods of time,46 no such rule exists at the federal level. Idling trucks emit an estimated 0.37 tons of NOx per year per vehicle,47 and increase public exposure to diesel particulate matter and other tailpipe emissions.48 For this reason, CR supports the inclusion of these standards in the final rule, and urges EPA to make this standard mandatory rather than voluntary. [EPA-HQ-OAR-2019-0055-1285-A1, p.7]

46 13 C.C.R. 2485; United States EPA, Compilation of State, County, and Local Anti-Idling Regulations,(April 2006). Available at: https://www.epa.gov/sites/default/files/documents/CompilationofStateIdlingRegulations.pdf

47 Maryland Department of Environment, Facts about Idle Reduction Technology. Available at: https://mde.maryland.gov/programs/Air/MobileSources/Documents/Idling%20Technology%20Fact%20Sheet%20Final.pdf

48 Hannu Jääskeläinen, Idling Emissions, (April 2017). Available at: https://dieselnet.com/tech/emissions_idle.php

Organization: *Cummins Inc. (Cummins)*

Cummins supports EPA's proposal to finalize a nationwide voluntary Clean Idle NOx emissions standard. Cummins also supports EPA adopting CARB's existing two-mode idle NOx test procedure to which Cummins has been voluntarily certifying for many years. [EPA-HQ-OAR-2019-0055-1325-A1, p. 5]

For MY 2024 through 2026, Cummins recommends that EPA's optional Idle NOx standard align with CARB's current Clean Idle NOx level of 30 g/hr. For those model years, there is inadequate lead-time to develop, demonstrate, certify, produce, and integrate into vehicles new and reliable engine technologies to further control idle NOx emissions, while at the same time avoiding higher idle fuel consumption that increases GHG emissions. EPA's proposed 10 g/hr NOx idle standard is not feasible without active and efficient SCR. The SCR catalyst cannot be maintained at sufficient idle temperatures with 2024-2026 technologies without unduly increasing GHG and fuel consumption to a point that is fuel cost prohibitive for operators. [EPA-HQ-OAR-2019-0055-1325-A1, p. 5]

For MY 2027 and beyond, Cummins recommends that EPA's optional Idle NOx standard be set at a NOx level of 10 g/hr, with a 5 g/hr in-commerce variability allowance, primarily to account for idle exhaust flow measurement variability. EPA has evaluated idle measurement variabilities, as documented in a December 2019 SwRI report, "Measurement Variability Assessment of the GHG Phase 2 Fuel Mapping Procedure" (US EPA Contract No. EP-C-15-006, OMB Clearance Number 2031-2005, Work Assignments 2-08, 3-08, and 4-03). In the report, direct measurements showed up to 45% idle measurement variability between maximum and minimum measurements divided by the average. As long as EPA finalizes a 10 g/hr idle NOx standard with a 5 g/hr in-commerce variability allowance, Cummins projects that technologies that currently are being developed and on track for production starting in the 2027 model year could be used to achieve that lower level of idle NOx emissions, without the fuel and GHG penalties that would occur with 2024-2026 technologies at that level. [EPA-HQ-OAR-2019-0055-1325-A1, p. 5]

EPA requested comment on finalizing an approved vehicle label design, which would inform local enforcement personnel that a vehicle is equipped with an engine compliant to EPA's optional idle emissions standard and is allowed to idle. Cummins is certain that such a label will be necessary for operators to avoid shutting down engines when engine power is needed. Therefore, it is essential that EPA finalizes a label design. Otherwise, there is no incentive to certify to the voluntary standard, which could lead to NOx emissions increases caused by further fuel consumption optimization. [EPA-HQ-OAR-2019-0055-1325-A1, pp. 5 - 6]

EPA also must finalize with CARB an agreement that all vehicles with the federal Clean Idle label will be allowed to idle the same as vehicles with the CARB Clean Idle label. That will be essential not only in California, but also for CARB to continue to lead the other states and municipalities that currently recognize CARB's label. Because this is a nationwide MY 2024 issue, created when CARB lowered its voluntary Clean Idle standard for 2024, Cummins is willing and ready to work with both EPA and CARB now to achieve such an agreement in the near term. [EPA-HQ-OAR-2019-0055-1325-A1, p. 6]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

For manufacturers that certify their engines to EPA's proposed optional low NOx idle standards, Daimler Truck recommends that the Agency provide an EPA-specific clean idle sticker, sta1ting no later than MY 2024. [EPA-HQ-OAR-2019-0055-1168-A1, p.63]

Currently, only California provides an optional clean idle sticker, and the State only issues the sticker for vehicles with engines certified to all other California emission standards. If a customer would like a clean idle sticker, they are forced to purchase a vehicle that contains a California-certified engine, with the accompanying emissions controls, warranty requirements, OBD standards, and more. In this manner, a California Clean Idle sticker represents not just the engine's idle NOx emissions but rather its compliance with the full set of California emissions requirements. As California's standards continue to diverge from EPA's standards, this difference becomes even starker. Starting in MY 2024, customers will not be able to get clean idle stickers for their non-California certified vehicles, regardless of how low their idle emissions are. We expect that there will be significant splintering of the market between EPA and CARB-certified vehicles beginning in MY 2024, and some customers and applications will be left without a solution that enables obtaining a clean idle sticker due to technical and/or lead time constraints. [EPA-HQ-OAR-2019-0055-1168-A1, pp.63-64]

As the California Clean Idle sticker encompasses a growing suite of stringent requirements above and beyond merely clean idle status, the market still has a need for a clean idle sticker that reflects just that—low-NOx idle emissions. Many municipalities have passed laws allowing vehicles to idle only if they are equipped with clean idle stickers. While many of these municipalities specifically reference the California sticker, DTNA believes that most did not intend to force adoption of all of the other California requirements now required to equip a vehicle with a sticker. In fact, some locales specifically anticipate that an EPA sticker might exist. For example, Texas motor vehicle emissions regulations exempt heavy-duty vehicles from the State's anti-idling requirements if they are equipped with a 2008 or subsequent MY heavy-duty diesel (or liquefied or compressed natural gas) engine that has been certified by EPA or a state agency to emit no more than 30 g-hr NOx when idling.86 [EPA-HQ-OAR-2019-0055-1168-A1, p.64]

86 See 30 TAC 114.512(2).

Daimler Truck believes that the EPA should offer a voluntary clean idle certification, with an identifying sticker, similar in nature and location to the existing California sticker, to certify that vehicles emit no more than 30 g-hr NOx when idling. The specific threshold for certification could be adjusted according to the applicable MY NOx idle standards and the limits the engine is certified to. EPA should offer such a program no later than MY 2024. Customers are buying more expensive, California-certified trucks to receive this sticker today, even though their less expensive, EPA-only counterparts have the same low NOx idle emissions. [EPA-HQ-OAR-2019-0055-1168-A1, p.64]

Organization: *District of Columbia Department of Energy and the Environment (DOEE)*

EPA seeks comment on whether to include an idle standard. In the Heavy-duty NOx Omnibus Regulation, California adopted a mandatory idle standard of five grams/hour (g/hr). Since then, SwRI and Achates Power have demonstrated that heavy-duty trucks can achieve, and continuously sustain, significantly lower idle standards – all below one g/hr – over an indefinite period of time. This is an important development for heavy-duty trucks, which routinely idle for long periods of times. Achates, for example, has field data from actual truck operation in 40° F weather showing 0.15 g/hr average NOx at idle. EPA should finalize a mandatory idle NOx standard for MY 2027-2030 engines in the range of 0.5 to 1 g/hr. [EPA-HQ-OAR-2019-0055-1299-A1, p. 5]

Organization: *Edwin J. Ward*

Increased stringency of engine idling testing requirements
An important place to start in reducing heavy duty vehicle emissions is with vehicle idling. Section III(D)(IV) of the proposed rule explains EPA's intention to begin regulating engine idling. According to the proposed rule, engine idling over four minutes can lead to higher-than-expected emissions of criteria pollutants because the catalyst is allowed to cool below the "light-off temperature" of 350°C. I strongly support EPA's proposal to take into account idling emissions beyond four minutes and require a minimum light-off temperature of 350°C. [EPA-HQ-OAR-2019-0055-1050]

The emissions associated with heavy-duty vehicle idling are most pronounced in already-polluted, heavily urbanized areas where delivery vehicles make many stops and others are subjected to traffic-choked streets. In the Bronx, NY, the Hunts Point Cooperative Market is the largest food distribution center in the world, and supplies the majority of New York City's produce. Located in a majority Black and Puerto Rican neighborhood,6 the food market sees 13,000 heavy-duty trucks every single day.7 The sheer number of trucks per day in a 1.5 square mile neighborhood alone is enough to accentuate levels of criteria pollutants. But due to infrastructure constraints and a lack of refrigeration space, trucks must idle at all hours of the day to keep produce cold.8 This isn't a new problem for the residents of Hunts Point, who have witnessed nearly two decades of failed carrot and stick programs from local and state government, including a supposed "crackdown" on illegal idling9 and nearly $200 million previously allocated.8 Despite supposed state and local action, child asthma emergency room visits are 63% higher in Hunts Point than the rest of the city, and the neighborhood ranks seventh highest in adult asthma emergency room visits.8 [EPA-HQ-OAR-2019-0055-1050]

The Hunts Point neighborhood is a clear environmental justice community that has been and continues to be negatively impacted by air pollution caused by heavy-duty vehicle emissions from idling. Those impacts persist despite stringent local and state laws prohibiting idling, proving the importance of EPA finally taking action on this issue. By regulating heavy-duty vehicle idling, EPA can simultaneously reduce fuel costs for drivers and trucking companies, while also reducing the environmental burden on communities like Hunts Point, NY. [EPA-HQ-OAR-2019-0055-1050]

EPA's proposed rule further requests relevant data on idling reduction technologies like "start-stop." Having been widely deployed in light-duty vehicles in recent years, the technology must be studied further in diesel engines as it could have the paradoxical effect of allowing the catalyst to cool below light-off temperature and increasing emissions. Perhaps vehicle manufacturers could implement a start-stop feature that initiates only in park and after five minutes to ensure that the emissions saved from idling aren't outweighed by emissions in the subsequent engine warm-up period. [EPA-HQ-OAR-2019-0055-1050]

Ultimately, I urge EPA to move forward on increasing stringency of engine idling standards and testing requirements starting with requiring a minimum light-off temperature of 350°C during idling beyond four minutes. I also urge EPA to evaluate potential new technologies like "start-stop" while considering that these solutions alone may not achieve a significant emissions reduction. [EPA-HQ-OAR-2019-0055-1050]

[Conclusion] In the short term, EPA should adopt stringent engine idling standards and testing requirements starting with requiring a minimum light-off temperature of 350°C during idling beyond four minutes. This will create immediate air pollution benefits for environmental justice communities. EPA should also reject the proposed revision to Section 86.1823-08 to prevent any further erosion of emissions standards for light-duty trucks. [EPA-HQ-OAR-2019-0055-1050]

[1] Jiawen Liu et al., *Disparities in Air Pollution Exposure in the United States by Race/Ethnicity and Income, 1990– 2010*, ENV'T HEALTH PERSP., Dec. 15, 2021, at 1.
[2] Natalia Rommen, *Syracuse's Proposed Community Grid Could Right a Decades-Old Wrong*, Next City (Aug. 13, 2019), https://nextcity.org/urbanist-news/syracuses-proposed-community-grid-could-right-a-decades-old-wrong.

[3] LANESSA OWENS-CHAPLIN ET AL., BUILDING A BETTER FUTURE: THE STRUCTURAL RACISM BUILT INTO I-81, AND
HOW TO TEAR IT DOWN 12 (NYCLU, 2020),
https://www.nyclu.org/en/publications/building-better-future.
[4] UNION OF CONCERNED SCIENTISTS, CARS, TRUCKS, BUSES AND AIR POLLUTION (2018), https://www.ucsusa.org/resources/cars-trucks-buses-and-air-pollution.
[5] SCIENCEDAILY, LARGE TRUCKS ARE BIGGEST CULPRITS OF NEAR-ROAD AIR POLLUTION (2018),
https://www.sciencedaily.com/releases/2018/09/180910111237.htm.

[6] *New York City demographic shifts, 2000 to 2010*, CTR. FOR URB. RSCH., http://www.urbanresearchmaps.org/plurality/narrative.htm (last visited Apr. 30, 2022).
[7] N.Y. STATE DEP'T OF TRANSP., HUNTS POINT INTERSTATE ACCESS IMPROVEMENT PROJECT FINAL DESIGN REPORT FINAL ENVIRONMENTAL IMPACT STATEMENT FINAL SECTION 4(F) EVALUATION 1-5 (Apr. 2019).
[8] Juliette Gaudamer & Evelyn Nam, *Hunts Point Produce Market to Get $100 Million Makeover to Lose Its 'Dirtiest' Image*, NY CITY LENS, (Apr. 28, 2022), https://nycitylens.com/hunts-point-produce-market-get-100- million-makeover-lose-dirtiest-image/.
[9] N.Y. STATE OFF. OF THE ATT'Y GEN., HUNT'S POINT MARKET TO REDUCE DIESEL FUMES IN THE SOUTH BRONX (Jun. 20, 2003).

Organization: *Environmental Defense Fund (EDF) (1265 and 2855)*

In addition to adopting the most rigorous engine NOx emissions standards, we urge EPA to adopt mandatory NOx idle emissions standards. Medium- and heavy-duty vehicles can spend 30-40 percent of their time at idle and NOx emissions at idle can represent up to 20 percent of an engine's total NOx emissions.100 California adopted 'clean idle' standards in 2008 that required new engines to equip a 5-minute non-programmable automatic engine shutdown system (AESS) or certify to a clean idle NOx standard of 30 grams per hour (g/hr).101 EPA's in-use data, presented by ICCT, shows that the majority of diesel engines across most manufacturers were already meeting the 30 g/hr threshold in 2019.102 In 2021, California adopted its Heavy-duty Engine and Vehicle Omnibus regulation that included updated NOx idling standards for all medium- and heavy-duty vehicles, including a 10 g/hr standard for MYs 2024-2026 and a 5 g/hr standard for MY 2027 and beyond. [EPA-HQ-OAR-2019-0055-1265-A1, p.24]

100 Huzeifa Badshah, Francisco Posada, Rachel Muncrief. 2019. Current State of NOx Emissions from In-Use Heavy-duty Diesel Vehicles in the United States, ICCT, page 17, Figure 10; page 18, Figure 11.

101 California Air Resources Board, 'Proposed Heavy-duty Engines and Vehicle Omnibus Regulation and Associated Amendments. Staff Report: Initial Statement of Reasons,' (June 23, 2020) ('ISOR'), page I-7.

102 Huzeifa Badshah, Francisco Posada, Rachel Muncrief. 2019. Current State of NOx Emissions from In-Use Heavy-duty Diesel Vehicles in the United States, ICCT, page 20, Figure 13.

EPA has proposed voluntary NOx idle emissions standards for medium- and heavy-duty vehicles beginning in MY2023 at 30 g/mi and ramping up to meet California's 5 g/mi standard for MYs 2027 and beyond. However, a voluntary standard misses the opportunity to make significant reductions in harmful diesel pollution that is often concentrated in urban areas where diesel emissions are already a serious burden on local communities. Accordingly, we urge EPA to finalize mandatory requirements to reduce idle emissions. [EPA-HQ-OAR-2019-0055-1265-A1, p.24]

The Air Resources Board (ARB) staff concluded in its Initial Statement of Reason (ISOR) for the Heavy-duty Omnibus regulation that the 10 g/hr NOx idle emission standard for the 2024-2026 MYs is feasible, based primarily on a Southwest Research Institute (SwRI) Low NOx testing program that evaluated the emission reductions achievable by changing calibrations during idle.103 SwRI demonstrated that reducing exhaust flow at idle can reduce NOx emissions during idle by almost 90 percent. In fact, with an auxiliary load, idle emissions were demonstrated as low as 1.6 g/hr, far below the 10 g/hr standard adopted for 2024 and the 5 g/hr standard adopted for MY2027 and beyond. ARB states that its 10 g/hr standard is indeed conservative. [EPA-HQ-OAR-2019-0055-1265-A1, p.24]

103 ISOR, page III-14.

It is critical that EPA adopt mandatory NOx idle emissions standards that are at least as protective as California's Omnibus regulation. According to ARB, in 2019, there were already a number of engines certified with idle emissions below 10 g/hr and a number of the best performing engines already achieved the 5 g/hr standard.104 Therefore, engines are already capable of the most protective standard a full 8 model years before it goes into effect.
A voluntary standard would do little to compel action to reduce harmful NOx emissions at idle.
A mandatory standard would cement the available emissions reductions experienced by California across the nation. [EPA-HQ-OAR-2019-0055-1265-A1, pp.24-25]

104 ISOR, page III-15.

EDF also recommends that EPA adopt a mandatory NOx idle standard for 2027 and beyond that goes beyond California's 5 g/mi standard. SwRI conducted additional testing since the adoption of the Omnibus regulation.105 Over a range of different duty cycles, SwRI demonstrates that, even at high mileage, engines can reduce NOx idle emissions to well below 1 g/mi. In fact, the highest idle emission rate they found was 1.4 g/mi. Engine manufacturers would still have a full 5 model years to achieve the more protective standards. [EPA-HQ-OAR-2019-0055-1265-A1, p.25]

105 Presentation by Christopher Sharp, SwRI, 'Update on Continuing Progress Towards 2027 Heavy-duty Low NOx Targets,' 32nd CRC Real World Emissions Workshop (March 14, 2022). Presentation by Christopher Sharp et. al., SwRI, 'An Update on Continuing Progress Towards Heavy-duty Low NOx and CO2 in 2027 and Beyond,' WCX (April 5-7, 2022).

It is critical that EPA utilize the most recent research and testing and the clear demonstration of success in California to adopt mandatory and protective NOx idle standards based on the greatest emissions reductions achievable by today's engines. [EPA-HQ-OAR-2019-0055-1265-A1, p.25]

ARB has determined that all medium- and heavy-duty vehicles are capable of meeting the mandatory idle emissions standards. California's 2008 clean idle standards exempted all medium-duty vehicles as well as buses and recreational vehicles because it was assumed that most manufacturers would meet the idle standards by installing an AESS, and that technology did not make sense for those particular vehicle segments at the time the rule was adopted.

However, all manufacturers have instead met the idle regulations by certifying to clean idle standards through the use of EGR and air-fuel ratios. Therefore, ARB determined in its 2020 ISOR that ‘EGR and air-fuel ratio controls are feasible for buses, recreational vehicles, medium-duty vehicles, armored vehicles, and workover rigs, just like for any heavy-duty vehicle, and so the rationale for exempting these vehicles that existed in 2005 no longer exists.’106 ARB also determined that other strategies for meeting the updated standards could include ‘raising the exhaust temperature to enable SCR operation using cylinder deactivation, mild hybrid systems, stop-start systems, or a combination of all of these strategies.’107 Therefore, it is clear that all medium- and heavy-duty engines must be subject to health-protecting NOx idle emissions standards that begin in MY 2024 and reflect the reductions [EPA-HQ-OAR-2019-0055-1265-A1, p.25]

106 ISOR, page II-8.

107 ISOR, page III-15.

Organization: *Ford Motor Company (Ford)*

We support the adoption of optional Clean Idle test procedures and standards. These optional Clean Idle standards will be needed for non-50 state engine families and the owners and operators of vehicles equipped with them to comply with Clean Idle requirements outside of California. [EPA-HQ-OAR-2019-0055-1300-A1, p. 4]

Organization: *Maine Department of Environmental Protection (Department)*

Using the CARB Heavy-Duty Omnibus Regulation as a bellwether, the Department requests the following revisions to the federal proposal: [EPA-HQ-OAR-2019-0055-1288-A1, p.6]

- Idle standards. EPA should finalize a mandatory idle standard of 5 g/hr for model year 2027-2030 engines as CARB has finalized for the Heavy-Duty Omnibus Regulations, rather as an optional standard. Idling heavy-duty vehicles disproportionately impact populations and communities that are already overburdened by air pollution. Based on test results by the Southwest Research Institute,15 a 5gm/hr (or even less) idle standard is feasible through 800,000 miles of operation. Since heavy-duty vehicles may be operated at idle for as much as 33% of the time, 16 the Department suggests EPA make the idle standard mandatory and consider increasing the stringency of the standard in the final rule. [EPA-HQ-OAR-2019-0055-1288-A1, p.7]

15Sharp, C., “Update on Heavy-Duty Low NOx Demonstration Program at SwRI,” Southwest Research Institute, September 26, 2019, see Update on Heavy-Duty Low NOx Demonstration Programs at SwRI (ca.gov).

16 EPA, “Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engines and Vehicle Emission Standards,” Draft Regulatory Impact Assessment, March 28, 2022. See page 75, Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards – Draft Regulatory Impact Analysis (EPA-420-D-22-001, March 2022)

Organization: *Moving Forward Network (MFN)*

Beginning in 2008, California required new trucks sold in the state to meet a "Clean Idle" standard. There are two means by which a truck can be certified to the standard, either by having an automatic shut-off that cuts the engine after five minutes of idling, or by meeting a 30 g/hr NOx idling standard. Rather than an increase in availability of stop-start and zero-emission technologies, which CARB's idle rule was meant to promote,138 all heavy-duty engines in 2020 comply with the standard by meeting the 30 g/hr requirement.139 Though this standard was implemented only in California, it has driven 50-state improvements, with EPA's in-use data showing that the vast majority of diesel engines meet the 30 g/hr threshold.140 [EPA-HQ-OAR-2019-0055-1277-A1, pp. 34 - 35]

> 138. Chen, D. 2008. California's heavy-duty vehicle idling regulations. (Presentation). NCSL conference call, January 28, 2008. Online at https://www.ncsl.org/print/energy/dchenidling07.pdf.
>
> 139. CARB. 2020. New Vehicle and Engine Certification: Executive Orders for MY2020 Medium-Duty and Heavy-Duty Engines. https://ww2.arb.ca.gov/sites/default/files/classic/msprog/nvepb/executive_orders/EO%20Summaries/MDEHDE/EO_Summary__MDE-HDE__2020__Public.xlsx.
>
> 140. Badshah, et al. 2019, Figure 13.

In-use data shows a higher fraction of idling than current test procedures,141 and it is well-established by EPA's data that idling is precisely the type of low-load operation where current emissions controls behave sub-optimally, a major rationale for the LLC. EPA's own in-use ("off-cycle") program bases the lowest level bin on idle test emissions, indicating both a heightened awareness of the problems these emissions hold and an understanding that it represents a significant share of general truck operations. [EPA-HQ-OAR-2019-0055-1277-A1, p. 35]

As EPA noted, CARB has lowered this standard to 10 g/hr for 2024, and to 5 g/hr for 2027 and beyond. This is not voluntary in California, and it should not be voluntary federally, either. The best-performing current engines can already achieve the 5 g/hr requirement.142 EPA's SwRI data shows that its Stage 3RW engine is also capable of meeting such a standard, with a wide compliance margin.143 And Achates Power's opposed-piston engine meets CARB's 5 g/hr requirement with even greater compliance margins.144 [EPA-HQ-OAR-2019-0055-1277-A1, p. 35]

> 142. https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hdomnibuslownox/isor.pdf, Figure III-3.
>
> 143. EPA-HQ-OAR-2019-0055-1082
>
> 144. Salvi et al. 2022

Given the importance of reducing idling emissions to communities near ports and warehouses and other heavily-trafficked areas, not only should EPA make its idling standards mandatory, but it should consider setting standards that fall well below CARB's current "Clean Idle" limits, which appear extremely conservative given the technical capacity of the next generation of diesel engines. [EPA-HQ-OAR-2019-0055-1277-A1, p. 35]

Organization: *National Association of Clean Air Agencies (NACAA)*

NACAA supports inclusion in the final rule of performance requirements to ensure achievement of emission standards across all duty cycles, including idle and low load. [EPA-HQ-OAR-2019-0055-1232-A1, p. 11.]

EPA seeks comment on whether to include an idle standard. In the Omnibus, California adopted a mandatory idle standard of 5 grams/hour (g/hr). Since then, SwRI and Achates Power have demonstrated that heavy-duty trucks can achieve and continuously sustain significantly lower idle standards – all below 1 g/hr – over an indefinite period of time. This is an important development for HD trucks, which routinely idle for long periods of times. Achates, for example, has field data from actual truck operation in 40° F weather showing 0.15 g/hr average NOx at idle. EPA should finalize a mandatory idle NOx standard for MY 2027-2030 engines in the range of 0.5 to 1 g/hr. [EPA-HQ-OAR-2019-0055-1232-A1, p. 11]

Organization: *Navistar, Inc. (Navistar)*

In particular, we support: The implementation of a national clean idle program in 2024, which is technically feasible, and does not create negative CO2 impacts. [EPA-HQ-OAR-2019-0055-1318-A1, p. 2]

Organization: *Northeast States for Coordinated Air Use Management (NESCAUM)*

Should EPA instead promulgate Option 1, we urge the Agency to make the following changes to the proposed standards: We request that EPA finalize a mandatory idle standard of 5 g/hr for model year 2027 and later engines consistent with CARB's finalized Omnibus regulation, rather than an optional standard. A Center for Environmental Research and Technology (CE-CERT) study found that vocational vehicles spend approximately 33% of the time at idle.36 Idling trucks emit pollution in crowded urban areas in communities already overburdened with air pollution.37 Southwest Research Institute's Stage 3 research program measured idle emissions at 435,000 miles in the range of 0.30 to 1.40 grams NOx per hour on five different duty cycles and 0.40 to 3.3 grams per hour at 800,000 miles.38 These values are well below the proposed standard and demonstrate the feasibility of NOx control at idle through 800,000 miles. Given these and other test results, we encourage EPA to make the idle standard mandatory and increase the stringency of the standard in the final rule. [EPA-HQ-OAR-2019-0055-1249-A1, p. 12]

> 36 EPA, "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards," Draft Regulatory Impact Assessment, March 28, 2022. See page 75, Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards – Draft Regulatory Impact Analysis (EPA-420-D-22-001, March 2022).

37 Michael J. Bradley & Associates, “Newark Community Impacts of Mobile Sources.” November 2020. Available at MJBA_Report_NewarkCommunityElectrification_Nov2020.pdf (accessed May 12, 2022).

38 Sharp, C., “Update on Heavy-Duty Low NOx Demonstration Program at SwRI,” Southwest Research Institute, September 26, 2019. Available at Update on Heavy-Duty Low NOx Demonstration Programs at SwRI (accessed April 25, 2022).

Organization: *Ozone Transport Commission (OTC) and Mid-Atlantic/Northeast Visibility Union (MANE-VU)*

Idle Standard: We request that EPA finalize a mandatory idle standard of 5 g/hr for model year 2027 and subsequent model year engines, as CARB has finalized for its Omnibus regulation, rather than an optional standard. A Center for Environmental Research and Technology (CE-CERT) study found that vocational vehicles spend approximately 33% of the time at idle.37 Idling trucks emit pollution in crowded urban areas in communities already overburdened with air pollution.38 Southwest Research Institute’s Stage 3 research program found that idle emissions from 0.30 to 1.40 grams per hour at 435,000 miles on five different duty cycles and 0.40 to 3.3 grams NOx per hour at 800,000 miles are feasible.39 These values are well below the proposed standard and demonstrate the feasibility of NOx control at idle through 800,000 miles. Given these and other test results, we encourage EPA to make the idle standard mandatory and consider increasing the stringency of the standard in the final rule. [EPA-HQ-OAR-2019-0055-1250-A1, pp.14-15]

37 See footnote 35, at p. 75.

38 Michael J. Bradley & Associates, 'Newark Community Impacts of Mobile Sources.' November 2020. Available at MJBA_Report_NewarkCommunityElectrification_Nov2020.pdf. Accessed May 12, 2022.

39 See footnote 24 (Sharp et al., Southwest Research Institute, April 5-7, 2022).

Organization: *PACCAR, Inc (PACCAR)*

PACCAR supports EPA’s proposal to include a voluntary ‘low NOx idle’ emissions standard. The specific proposed standards are a concern, however, because compliance to an idle-NOx standard is contingent upon the low-NOx technologies that will need to be deployed to meet the FTP, RMC and LLC standards, which will not be fully known until the NPRM is finalized. For MY 2024 to MY 2026 there are no significant nation-wide planned engine or aftertreatment upgrades currently anticipated, even though meeting the level proposed for MYs 2024 to 2026 (10.0 g/hr) would not be possible with today’s technology. Since there is no major planned change to technology until MY 2027, PACCAR does not support a decrease from the current level until MY 2027. PACCAR supports a standard that does not encourage backsliding and thus supports 30.0 g/hr through 2027. At the next step in the regulation to Low NOx in 2027, PACCAR would support a 10.0 g/hr standard with a 5.0 g/hr in-commerce variance allowance that is aligned with the anticipated technology to meet that regulated level. Although PACCAR generally supports the proposed 'Clean Idle test' provisions (see 40 C.F.R. 1036.514), PACCAR did not identify any corresponding Clean Idle label provisions. If EPA intends to promulgate Clean Idle testing provisions, it should also promulgate Clean Idle labeling provisions to enable local enforcement personnel to easily identify clean idle compliant vehicles. EPA should also secure agreement from CARB to accept the EPA clean idle provision, thereby allowing federally-compliant labeled Clean Idle vehicles to idle in California and other CARB-aligned jurisdictions. [EPA-HQ-OAR-2019-0055-1346-A1 pp.40-41]

Organization: *Southern Environmental Law Center (SELC)*

Under the current Option 1 proposal, however, idling standards and test procedures remain voluntary.37 Data indicates that NOx emitted during low load conditions and idling contributes between 15 and 60 percent of NOx emissions over duty cycles,38 and we encourage EPA to make idling standards and test procedures mandatory and consistent with California's Clean Idle NOx standard.39

Organization: *Truck and Engine Manufacturers Association (EMA)*

EMA supports EPA's proposal to include a voluntary "low NOx idle" emissions standard, and to base that standard on the CARB idle-NOx test procedure that has been in place since 2008. The specific proposed standards are a concern, however, because compliance to an idle-NOx standard is contingent upon the low-NOx technologies that will need to be deployed to meet the FTP, RMC and LLC standards, which will not be fully known until the rule is finalized. In addition, future developments related to the electrification of the HD fleet will offer new, more practical alternatives to reduce emissions from extended idling. [EPA-HQ-OAR-2019-0055-1203-A1, p. 41]

CARB created a two-speed idle emissions test procedure to support a voluntary idle-NOx standard as an alternative to a 5-minute non-programmable automated shutdown requirement. EPA is now proposing a voluntary idle-NOx standard of its own to reduce emissions during periods of extended idle, such as during loading and unloading operations, as well as during the extended idling to provide overnight hoteling loads. The Agency's proposed idle-NOx standard would be based on the same CARB test procedure, at a level matching CARB's low-NOx idle standard of 5g/hr, effective with MY 2027. The voluntary standard would initially become available in MY 2023 at 30g/hr, and then would be reduced to 10.0g/hr in 2024. [EPA-HQ-OAR-2019-0055-1203-A1, p. 41]

As an initial matter, there are no significant industry-wide planned engine or aftertreatment upgrades anticipated for model years 2024 through 2026. As manufacturers work to develop emissions control strategies to comply with the MY 2027 standards (while also evolving their product lines to zero-emissions solutions), there are minimal resources available to develop new technical solutions to achieve idle-NOx emissions controls superior to those offered today, and too little time to develop and verify the new hardware solutions that would be needed. For this reason, EMA recommends that the optional Idle-NOx standards remain at 30.0 g/hr for MY

2024-2026, and that EPA incorporate by reference CARB's test procedures and other clean-idle requirements for MYs 2024-2026, and that EPA incorporate by reference CARB's test procedures and other Clean Idle requirements for MY2024-2026. [EPA-HQ-OAR-2019-0055-1203-A1, p. 41]

EPA also proposes in §1036.104(b) that, "The mass emission rate of HC, CO, and PM in g/ hr during the Clean Idle test may not exceed the emission results from the idle modes of the SET duty cycle as described in §1036.505(h) or the idle segments of the FTP duty cycle as described in §1036.510(g)." That proposed requirement is unworkable. First, it is impractical to measure PM emissions over short durations of a cycle test. The PM demonstration requirement is also unnecessary, because today's HDOH PM standards require the use of DPFs to comply, which provides the maximum PM reduction technically achievable. The requirement to measure and demonstrate PM emissions levels relative to the optional idle-NOx-measured PM emissions should be eliminated. [EPA-HQ-OAR-2019-0055-1203-A1, p. 42]

Regarding HC and CO emissions during the optional idle demonstration test, the proposed requirement that those emissions not exceed the levels measured in the idle portions of the FTP and RMC is essentially a requirement that the optional idle performance be designed to decrease the HC and CO emissions relative to the FTP and RMC, including to overcome test-to-test variability and minor fluctuations with operating conditions. EMA questions the need for HC and CO controls to be in place during extended idle conditions, as there would be no perceived benefit to manufacturers to calibrate that mode of idle operations to include higher concentrations of HC or CO. As a result, there is no basis for the proposed requirement. If the Agency nonetheless decides to constrain HC and CO emissions through regulation, EMA recommends setting time specific standards under the clean-idle demonstration test for MY 2027 and beyond. Appropriate standards would have to be set following data review, especially from the Stage 3 engine or other engines similarly equipped. Another option, though not preferred, would be for EPA to require that the optional clean-idle results for HC and CO be no more than 30% higher than levels measured during idle portions of the FTP and RMC. EMA further recommends that §1036.104(b) state that EPA may approve alternative procedures with regard to controlling and demonstrating optional clean-idle NOx, and potentially HC and CO levels. [EPA-HQ-OAR-2019-0055-1203-A1, p. 42]

With respect to the proposed NOx standard starting with MY 2027, achieving an idle standard of 10.0 g/hr would require the use of CDA, elevated EGR rates, and/or additional load by way of an intake air throttle or similar technique. One or more of those strategies would be needed to increase aftertreatment temperature sufficiently to result in the enhanced SCR efficiencies required to achieve those levels. As discussed above, EMA has numerous concerns associated with the implementation of CDA on heavy heavy-duty applications. [EPA-HQ-OAR-2019-0055-1203-A1, p. 42]

NVH issues are the most significant concerns, with NVH being of particular relevance for hoteling needs during mandatory rest periods. The increased NVH with CDA could preclude maintaining the type of quiet, low-vibration environment that is critical to enabling proper driver rest during required service breaks. If alternating CDA control modes proves to be necessary to optimize the minimum SCR temperature/CO2 emissions trade-off, or for long-term durability reasons, mode switching could be particularly disruptive to drivers' needs for restful sleep. Given that, there is additional concern that drivers will attempt to defeat or work around the CDA functionality or diagnostic capabilities to avoid those disruptions. [EPA-HQ-OAR-2019-0055-1203-A1, p. 42]

Other methods to reduce idle emissions, such as increased EGR rates are known to increase the frequency and severity of EGR cooler fouling, increased soot formation, catalyst face plugging, and aftertreatment degradation. An alternative approach to increase exhaust temperatures would be to increase engine loads through a variety of methods. While effective, that approach adds complexity, diagnostic burden, and an increase in CO2 emissions and operating costs. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 42 - 43]

That said, starting in 2027, a 10.0 g/hr idle-NOx certification standard could be achievable, with an additional 5.0 g/h NOx variability allowance for any in-use testing. Anything lower than 10.0 g/hr would prove challenging to meet consistently across manufacturers' full product lines. For example, applications such as transit buses with high accessory loads may not be capable of meeting a standard less than 10.0 g/hr. Additionally, idle standards lower than 10.0 g/hr could disrupt product plans that involve the use of ABT provisions to bring the entire engine lineup into compliance with the new standards. Accordingly, EMA recommends that EPA finalize the rule with a 10.0 g/hr optional idle-NOx standard, and also provide a 5.0 g/hr NOx variability allowance for any in-use testing. [EPA-HQ-OAR-2019-0055-1203-A1, p. 43]

EPA has requested comment regarding whether an approved hood label should be provided for to inform local enforcement personnel that the vehicle is equipped with an engine compliant to the optional low-idle emissions standard. EMA believes it is imperative that such a label be specified and controlled in a manner similar to CARB's approach to its CLEAN IDLE hood label. Without such a federal label, there is no easy way for enforcement personnel to know that the vehicle's idle emissions are well controlled. [EPA-HQ-OAR-2019-0055-1203-A1, p. 43]

EPA also should secure agreement from CARB that the State of California will allow vehicles with the federal clean-idle label to idle for extended periods in California, including overnight idling, in the same way that the State acknowledges the CARB CLEAN IDLE hood label. This should be the case even if the federal idle standard is not as stringent as California's. The federal voluntary clean-idle standard, and its associated label, will be an important feature for various municipalities and states outside of California to allow for extended idle operation in locations currently requiring the CARB CLEAN IDLE label. Without those necessary label provisions, including authorization to idle for extended periods in California and elsewhere, there will be no incentive for manufacturers to develop clean-idle capability, or to certify their products to the optional clean-idle standard. [EPA-HQ-OAR-2019-0055-1203-A1, p. 43]

Organization: *Truck Renting and Leasing Association (TRALA)*

Finally, a true and workable national standard would allow the EPA to set a national clean idle standard for trucks in all states. As TRALA members are encouraging their customers to incorporate the latest safety and environmental technologies into their new trucks, a national clean idle standard would reduce confusion for drivers regarding which states they can utilize clean idle technology and would increase the adoption of the technology for new trucks. [EPA-HQ-OAR-2019-0055-1180-A1, p. 4]

Organization: *Volvo Group*

The Volvo Group supports a federal voluntary clean idle standard and its associated label. However, the Volvo Group believes a label must be specified and controlled in a manner similar to the California Air Resources Board (CARB)'s Clean Idle hood label approach. Without such a federal label, it is not easy for enforcement to know that the vehicle's idle emissions are well-controlled. For model years 2024-2026, the Volvo Group recommends a 30g NOx EPA Clean Idle level consistent with the current CARB Clean Idle level. [EPA-HQ-OAR-2019-0055-1324-A1, p. 5]

The criticality of this issue has already been seen due to the change in CARB's warranty requirements for MY2022 vehicles. The current lack of a federal voluntary clean idle standard with an associated label meant that fleets in all states that automatically opt-in to CARB's medium- and heavy-duty vehicle standards, as well as those municipalities or entities with existing clean idle ordinances, were required to pay over $2,000 more for their vehicles to pay for the CARB certification and its linked Clean Idle label, even though the additional warranty had no relevance to the idle technology, which was exactly the same as those vehicles without Clean Idle labels. The failure of EPA to develop a federal voluntary clean idle standard and label would lead to the forfeiture of federal rulemaking authority over vehicles for fleets seeking to comply with state or local ordinances requiring clean idle labels and impose the increased cost and technology risk that will be incurred under the California Omnibus NOx standard. [EPA-HQ-OAR-2019-0055-1324-A1, p. 5]

Organization: *Great Rivers Environmental Law Center and Dutchtown South Community Corporation (DSCC)*

The Proposed Regulation demonstrates that emissions from HD vehicles are particularly high when vehicles are idling or operated in stop and go traffic, likely because increases in exhaust temperature causes emissions restriction devices to be less effective or ineffective.14 Reports estimate that in some cases, NOx emissions from vehicles operated in such low-load engine conditions may be more than double that of emissions produced during normal operation.15 As a result, the undersigned believe that one of the most important ways in which EPA and MDNR can combat transportation-related pollution is to ensure that emissions are a low as possible during idling and low-load operation of HD vehicles. [EPA-HQ-OAR-2019-0055-1323-A1, p.4]

14 Proposed Regulation at p.17418.

15 Id.

Purportedly as a means of addressing the ozone problem in the St. Louis area, in 2009 MDNR enacted an anti-idling regulation applicable to the region. 10 CSR 10-5.385. This regulation prohibits heavy diesel commercial, public and institutional vehicles from idling for more than five minutes within any 60-minute period. This state regulation is incorporated into Missouri's

SIP in an attempt to reduce ozone levels in the area.16 However, Great Rivers has collected data demonstrating that this regulation is ineffective largely because of lack of enforcement. [EPA-HQ-OAR-2019-0055-1323-A1, p.4]

16 MDNR, Missouri State Implementation Plan Revision, Infrastructure Elements for the 2015 Ozone Standard at p.8 (Adopted March 28, 2019).

Great Rivers has collected data regarding the real-time use and effectiveness of anti-idling regulations as a means of reducing ozone pollution from traffic. This task was complicated by the fact that while MDNR enacted the anti-idling regulation and included it in the Missouri SIP, the actual implementation of the control requirement depends upon local enforcement, which is further complicated by the unique system of municipal governance and policing common to the St. Louis metropolitan area. Instead of one centralized local system of government, the area covered by Missouri DNR 10 CSR 10-5.385 is fractured into more than 120 different municipal governments, overlaid by four different county governments.17 Many of these local governments have their own police force and an independent system of ordinance enforcement. Despite the patchwork quilt of governmental structure in the St. Louis area, Great Rivers has been able to use records requests to individual municipal agencies to ascertain that none of the four county governments in the St. Louis metro area (Franklin, Jefferson, St. Charles and St. Louis County), nor the City of St. Louis, have records of enforcement of 10 CSR 10-5.385 within the last five years. Additionally, the 36 municipalities that have responded to Great Rivers' records requests to date have no records of enforcement of 10 CSR 10-5.385 within the same time period. Further, although St. Louis City and County have their own anti-idling ordinances, neither government has records of enforcement of those provisions within the last five years.18 Similarly, none of the municipalities located in St. Louis County responding to Great Rivers' records requests have issued tickets or other citations pursuant to St. Louis County's anti-idling ordinance. A similar lack of enforcement of anti-idling laws has been observed around the country.19 Given the lack of meaningful implementation and enforcement of these state and local anti-idling regulations, the stringency of the national idling standards for HD vehicles proposed by these regulations becomes even more important. [EPA-HQ-OAR-2019-0055-1323-A1, pp.4-5]

17 St. Louis Magazine, St. Louis County municipalities and Better Together: 4 things to know (March 8, 2019), located at https://www.stlmag.com/news/politics/st-louis-county-municipalities-better-together; Franklin County, Welcome to Franklin County, located at https://www.franklinmo.org/index.asp?SEC=FE9732F6-C363-4510-9D34-6766EB2EE285; Aboutstlouis.com, Jefferson County Cities, located at https://aboutstlouis.com/local/jefferson-county-missouri-cities; Aboutstlouis.com, St. Charles County Cities, located at https://aboutstlouis.com/local/st-charles-county-missouri-cities#:~:text=in%20the%20city.-,St.,that%20cover%20592%20square%20miles.

18 St. Louis City's anti-idling ordinance, section 68137 is located at https://www.stlouis-mo.gov/government/city-laws/ordinances/ordinance.cfm?ord=68137 (limiting idling to 5 minutes when ambient temperatures are higher than 32º); St. Louis County's anti-idling ordinance, section 612.340, is located at

https://library.municode.com/mo/st._louis_county/codes/code_of_ordinances?nodeId=TITVIPUHEWE_CH612AIPOCO_612.340AIPONUPR (precluding idling for longer than 3 consecutive minutes).

19 Bloomberg, How to Win the War on Car Idling, (August 10, 2021), located at https://www.bloomberg.com/news/features/2021-08-10/can-cities-finally-win-the-war-on-vehicle-idling.

The undersigned support inclusion of the following requirements in the Final Regulation:

- Mandatory idling mode and low-load cycle testing of both CI and SI engines, conducted at certification and during in-use testing; [EPA-HQ-OAR-2019-0055-1323-A1, p.5]

EPA Summary and Response

Summary:

All commenters provided general support for EPA's proposal to set idle standards for heavy duty engines, with some qualifications. Some commentors supported making idle standards mandatory, while others commented that the idle standards should be optional. With regard to the level of the idle standard, there was support from many commenters that the standards should be set at the Proposed Option 1 level or lower, while several manufactures stated that 10 g/hr for certification and 15 g/hr in-commerce would be the lowest feasible standards for NOx. One manufacturer commented that EPA must set standards that do not increase CO_2 emissions. Another commenter said that NVH should be considered since many drivers idle the engine of the truck when sleeping in the truck.

Response:

EPA has considered these comments, along with the available data including the data from the EPA Stage 3 engine, and is finalizing voluntary idle NOx standards for MY 2024 - 2026 and MY 2027+ engines. The level of the standards, including EPA's analysis of the feasibility of the standards and response to some of these comments, are discussed in Section III of the preamble.

We are finalizing voluntary clean idle standards for two main reasons. The first is that the stringency of the final off-cycle standards will require that all engines have low NOx emissions when idling. This optional clean idle test will help further ensure that NOx emissions stay well controlled as aftertreatment temperatures are critical to controlling NOx, and this test will ensure control over a long period of extended idle time. Second, we believe an EPA clean idle label will facilitate the ability of state and local law enforcement officers to enforce certain state and local clean idle rules. The reason we believe that mandatory idle duty-cycle standards wouldn't alleviate the need for a clean idle label is because enforcement officers cannot tell from the outside of the vehicle what the model year the engine is. We have heard from stakeholders, including CARB, that this is important, so that enforcement officers don't have to wake up a sleeping driver to check if the engine meets the clean idle requirements.

Regarding the comment on considering NVH when setting the standards, as outlined in RIA Chapter 3, we have conducted NVH testing at idle with CDA active. EPA's assessment based on this testing is that there are several ways to reduce NVH to acceptable levels through design of the complete system, including, where CDA is used, engine mounts, cab mounts, and seat calibration. Based on consideration of this testing, we have determined that the final standards are achievable without increasing NVH outside of the acceptable range.

Some commenters stated that the proposed PM, HC, and CO standards are unworkable since the standards are set at the level the engine emits at during idle over the engine FTP and SET duty cycles and that variability in the emissions between the different tests could cause the engine to fail the idle PM, HC, and CO standards. EPA recognized this issue in the proposal and requested comment on if EPA should instead set PM, HC, and CO standards that are fixed and not based on the emissions from the engine during the FTP and SET. EPA has considered these comments and is not finalizing idle PM, HC, and CO standards for two main reasons. The first is that we agree that setting the standards right at the idle emissions level of the engine on the FTP and SET could cause false failures due to test-to-test variability. Second, we believe that the final off-cycle PM, HC, and CO standards, as discussed in Section III of the preamble, will ensure that PM, HC, and CO emissions will be controlled at idle, as this type of operation is covered by the FTP and LLC standards and control of these pollutants is less affected by changes in aftertreatment temperature.

Finally, EPA agrees with the comments from EDF that there should not be exemptions for buses and recreational vehicles, since the standards are voluntary and EPA's analysis shows that the standards are feasible.

3.6 Other proposed requirements for Spark-ignition HDE

3.6.1 Other requirements for Spark-ignition HDE

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

CARB staff supports the proposed idle control in 40 Code of Federal Regulation (CFR) 1036(j)(1) that requires the catalyst bed used in SI HDEs to maintain a minimum temperature of 350 °C to ensure emission are controlled during extended idling. CARB staff also supports the proposal to use modeled exhaust component temperatures to protect the catalyst instead of designing the engine to continuously monitor exhaust component temperatures, as specified in 40 CFR 1036(j)(2). [EPA-HQ-OAR-2019-0055-1186-A2, p.49]

The NPRM requests comments on the proposal to allow vehicle manufacturers the option to request approval to certify the OBD of the spark-ignited, engine-certified products using data from similar chassis-certified Class 2b and Class 3 vehicles that meet the provisions of 86.1806-17, provided they show that both products use the same engine and similar emission controls. CARB staff generally agrees with the proposal since CARB's HD OBD regulation includes similar allowances for spark-ignited engines. [EPA-HQ-OAR-2019-0055-1186-A2, p.66]

However, CARB staff has concerns regarding the language in 1036.110(a)(2), which seems to be the proposed regulation language that will cover this provision but does not include language requiring manufacturers to provide information showing the products use the same engine and similar emission controls. Further, the language indicates that HD spark-ignited engines for over 14,000 pounds GVWR may meet the requirements of 86.1806 if the engines ‘share essential design characteristics with engines that the engine manufacturer also installs in vehicles certified under 40 CFR part 86, subpart S.’ CARB staff believes the phrase ‘share essential design characteristics’ is vague and does not provide enough details about what design characteristics are considered or not considered by U.S. EPA in making this determination. CARB staff recommends that U.S. EPA make changes to the regulation language to provide more specifics. [EPA-HQ-OAR-2019-0055-1186-A2, p.66]

U.S. EPA states that they are proposing that spark-ignited engine manufacturers monitoring component temperatures to engage thermal protection modes make available the component temperature parameters (measured and modeled, if applicable) publicly available ‘as specified in a new c However, this regulation section does not exist in the version of 1036.110 provided. CARB staff is not sure if this was an oversight or if U.S. EPA was not going to propose such a requirement. If this was an oversight, CARB staff cannot comment on whether the proposal has issues or not since there is no regulation language to review. [EPA-HQ-OAR-2019-0055-1186-A2, p.78]

The requirements outlined §1036.205(b) for disclosing AECD at the time of certification are consistent with CARB guidance and the current requirements in 1039.205 (b). There is also a long-standing guidance form U.S. EPA and CARB that prohibits the use of component protection AECDs in the case of frail design of engines and aftertreatment components. VPCD-98-13 (x) states, "…whether an AECD is justified as necessary depends in part on considerations of currently available technology. For example, engine protection would not justify an AECD if the need for engine protection is the results of inadequate design of the engine, when viewed in comparison to currently available technology." And CCD-01-02 (v) states, "As set put in the 1998 guidance, U.S. EPA will not approve an AECD for a frail engine design where the need for engine protection is the result of inadequate design of the engine, when viewed in comparison to available technology." So, for the sake of consistency and a level playing field for the entire industry, CARB staff believes this prohibition against component protection AECDs used in the case of frail design should be codified in §1036.205(b)(11). This would be consistent with CARB and U.S. EPA position that any manufacturer who exercise poor or negligent engineering practices be held accountable for the impact to air quality and public health because of excess emissions from poorly designed products. [EPA-HQ-OAR-2019-0055-1186-A2, p.125]

Organization: *Cummins Inc. (Cummins)*

EPA proposes in §1036.115(j)(1) that manufacturers must design SI engines such that catalyst bed temperature does not fall below 350 °C during extended idle or may request an alternative strategy to keep emissions from increasing. It is not clear for what duration the temperature must be maintained, under what range of ambient conditions, what level of which pollutant is considered an emissions increase, or how a catalyst with a different light-off temperature or location would be addressed. In addition to providing clarifications to these questions, EPA could consider a more technology-neutral approach by referencing the target temperature generically as “light-off temperature” rather than 350 °C specifically. [EPA-HQ-OAR-2019-0055-1325-A1, p. 19]

EPA also proposes in §1036.115(j)(2) that for catalyst thermal protection, manufacturers can model exhaust component temperatures if they demonstrate at certification that modeled temperatures are within 5 °C of actual temperatures, rather than designing the engine to continuously monitor exhaust component temperatures. We are concerned that 5 °C is not achievable for accuracy of the model and request for EPA to share any data used to validate the 5 °C threshold. Also, EPA should clarify that engines not using enrichment for catalyst protection would not be subject to this provision. [EPA-HQ-OAR-2019-0055-1325-A1, p. 19]

Spark Ignited Scantool, 40 CFR 1036.110(b)(10)(i): Propose to clearly define air/fuel enrichment, either generic enough for the modes called out in this requirement, or in the context of the 3 modes (throttle, engine protect, catalyst protection) called out in the EPA regulations. [EPA-HQ-OAR-2019-0055-1325-A1, p. 30]

Organization: *Oshkosh Corporation*

Currently, heavy-duty certification requirements—and onboard diagnostic (OBD) requirements in particular—pose a substantial barrier to entry for these technologies due to high development and testing costs. This situation is further complicated by megatrends toward electrification in the transportation industry. We support the aspects of EPA’s proposal intended to provide flexibility in OBD compliance, including EPA’s proposal to allow, with the Agency’s approval, certain OBD test data from spark-ignition (SI) engine-certified products to be carried over to heavy-duty vehicle certification. See 87 Fed. Reg. at 17,483. Under this proposal, manufacturers would be able to certify the OBD of their engine-certified SI products using data from similar chassis-certified Class 2b and Class 3 vehicles meeting the provisions of 40 CFR 86.1806–17 upon showing that the engine- and chassis-certified products use the same engines and generally share similar emission controls (i.e., are “sister vehicles’”). Oshkosh requests that EPA finalize this flexibility with clarification that “sister vehicles” need not be produced by the same manufacturer; in other words, that OBD certification data shared between different manufacturers of record could be used to meet this compliance option, assuming the similarity requirement is met. [EPA-HQ-OAR-2019-0055-1226-A1, pp. 3 - 4]

Organization: *Roush CleanTech (Roush)*

Roush believes the 350ºC extended idle temperature standard, with compliance by manufacturer description as well as flexibility to use alternative methods, as proposed in 1036.115(j)(1) is reasonable. While we concur with EPA that reducing excess idling would be ideal, we appreciate the clear EPA guidance on reference expectations for balancing criteria emissions with CO2 and fuel consumption in this condition. [EPA-HQ-OAR-2019-0055-1276-A1, p.2]

Roush is concerned with EPA’s approach regarding spark ignited thermal modeling discussed in D.2.vi and proposed in 1036.115(j)(2). We believe that the OBD framework already provides a clear methodology for ensuring that inputs (whether physical or models) meet the requirements for emissions controls, and that industry is continually working with the agencies on items very similar to this (reference the performance-based demonstrations required for the thermal modeling used for thermostat monitor, cold start emissions reductions, etc.). We recommend that EPA not pursue this change as part of this regulation and pursue the concern with ARB and industry for implementation in future ARB OBD regulation if necessary. Some of our specific concerns and recommendations as follows:

- We are concerned about EPA's general assumption that temperature sensors are preferred to models, especially in the challenging measurement environments covered here. We believe that if EPA is concerned about the accuracy of information used for thermal protection AECD's, the requirements should be applicable to whatever combination of physical and virtual inputs are used. [EPA-HQ-OAR-2019-0055-1276-A1, p.2]
- The language of (j)(2) is confusing regarding scope of the requirement. The first sentence is specific to 'modeled exhaust component temperatures to protect the catalyst', but later in the paragraph requires 'all modeled and actual temperatures differ by 5ºC or less'. We recommend that EPA make it clear on whether the only accuracy requirement is for the specific modeled parameter used to initiate catalyst protection, or whether the accuracy requirement applies more broadly to include some or all modeled parameters associated with exhaust, even if larger errors in those parameters would not result in excessive activation of the AECD. [EPA-HQ-OAR-2019-0055-1276-A1, pp.2-3]
- We are concerned that EPA seems to be assuming that manufacturers would either utilize sensors or models ('You may use modeled exhaust component temperatures… instead of designing the engine to continuously monitor'); in practice we believe manufacturers almost always utilize models in addition to sensors due to the inherent limitations and failure modes of physical sensors. Specific to catalyst midbrick, in the interest of durability of both the sensors and the catalyst, we would almost certainly not attempt to measure the catalyst midbrick with a production sensor; we would measure gas temperatures at the catalyst inlet and outlet, and then use a model based largely on those temperatures to estimate the brick temperature. The regulation as written would still seem to consider this a 'modeled exhaust component temperature' (the catalyst midbrick temperature is modeled, not measured) and would still require it to meet the accuracy requirement. We don't believe this is what EPA was intending, and illustrates the issues associated with the 'sensor or model' approach. [EPA-HQ-OAR-2019-0055-1276-A1, p.3]
- We believe the requirement as specifically applied to spark-ignited engine catalyst temperatures over the FTP and SET cycles is largely redundant. The FTP emissions standards already ensure that manufacturers do not use enrichment during transient operation expected to be seen during urban vocational use, and the new SET requirement will ensure that enrichment is not triggered during sustained high-load operation as may be seen on heavier over-the-road usage. It is unclear what further air quality benefit would be associated with the additional model accuracy requirement, making it difficult to understand the justification for the increased cost to manufacturers and consumers (both for the initial cost of the additional sensor(s), wiring, and ECU content, the increase in testing costs, as well as the associated increased repair costs). There is offsetting reduction in engineering cost due to the use of sensors—a robust catalyst temperature model would still need to be developed and validated in order to protect the catalyst

during sensor failure conditions, to verify the sensors are accurate, etc.[EPA-HQ-OAR-2019-0055-1276-A1, p.3]

- We do not believe the proposed 5ºC accuracy value is reasonable, and is well beyond the standards even for laboratory equipment. For reference, 1065.307 allows up to 1% of Tmax variation for temperature measurement. For a catalyst midbed sensor capable of 2000ºF (1367K), this would be equivalent to 14ºC allowable error on a certification quality sensor and acquisition system. Clearly the production sensor or model cannot be expected to be anywhere near this accurate. We believe that correlation of the sensor or model of effectively twice the 1065.307 standard (linearity within 2% of Tmax) would be the bare minimum, but even this requirement seems excessive. Again, we don't believe models should be required to meet any requirements which don't apply equally to sensors. [EPA-HQ-OAR-2019-0055-1276-A1, p.3]
- At minimum, we believe EPA would need to develop a robust and complete test method, specifying at least the following:
  - Clarification of which components would be expected to be validated in the regulatory language, including thorough justification in the final rule. EPA language in the NPRM is inconsistent whether the intent is to require model accuracy verification for catalyst midbrick only, or whether such verifications would be required for any engine and/or aftertreatment component where enrichment could be utilized as part of the thermal protection strategy.
  - Clarification on whether EPA is allowing such instrumentation for certification testing, or whether separate tests would be required. Roush's current assumption is that instrumented catalysts and oxygen sensors cannot be used for certification (the instrumentation is intrusive and modifies out of the certified configuration) and therefore there would be additional test burden associated with the requirements in (j)(2).Specific design and accuracy of the reference temperature sensor for each of the component locations EPA would expect to be verified. Catalyst midbrick and oxygen sensors can be extremely challenging even for development purposes; we're interested in what measurement techniques EPA would propose that would meet the requirements for 1065.307.
  - Installation tolerances for the reference sensors (for instance, that the sensor must be located within a specified radial distance of the manufacturer specified modeled location). Obviously manufacturers will attempt to place the sensors as accurately as possible for our own testing, but since these requirements would be subject to agency or independent testing, it is crucial to ensure that the sensor location is well defined.
  - Methodology to account for the transient response characteristics of the reference sensor; models do not have the response delay associated with physical measurement. Filtering the model value based on the measured sensor system time response prior to performing the accuracy validation would seem to be appropriate, but we are open to other suggestions.
  - What condition the engine and/or aftertreatment system should be during testing—should this represent a stabilized (125-hour) condition, full useful life condition, OBD threshold condition, etc.
  - What compliance attestation is expected—are manufacturers considered compliant simply because they have evidence that one engine on day in one cell

> met the requirement, or is there an expectation that any engine on any day in any cell would pass? What level of in-use accuracy is expected, and how would surveillance testing be performed? [EPA-HQ-OAR-2019-0055-1276-A1, pp.3-4]

Organization: *Truck and Engine Manufacturers Association (EMA)*

Regarding idle requirements for SI engines, §1036.115(j)(1) requires that manufacturers maintain 350°C catalyst bed temperatures during extended idle. EMA supports the option to propose alternative strategies to prevent emissions from increasing during extended idling. [EPA-HQ-OAR-2019-0055-1203-A1, p. 43]

EPA Summary and Response

The summary and response for this section includes a summary of comments by category and the responses follow each summary.

EPA proposed two provisions for SI engines in a new 40 CFR 1036.115(j). Specifically, in paragraph (j)(1), we proposed that manufacturers would be required to show how they maintain a catalyst bed temperature of 350 °C in their application for certification or get approval for an alternative strategy that maintains low emissions during idle. In paragraph (j)(2), we proposed to require manufacturers to demonstrate that any thermal models used to initiate catalyst protection are accurate to within 5 °C.

CARB and Roush supported EPA's proposal that manufacturers ensure catalyst bed temperatures maintain a minimum of 350 °C and EMA supported the option for manufacturers to propose alternative strategies for preventing SI engine emissions during idle. Cummins requested that EPA clarify the duration and range of ambient conditions over which that temperature must be maintained, the emission level that would indicate an "increase" from a given pollutant, and whether a different temperature could be used if the catalyst has a different light-off temperature or location. Cummins suggested EPA could consider referencing a generic "light-off temperature" target rather than 350 °C.

<u>Response</u>:

- We disagree with Cummins' suggestion to replace the 350 °C target with "light-off temperature", because we prefer to rely on a specific numeric value, based on the industry-accepted light-off temperature for current catalyst systems, and provide flexibility for manufacturers to identify and obtain approval for a different value as needed. We recognize that the industry may develop new, advanced catalyst formulations or manufacturers may relocate catalysts to a position that would merit a different temperature specification. We are finalizing the 350 °C target, with the option to request approval for a different strategy, as proposed. If a manufacturer chooses such an alternative strategy, they would have to justify to EPA why their strategy is equivalent to maintaining catalyst temperature, including any conditions where emissions vary over time or under specific ambient conditions. We are revising our proposal to also allow manufacturers to request approval of a temperature lower than 350 °C; EPA review of a manufacturer's request would allow us to adjust the temperature specification to account for a different light-off temperature or catalyst location, which is consistent with Cummins' suggestion in the comment.

- We did not intend to limit the scope of the requirement to meet the exhaust temperature specification during extended idle and are therefore not adding specific conditions in response to Cummins' requests for clarification. Manufacturers should be able to demonstrate with engineering analysis and with testing that engines operating indefinitely at idle in any ambient conditions would be able to keep exhaust temperatures above the specified temperature setpoint.
- We intended for the new requirement to maintain exhaust temperatures to apply instead of adopting a defined procedure for measuring emission levels. Our approach of focusing on maintaining a sufficiently warm catalyst temperature, as indicated by our final temperature threshold, avoids the complexity and burden of compliance with a standard with a corresponding test procedure while nevertheless ensuring emissions will be controlled. As a result, there is no need to establish an allowable level of increased emissions.

CARB supported EPA's proposal in paragraph (j)(2) to allow manufacturers to use modeled exhaust component temperatures to protect the catalyst instead of designing the engine to continuously monitor exhaust component temperatures.

Response:

- We appreciate CARB's support for the proposed paragraph (j)(2), but CARB appears to have misinterpreted the proposal as a *new* option to allow manufacturers to model exhaust component temperatures. Manufacturers currently use modeled exhaust temperatures in lieu of continuously monitoring for many of their modern emission control systems for SI engines. Our proposal, which we are finalizing with some revisions noted in this section 3.6.1, was intended to be a new certification step for manufacturers to *validate* those temperature models.
- Manufacturers are already required to report AECDs as part of the certification process. We are updating the proposed regulatory language to clarify that the final validation requirement is specific to temperatures used in AECDs for catalyst protection. These AECDs, which are often activated in sustained high load operation, inherently result in changes in emissions levels in real world scenarios, but would not be observed in the FTP or SET duty cycles run in the laboratory. This validation step would ensure that SI engines relying on catalyst operation at stoichiometric ratios to certify in the laboratory are not excessively triggering enrichment with an AECD in the real world due to conservatively modeled component temperatures (i.e., catalysts, manifolds, exhaust valves, sensor, etc).

Roush and Cummins commented that they do not see the proposed 5 °C allowance as a reasonable delta between modeled and measured exhaust temperatures. Cummins requested that

EPA share data that validates the 5 °C threshold and suggested that engines that do not use enrichment for catalyst protection would not be subject to this requirement. Roush suggested that changes to requirements for thermal modeling are better addressed in a future OBD regulation with the California ARB. Roush expressed concern with EPA's assumption that temperature sensors are preferred, when it is impractical to apply a sensor for some components, such as the catalyst itself. Roush also suggested that a more "robust and complete test method" would be required, and included several clarifications to the proposal.

Response:

- We are revising our proposed provision to remove the specific accuracy demonstration requirement. We believe our revised approach will ensure EPA has the information needed to appropriately assess a manufacturer's AECD strategy, while avoiding Roush's concern over overlap with OBD requirements. We are revising the proposed paragraph (j)(2) as follows:
    - Clarifying that the new validation process is an additional requirement for any spark-ignition engine that includes an AECD for thermal protection in its application for certification.
    - Replacing the proposed 5 °C accuracy demonstration with a more general validation process that builds on the information requirements that we proposed and are finalizing for 40 CFR 1036.205(b). Manufacturers would describe why they rely on an AECD instead of other engine designs that can provide thermal protection, and describe the accuracy of any modeled or measured temperatures that would activate the AECD. Instead of requiring manufacturers to upfront submit second-by-second data to demonstrate a specific accuracy requirement is met, the final regulation gives EPA discretion to request the information at certification.
- In response to Cummins, we reiterate here and in the preamble for this final rule that this requirement would not apply to engines that manufacturers certify without an AECD for thermal protection.
- In response to Cummins request for data, the proposed 5 °C threshold was chosen based on EPA experience with manufacturer compliance data, but we are not including that proposed accuracy requirement in this final rule.
- In response to Roush's requests for a test method and additional clarification, we did not intend for this new requirement to include a defined test procedure. The more general validation process we are finalizing in this rule will not require additional testing to demonstrate a specific accuracy. Instead, we are requiring manufacturers to share more specific information to justify their AECD strategy during the certification process. Manufacturers are generally allowed to continue to use the modeled or measured temperatures that are most appropriate for their engines. We agree with Roush's suggestion that EPA should apply the same accuracy requirements to physical and virtual inputs used to AECD. The final provision includes a requirement to describe the accuracy of any AECD-triggering measured temperatures in addition to modeled temperatures.

EPA proposed a new 40 CFR 1036.110(b)(10) with two OBD provisions requiring new parameters to be available using a generic scan tool. For the first provision, Cummins requested EPA clarify the term "air/fuel enrichment" in proposed 40 CFR 1036.110(b)(10)(i), requesting a definition that is either generic enough for the modes called out in this requirement, or in the context of the 3 modes (throttle, engine protect, catalyst protection). CARB did not comment on the proposed 40 CFR 1036.110(b)(10), but did refer to the text for the second generic scan tool requirement that was in the preamble, noting that their staff could not locate the specific regulatory language.

Response:

- In response to Cummins request for clarification, we revised the proposed 40 CFR 1036.110(b)(10)(i) to include a description of the engine operation we consider in enrichment. Specifically, we are adding two sentences specifying that manufacturers include all time after engine warm-up when the engine is not operating at the air-fuel ratio designed for peak three-way catalyst efficiency and describing peak efficiency as typically involving closed-loop feedback control. As proposed, we are finalizing the requirement that the OBD system track enrichment based on throttle, engine protection, and catalyst protection. We intend this to mean that OBD parameter will indicate if the enrichment is due to 1) engine load, which includes inputs such as throttle, mass air flow, manifold pressure, 2) engine and engine component protection, and/or 3) protection of the catalyst or other exhaust emissions components.
- In response to CARB, we regret that the preamble text described the provision in proposed 40 CFR 1036.110(b)(10)(ii), but incorrectly referred to paragraph (c). We are not taking final action on this proposed provision to require modeled or measured component temperature parameters for heavy-duty spark-ignition engines at this time. We would like to clarify the type of information we would like the generic scan tool to include for component temperatures and believe it is better to solicit additional information in a future rule.

In a new 40 CFR 1036.110(a)(2), we proposed to allow vehicle manufacturers the option to request approval to certify the OBD of their spark-ignition, engine-certified products using data from similar chassis-certified Class 2b and Class 3 vehicles that meet the provisions of 40 CFR 86.1806-17. Oshkosh Corporation and CARB commented in support of the proposed OBD flexibility and CARB suggested some revisions to the proposed regulatory language. CARB suggested that the expression 'share essential design characteristics' was too vague, and requested EPA provide more specific information on what EPA will use to make their determination.

Response:

- We are revising our proposed regulatory language after considering CARB's request for more specific information. As described in the proposed rule, we want to encourage manufacturers to gain the advantage of more comprehensive monitoring by meeting chassis-based OBD requirements for vehicles that are closely related to Class 2b and 3 vehicles certified under 40 CFR 86.1806-17. Commenters shared only a general concern regarding the ambiguity of the proposed provisions rather than responding to the request in the proposed rule for comments suggesting regulatory changes that provide specific criteria to qualify candidate vehicles under this provision. This flexibility is approved through the certification process and the provision requires manufacturers to identify the design characteristics and justify their request. We are adjusting the wording of 40 CFR 1036.110(a)(2) to more carefully track the proposed preamble for describing how manufacturers qualify for this provision by installing the same engines into vehicles above and below 14,000 lb GVWR that share similar emission controls.

CARB staff commented that EPA should codify in 40 CFR 1036.205(b)(11) the prohibition against component protection AECDs used in frail design, as described in existing EPA guidance (VPCD-98-13 and CCD-01-02). CARB has published similar guidance. CARB stated that the guidance documents prohibit the use of component protection AECDs in the case of frail or inadequate design of engines and aftertreatment components. CARB further stated that any manufacturer exercising poor or negligent engineering practices should be held accountable for the impact to air quality and public health because of excess emissions from poorly designed products.

Response:

- The fundamental provision of the guidance related to “frail designs” is that EPA will not approve an AECD for a frail engine design where the need for engine protection is the result of inadequate design of the engine, when viewed in comparison to available technology. The proposed provisions related to engine and catalyst protection for spark-ignition engines were intended to accomplish that same purpose of relying on AECDs for protection only to the extent that other engine designs are not suitable to accomplish that protection. The final rule at 40 CFR 1036.115(j)(2) includes a requirement for manufacturers to justify their need for AECDs instead of other engine designs for thermal protection of catalyst or other emission-related components. We may consider revising 40 CFR 1036.205 in a future rulemaking to include additional elements from the guidance.

3.6.2 Off-cycle standards and low load cycle for Spark-ignition HDE

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

U.S. EPA requested comment on allowing manufacturers to attest to off-cycle emissions compliance. CARB staff suggests adding a compliance statement for SI HDE engines with off-cycle standards, similar to the requirements in the Omnibus regulation.134 A compliance statement would hold manufacturers accountable for the real-world emissions without the requirement that manufacturers need to conduct in-use testing. This would allow U.S. EPA the option of conducting off-cycle testing if it chooses to do so. SI HDEs do not have the same emission control challenges faced by CI engines. SI HDEs are capable of quick thermal management enabling early emission control during cold starts and do not have the same challenges to maintain emission control under extended low load operation. CARB staff recommends adopting the Omnibus off-cycle standards for SI HDEs as implemented by CARB's Omnibus program. [EPA-HQ-OAR-2019-0055-1186-A2, p.62]

134 https://ww2.arb.ca.gov/rulemaking/2020/hdomnibuslownox

U.S. EPA requested comment on allowing manufacturers to attest to off-cycle emissions compliance. CARB staff supports the addition of 1036.205(p) requiring a compliance statement stating the engines meet the off-cycle emissions standards when tested using the off-cycle test procedures. This is an important change with the new off-cycle emission standards and test procedures for newer engines. [EPA-HQ-OAR-2019-0055-1186-A2, pp.62-63]

Organization: *Great Rivers Environmental Law Center and Dutchtown South Community Corporation (DSCC)*

The undersigned support inclusion of the following requirements in the Final Regulation:

- Mandatory idling mode and low-load cycle testing of both CI and SI engines, conducted at certification and during in-use testing; [EPA-HQ-OAR-2019-0055-1323-A1, p.5]

Organization: *National Propane Gas Association (NPGA) and Propane Education & Research Council (PERC)*

We suggest the following modifications to the Proposed Option 1:

- 3. **Comments on Low Load Cycle (LLC)**: In response to the agency’s solicitation of feedback on the proposed requirements for LLC certification for spark ignited engines, we do not have significant concerns.11 However, stoichiometric spark ignited engines operating with propane do not undergo frequent catalyst deactivation; unlike diesel engines due to the higher exhaust temperatures and shorter time for catalyst reactivation during load changes. Therefore, the inclusion of LLC certification requirements would provide an opportunity for propane engines to compare more favorably to diesel engines. [EPA-HQ-OAR-2019-0055-1263-A1, p.3]

11 Supra note 1, at 17460.

Organization: *Truck and Engine Manufacturers Association (EMA)*

Regarding spark-ignited engines, EMA does not support the addition of the in-use MAW requirements for gasoline SI engines. EPA’s addition of the SET test for gasoline engines sufficiently covers real-world operation, especially with respect to high-load operation where gasoline engines are most challenged for tailpipe criteria emissions. Additionally, low-load operations should not be a concern, since gasoline SI engine inherently have much higher exhaust temperatures than diesel. [EPA-HQ-OAR-2019-0055-1203-A1, p. 85]

EPA Summary and Response

The summary and response for this section includes a listing of the topics raised, then the comments are summarized by category and the responses follow each summary.

CARB staff recommended EPA adopt off-cycle standards for SI HDEs as implemented by CARB's Omnibus program. CARB staff suggested adding a compliance statement for SI HDE engines with off-cycle standards would hold manufacturers accountable for the real-world emissions without the requirement that manufacturers perform in-use testing. CARB indicated that the compliance statement would allow EPA the option of off-cycle testing if it chooses. CARB staff recommends adopting the Omnibus off-cycle standards for SI HDEs as implemented by CARB's Omnibus program.

EMA does not support the addition of the in-use MAW requirements for gasoline SI engines, suggesting that the SET test for gasoline engines would cover the high-load operation where gasoline engines are most challenged for tailpipe criteria emissions in real world operation.

Response:

- We did not propose and are not finalizing separate off-cycle standards or in-use testing requirements for Spark-ignition HDE in this rule. This final rule includes several new requirements for manufacturers of Spark-ignition HDE that will ensure manufacturers are designing their engines to address emissions over a broader range of operating conditions that are not covered by the FTP duty cycle currently used for certification. We intend to evaluate certification data from the new SET duty cycle, in combination with the new idle and enrichment requirements we are finalizing in 40 CFR 1036.115(j), and may consider adopting off-cycle standards or in-use testing requirements for Spark-ignition HDE in a future rule.

- We disagree with CARB that off-cycle standards are needed for SI engines. EPA has the ability to do any amount of inspection or testing to inform our decision making about which engines to test for evaluating compliance with duty cycle standards. In-use and off-cycle test results, from EPA or others, can serve as a screening tool to help EPA identify the need for further duty cycle testing. As noted in section III of the preamble, we are expanding the engine operation covered by heavy-duty SI duty cycle testing by setting new standards over the SET duty cycle to apply for those engines. We believe the combination of the SET and FTP duty cycles represent most of operation of heavy-duty SI engines and will capture most real-world emissions from those engines. Furthermore, EPA's current approach of reviewing designs for defeat devices will further ensure that manufacturers will control emissions over the full range of engine operation, which can achieve a similar result as manufacturers attesting to off-cycle emissions compliance.

Great Rivers et al. and NPGA/PERC commented in support of the LLC for SI engines. Neither organization provided data or additional information. Great Rivers et al. also supported mandatory idling mode to apply at certification and in-use. EMA stated that low-load operations should not be a concern, since gasoline SI engine inherently have much higher exhaust temperatures than diesel.

Response:

- We did not propose and are not finalizing LLC to apply for heavy-duty SI engines at this time. We did not include LLC as part of our SI engine demonstration program to inform feasibility of LLC standards. We recognize that, at this time, we are primarily addressing high-load and idle operation with the new SET duty cycle standards, enrichment requirements, and idle requirements we are finalizing in this rule. We note that our prioritization for this rule does not mean we agree with EMA that low-load operations "should not be a concern"; we intend to evaluate certification data from the new SET duty cycle, in combination with the new idle and enrichment requirements we are finalizing in 40 CFR 1036.115(j). We may consider adopting low-load requirements for Spark-ignition HDE in a future rule.
- We did not propose and are not finalizing mandatory idle testing for heavy-duty SI engines. We are finalizing a requirement to ensure that SI engine catalysts maintain a temperature of 350 °C during extended idle and we continue to believe, as noted in the NPRM, that the catalyst temperature control provision we are finalizing would effectively address idle emissions for heavy-duty SI engines in the lab and in the real world. See Section III.D of the preamble to this final rule and section 3.6.1 of this document.

3.6.3 ORVR for Spark-ignition HDE

Comments by Organizations

Organization: *Truck and Engine Manufacturers Association (EMA)*

The Agency's proposal includes new evaporative emissions control requirements during refueling. Those requirements, new to HD gasoline vehicles, will require Onboard Refueling Vapor Recovery (ORVR) systems to comply. EPA has requested comment on the proposed ORVR standard level, test procedures, canister conditioning and fuel-rig testing. [EPA-HQ-OAR-2019-0055-1203-A1, p. 120]

Although similar light-duty ORVR hardware could be deployed on heavy-duty incomplete vehicles to meet the new refueling evaporative emissions limits, the large fuel tank and canister sizes of those vehicles present a unique challenge to industry in balancing ORVR and canister BETP emissions. They will also require complete fuel system redesigns on many heavy-duty vehicles. Large scale use of these larger canisters to ORVR and canister BETP requirements has not been demonstrated by industry. Due to the uncertainty regarding the use of the new canister designs, EMA is requesting longer test schedule drive sequences and a heavy-duty ORVR compliance three-year phase-in of 30%, 60% and 100%. [EPA-HQ-OAR-2019-0055-1203-A1, p. 120]

EPA acknowledges that the real-world operating conditions of heavy-duty vehicles are more challenging than for light-duty vehicles (87 FR at p. 17491), and requests comments on possible adjustments to the ORVR test procedure. EMA recommends that an additional FTP-75 drive schedule be added to the 3-Day, 2-Day, canister BETP and ORVR test procedures following the canister load and prior to the drive schedule. That procedure would align with existing approved drive schedules utilized for certification by heavy-duty vehicle manufacturers. [EPA-HQ-OAR-2019-0055-1203-A1, p. 121]

EPA also requested comment on potential adjustments to the canister-load procedure. Manufacturers have several decades of testing experience with canisters loaded to a saturated condition and are uncertain as to any appropriate adjustments regarding the canister-load procedure. To propose an alternate canister-loading condition, extensive testing would be required to determine the correct condition and resulting impact on the emission test results. Due to that uncertainty, EMA proposes that EPA adjust the drive schedules, as proposed above, to better reflect heavy-duty vehicle real-world operating conditions rather than consider adjustments to the canister-load condition. [EPA-HQ-OAR-2019-0055-1203-A1, p. 121]

Also due to the uncertainty of the execution of these new canister designs to meet the ORVR requirements, EMA requests a heavy-duty ORVR three-year compliance phase-in of 30%, 60% and 100%, starting with MY 2027. EPA should also consider an alternative OBD2-style ORVR phase-in schedule, which would incentivize OEMs to certify products to the heavy-duty ORVR requirements as early as possible, and may encourage OEMs to certify 8,501 to 14,000 lb. GVWR incomplete vehicles to the heavy-duty ORVR requirements. CARB provided for an optional phase-in period to comply with the LEV III evaporative and refueling requirements. OEMs found the phase-in to be useful and necessary in transitioning their product lines to the new requirements, and therefore EMA recommends a similar option for HD vehicles. [EPA-HQ-OAR-2019-0055-1203-A1, p. 121]

For fuel system rigs and vehicles that can fit into the existing ORVR SHEDs, the light-duty test procedures with the proposed revised drive schedules, or a bench purge of the canister for rig testing as outlined in the CARB section 12.5.2 BETP test procedure, could be conducted. [EPA-HQ-OAR-2019-0055-1203-A1, p. 121]

Due to the steady-state temperature condition and short duration of the ORVR test, nonfuel-based background emissions do not have an impact on the ORVR test results. Overall vehicle contribution to the ORVR HC mass observed in the SHED is negligible. For example, consider the case of a 1-hour hot soak during the 2-day evaporative test, where the vehicle may emit 0.05g/60min, while also assuming a 50-gallon fuel tank undergoing a refueling test at 9.8 gal/min (assuming a 10% prefill and 1 minute dwell time after nozzle shutoff). Such a case would result in 0.0001 g/gal HC dispensed, less than 0.05% of the ORVR standard. The outcome of this analysis under reasonable assumptions indicates that an adjustment to the ORVR standard is not required to account for the extremely small differences in rig tests and vehicle tests. [EPA-HQ-OAR-2019-0055-1203-A1, p. 121]

Testing heavy-duty vehicles and rigs can present unique test procedure challenges compared to those involved in light-duty vehicle testing. There are situations where a heavy-duty refueling test must be stopped and restarted (e.g., dual fuel tanks with separate filler tubes or fuel dispensing constraints). For testing those systems, EMA recommends following the ORVR light-duty vehicle test procedures with the proposed drive schedules, but further recommends treating the actual refueling portion of the test as two separate fueling actions. More specifically, EMA recommends the following provision: Measure the hydrocarbon increase in the SHED for each refueling action. Sum the two hydrocarbon increases and divide by the total amount of fuel dispensed for both ORVR refueling events. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 121 - 122]

The revisions to the test procedures and the ORVR phase-in schedules proposed by EMA should be taken into consideration by EPA for future rulemakings that are applicable to 8,501 to 14,000 lb. GVWR incomplete heavy-duty vehicles. EMA also recommends that EPA clarify that the ORVR requirements would be applicable to vehicles that operate on volatile fuels, but exclude diesel-fueled vehicles. [EPA-HQ-OAR-2019-0055-1203-A1, p. 122]

EPA is proposing to use engineering analysis for heavy-duty ORVR compliance in lieu of demonstration testing (87 FR at p. 17491). EMA supports that proposal, which is reflective of existing practice in the current HD regulations. EMA also supports EPA's proposal to align heavy-duty ORVR useful life requirements with the existing evaporative useful life requirement of 15 years or 150,00 miles (87 FR at p. 17490). Such alignment reduces certification and database burden. [EPA-HQ-OAR-2019-0055-1203-A1, p. 122]

EPA has requested comment on the appropriate ORVR SHED mixing time for heavy-duty vehicle testing (see 87 FR at pp. 17491 and 17495). Modifications to the mixing time are not required on existing ORVR SHEDs. If existing ORVR SHEDs and/or the rig approach are used, SHED mixing time modifications are not required as the longer fuel-fill events for large fuel tank refills address this concern, where canister emissions must be controlled during the ORVR fill. The graph below presents an example of an ORVR test on a large fuel tank product, where the FID reading is stable within the current mixing time of 60 seconds. [EPA-HQ-OAR-2019-0055-1203-A1, p. 122]

EMA recommends that the vehicle volume used for fuel rig testing should be the same volume used for PZEV rig testing (5 cubic feet as specified in CARB MAC 2001-03, November 2001). Manufacturer testing of large fuel tank fuel rigs indicates that the current mixing time is appropriate, and the 5 cubic feet vehicle volume value as specified in CARB MAC 2001-03 is appropriate for heavy-duty ORVR testing. [EPA-HQ-OAR-2019-0055-1203-A1, p. 122]

EPA's proposal provides that in cases where there is a secondary manufacturer, the ORVR certification and fuel system installation instructions will be controlled by the original OEM (87 FR at pp. 17491-17492). EMA supports the EPA proposal, as it is consistent with current practice related to heavy-duty spitback compliance regulations. [EPA-HQ-OAR-2019-0055-1203-A1, p. 123]

Updates and corrections are required to the proposed evaporative SHED calculations outlined in proposed §86.117-96. EPA's proposed equation in §86.117-96(d) for Methanol mass contains a typographical error. The temperature of the sample withdrawn (TE) is only multiplied by the concentration from the 1st Impinger. TEf and TEi need to move outside of the parenthesis so it applies to the sample from both impingers. [EPA-HQ-OAR-2019-0055-1203-A1, p. 123]

Additionally, for consistency, EPA should align the Methanol mass equation in §86.143-96(b)(1)(i) with the Methanol mass equation in §86.117-96(d), as proposed in the NPRM. [EPA-HQ-OAR-2019-0055-1203-A1, p. 123]

Also related to the proposed calculations, updates and corrections are required to the SHED evaporative calculations to be consistent with other areas of the CFR and to reflect the latest available standard practices for evaporative calculations. For example, the THC density referenced for the THCE equation in §86.143-96(c) is incorrect. The THC density referenced in §1066.1005(f) is based on a hydrogen-to-carbon ratio of 1.85. As defined 86.143-96(b)(ii), for evaporative emissions, the THC mass assumes a hydrogen to carbon ratio of 2.3. EMA recommends using a density of THC with an H/C ratio of 2.3 in §1066.1005(f), and that EPA update the reference in §86.143-96(c) accordingly. [EPA-HQ-OAR-2019-0055-1203-A1, p. 123]

EMA also has concerns about how the test fuel is specified for ORVR testing. Having a singular test fuel reduces regulatory burden and streamlines the laboratory testing process. The general testing fuel outlined in §1065.710 aligns with the other testing requirements specified in the EPA Tier 3 regulations. Both conventional and flex-fuel vehicles use the same commercial E10 fuel during refueling. Accordingly, the test fuel specified for both should be the same. EMA recommends that EPA specify that the heavy-duty ORVR test fuel should meet the fuel requirements outlined in §1065.710 for general testing for both conventional and flex-fuel vehicles. [EPA-HQ-OAR-2019-0055-1203-A1, p. 123 - 124]

Finally, EMA recommends that EPA revise the ORVR fuel-dispensing rate specification. Having a uniform dispensing rate reduces regulatory burden and streamlines the laboratory testing process. Providing for a 9.8 gpm fuel rate would align with the global ORVR fuel-dispensing rate requirements. For fleet customers it is desirable to maximize fill rate (e.g., minimize refueling time) to minimize vehicle down-time. EMA therefore recommends that EPA specify the ORVR fuel dispensing rate as a uniform regulated rate of 9.8 gpm. [EPA-HQ-OAR-2019-0055-1203-A1, p. 124]

With the above recommended modifications to the final rule, EMA believes that the refueling evaporative emissions requirements would be workable and achievable. EMA is ready to work with the Agency on these detailed recommendations. [EPA-HQ-OAR-2019-0055-1203-A1, p. 124]

Organization: *Alliance for Vehicle Efficiency (AVE)*

AVE supports EPA's proposal to expand Onboard Refueling Vapor Recovery (ORVR) to incomplete heavy-duty vehicles rated over 14,000 lbs. [EPA-HQ-OAR-2019-0055-1280-A1, p. 6]

AVE recommends EPA expand ORVR to incomplete heavy-duty vehicles rated over 14,000 pounds Gross Vehicle Weight Rating, with a refueling emission standard of 0.20 grams hydrocarbon per gallon of liquid fuel dispensed, applicable for a useful life of 15 years or 150,000 miles. [EPA-HQ-OAR-2019-0055-1280-A1, p. 6]

With regulatory developments since ORVR was first introduced in 1994, primary and secondary manufacturers have gained significant experience with ORVR technology on all categories of gasoline vehicles, including complete heavy-duty gasoline vehicles (HDGVs) and even incomplete light-heavy-duty gasoline vehicles (LHDGVs). [EPA-HQ-OAR-2019-0055-1280-A1, p. 6]

Cost-effective ORVR technology is available to control refueling emissions, supported by the EPA's draft regulatory impact analysis for this proposed rule. ORVR is a proven technology to significantly reduce evaporative and refueling emissions, resulting in meaningful emission reductions of volatile organic compounds that lead to the formation of ozone and secondary particulate matter (PM2.5), as well as emissions of hazardous air pollutants. [EPA-HQ-OAR-2019-0055-1280-A1, p. 7]

Organization: *Ingevity Corporation (Ingevity)*

Ingevity supports EPA's proposal to expand ORVR to incomplete heavy-duty gasoline vehicles (HDGVs) rated over 14,000 lbs. GVWR, including the proposed refueling emission standard of 0.20 grams hydrocarbon per gallon of liquid fuel dispensed applicable for a useful life of 15 years or 150,000 miles. ORVR is a proven technology to significantly reduce evaporative and refueling emissions, resulting in emission reductions of volatile organic compounds that lead to the formation of ozone and secondary particulate matter (PM2.5), as well as emissions of hazardous air pollutants. [EPA-HQ-OAR-2019-0055-1213-A1, p. 2]

EPA should pursue ORVR for incomplete vehicles above 14,000 lb. GVWR (hereinafter referred to as HHDGVs)2, as this is the only remaining class of gasoline motor vehicles without refueling control. With regulatory developments since ORVR was adopted in 1994, manufacturers have gained significant experience with ORVR technology on all categories of gasoline vehicles, including complete heavy-duty gasoline vehicles (HDGVs) and even incomplete light-heavy-duty gasoline vehicles (LHDGVs). Cost-effective technology is available to control refueling emissions and there should no longer be implementation concerns. [EPA-HQ-OAR-2019-0055-1213-A1, p. 3]

> 2. Within this document LHDGV: means an HDGV with a GVWR between 8,501 and 14,000 lbs. GVWR. ORVR test procedures within 40 CFR 86 Subpart B apply to complete and incomplete LHDGVs. HHDGV means an incomplete HDGV with a GVWR more than 14,000 lbs.

OEMs and secondary manufacturers now have 35 model years of experience in working together on measures to ensure that any actions taken by the secondary manufacturer to complete the vehicle do not violate the certificate of conformity or create in-use issues for on-vehicle fuel vapor control systems. In addition, there are now several regulatory provisions which provide structure to how OEMs and secondary manufacturers may work together (40 CFR §§1037.130,621, 622) under EPA's certification programs. This long experience together with the very recent regulatory provisions suggest that any concerns have been addressed and there is no need for added regulatory measures. [EPA-HQ-OAR-2019-0055-1213-A1, p. 3]

In the feasibility analysis for ORVR of the NPRM10, EPA includes a discussion on the activated carbon working capacity assumptions for sizing a canister. Ingevity believes a clarification to this text is needed for the use of the terms and values for "efficiency" and "canister loading efficiency". The original text and a proposed change for clarification are provided below. [EPA-HQ-OAR-2019-0055-1213-A1, p. 4]

10. 87 FR 17493, (March 28, 2022).

Original text: "During the diurnal test, the canister is loaded with hydrocarbons over two or three days, allowing the hydrocarbons to load a conventional carbon canister (1500 GWC, gasoline working capacity) at a 70 percent efficiency. In contrast, a refueling event takes place over a few minutes, and the ORVR directs the vapor from the gas tank onto the carbon in the canister at a canister loading efficiency of 50 percent. For our analysis, we added a design safety margin of 10 percent extra carbon to our ORVR systems." [EPA-HQ-OAR-2019-0055-1213-A1, pp. 4 - 5]

Proposed change for clarification: During a diurnal test, the carbon canister is loaded with hydrocarbons from the fuel tank over the course of two or three days. Under these very slow loading conditions, a Tier 3 baseline canister filled with 15 BWC carbon11 will exhibit a gasoline working capacity (GWC) of around 70 g/L of carbon. In contrast, during a refueling event, hydrocarbons are being directed from the fuel tank to the ORVR canister within only a few minutes. This faster loading rate results in a reduction of the GWC to approximately 50 g/L. For this analysis, a design safety margin of 10 percent was added to the minimum ORVR carbon volume. [EPA-HQ-OAR-2019-0055-1213-A1, p. 5]

11. 15 BWC = butane working capacity as defined by ASTM D5228

Approaches to adapt the current test procedures used by lower GVWR vehicles for vehicles above 14,000 lb. GVWR and appropriate conditioning procedure for these larger vehicles [EPA-HQ-OAR-2019-0055-1213-A1, p. 5]

In the NPRM, EPA requests comment on appropriate mixing times and approaches for calculating SHED displacement for larger SHED enclosures. In EPA's final rule, "Control of Air Pollution From New Motor Vehicles and New Motor Vehicle Engines; Evaporative Emission Regulation and Test Procedure for 1985 and Later Model Year Gasoline-Fueled Heavy-Duty Vehicles"12, EPA included a mixing rate of 500-750 cfm/1000ft3 of SHED volume and default vehicle volume of 100 ft3. Ingevity agrees that requiring the concentration in the SHED to stabilize before the final concentration measurement would be an appropriate approach. [EPA-HQ-OAR-2019-0055-1213-A1, p. 5]

12. 48 FR 1465 (Jan 12, 1983)

EPA asked for comment on specific canister conditioning cycle or adjustments to the current conditioning cycle to better represent real-world heavy-duty vehicles during a refueling event.

Current evaporative emission test procedures which apply to all HDGVs and refueling emission test procedures which apply to LHDGVs and complete HHDGVs are based on the procedures and drive cycles specified in 40 CFR §86 Subpart B. In the past there were HDGV specific drive cycles under 40 CFR §86 Subpart M.13 Even in the earlier HDGV evaporative emission test procedures, manufacturers had the opportunity to use light-duty procedures in lieu of those specific to HDGVs. In the Tier 3 final rule, the HDGV specific procedures were dropped and replaced completely with those in 40 CFR §86 Subpart B and the provisions of 40 CFR §1037.103(c) were applied to all HDGVs over 14,000 lbs. GVWR as an option for evaporative and refueling emissions certification. [EPA-HQ-OAR-2019-0055-1213-A1, p. 5]

13. See §86.1245 (Subpart M) within "Evaporative Emission Regulation and Test Procedure for 1985 and Later Model Year Gasoline-Fueled Heavy-Duty Vehicles," 48 FR 1465, Jan 12, 1983.

Given that evaporative and refueling emission control systems depend on the same purge systems and canisters for effective control, it would not be possible to substitute different preconditioning drive cycles for HHDGV ORVR without also changing those for HHDGV evaporative emission control. Beyond this, since much of the premise for certification under 40 CFR §1037.103(c) depends on LHDGV certification data developed under 40 CFR §86 Subpart B, the current construct of the HHDGV evaporative and refueling emission regulations would have to be reproposed. Nevertheless, EPA retains the authority and flexibility provided under 40 CFR §1066.10. [EPA-HQ-OAR-2019-0055-1213-A1, p. 5]

Other testing options EPA should consider for manufacturers to demonstrate the effectiveness of their ORVR systems on incomplete vehicles above 14,000 lb. GVWR. [EPA-HQ-OAR-2019-0055-1213-A1, p. 6]

In our comments on the ANPRM, Ingevity suggested that HHDGV ORVR certification be based primarily on 40 CFR §86 Subpart B test procedures, with engineering analysis only applicable when SHED based procedures are not practical. After reviewing the language in the NPRM, Ingevity supports a two-prong approach to the certification provisions. The refueling emission standard (0.20 g/gal of dispensed gasoline) is a performance standard and we believe it is essential that EPA adopt specific laboratory test procedures such as the SHED based procedures in 40 CFR §86 Subpart B for demonstrating compliance. These test procedures already apply to LDVs, LDTs, and LHDGVs, and with appropriate modifications, can and should be applied to all HHDGVs. Nonetheless, there are technical and practical reasons why the current language in 40 CFR §1037.103(c) provides manufacturers of HHDGVs the option to certify evaporative and refueling emissions using an engineering analysis approach in addition to the 40 CFR §86 Subpart B test procedures.14 We support providing the manufacturers the option to use 40 CFR §1037.103(c) for refueling emission certification for both complete and incomplete HHDGVs. [EPA-HQ-OAR-2019-0055-1213-A1, p. 6]

14. See p. 23508 of "Control of Air Pollution from Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards," 79 FR 23414, April 28, 2014.

EPA also sought comment on two other approaches for certification. The first is a bench test where a fuel/evaporative/refueling emission control system mock-up is installed in a light-duty SHED instead of on an HDGV chassis. The second is the evaluation of a component, subassembly, and/or a full assembly in a light-duty SHED or a mini-SHED. EPA did not specify how information from these evaluations could be used as a basis for certification. Component/subassembly/assembly evaluations conducted by vendors and vehicle manufacturers are valuable tools in the development and prove out of hardware and system designs and indeed may be useful in assessments related to establishing designs, assessing some elements of performance, functional durability, and diagnosing problems. Such information could be useful in certification under 40 CFR §1037.103(c). A good example of this might be where an element of design is used in an HHDGV configuration, but a similar element of design is not found in an LHDGV system (e.g., mechanical fill pipe seal). However, information from these types of tests alone would not provide conclusive evidence of full system performance for certification purposes. [EPA-HQ-OAR-2019-0055-1213-A1, p. 6]

The NPRM does not specifically state that the ORVR requirement would apply to new HHDGVs sold in all 50 states. While it is possible that CARB will move to adopt HHDGV ORVR requirements within their mobile source emission standards program, we recommend that EPA affirmatively state in the final rule that the requirements are nationwide such as was done in the preamble to the original ORVR final rule.15 [EPA-HQ-OAR-2019-0055-1213-A1, p. 6]

> 15. See p. 16266, ”Control of Air Pollution From New Motor Vehicles and New Motor Vehicle Engines; Refueling Emission Regulations for Light-Duty Vehicles and Light-Duty Trucks,” 59 FR 16262, April 6, 1994.

The family criteria for evaporative and refueling emissions certification are codified in 40 CFR §86.1821-01. These criteria are quite general and leave much to the manufacturers use of good engineering judgment. It is recommended that these provisions be clarified to address that they apply to LDVs, LDTs, and HDGVs. Furthermore, for refueling emissions, EPA should address whether LHDGVs certified using Subpart B test procedures can be grouped with HHDGVs certified using the Compliance Demonstration provisions in 40 CFR §1037.103(c) or if they should be kept separate. Also, to help inform the manufacturers use of good engineering judgment under §86.1821-01 and 40 CFR §1037.103(c) it would be helpful to add criteria related to fuel tank volume, total canister adsorptive capacity, and purge in certification guidance. Finally, to facilitate certification and reduce testing burdens for HHDGVs, the evaporative and refueling family criteria should be clarified and optimized as needed to allow for maximum application of certification data across LHDGVs and HHDGVs, consistent with good engineering practice and in other regulations. [EPA-HQ-OAR-2019-0055-1213-A1, p. 7]

EPA has proposed that HHDGVs meet the refueling emission standards for a useful life of 15-years/150,000 miles, consistent with their requirements for evaporative emission standards. We support this requirement. EPA is seeking comment on other useful life periods for HDGE exhaust emission standards for model years later than the 2027 model year implementation proposed for ORVR implementation. In no case should future useful life requirements for evaporative/refueling emissions be longer than for the exhaust emission standards, and since EPA did not explicitly propose that evaporative and refueling emission standards be included in the potential longer useful life periods on which EPA is seeking comment for exhaust emission standards, we recommended that the useful life for evaporative/refueling emission standards not be extended beyond 15-years/150,000 miles in this rule, even if it is for HDGE exhaust emissions. [EPA-HQ-OAR-2019-0055-1213-A1, pp. 7 - 8]

Evaporative/refueling emission standard durability assessment provisions are covered in 40 CFR §§86.1824-08 and 86.1825-08. EPA is proposing a set of changes for exhaust emissions, but no changes or new provisions were proposed for evaporative or refueling emissions. We recommend that the current provisions for evaporative and refueling emissions be retained. [EPA-HQ-OAR-2019-0055-1213-A1, p. 8]

The NPRM included a brief discussion regarding the use of mechanical fill pipe seals which in our view provided an incomplete picture of the potential for their use in HHDGVs. While EPA did not oppose or preclude the use of mechanical fill pipe seals, previous EPA regulatory analyses for ORVR systems were based mostly on the use of liquid fill pipe seals (dynamic and submerged). There were several reasons for this approach. The first, as expressed by EPA in the NPRM, was component durability and related to this the potential for adverse impacts of worn nozzle spouts. Second, most if not all LDVs, LDTs, MDPVs, and LHDGVs covered by ORVR had enough fill height for a liquid seal to work effectively, even with the system backpressure. However, EPA also favored liquid seals because overall hardware costs were less and the viability of such designs was demonstrated by the fact that several vehicle models already had fill neck and fill pipe geometries which effectively functioned as a liquid fill pipe seal and included one of several types of anti-spit back valves (sometimes referred to as a fuel filler tube check valve) needed to address spillage at nozzle automatic shut-off. In discussing liquid versus mechanical seals, it was noted that limited data indicates that refueling vapor generation is 20-25% less in a mechanical seal versus liquid seal design.16 This could be an advantage for some vehicle models. [EPA-HQ-OAR-2019-0055-1213-A1, p. 8]

> 16. S.R. Reddy, "Mathematical Models for Predicting Vehicle Refueling Vapor Generation," SAE 2010-01-1279, April 2010.

Over the past 10-15 years there have been two changed circumstances related to mechanical seals. First, there have been improvements in the materials used in the seals which at least directionally improves durability in areas such as tolerance to alcohols and temperature extremes. Second, powertrains and fuel system designs have evolved, and these changes have led some manufacturers to use mechanical seals to reduce refueling vapor generation. This has mostly occurred in vehicles such as PHEV models (many with NIRCOS) which tend to have powertrain designs which provide less canister purge. These vehicles now have a 15-year/150,000-mile useful life requirement and are subject to IUVP. Thus far, EPA has not reported issues with the durability or performance of these seals nor has CARB or EPA ever discussed adding an OBD requirement for this technology. [EPA-HQ-OAR-2019-0055-1213-A1, p. 8]

A few HHDGV models without adequate fill height (e.g., metal tanks mounted on the outside of the chassis frame rail which fill through a bung-type opening) may need to use a mechanical seal and depending on the fuel/ evaporative/refueling system configuration some dual tank vehicles may elect to do so as well. The rule is expected to include adequate lead time for engineering to further optimize the design of a mechanical seal assembly and for its integration into the fuel system and to comply with other applicable Federal regulations. [EPA-HQ-OAR-2019-0055-1213-A1, p. 8]

Organization: *Eaton Vehicle Group (Eaton)*

Agency Request / Topic: For SI engines, we request comment on our proposed refueling HC emission standard for incomplete vehicles above 14,000 lb GVWR, including requests for comment and data to inform test procedure updates we should consider to measure HC emissions from these larger fuel systems and vehicles. [EPA-HQ-OAR-2019-0055-1252-A1, p.8]

Eaton Comment Strategy / Materials:Eaton supports ORVR extension to HD vehicles that use SI engines, as this technology is cost-effective and traps evaporative emissions. As the alternative is to retrofit fuel pumps, ORVR remains the overall cost-effective solution. We believe the procedures outlined in the NPRM are feasible and incomplete vehicles can be managed through delegated authority as is established for GHG certification. [EPA-HQ-OAR-2019-0055-1252-A1, p.8]

Organization: *Manufacturers of Emission Controls Association (MECA)*

EPA's regulatory framework offers the most comprehensive evaporative/refueling control program in the world for chassis certified vehicles. Onboard Refueling Vapor Recovery (ORVR) has been successfully implemented in the U.S. and Canada for over 25 years. Within EPA's IUVP program, there have been over 4500 tests conducted on in-use vehicles equipped with ORVR with an average reduction efficiency of 98% [24]. The odometer readings on a large fraction of these vehicles exceeded 100,000 miles. U.S. Tier 2 or California LEV II have reduced evaporative emissions by 90%, and U.S. Tier 3 or California LEV III are 98% effective in reducing evaporative VOC emissions. [EPA-HQ-OAR-2019-0055-1320-A1, pp.21-22]

> [24] G. Passavant, 'Summary and Analysis of 2000-2015 Model Year IUVP Evaporative and Refueling Emission Data,' 2017.

Heavy-duty gasoline vehicles (HDGVs) fall into two categories. The first category, light HDGVs (LHDGVs) (GVWR < 14,000 lb.) are usually chassis certified and have been required to meet refueling emission standards since the 2018 model year. The second category, heavy HDGVs (HHDGVs) (> 14,000 lb. GVWR) usually are classified as incomplete vehicles since the engine is tested on a dynamometer for exhaust emissions and during production the engines are installed on a chassis where the chassis is completed by a secondary manufacturer [25] [26]. While Tier 3 evaporative requirements apply to HHDGVs, refueling emission standards do not yet apply to this subcategory of HDGVs. MECA estimates that HHDGV refueling emissions are equivalent to about 0.37 g/mile (based on 4.1 g/gallon emission rate and average fuel efficiency of 11 mpg). Control of refueling emissions with ORVR is a significant opportunity to reduce VOC emissions (ozone and PM2.5 precursors and air toxic emissions) from these HDGVs. [EPA-HQ-OAR-2019-0055-1320-A1, p.22]

[25] EPA, ‘Tier 3 Motor Vehicle Emission and Fuel Standards,’ 28 April 2014. [Online]. Available: https://www.govinfo.gov/content/pkg/FR-2014-04-28/pdf/2014-06954.pdf.

[26] 40 CFR 85.020.

Specific to EPA’s proposal, MECA supports extending ORVR requirements to HHDGVs at a refueling emission standard of 0.20 grams hydrocarbon per gallon of liquid fuel dispensed as now applies to LDVs, LDTs, MDPVs, LHDGVs, and complete HHDGVs. The OEMs have twenty-five model years of experience with the design and certification of ORVR systems, which together with the EPA IUVP data mentioned above, clearly demonstrate the feasibility. Very recently, a complete HHDGV with a fuel tank of one hundred gallons was certified to ORVR for the 2022 model year [27]. [EPA-HQ-OAR-2019-0055-1320-A1, p.22]

[27] PRWeb, ‘ROUSH CleanTech and Blue Bird First to Achieve Certification to 2022 Heavy Duty Refueling Standard,’ 2 May 2022. [Online]. Available: https://www.prweb.com/releases/roush_cleantech_and_blue_bird_first_to_achieve_certification_to_2022_heavy_duty_refueling_standard/prweb18651222.htm.

Consistent with the current requirements for evaporative emission and refueling emission controls for all lighter weight vehicles, MECA supports EPA’s proposal to apply a useful life of 15 years/150,000 miles to the HHDGV refueling emission standard. The Tier 3 evaporative emission standard useful life for all HDGVs is currently 15 years/150,000 miles. Given that integrated ORVR/evaporative control system designs share hardware such as the activated carbon canister and purge valve and functions such as vapor transport and canister purge, a common requirement for evaporative and refueling emission standard useful life is logical and necessary. [EPA-HQ-OAR-2019-0055-1320-A1, p.22]

MECA believes the implementation of ORVR is feasible and practical for primary and secondary manufacturers. Since the first HDGV evaporative emission standards were implemented in the 1985 model year, OEMs and secondary manufacturers now have thirty-five model years of experience in working together on measures to ensure that any actions taken by the secondary manufacturer to complete the vehicle do not violate the certificate of conformity or create in-use issues for on-vehicle fuel vapor control systems. In addition, there are now several regulatory provisions within 40 CFR1037 which provide guidelines on how OEMs and secondary manufacturers may work together under EPA’s certification programs [28]. This extensive experience together with these recent regulatory provisions suggest that any concerns have been addressed and there is no need for added regulatory measures. Regarding testing for refueling emissions certification, the ORVR test procedures promulgated in 1994 are fully fit for purpose and, perhaps with minor changes or clarifications, should be applied to HHDGVs using the driving cycles and SHED-test procedures currently specified in Subpart B. MECA supports a compliance demonstration through a full vehicle emission testing and certification as contained in Subpart B plus continuation of the manufacturers’ certification option using the compliance demonstration flexibility provided in 40 CFR1037.103(c). [EPA-HQ-OAR-2019-0055-1320-A1, pp.22-23]

[28] 40 CFR Part 1037.130, 1037.621, 1037.622.

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

For SI engines, EPA requests comment on their proposed refueling HC emission standard for incomplete vehicles above 14,000 lb GVWR, including requests for comment and data to inform test procedure updates. EPA should consider measuring HC emissions from these larger fuel systems and vehicles. MEMA also recommends avoiding “break points” in the standards that could result in intentionally shifting a vehicle to a higher GVWR class to reduce emissions compliance equipment. In essence developing a continuum of standards and technology applications rather than a sharp break or jump. MEMA also recommends that on-board vapor recovery technology be required. SI engines should have the best available evaporative emissions control technologies. In addition, higher truck classes should use all available lower truck class technologies. [EPA-HQ-OAR-2019-0055-1322-A1, p. 6]

Organization: *Oshkosh Corporation*

EPA requests comments regarding options for sealed housing evaporative determination (SHED) testing for heavy-duty vehicles related to evaporative and refueling emissions. See Proposed Rule, 87 Fed. Reg. at 17,491. Oshkosh generally opposes the expansion of these requirements based upon the same concerns raised above related to OBD test and certification burdens, as well as the limited availability of SHED facilities sufficiently sized to accommodate larger heavy-duty vehicles, which EPA acknowledges in the Proposed Rule. See id. at 17,490-91. Specifically, Oshkosh notes that there are few if any existing SHED testing facilities available to accommodate vehicles such as a fire truck or concrete mixer. These logistical concerns should be accommodated in the final rule. Oshkosh thus supports EPA’s proposal to continue to allow manufacturers to demonstrate compliance with applicable evaporative and refueling emission standards by using an engineering analysis rather than requiring SHED testing data. The Company also supports EPA’s proposal to allow manufacturers to demonstrate compliance by testing refueling components only, separate and apart from the vehicle body and chassis. See id. at 17,491. A final alternative would be for manufacturers to demonstrate compliance by use of “sister vehicle” data, similar to EPA’s proposal for demonstrating OBD compliance. Under this approach, EPA could allow manufacturers to rely upon test data from vehicles with similar fuel system characteristics (e.g., a comparable fuel tank and carbon cannister) to show compliance with the applicable evaporative and refueling emission standards. [EPA-HQ-OAR-2019-0055-1226-A1, pp. 4 - 5]

Organization: *Roush CleanTech (Roush)*

Roush is fully in support of the heavy-duty refueling emissions requirements for incomplete spark ignited vehicles. As we have demonstrated in our 2022MY complete vehicle certification, compliance to the standards is feasible, with significant air quality benefits. We do have a few specific suggestions:

- We fully agree with the continued allowance for compliance by attestation for heavy-duty vehicles. As noted, it is extremely difficult to perform the light-duty evaporative cycles on heavy-duty vehicles, and for incomplete vehicles it is extremely difficult to determine what a representative completed vehicle would even be. Specific to the refueling tests, use of rigs should be explicitly permitted as the basis for compliance judgement; this permits the use of existing light-duty ORVR test facilities and procedures, and provides a fully representative result as the non-refueling emissions are negligible given the short sampling time involved.

- We recommend allowing additional drive time as part of the test sequences. In our experience, the requirements of the refueling and BETP standards particularly are in conflict, although different manufacturers may experience difference constraints based on their specific designs. The existing drive cycles are all based on light-duty consumer usage, and were never intended to be reflective of heavy-duty commercial vehicle use. We believe that providing manufacturers the option to conduct a second series of drive cycles for the two-diurnal, BETP, and refueling tests without need for any additional justification is entirely reasonable. The running loss / 3-diurnal test sequence is more complex due to the need for fuel tank heating; we would suggest simply providing flexibility for manufacturers to request additional preconditioning for this procedure. [EPA-HQ-OAR-2019-0055-1276-A1, pp.4-5]

EPA Summary and Response

The summary and response for this section includes a listing of the topics raised, then the comments are summarized by category and the responses follow each summary.

EPA proposed a 0.20 g HC/ gal liquid fuel refueling emissions standard for incomplete vehicles above 14,000 lb GVWR and ORVR test procedures. Comments relating to the proposed refueling emission standards fell into the following general categories:

- Support or opposition for the refueling standards or ORVR requirements in general
- Test procedure recommendations based on EPA requests for comment
- Corrections and clarifications of the test procedure
- Unsolicited recommendations for updates

Support or opposition for the refueling standards or ORVR requirements in general

Several commenters expressed explicit support for the refueling standards, useful life and/or ORVR requirements in general, including: Truck and Engine Manufacturers Association (EMA), Alliance for Vehicle Efficiency (AVE), Ingevity Corporation, Eaton Vehicle Group, Manufacturers of Emission Controls Association (MECA), Motor & Equipment Manufacturers Association (MEMA), and Roush CleanTech. Except for one comment regarding a request for a phase-in of the ORVR standard, we received no comments opposing the refueling emission standard for incomplete vehicles above 14,000 lb GVWR. EMA commented that EPA underestimated the challenge of implementing ORVR technology on the larger vehicles with larger fuel tanks. To address uncertainties for those vehicles, they requested a three-year phase in of 30%, 60%, and 100% starting in MY2027, including an option that can encourage OEMs to certify 8,501 to 14,000 lb GVWR incomplete vehicles. Commenters did also express concern with some of the test procedure options EPA was considering in the proposal, discussed further below.

Response:

- We thank the commenters for their support. As explained in preamble Section III.E and further justified in RIA Chapter 3, we are finalizing the refueling emission standard of 0.2 g HC/gal liquid fuel as proposed, with a final regulatory useful life of 15 years or 150,000 miles (whichever occurs first).
- We disagree with EMA that a phase-in is necessary to comply with the new refueling emission standard. We are finalizing the implementation starting in MY 2027 for the reasons shared in preamble Section III.E.
- However, we considered that an optional phase-in that encompasses incomplete 8,501 – 14,000 GVWR vehicles may encourage OEMs to certify those additional incomplete vehicles to the new heavy-duty refueling emission standard while also providing some flexibility to manufacturers in meeting the new refueling emission standard.
- As detailed in preamble Section III.E of the final rule, manufacturers will have the option of certifying all incomplete vehicles above 14,000 pounds GVWR to the refueling standard in model year 2027, or in the alternative, manufacturers can opt into the alternate phase-in that applies for all incomplete heavy-duty vehicles, regardless of GVWR.

Test procedure recommendations based on EPA requests for comment

Ingevity and MECA commented in support of the full vehicle test. Ingevity indicated that a bench test and component/subassembly/assembly evaluations would not provide conclusive evidence of full system performance, but noted that an engineering analysis may be appropriate when a full SHED test is "not practical". EMA, MECA, Oshkosh, and Roush also supported EPA's proposal to allow engineering analysis as an option to demonstrate compliance with the refueling standard.

Response:

- We thank commenters for their support of our proposed testing approaches. We proposed and are finalizing that refueling emissions would be measured over the same test procedures that currently apply for complete vehicles in 40 CFR 1037.103, including a full-vehicle SHED test as the primary compliance demonstration pathway with
- the option for manufacturers to perform an engineering analysis in 40 CFR 1037.103(c) for demonstrating they meet the new refueling emissions standard.
- See the comments that follow for specific revisions to our test procedures after considering comments, and our responses to approaches raised in comments that would be relevant to the engineering analysis. While we have not revised 40 CFR 1037.103(c) to include reference to good engineering judgment, we note here that 40 CFR 1068.5 continues to apply for all sectors covered by 40 CFR part 1068, including highway heavy-duty engines and vehicles.

EPA requested comment on the updates to the conditioning procedure to account for larger vehicles. EMA recommended adding an additional FTP-75 drive schedule to the 3-day, 2-day, canister BETP, and ORVR test procedures following the canister load and prior to the drive schedule. EMA noted that an additional FTP-75 would align with existing approved drive schedules utilized for certification by heavy-duty vehicle manufacturers now and would be preferred over updating the canister loading procedure, which would require "extensive testing" to validate. Roush also commented on a need for additional drive time after the canister load. Roush suggested providing manufacturers the option to conduct a second series of drive cycles for the two-day and BETP. They also suggested that the 3-day test may require additional conditioning.

Response:

- We thank EMA and Roush for their comments, insight, and observations regarding conditioning procedures that occur between the canister load and drive schedule. As noted in preamble Section III.E, we are revising the 2-day diurnal and BETP tests to include a second FTP duty cycle for vehicles with fuel tank capacity above 50 gallons, which have the greatest need for additional conditioning.
- We agree with EMA that updating the canister loading procedure would require additional validation and we are not revising that procedure in this rule. We disagree with EMA that the additional FTP-75 is also needed for the 3-day diurnal procedure; we believe the existing 3-day diurnal procedure is already appropriate for larger fuel tanks since it has two additional UDDS (Urban Dynamometer Driving Schedule) and two additional NYCC (New York City Cycle) as compared to the existing 2-day diurnal procedure.

Several commenters recommended analyses or testing in response to EPA's request for comment on approaches to consider for adapting the current 40 CFR part 86, subpart S, test procedures used by lower-GVWR vehicles for vehicles above 14,000 lb. GVWR. We address specific commenters' recommendations for analysis or testing below. We are not finalizing the prescriptive test procedure changes requested at this time, but in most cases, the approaches raised in comments would be relevant to the engineering analysis option as noted in the responses below.

Response:

- EMA indicated that the full vehicle light-duty test procedures would work if the HD vehicle could fit in the existing SHED, but reiterated their request for revised drive schedules (i.e., an additional FTP-75). If a manufacturer was performing a fuel system rig test, EMA recommended a bench purge of the canister using CARB's BETP procedure as a reference. EMA commented, with example calculations, that the vehicle contribution of HC mass is negligible, so the rig test and full vehicle test should be similar. For vehicle volume, EMA recommended the fuel rig testing should be the same volume (5 cubic feet) used for partial zero-emission vehicle (PZEV) rig testing (CARB MAC 2001-03, November 2001).

  - We acknowledge EMA's agreement that the light-duty test procedures we are finalizing are appropriate for HD vehicles that can fit in existing SHED enclosures. As noted previously, we are finalizing an additional FTP-75 for 2-day diurnal and the BETP cycles for fuel tanks with greater than 50 gallons capacity.
  - As noted in the NPRM, we recognize there is limited availability of SHEDs that can fit certain heavy-duty vehicles and a manufacturer can request approval of a rig test as their engineering analysis for those vehicles. Manufacturer engineering analysis of the HC mass contribution from the vehicle, as well as their recommendation to use CARB's bench purge and the PZEV-based vehicle volume, would be appropriate information to share with EPA to demonstrate the use of good engineering judgment in a supporting compliance demonstration.
- Ingevity stated that a bench test of a fuel/evaporative/refueling emission control system mock-up and component/subassembly/assembly evaluations would not, by itself, provide conclusive evidence of full system performance.
  - EPA agrees that the bench test would not by itself, prove conclusive. Rather, the bench test will be part of a larger collection of evidence, both data and engineering analysis, to demonstrate compliance.
- Oshkosh expressed support for EPA's proposal to allow manufacturers to demonstrate compliance by testing refueling components only, separate and apart from the vehicle body and chassis. Roush commented that, "Specific to the refueling tests, use of rigs should be explicitly permitted as the basis for compliance judgement; this permits the use of existing light-duty ORVR test facilities and procedures, and provides a fully representative result as the non-refueling emissions are negligible given the short sampling time involved."
  - EPA agrees that component and system data, like that generated with a SHED or mini-SHED, when applied with good engineering judgement as part of an engineering analysis, may appropriately demonstrate compliance. Manufacturers will need to present compelling evidence, such as component and full SHED data that shows comparable results. We note that we are not finalizing a specific component- or system-based procedure at this time.
- Oshkosh also requested a final alternative where manufacturers could demonstrate compliance by use of "sister vehicle" data, similar to EPA's proposal for demonstrating OBD compliance.
  - EPA agrees that a manufacturer may apply good engineering judgement to use data from similar vehicles in an engineering analysis to demonstrate compliance with the refueling standard. We would expect such an engineering analysis to include fuel system detail, vehicle design information, and vehicle expected use information along with any other relevant information.

Corrections and clarifications of the test procedure

For dual fuel tanks with separate filler tubes, EMA recommended: "Measure the hydrocarbon increase in the SHED for each refueling action. Sum the two hydrocarbon increases and divide by the total amount of fuel dispensed for both ORVR refueling events."

Response:

- We generally agree with EMA's recommendation for assessing refueling emissions from dual-tank vehicles. Since other assessment methods may also be valid, we are not finalizing a prescriptive approach for these vehicles; instead, as noted in the preamble section III.E, we are finalizing a revision to 40 CFR 86.154-98 that directs manufacturers to use good engineering judgment for dual tank configurations.

EMA agreed with EPA's assessment in the NPRM that in cases where a secondary manufacturer finishes an incomplete vehicle subject to the new refueling standards, the ORVR certification and fuel system installation instructions will be controlled by the original OEM as it is consistent with HD spitback compliance regulations.

Response:

- We thank EMA for confirming our assessment from the proposal. We continue to expect, as stated in the proposal, that the addition of any ORVR hardware and all ORVR-related aspects of the certified configuration would continue to be managed and controlled by the chassis manufacturer that holds the vehicle certificate. Accordingly, we do not expect that addition of the ORVR hardware would result in any appreciable change in a secondary manufacturer's obligations or require secondary builders to perform significant modifications to their products.

EMA identified a typographical error in the methanol mass equation as well as an opportunity for driving consistency in related equations.

Response:

- This correction and an update to make equations consistent are in the final regulations.

EMA also shared fuels information regarding hydrogen to carbon (H/C) ratio and the resulting fuel density.

Response:

- This topic is responded to in section 32.2 of this document.

Ingevity noted that the NPRM does not specifically state that the ORVR requirement would apply to new heavy heavy-duty gas vehicles (HHDGVs) sold in all 50 states. They recommend that EPA affirmatively state in the final rule that the requirements are nationwide such as was done in the preamble to the original ORVR final rule.

Response:

- CAA section 203 and our regulations prohibit the sale or introduction into commerce of new heavy-duty engines subject to EPA emission standards unless they are covered by a valid certificate of conformity complying with EPA emission standards and regulations for that model year. Thus, our federal standards apply to all new heavy-duty engines. Under CAA section 209, there are circumstances under which manufacturers' compliance with state standards shall be treated as compliance with applicable federal standards. We intend to work with CARB and manufacturers to answer compliance questions as they arise in a given model year.

Ingevity noted that the family criteria for evaporative and refueling emissions certification (40 CFR 86.1821-01) are quite general and leave much to the manufacturers use of good engineering judgment. They recommended that these provisions be clarified to address that they apply to LDVs, LDTs, and HDGVs. Ingevity also requests clarity on whether LHDGVs certified using Subpart B test procedures can be grouped with HHDGVs

Response:

- The FRM includes edits in 40 CFR 86.1821 to state that the engine-family provisions apply for all sizes of vehicles subject to evaporative or ORVR standards. The FRM also includes edits in 40 CFR 86.1821 to clarify that manufacturers must certify HDV greater than 14,000 lb GVWR in families that are separate from HDV at or below 14,000 lb GVWR that are certified based on testing.

Unsolicited recommendations for updates

Ingevity noted that the feasibility analysis uses the term "percent efficiency" when discussing carbon canister loading and that "g/L" may be more precise for gasoline working capacity (GWC).

Response:

- We thank Ingevity for their thorough review and proposal on wording related to canister efficacy. In this feasibility discussion, the term "g/L" is more precise than "%". We have made this change. However, it is important to note that in the feasibility table and calculations, g/L is shown and properly applied. The calculations, analysis, and feasibility do not change.

Ingevity shared that, “it would be helpful to add criteria related to fuel tank volume, total canister adsorptive capacity, and purge in certification guidance”.

Response:

- We did not propose to specify fuel tank and purge design criteria and are not including any such criteria in this final rule.

EMA suggested we specify E10 for the ORVR testing (in place of E0). EMA requested EPA streamline the laboratory test process by focusing the fuel flow rate on 9.8 gpm fuel-dispensing rate as opposed to the current regulations in 40 CFR 86.154(e) that require proven function at 9.8 gpm and allows verification down to 4.0 gpm. EMA recommended that EPA clarify that the ORVR requirements apply to vehicles operating on volatile fuels but exclude diesel fueled vehicles.

Response:

- We did not expressly request comment on certain aspects of the existing evaporative and refueling emission standards test procedures such as the test fuel(s) or fuel-dispensing rate that we proposed to make applicable to incomplete HD vehicles greater than 14,000 lb GVWR.
- We did not propose changes to the testing fuel type and are not including any changes to the testing fuel type in the final rule. We may consider such a change in a future rulemaking.
- We also did not propose changes for fuel dispensing rate and are not including any such changes in this final rule. We may consider such a change in a future rulemaking.
- The existing regulations in 40 CFR 1037.103(a) provide the clarity requested by one commenter regarding applicability of ORVR standards, and consistent with the proposal will be applicable to the new refueling standard for incomplete HD vehicles greater than 14,000 lb GVWR under the final rule. The existing provision specifies that evaporative and refueling emission standards specified in 40 CFR 1037.103 apply for HD vehicles above 14,000 lb GVWR fueled by “volatile liquid fuels (such as gasoline or ethanol) or gaseous fuels (such as natural gas or LPG).”

3.7 Certifying hybrid electric vehicles

Comments by Organizations

Organization: *Allison Transmission, Inc. (Allison)*

- EPA should additionally simplify powertrain certification requirements for GHGs. EPA should consider methods involving the testing of standalone components and/or a further build-out of the Greenhouse Gas Emissions Model (“GEM”) as an alternative to the proposed requirements and should not mandate powertrain testing for hybrid vehicles [EPA-HQ-OAR-2019-0055-1231-A1, p.6]

EPA has requested comments whether using powertrain testing to certify heavy-duty hybrids should be mandatory for all hybrid engine and powertrain combinations.58 Allison believes that powertrain testing/certification should remain an option in addition to standalone certification and chassis dynamometer testing/certification. There are two major concerns: [EPA-HQ-OAR-2019-0055-1231-A1, p.28]

58 87 Fed. Reg. at 17,457.

- If EPA were to mandate powertrain testing, this result would not only increase the direct cost of regulation (e.g., through additional testing burdens) but also create substantial logistical difficulties between hybrid powertrain vendors and OEMs responsible for final assembly of the vehicles. All these expenses would be incurred in what has been a traditionally low volume market, meaning that per vehicle costs would be proportionally higher since they could not be allocated to high-volume vehicles. Although some measure of empirical value might be obtained through the generation of powertrain testing data, the per-vehicle cost increases would make it more difficult for this technology to further expand in the commercial market sector. Requiring mandatory powertrain criteria pollutant certification for hybrid technology is expected to drive additional logistics and/or capital expense to certification process of a low volume market. Added cost and logistics contributes to regulatory overhead, and this makes the technology more difficult to apply at a reasonable cost to customers with lower volume applications that could benefit from hybrid emissions reduction. [EPA-HQ-OAR-2019-0055-1231-A1, p.28]

- Powertrain certification testing cycles are also not reflective of real-world applications where hybrid technology works well, such as transit bus operation. Powertrain certification duty cycles contain sustained high load operation (under SET) and SS55MPH/SS65MPH operation. These type of duty cycles do not reflect the typical applications that benefit from hybrid technology and which the market will preferentially select. Allison recommends that in lieu of the duty cycles proposed, EPA should utilize duty cycles related to metro transit authority routes that would better represent real world operation of hybrid transit bus operations with lower average speed and a greater number of stops. A few metro transit duty cycles that could be considered include Manhattan Cycle and OCTA. See Appendix 3.[EPA-HQ-OAR-2019-0055-1231-A1, p.28]

Organization: *Cummins Inc. (Cummins)*

EPA proposes to allow manufacturers the option to certify hybrid engines and powertrains to engine criteria pollutant emissions standards using a powertrain test procedure starting in MY 2023, including the ability to participate in the engine NOx ABT program. (EPA had previously finalized a similar powertrain test option for certifying to engine GHG standards.) Cummins supports adding this option which provides a path for manufacturers to better demonstrate the emissions reductions that can be achieved with hybrids. EPA requested comment on whether they should require powertrain testing for hybrids rather than offering it as an option. Cummins supports keeping it optional in addition to the existing process of engine-only certification for hybrids. [EPA-HQ-OAR-2019-0055-1325-A1, p. 19]

Plug-in hybrid electric vehicles (PHEV) can serve as a bridge to zero emissions operation in applications where BEV or FCEV are not yet technically or commercially viable. As discussed above, manufacturers may use the optional powertrain test procedure to certify PHEV to engine criteria pollutant and GHG standards, which Cummins supports. However, improvements in certification and compliance processes are needed to recognize more fully the real-world NOx reductions that can be achieved by PHEV and to reduce complexity. [EPA-HQ-OAR-2019-0055-1325-A1, p. 19]

Zero emissions (ZE) mode is a critical part of the operation of a PHEV, delivering significant NOx and GHG reductions to the environment. EPA's proposed procedure captures the GHG benefit of PHEV ZE mode through use of a utility factor (UF) to weight emissions from charge-depleting (CD) and charge-sustaining (CS) operation. However, manufacturers are required to meet criteria pollutant standards under the worst-case condition from CD or CS operation. ZE mode is not factored into the emissions result. Cummins recommends allowing manufacturers to use a UF-based calculation (i.e., Equation §1036.505- 10) for criteria pollutant emissions including NOx, in order to account for the criteria pollutant reductions demonstrated by PHEV in ZE mode. [EPA-HQ-OAR-2019-0055-1325-A1, p. 19]

As proposed, the 3B-MAW approach for in-use testing also does not account for ZE mode emissions properly. When the engine is off for purposes of optimizing CO2 and criteria pollutants, the data will be excluded per §1036.515(c)(2) even though powertrain work is non-zero. Another critical mode of operation for PHEV is when the battery/motor assists the engine. While the hybrid certification process captures the impact of this mode, 3B-MAW will not appropriately identify bins per the overall powertrain work which would be different from engine-only work measured from CO2. These concerns also apply to non-plug-in hybrids. The applicability of the proposed 3B-MAW calculation method should be modified to align with PHEV and HEV real world operation. Updates are needed in §1036.515 to address these issues. [EPA-HQ-OAR-2019-0055-1325-A1, p. 20]

A series hybrid system can be integrated with multiple types of traction systems based on application requirements. The proposed certification procedure would require testing of the complete system including the traction system. However, traction systems such as hub motor, in-wheel motor, and e-axle (6x4) configurations introduce test cell complexity. Cummins suggests that EPA allow an option to use a generic traction system model in a hardware-in-the-loop (HIL) simulation, analogous to the use of a generic transmission model in powertrain testing, to reduce certification complexity. [EPA-HQ-OAR-2019-0055-1325-A1, p. 20] See Appendix B for additional test procedure comments. Cummins would like to work with EPA on continued improvements to hybrid-related procedures. [EPA-HQ-OAR-2019-0055-1325-A1, p. 20]

1036.514

Hybrid functions enable reduction in idle fuel consumption and emission management. Clarification is requested why hybrid functions needs to be disabled only for plug-in hybrids. Cummins suggests hybrid functionality should be enabled for both plug-in and non-plug-in hybrids. [EPA-HQ-OAR-2019-0055-1325-A1, p. 25]

1036.527(e)

Clarification is requested for definition of Psys for series hybrids which have different types of electric traction systems. See figures below: [EPA-HQ-OAR-2019-0055-1325-A1, p. 26]

Organization: *Ford Motor Company (Ford)*

We support the added regulatory flexibility to test hybrid and plug-in hybrid vehicles on either an engine dynamometer or a powertrain dynamometer. We believe that the powertrain dynamometer test procedures produce emission results that are more representative of on-road operation than engine-only testing. [EPA-HQ-OAR-2019-0055-1300-A1, p. 5]

Organization: *Hyliion, Inc.*

The heavy-duty trucking industry is one that is steeped in tradition and reliability. However, it is an industry that is both innovative and flexible when addressing decarbonization and clean air goals. [EPA-HQ-OAR-2019-0055-1238-A1, p. 3]

As the EPA recognizes: “NOx exposures over short periods can aggravate respiratory diseases, particularly asthma, leading to respiratory symptoms (such as coughing, wheezing or difficulty breathing), hospital admissions and visits to emergency rooms. Longer exposures to elevated concentrations of NO2 may contribute to the development of asthma and potentially increase susceptibility to respiratory infections. People with asthma, as well as children and the elderly are generally at greater risk for the health effects of NO2.”1 [EPA-HQ-OAR-2019-0055-1238-A1, p. 3]

1. https://www.epa.gov/no2-pollution/basic-information-about-no2

We at Hyliion recognized the negative effects of air pollutions particularly in the communities that are most vulnerable. Through utilizing our All-Electric Range solution, we are able to provide a zero-emission solution in ports, city centers, and environmental justice communities where limited emissions are most critical. However, while addressing this urgent problem, we encourage the EPA embrace a multi-technology approach. We agree that EVs are an excellent option for many business models in the trucking industry, particularly in shorter distance hauls. However, neglecting the real and nonnegotiable aspects of long-haul heavy-duty trucks is not in the best interests of our global goals and certainly not for our communities who consistently bear the burden and negative health implications of air pollution. [EPA-HQ-OAR-2019-0055-1238-A1, p. 3]

BEVs available today for this space are simply too heavy to accomplish the goals we require from this industry. A full BEV is impractical for long haul because the batteries compete with payload and diminish the ability of the truck to generate revenue. With this in mind, the ERX utilizes smaller batteries that remain constantly charged by an onboard generator allowing for drivers to maintain a cost-effective payload. [EPA-HQ-OAR-2019-0055-1238-A1, pp. 3 - 4]

As a hybrid technology, we have a unique challenge to identify appropriate in use testing and certification pathways that correctly and accurately demonstrate our ability to both perform and be compliant with necessary standards. Regulators sometimes are challenged to understand and integrate the hybrid duty cycle with their existing testing and certification parameters. We urge EPA to work closely with CARB to coordinate a common approach to hybrid testing and certification and that allows for various pathways to certification that best fit the needs of both the manufacturers who are developing clean, advanced engine and powertrain technology and the regulatory agencies seeking to reduce the impact of air pollution on U.S. cities. [EPA-HQ-OAR-2019-0055-1238-A1, p. 5]

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

EPA also requests comment on the proposed clarification in 40 CFR 1036.101(b) that gives manufacturers the option to test the hybrid engine and powertrain together, rather than testing the engine alone. Specifically, the agency has asked for feedback on whether EPA should require all hybrid engines and powertrains to be certified together, rather than making it optional. MEMA agrees that an engine-only test does not show the benefits of hybrid technology, so this is a good additional option. However, this option should not preclude engine-only or powertrain-only testing and certification. [EPA-HQ-OAR-2019-0055-1322-A1, p. 5]

Test cycles should be modified to be more reflective of real-world conditions including transient, steady state, and high-speed steady state. This is especially true in the areas of lower speed, transient, and stop and go conditions where hybrids can provide the most significant benefit. MEMA supports EPA requiring an idle cycle for all powertrains with accountability for hybridized systems. Any idle certification cycle should encourage available technologies like start-stop and engine off coasting, also known as sailing. [EPA-HQ-OAR-2019-0055-1322-A1, p. 6]

Organization: *Natural Gas Vehicles for America (NGVAmerica)*

Hybrid powertrains present some unique testing challenges and, as such, we urge EPA to provide sufficient flexibility in the certification and testing of hybrid natural gas/electric power-trains; [EPA-HQ-OAR-2019-0055-1330-A1, p.13]

Organization: *Oshkosh Corporation*

As a vehicle manufacturer actively engaged in the development of battery-electric vehicles (BEVs), Oshkosh is pleased to provide comments intended to support EPA's efforts to reduce regulatory barriers and to facilitate market launch of these vehicles. Vocational vehicle duty cycles in particular present unique challenges for power supply that may be solved with hybrid or other range-extending solutions, and we encourage EPA to consider how the Agency can facilitate the development of such solutions in this rulemaking. In the same way that hybrid technologies have served as a bridge between internal combustion engine (ICE) and electric vehicle (EV) technologies in other sectors of transportation (i.e., passenger cars), hybrid and range-extending technologies have an important role to play in bridging the transition for the heavy-duty sector as well. [EPA-HQ-OAR-2019-0055-1226-A1, p. 3]

Organization: *Valero Energy Corporation*

EPA also proposes to establish provisions to quantify NOx emissions from hybrid electric vehicles (HEVs) in order to allow HEVs to generate NOx emission credits. [EPA-HQ-OAR-2019-0055-1328-A2, p.6]

7 40 CFR 86.016-1(d)(4)

Both CARB and EU have recently raised concerns about emissions from HEVs, which can experience multiple high-power cold-start events over a single trip. The EU has determined that under its current certification test procedure, plug-in hybrids register only 25% of the emissions measured under real world driving conditions.9 An analysis of REV found that they consume more energy and may have as much as four times more emissions than attributed to them in the certification procedure. Given concerns about the true emissions from HEV and the ability of current test procedures to capture those emissions, it is not appropriate for EPA to allow NOx emission credits to be generated from HEVs. [EPA-HQ-OAR-2019-0055-1328-A2, p.6]

9 https://theicct.org/analysis-of-plug-in-hybrid-electric-passenger-car-data-conams-real-world-co2-emissions-aretwo- to-four-times-higher-than-official-yalues/ and https://theicctorg/publication/real-world-usage-of-plug-inhybrid- electric-yehicles-filel-consumption-electric-driying-and-co2-emissions/

<u>EPA Summary and Response</u>

Preamble Section III.A provides a high-level overview of comments received and EPA responses to comments on the proposed updates and clarifications to regulatory language, as well the proposed test procedures for hybrid engines and hybrid powertrains. In this Section 3.7 of the Response to Comments document, we provide additional detail summarizing comments received and our responses to those comments.

<u>Summary</u>:

Some commenters generally highlight that different technology solutions may be better suited for different use cases or duty-cycles, and urge EPA to consider multiple technologies, including hybrid or range extending technologies, in the development of the final rulemaking.

As discussed in preamble Section III.A, commenters generally support the proposed option to conduct powertrain testing to certify a hybrid engine or hybrid powertrain. Commenters who stated that powertrain testing for certification should remain an option, but not be required, noted that powertrain dynamometer test procedures produce emission results that are more representative of hybrid engine or powertrain on-road operation than engine-only testing; however, they state that requiring powertrain testing, rather than engine dynamometer testing, would add regulatory costs to hybrid vehicles, and result in logistical difficulties between hybrid powertrain vendors and manufacturers for final vehicle assembly. They further stated the per-vehicle cost increases would make it more difficult for hybrid technology to further expand in the commercial market sector. Once commenter urged EPA to work closely with CARB to coordinate a common approach to hybrid testing and certification that allows for various certification pathways.

Commenters who stated that the proposed test cycles are not reflective of hybrid operations, recommend that EPA utilize duty cycles related to metro transit authority routes (e.g., Manhattan Cycle and OCTA); they stated the metro transit authority routes would better represent real world operation of hybrid transit bus operations with lower average speed and a greater number of stops. Another commenter recommended EPA allow manufacturers to use a utility factor (UF)-based calculation (i.e., Equation §1036.505- 10) for criteria pollutant emissions including NOx, in order to account for the criteria pollutant reductions demonstrated by hybrids. In contrast, one commenter pointed to data collected from light-duty hybrid electric vehicles in Europe that the commenter stated shows hybrid electric vehicles emit at higher levels than demonstrated in current certification test procedures; based on those data the commenter stated that EPA should not allow HEVs to generate NOx emissions credits.

Another commenter stated that, in addition to the defined duty cycles, the 3B-MAW off-cycle test procedure does not properly account for emissions reductions from hybrid systems; the commenter stated that EPA should modify the 3B-MAW calculation method to align with hybrid operations in the real world.

One commenter also requested EPA allow an option to use a generic traction system model in a hardware-in-the-loop (HIL) simulation, analogous to the use of a generic transmission model in powertrain testing, to reduce certification complexity for certifying series hybrids. This commenter provided additional requests for clarification of two specific aspects of the proposed hybrid test procedures. Another commenter stated that EPA should require an idle cycle for all powertrains with accountability for hybridized systems.

In addition, one commenter urged EPA to simplify powertrain certification requirements for GHGs.

Response:

EPA agrees with a multi-technology approach to reduce emissions as the heavy-duty industry increasingly moves towards application of zero emissions technologies. As commenters point out, we proposed and are finalizing test procedures for manufacturers to optionally use hybrid engines or hybrid powertrains to demonstrate NOx emissions performance. Manufacturers and customers can therefore select the technology that best fits the needs of their duty-cycle. If testing the hybrid engine and hybrid powertrain together results in NO_X emissions that are below the final standards, then manufacturers can choose to certify to a FEL below the standard and participate in the NOx ABT program in the final rule.[15] See Preamble Section III.A for more discussion on our decision to finalize as proposed the allowance for manufacturers to use powertrain or engine dynamometer testing to certify hybrid engines or hybrid powertrains.

EPA disagrees that metro transit authority routes or other similar test cycles would be more representative of hybrid operations. While transit authority routes would be representative of hybrid bus operations, they would not represent the duty cycles of other hybrid vehicle types. We expect to continue working with manufacturers to identify data or other information that would support updates to the test procedures for certifying hybrid systems; we may consider this information in the development of future rules relevant to heavy-duty highway hybrid systems. Section III of the preamble includes additional details on the certification and off-cycle test requirements we are finalizing for hybrid systems, including clarifications on the use of HIL simulation where appropriate. As discussed in preamble Section III, we are finalizing that the applicable criteria pollutant standards must be met under the worst-case conditions, which is achieved by testing and evaluating emissions from plug-in hybrids (PHEVs) under both charge-depleting (CD) and charge-sustaining (CS) operation. This approach ensures that criteria pollutant emissions are controlled under all conditions, which would include under conditions where the PHEV is not charged and is only operated in charge sustaining-operation, rather than allow the use of a utility factor curve to weight CD and CS emissions as suggested by one commenter. [16,17] We note that by not assuming a zero-emissions tailpipe performance of all hybrid engines and hybrid powertrains (PHEV and non-plug-in hybrids) in the final rule, we are ensuring that hybrid engines and hybrid powertrains only generate NO_X emissions credits that are reflective of their emissions performance over the required test procedures. Further, the updates to our duty-cycle and off-cycle test procedures ensure that a broader range of operations are captured. The combination of updates to our test procedures and requiring manufacturers to meet the final criteria pollutant standards under the worst-case conditions addresses the concern that one commenter raised about allowing hybrid electric vehicles to generate NO_X emission credits if hybrid electric vehicles emit at higher levels than demonstrated in certification test procedures.[18] Section III of the preamble also includes details on the optional idle test that we are

[15] We note that our approach to NO_X emissions credits for hybrid engine and hybrid powertrain differs from our approach to NO_X emissions credits for ZEV in the final rule based on our consideration of several factors; see Section 12.6 of this Response to Comment document for discussion on this topic.

[16] We acknowledge that the draft RIA for the proposed rule also included discussion on the potential for higher NO_X emissions under some heavy-duty hybrid operating conditions. As discussed in this section of the Response to Comments document, the test procedures we are finalizing address NOx emissions under all operations, and thus will ensure that the applicable criteria pollutant standards are met under all conditions, including worse-case conditions.

[17] Testing under worst-case conditions is consistent with the Agency's longstanding approach of requiring engines and vehicles to meet emissions standards under all conditions. As discussed in preamble Section III.B, we are allowing a UF curve for certifying PHEVs to GHG emissions standards; we believe this difference in approach is warranted because of differences in the spatial scale of GHG versus criteria pollutant impacts and the relative accuracy of a UF curve when representing emissions on average versus the specific emissions of a particular engine or powertrain configuration. Specifically, the UF approach is appropriate for capturing the average GHG emissions from a PHEV, which is appropriate for GHG emission impacts; however, the UF approach cannot fully capture the specific criteria pollutant emissions from a particular PHEV configuration, which is important for the local nature of criteria pollutant emission impacts.

[18] We note that the referenced data relate to CO_2 emissions from light-duty hybrid electric vehicles, rather than NO_X emissions from heavy-duty hybrid electric vehicles. While we're finalizing limited changes to heavy-duty test

finalizing; EPA continues to believe it is appropriate for the idle test to be voluntary for all powertrains, including hybrid systems, since the off-cycle standards will capture emissions performance during idle operations.

As discussed in preamble Section III.B, we are finalizing updates to further clarify how to carry out the test procedure for plug-in hybrids to measure GHG pollutants; however, substantive changes to the powertrain certification requirements for GHGs are outside the scope of this rulemaking.

3.8 Regulatory useful life

Comments by Organizations

Organization: *Alliance for Vehicle Efficiency (AVE)*

AVE supports EPA's proposed Option 1 standard, with a modification of the proposed full useful life timelines and warranty requirements, as the best option for driving more rapid adoption of advanced engine and emission control technologies. [EPA-HQ-OAR-2019-0055-1280-A1, p. 2.]

AVE asks EPA to modify the proposed full useful life timelines and warranty requirements. [EPA-HQ-OAR-2019-0055-1280-A1, p. 2.]

Currently, suppliers are not provided the necessary data (and certain data may not exist) nor information to design for a reasonable warranty and to determine if the proposed full useful life (FUL) timelines are feasible. Suppliers lack the data necessary, beyond the current goals to extended distance, time-in-service and beyond the first owner/user of vehicle, to make accurate assessments about the durability of many products. More research on engine wear and use patterns that result in degradation is needed before proposing longer warranties and extending FUL timelines. As such, AVE recommends several changes to EPA's proposed warranty requirements and FUL timelines: [EPA-HQ-OAR-2019-0055-1280-A1, p. 2.]

- Consider re-evaluating the FUL timeline once more engine test data is available. [EPA-HQ-OAR-2019-0055-1280-A1, p. 2.

AVE supports additional modifications to Option 1 to provide the best opportunity for driving more rapid adoption of advanced engine and emission control technologies. These additional modifications include:

procedures for hybrid engines and hybrid powertrains, we do not consider the data submitted by the commenter to be directly relevant to the test procedure changes we are finalizing since the data are not relevant to NOx (i.e., CO_2 emissions were measured in the referenced studies) and further are not relevant to heavy-duty vehicles since the data reflect the behavior of light-duty passenger car drivers, not heavy-duty commercial vehicle drivers. Further, any changes to light-duty vehicle test procedures based on the data submitted are outside the scope of this rule.

- Alignment of the EPA proposed standard with California's Omnibus rule by adding an intermediate useful life standard for MY2027 to 2030 engines up to 435,000 miles. [EPA-HQ-OAR-2019-0055-1280-A1, p. 3]
- ...

Organization: *Allison Transmission, Inc. (Allison)*

- EPA should also not finalize the Intermediate Useful Life ("IUL") standards that have been proposed. This additional certification requirement would add to the overall costs that customers will experience during the transition period to lower NOx standards and such cost is of dubious value for vocational vehicles that may have a low likelihood to exceed mileage or hours thresholds. [EPA-HQ-OAR-2019-0055-1231-A1, p.6]

Option 2 standards are also the preferable option for the final rule due to the inherent challenges and lead-time required for the validation of new emission control technologies. In this regard, EPA is concurrently proposing to extend useful life periods for both spark-ignition and compression ignition HDVs. Like the stringency of required NOx emission levels, useful life periods are more aggressive under Option 1 than Option 2 when fully phased-in by MY 2031, although the first phase of Option 1 is somewhat less aggressive than Option 2 as applied to MY 2027 and later MY vehicles.8 Whatever useful life periods are contained in the final rule, however, the longer useful life periods will impose substantial upfront engineering and materials costs. As EPA is aware, systems will need to be designed and built to ensure sufficient "head room" for compliance over many years, which in the case of EPA's proposed standards, may be up to 15 years. Companies that supply original equipment manufacturers ("OEMs") with various systems, like Allison, will need to ensure that the lengthy proposed mileage/time periods can be accommodated. Because EPA intends to move this regulation forward to completion in 2022, there will be only four years (perhaps less) time from the finalization of the regulation to the time where fully-engineered vehicle systems will need to be developed, produced, and sold to ultimate purchasers. This means that interim dates for design, testing, validation, production, and distribution will be challenging even under the least stringent options being considered by EPA. [EPA-HQ-OAR-2019-0055-1231-A1, p.8]

> 8 Table 1 – Proposed Options 1 and 2 Emission Standards for Heavy-Duty CI and SI Engines on Specific Duty Cycles, Id. at 17,422.

Within Option 1, EPA has proposed to utilize intermediate useful life ("IUL") standards of 435,000 miles that incorporate additional emission levels that must be met at such mileage thresholds in order to ensure that the emissions performance of an engine or vehicle does not degrade so as to threaten the ability to comply at the end of their applicable full useful life periods. Compliance with IUL would be determined through the use of deterioration factors as specified in proposed 40 C.F.R. §1036.245. [EPA-HQ-OAR-2019-0055-1231-A1, 10]

While EPA recognizes that heavy duty highway vehicles include vocational vehicles (which represent a "diverse array of vehicles . . . categorized into weight classes based on gross vehicle weight ratings (GVWR) that span Class 2b trucks and vans greater than 8,500 lbs. GVWR through Class 8 long-haul tractors and other commercial vehicles that exceed 33,000

GVWR"16) the proposed IUL standards do not take into account this extremely varied utilization. For MYs 2031 and later, the only variation to IUL standards occurs with respect to whether a vehicle is spark ignition or compression ignition and regarding its broad weight class. IUL standards are varied with respect to the three duty cycles, but all vehicles within the heavy-duty weight class are treated the same. This regulatory structure fails to account for numerous heavy-duty vehicles which have unique operating profiles for which the same IUL standard may be inappropriate.[EPA-HQ-OAR-2019-0055-1231-A1, 10]

16 87 Fed. Reg. at 17,417.

Allison would therefore first argue that EPA should not utilize IUL standards. EPA's basic rationale for such standards is that IUL standards are needed to ensure overcompliance with emission standards. Specifically, EPA is "proposing intermediate useful life standards that engines do not degrade in performance down to the duty cycle and off-cycle standards too quickly and allow for an intermediate check on emissions performance deterioration over the useful life."18 This rationale has two logical faults. First, EPA standards are the legal measure of compliance; if an in-use engine continues to meet the standards it was certified to during the applicable regulatory period, it is compliant. An engine that is closer to or further away from the required emission standards is still compliant. Second, intermediate useful life standards do not allow for a "check on emissions performance." That role is served by in-use standards and EPA is already proposing to require longer regulatory useful life and emission-related warranty requirements as well as a "low-load test cycle and off-cycle test procedure for CI engines [to] help ensure that the reductions in tailpipe emissions are achieved in-use, not only under high-speed, on-highway conditions, but also under low-load and idle conditions."19 [EPA-HQ-OAR-2019-0055-1231-A1, 11]

18 87 Fed. Reg. at 17467.

19 Id. at 17,427.

The IUL standards amount to an additional certification requirement which adds additional cost and is of dubious value for vocational vehicles that may have a low likelihood to exceed mileage or hours thresholds. EPA's justification that "it could be many years after engines are on the road before EPA could verify that the engines meet the standards our to useful life"20 does not account for the fact that such assurance is also provided by longer regulatory useful life and emission-related warranty requirements. Manufacturers are directly incentivized by such provisions to ensure that engines will meet requirements over many years -- at the very real risk a substantial, future compliance costs related to potential recalls/remedial actions. EPA has proposed to at least double currently applicable emission related warranty periods based on mileage and impose new hours requirements.21 The IUL standards amount to an additional regulatory layer that is unvalidated in many vocational vehicle applications. [EPA-HQ-OAR-2019-0055-1231-A1, 11]

20 Id. at 17,461.

21 Table 4 – Proposed Options 1 and 2 Emission-Related Warranty Periods for Heavy-Duty CI and SI Engines Criteria Pollutant Standards, 87 Fed. Reg. at 17,425.

Although as stated above, Allison does not recommend that EPA finalize the proposed IUL requirements, if EPA determines to include IUL standards in the final rule, EPA must at minimum align such requirements with the California Air Resources Board ("CARB") Omnibus Regulation which is limited to an eight, versus ten year period.22 Given the broad categories of vehicles involved, there would appear to be no rationale for not harmonizing this element of EPA's heavy-duty vehicle program with the current California program. [EPA-HQ-OAR-2019-0055-1231-A1, 11]

22 13 C.C.R. 1956.8(j)(11).

In the proposed rule, EPA states that it will give "full consideration" to the useful life and warranty periods that it has proposed for Options 1 and 2, including "the full range of options between them."23 For the reasons stated below, Allison believes that EPA should finalize Option 2 regulatory periods. In our analysis, Option 2 more appropriately balances the costs and benefits of extended useful life and warranty periods and better takes into consideration the real-life dynamics concerning these periods and customer behavior. [EPA-HQ-OAR-2019-0055-1231-A1, p.12]

23 87 Fed. Reg. at 17,421.

It seems clear that EPA intends this proposed rule to incentivize the deployment of new emissions technology as well as deliver substantial public health and environmental benefits. But if useful life and warranty periods are extended too far into the future, these regulatory requirements will tend to inhibit, rather than incentivize, the development of new emissions control technology given that the longer periods will inherently favor the deployment of emission controls systems which can best be verified in the near-term. EPA should also consider that it has the legal ability to revisit useful life and warranty issues in a future rulemaking; it should therefore avoid the conclusion that it must finalize each and every component of the proposed rule at the high end of stringency in order to obtain intended benefits. Rather, EPA could move to finalize Option 2 useful life and warranty provisions now and assess at a later date how these provisions worked, or did not, work in practice and whether these periods should be extended in future years. Having the benefit of seeing how Option 2 requirements are actually complied with could only help to inform EPA's analysis of the proper length and extent of the useful life and warranty provisions. [EPA-HQ-OAR-2019-0055-1231-A1, pp.13-14]

Organization: *American Lung Association et al.*

To realize the maximum health benefits, US EPA recognizes the need to establish standards that look beyond the stringency levels and proposes updated test procedures, truck 'useful life' requirements and warranty provisions to support achieving pollution reductions across real-world driving conditions throughout the useful life of the truck. We believe that Option 1 provides a strong foundation, and offer the following recommendations to protect public health: [EPA-HQ-OAR-2019-0055-1271-A1, p.2]

Strengthen full useful life to 1 million miles. We appreciate that Option 1 would require emission controls to operate as intended over a more realistic useful life of the truck. By extending the mileage through which the control systems must operate correctly, the proposal recognizes that emissions can rise as engines age. We appreciate that Option 1 proposes to cover <u>more</u> of a vehicle's estimated full useful life than both existing rules and what would be covered by Option 2, but we believe that the mileage requirements for heavy-duty vehicles must be set to 1 million miles in order to capture all of the operational life of the vehicle, which EPA considers to be over 900,000 miles.4 [EPA-HQ-OAR-2019-0055-1271-A1, p.2]

> 4 US EPA. Overview Briefing of the Proposal at page 11. April 2022. https://www.epa.gov/system/files/documents/2022-04/hd-2027-stds-nprmoverview-2022-04.pdf

Organization: *American Truck Dealers (ATD)*

EPA claims that longer useful life periods will result in more durable emission control related components that, combined with longer warranty periods, could reduce repair costs for new CMV purchasers. EPA also suggests that these combined effects may increase new CMV sales (or more likely reduce the decline in sales discussed above).13 ATD disagrees and instead concurs with the position taken by EMA that the higher costs associated with unreasonably longer useful life mandates would undermine the technological feasibility of a revised NOx rule. [EPA-HQ-OAR-2019-0055-1321-A1, p. 6]

> 13. 87 Fed. Reg. 17414, 17590.

Organization: *American Trucking Associations (ATA)*

While ATA cannot address every aspect of HD2027, we are supportive of the underlying environmental objectives and several of the elements being proposed. ATA's areas of support include: [EPA-HQ-OAR-2019-0055-1326-A1, p. 3]

- Further reduction of NOx emissions over a broader range of operating conditions and maintaining emissions control over a greater portion of an engine's operational life are warranted. [EPA-HQ-OAR-2019-0055-1326-A1, p. 3]
- Current emission warranty and useful life periods for heavy-duty engines and vehicles should be revised from the current requirements to increase the durability and efficacy of in-use emissions compliance. [EPA-HQ-OAR-2019-0055-1326-A1, p. 3.]

Fleets desire durable products yet durability is a direct function of increased cost. Products age and deteriorate and as such, they are either replaced or repaired. Proposed useful life periods up to 800,000 miles should be reduced sufficiently so that manufacturers are not required to sell excessively expensive extended warranty packages to fleets that factor in multiple replacements of emission control systems and additional margins. Vehicles outside warranties but still within useful life periods may also be subject to costly recalls and vehicle downtime. At the end of the day one fact remains consistent – fleets will incur every cost associated with their equipment one way or another. In the trucking industry, every penny counts. [EPA-HQ-OAR-2019-0055-1326-A1, p. 7]

Organization: *Alliance for Vehicle Efficiency (AVE)*

AVE recommends EPA expand ORVR to incomplete heavy-duty vehicles rated over 14,000 pounds Gross Vehicle Weight Rating, with a refueling emission standard of 0.20 grams hydrocarbon per gallon of liquid fuel dispensed, applicable for a useful life of 15 years or 150,000 miles. [EPA-HQ-OAR-2019-0055-1280-A1, p. 6]

Organization: *BorgWarner*

1. BorgWarner is in favor of forward progress to consistently reduce NOx, CO2 and other emissions, but we have concerns with the proposal's full useful life (FUL) and emissions warranty provisions. [EPA-HQ-OAR-2019-0055-1234-A1, p. 1.]

BorgWarner recommends EPA include a specific engine-based component life and degradation assessment in its consideration of the final rules. The proposed FUL extension is based only on the accelerated testing of the aftertreatment components and systems, with no regard for engine degradation either due to mileage or time-based limits. It is impossible to design a system for the long durations proposed with no data from current technology to this time in service nor data on how the secondary, tertiary and other users might operate the vehicles. [EPA-HQ-OAR-2019-0055-1234-A1, p. 2]

Much of the analysis has considered the single use case of class 8 long haul and overlooks any vocational applications in classes 2B through 8. It is critical to understand how the engine system is used for all use profiles over the life, in order to translate that into correct design specifications for function and durability over the full life anticipated. [EPA-HQ-OAR-2019-0055-1234-A1, p. 2]

Organization: *California Air Resources Board (CARB)*

For MY 2031 heavy HDEs, U.S. EPA has proposed 20 mg/hp-hr NOx standard on both the FTP and SET duty cycles and a 50 mg/hp-hr on the LLC duty cycle at the IUL of 435,000 miles (Figure 5-1). [EPA-HQ-OAR-2019-0055-1186-A2, p.41]

U.S. EPA's justification for this proposal is that the longer UL of 800,000 miles for heavy HDEs warrants IUL NOx standards to '…ensure that the emissions from the engine are as low as feasible for the entire UL and provide an intermediate check on emission performance deterioration over the UL.'96 CARB staff agrees with the justification. However, considering the proposed UL of 600,000 miles for MY 2027 heavy HDEs, the same justification should also be used for the need of IUL NOx standard for MY 2027 heavy HDEs. As demonstrated in the Stage 3 RW, a 20 mg/hp-hr NOx on the FTP and SET and a 50 mg/hp-hr on the LLC at 435,000 miles is technically feasible 97 (See also Figure 5-2 for test results from the Stage 3 RW engine). There is enough lead time between now and 2027 to further develop technologies to achieve lower emissions levels than currently demonstrated by CARB and U.S. EPA. It is important to note that, because Omnibus was adopted in December 2021 with a 20 mg/hp-hr IUL NOx standard for model year 2027, manufacturers have additional lead time beyond what the CTP proposal provides. [EPA-HQ-OAR-2019-0055-1186-A2, pp.41-42]

96 NPRM 17461

97 Sanchez, James. 'Test Results from EPA Diesel Demonstration'. Memorandum to Docket: EPA-HQ-OAR-2019-0055. February 10, 2022.

Adoption of an IUL NOx standard by U.S. EPA for MY 2027 would also provide much-needed harmonization of standards with CARB's Omnibus, thereby allowing manufacturers to reduce complexity and cost by producing a single engine design nationally. [EPA-HQ-OAR-2019-0055-1186-A2, p.44]

UL periods in the Omnibus and included in U.S. EPA's proposed Option 1 were derived based on information from engine rebuild and replacement data reflective of real-world vehicle usage, as well as information from engine and aftertreatment system manufacturers. In both cases, the UL periods were chosen to roughly correspond to the age when engines get either rebuilt or replaced.121,122 In addition, the feasibility of the standards for the Omnibus UL periods (which are included in U.S. EPA's proposed Option 1) was demonstrated in the Stage 3 RW demonstration program. 123 [EPA-HQ-OAR-2019-0055-1186-A2, pp.49-50]

121 CARB Heavy-Duty Engine and Vehicle Omnibus Regulation and Associated Amendments. Staff Report. June 23, 2020 (pages III-57-III-60)
122 NPRM, 17497-17594
123 'An Update on Continuing Progress Towards Heavy-Duty Low NOx and CO2 in 2027 and Beyond'. Sharp, Christopher, B. Zavala, G. Neely, S. Rao. Southwest Research Institute. Presentation to the SAE 2022 WCX™ World Congress Experience. April 5-7. Detroit, Michigan.

CARB staff strongly suggests U.S. EPA adopt the proposed Option 1 UL periods for both CI and SI HDEs. In addition, CARB staff recommends that U.S. EPA adopt an IUL period of 435,000 miles for MY 2027 heavy HDEs. As mentioned above, an IUL period together with CARB recommended IUL NOx standards on all duty cycles for MY 2027 heavy HDEs would serve as an intermediate check to ensure emissions remain low during the earlier part of the UL. [EPA-HQ-OAR-2019-0055-1186-A2, p.50]

Organization: *Clean Air Board of Central Pennsylvania*

EPA is proposing two regulatory options for NOx. We support Option 1, which will implement stronger NOx standards in two steps. The first improvement would be required in 2027 with a second more stringent standard 2031 (a NOx standard that would be 90% lower than today's standards). We support Option 1 with longer useful life and warranty periods. Ensuring that the warranty and useful life requirements meet 100% of the expected life of these vehicles will ensure health benefits throughout the life of the vehicles. [EPA-HQ-OAR-2019-0055-1305-A1, p.1]

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

Option 1’s useful life and warranty periods align with those of the Omnibus, compelling manufacturers to make critical durability improvements that are still eminently feasible. 87 Fed. Reg. at 17,500, 17,508. Option 2, on the other hand, shaves off years and tens of thousands of miles from Option 1’s useful life periods without even attempting to provide a technological feasibility rationale. EPA even acknowledges that, according to its data, ‘most of the proposed standards are achievable well beyond the proposed Option 2 mileage’ for spark-ignition engines. 87 Fed. Reg. at 17,501 (emphasis added). Option 2 repeats the same mistake with its proposed warranty periods. 87 Fed. Reg. at 17,508. In light of Congress’s clear intent that EPA set technology-forcing standards, it would be unreasonable for the Agency to adopt useful life and warranty periods that are significantly weaker than what manufacturers can attain (and which are already required by the Omnibus). [EPA-HQ-OAR-2019-0055-1302-A1, p.50]

To further ensure that emissions will be properly controlled over a greater portion of an engine’s operational life, Commenters also support lengthening warranty and in-use periods. Emissions controls, like other components of engines, typically work less efficiently and become more likely to malfunction as they age. The Clean Air Act specifies that emissions standards under Section 202(a) ‘shall be applicable to such vehicles and engines for their useful life (as determined under [42 U.S.C. 7521(d)]…) whether such vehicles and engines are designed as complete systems or incorporate devices to prevent or control such pollution.’ 42 U.S.C. 7521(a)(1). EPA’s standards therefore include a durability requirement: a requirement that manufacturers demonstrate their engines will meet the standards throughout the regulatorily defined ‘useful life’ of the engine.241 The Clean Air Act also requires EPA to specify a warranty period within which manufacturers are responsible for the cost of repairing or replacing emissions control components that fail. 42 U.S.C. 7541(a)(1). [EPA-HQ-OAR-2019-0055-1302-A1, pp.59-60]

241 40 C.F.R. 86.004-26(c)-(d) and 86.004-28(c)-(d). 40 C.F.R. 86.004-2.

EPA is correct to note that, ‘practically, any difference between the regulatory useful life and the generally longer operational life of in-use engines represents miles and years of operation without an assurance that emission standards will continue to be met.’ 87 Fed. Reg. at 17,495. In a 2013 report, EPA found that in the real world, many HDEs did not reach the end of their operational life (their first rebuild) until they had been driven more than twice the current useful life mileages for those classes of engines. 87 Fed. Reg. at 17,498. In other words, many HDEs are driven hundreds of thousands of miles beyond the point to which manufacturers must currently show emissions controls can last. [EPA-HQ-OAR-2019-0055-1302-A1, p.60]

Commenters support increasing the useful life mileage values for HDEs and extending the warranty period to cover a larger portion of the engines’ operational lives. Because the current useful life and warranty periods cover only a fraction of the real-world operational life of trucks, older trucks on the road are very likely emitting higher levels of NOx, and neither truck operators nor manufacturers have the proper incentives to ensure that emissions controls on those older trucks are functioning properly. Useful life and warranty periods covering a greater fraction of HDEs' expected operational life will help to protect people from dangerous NOx, ozone, and particulate matter pollution, and will shift more of the costs and risks of designing functional pollution control equipment to engine manufacturers, who have control over design, rather than effectively requiring operators to bear those costs. [EPA-HQ-OAR-2019-0055-1302-A1, p.60]

Specifically, we urge EPA to adopt useful life and warranty periods at least as long as those proposed in Option 1. EPA notes that it 'could justify proposing useful life requirements equivalent to the operational life data presented in Section IV.A.2 [of the Proposal], but [is] proposing somewhat shorter (less stringent) values in proposed Option 1 considering the effect of useful life on the feasibility of meeting the proposed Option 1 standards.' 87 Fed. Reg. at 17,500. As the Proposal also notes, the Option 1 useful life periods generally align with those in the Omnibus. Id. EPA proposes in Option 1 to adopt warranty periods covering close to 80% of useful life, which would align with the MY 2027 and MY 2031 warranty periods adopted by CARB. 87 Fed. Reg. at 17,508. The fact that many manufacturers must comply with the Omnibus standards when they take effect supports the technological feasibility of setting useful life and warranty periods at a level approximately as stringent as the Omnibus. Given the Clean Air Act's command that EPA set regulations reflecting the 'greatest degree of emission reduction achievable,' 42 U.S.C. 7521(a)(3)(A)(i), and EPA's statement that it could justify even longer useful life periods equal to operational life, we urge EPA to consider setting useful life periods more stringent than those proposed in Option 1 if the Agency determines that longer periods would be feasible in combination with the emissions standards it finalizes. Additionally, we urge EPA to adopt new warranty and useful life values in a single step, finalizing its proposed Option MY 2031 values as standards applicable to MY 2027 in order to achieve the emissions reductions from these changes as swiftly as possible. [EPA-HQ-OAR-2019-0055-1302-A1, p.61]

Organization: *Clean Fuels Alliance America (Clean Fuels)*

Longer full useful life requirements will create value and overall reduced costs for U.S. customers that use diesel fuel, biodiesel, or renewable diesel. [EPA-HQ-OAR-2019-0055-1248-A1, p.3]

Organization: *Consumer Reports (CR)*

Under the CAA, manufacturers must only certify emission standards for 'useful life' of the vehicle and engine.49 The CAA also directs the EPA to prescribe warranty periods for heavy-duty engines, and requires manufacturers to provide an emissions warranty.50 The current designated useful life for all trucks is only 10 years and between 110,000 and 435,000 miles, depending on class. Warranties cover only 5 years of the vehicle's life. In contrast, most trucks remain on the road between 20 and 30 years and between 550,000 and 1.2 million miles, depending on class.51 As a result, many trucks spend more than a decade on the road while not meeting emission standards. [EPA-HQ-OAR-2019-0055-1285-A1, p.8]

49 42 U.S.C. 7521(a)(8).

50 42 U.S.C 7541(a).

51 Id.

EPA is proposing to increase the useful life of heavy-duty vehicles. Under Option 1 for light heavy-duty engines, EPA is proposing to increase the useful life from 10 years or 110,000 miles to 15 years or 250,000 miles. For medium heavy-duty engines EPA is proposing to increase the useful life from 10 years or 185,000 to 15 years or 325,000 miles. For heavy heavy-duty engines, EPA is proposing to increase the useful life from 10 years or 435,000 miles to 13 years or 800,000 miles. Under option 2, EPA is not proposing to extend the useful life years for any class of engine, and is proposing lower mileage increases. [EPA-HQ-OAR-2019-0055-1285-A1, p.8]

The proposed extended useful life and warranty periods are necessary to ensure that heavy-duty certified emissions levels are achieved in real-world settings. EPA must adopt the proposed Option 1 useful life and warranty periods. Option 2 does not go far enough to capture the real-world longevity of heavy-duty vehicles. [EPA-HQ-OAR-2019-0055-1285-A1, p.8]

Organization: *Cummins Inc. (Cummins)*

EPA proposes to significantly lengthen emissions useful life periods for all primary intended service classes starting in MY 2027. As discussed above, EPA's Option 1 proposal, including its associated two-step extended useful life periods, is not feasible. EPA's Option 2 proposals for longer useful life periods, although only one step, are still significant increases. For example, in EPA's Option 2 proposal, the mileage period for Heavy Heavy-Duty Engines (HDE) would increase from 435,000 miles today to 650,000 miles—a nearly 50% increase in miles. Useful life mileages would increase for all other primary intended service classes as well, with as much as a 2.3x increase in one class (Light HDE). Cummins does not support increases in emissions useful life periods. Such changes will increase the initial purchase price of the vehicle as manufacturers seek to re-coup the costs of paying for component replacements or other measures needed to comply with the longer requirements. Significantly increasing the useful life at the same time as introducing new technology will increase prices beyond just the added technology costs and likely impact the customer adoption of new engines with those technologies. If EPA does finalize increases to today's useful life periods, it will need to account for additional uncertainty and variability in the deterioration of engines operated in the field by allowing additional in use margin to the duty-cycle and off-cycle standards when those engines are tested for compliance. For those same reasons, EPA requested comment on such margins in Option 1, but those same uncertainties and variabilities also exist for Option 2's proposed longer useful life. [EPA-HQ-OAR-2019-0055-1325-A1, p. 7]

EPA proposes to continue the practice of including hours in the regulated useful life period for the Heavy HDE class to account for engines "that operated frequently, but accumulated relatively few miles due to lower vehicle speeds" (87 FR 17501), based on a 20 mile per hour speed threshold consistent with today's Heavy HDE useful life criteria of 435,000 miles and 22,000 hrs. EPA requests comment on the need for a useful life hours criterion for Heavy HDE and whether they should include one for other primary intended service classes. Cummins supports continuing to include useful life hours for Heavy HDE as well as adding useful life hours for the other primary service classes of Medium HDE, Light HDE, and SI HDE. Just as in Heavy HDE, and perhaps even more so, there are applications within the other classes that accumulate relatively few miles due to lower vehicle speeds. It is also appropriate to use an average speed of 20 miles per hour, the same threshold EPA is already proposing for warranty in those service classes, for determining hours for the other classes. Cummins has submitted average vehicle speed data and run hours to EPA for numerous vehicles and applications operating in-use, which supports adding hours limits based on the 20 mph speed threshold. [EPA-HQ-OAR-2019-0055-1325-A1, p. 7]

EPA proposes not to migrate the provision for an alternate useful life period assigned by the Administrator in paragraph (5) of the existing useful life definition in §86.004-2. That provision has been used in the past and should be migrated to Part 1036 for possible future use. [EPA-HQ-OAR-2019-0055-1325-A1, p. 7]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

EPA should change useful life and emissions warranty periods to be more reasonable, specifically: 95

- Class: Heavy HDEs
    - Useful Life Period: 10 years/500,000 miles
    - Emissions Warranty Period: 5 years/350,000 miles
- Class: Medium HDEs
    - Useful Life Period: 10 years/250,000 miles
    - Emissions Warranty Period: 5 years/175,000 miles [EPA-HQ-OAR-2019-0055-1168-A1, p.71]

95 Daimler Truck also supports adding appropriate equivalent standards for the number of hours of engine operation

A significant portion of the infeasibility, cost, uncertainty, and risk in the Proposed Rule derives from EPA's proposed extensions of the useful life and emissions warranty programs. It is cost prohibitive and impractical for manufacturers to adequately design components and be certain of their reliability for these extended periods, especially since EPA's rule proposals drive the development of new technology with only four years of lead-time and three years of stability between programs. 96 [EPA-HQ-OAR-2019-0055-1168-A1, p.71]

96 While Daimler Truck's comments in this section focus primarily on increased technology costs and compliance burdens associated with EPA's useful life and emission warranty period proposals, we also note that EPA's proposals will mean significantly increased info1mation collection costs and burdens on manufacturers, which are relevant to OMB's review of the Proposed Rule under the Pape1work Reduction Act, see 44 U.S.C. 3501 et seq. Increased useful life times, for example, will translate to increased durability testing, which will add burden to manufacturers in terms of costs and man hours. We anticipate that the incremental burden increase for collecting aging data alone (as compared to current useful life periods) would amount to thousands of hours.

Failure rates are likely to increase exponentially in the periods EPA considers, especially as these periods further tax manufacturers' ability to validate before production, and as engines typically experience increasing rates of ‘wear-out.’ Additionally, EPA underestimates the impact of new technology on warranty rates; new technology will always experience a period of increased failure rates as manufacturers’ experience in the field leads to more robust and mature technology. [EPA-HQ-OAR-2019-0055-1168-A1, pp.71-72]

Many manufacturers expect that, to meet the most stringent emission standards in the Proposed Rule at the extended useful life periods that EPA proposes, proactive replacement of catalysts will be necessary. This will be required to protect against aging and fuel-poisoning concerns that EPA fails to adequately recognize in the standard-setting parts of the Proposed Rule. Manufacturers will likely pay these replacement costs as warranty costs during useful life, which will translate to increased purchase prices for customers. After useful life, operators will have to keep replacing these components according to the same maintenance intervals (as with Diesel Particulate Filters today), likely at significant cost in perpetuity. [EPA-HQ-OAR-2019-0055-1168-A1, p.72]

EPA’s proposed standards are so tight that manufacturers will be required to replace aftertreatment components that lose very little relative effectiveness. An SCR that loses 1% total effectiveness over useful life will not reach EPA’s proposed emission standards over useful life, and manufacturers will be forced to replace them proactively, at significant cost. This represents a phenomenal cost for a very modest improvement in emissions as a vehicle ages. EPA has not considered these costs at all in the Proposed Rule. [EPA-HQ-OAR-2019-0055-1168-A1, p.72]

EPA can limit these exorbitant warranty costs by limiting the extended useful life to reasonable values so that manufacturers can realistically design and validate their products. By setting the useful life to 500,000 miles for a HHD truck, and 250,000 miles for a MHD truck, EPA can avoid costly replacement of aftertreatment components (which would have extremely limited emissions benefit and significant uncertainty. [EPA-HQ-OAR-2019-0055-1168-A1, p.72]

The approach that Daimler Truck proposes not only supports improved emissions outcomes, but also reduces uncertainties for manufacturers by:

- reducing the chances that a vehicle will be evaluated for in-use emissions performance in a failed state (after the warranty period, but before full useful life), since operators are incentivized by the warranty to repair their products
- providing validation timelines are more manageable for manufacturers than the extremely long timeframes that EPA has proposed;
- ensuring that deterioration factor (DF) validation and certification data can be compiled and completed in a timely manner; and
- potentially avoiding replacement of the SCR system during useful life. [EPA-HQ-OAR-2019-0055-1168-A1, pp.72-73]

98 Proposed Rule, 87 Fed. Reg. at 17,508.

The Company's proposed approach would also reduce manufacturer and customer cost uncertainty, since the true cost of maintaining emissions compliance through useful life will be calculated and priced in at the point of sale. [EPA-HQ-OAR-2019-0055-1168-A1, p.73]

Organization: *Eaton Vehicle Group (Eaton)*

Agency Request / Topic: We are requesting stakeholder input on our proposed useful life and warranty periods, as well as the range of options covered by the proposed Options 1 and 2, or other alternatives outside of that range [EPA-HQ-OAR-2019-0055-1252-A1, p.8]

Eaton Comment Strategy / Materials: We can only speak to the critical components we provide such as CDA hardware, power management devices for electrical and fuel heaters, and EGR pumps. We design all of these components for the life of the truck, which typically exceeds FUL. Eaton cannot speak to the rest of the system, namely the Aftertreatment catalysts and DEF dosers, their degradation, and potential warrantee exposure. [EPA-HQ-OAR-2019-0055-1252-A1, pp.8-9]

Organization: *Ingevity Corporation (Ingevity)*

Ingevity supports EPA's proposal to expand ORVR to incomplete heavy-duty gasoline vehicles (HDGVs) rated over 14,000 lbs. GVWR, including the proposed refueling emission standard of 0.20 grams hydrocarbon per gallon of liquid fuel dispensed applicable for a useful life of 15 years or 150,000 miles. ORVR is a proven technology to significantly reduce evaporative and refueling emissions, resulting in emission reductions of volatile organic compounds that lead to the formation of ozone and secondary particulate matter (PM2.5), as well as emissions of hazardous air pollutants. [EPA-HQ-OAR-2019-0055-1213-A1, p. 2]

Organization: *Great Rivers Environmental Law Center and Dutchtown South Community Corporation (DSCC)*

The undersigned support inclusion of the following requirements in the Final Regulation:

- Mandatory longer useful engine life requirements to ensure engines will meet applicable emissions standards throughout their useful life [EPA-HQ-OAR-2019-0055-1323-A1, p.6]

Organization: *Manufacturers of Emission Controls Association (MECA)*

We understand EPA's need to ensure that heavy-duty vehicles are meeting emission standards while in operation, which requires that emission critical components are durable and repaired quickly if a malfunction occurs. Based on several stakeholder meetings between EPA, CARB, and industry, we believe that EPA's Proposed Option 1 warranty and durability provisions have struck a suitable balance between stringency and phase-in time to allow suppliers to work with their customers to fill current information gaps and complete additional R&D to ensure future trucks continue to be durable and meet emissions warranty requirements. The phase-in approach will allow component suppliers to better understand the economic impact of longer warranty periods on their business as well as time to design longer durability into components. MECA supports hourly limits for vocational vehicles that may operate for thousands of hours at low speed or idle prior to reaching the mileage or year warranty clock threshold. We support Proposed Option 1 slight increase to the emission standards at the final longer durability periods to account for possible deterioration beyond the current FUL of 435,000 equivalent miles. Results from the SwRI demonstration program support the NOx limits at the FUL requirements in Proposed Option 1. [EPA-HQ-OAR-2019-0055-1320-A1, p.20]

One area of misalignment between EPA's Proposed Option 1 and CARB's Omnibus is the lack of an intermediate useful life standard for MY 2027-2030 engines in Proposed Option 1. MECA suggests that EPA add an intermediate standard for these model years that must be met for the first 435,000 miles of an engine's useful life. We believe that an intermediate standard will result in two major benefits compared to Proposed Option 1. First, it will lead to more robust emission control systems being installed on trucks and keep marginal systems off the roads. Second, this approach has precedence and better aligns with a single national program. In addition to the CARB and EPA engine and aftertreatment configurations being tested at SwRI, several other technologies and system configurations were also tested on technologies that were outside the scope of the agency work plans. Results from these parallel demonstration programs prove that there are further options to meeting the 0.02 g/bhp-hr standard at 435,000 miles. Three recent papers presented at the 2021 and 2022 SAE WCX meetings highlight the application of cylinder deactivation, supplemental heat and advanced aftertreatment to achieving down to 0.012 g/bhp-hr, which provides margin to the 0.02 g/bhp-hr proposed standard. The supplemental heat can be via a fuel burner [3] [4]or an electric heater [5]. A pre-publication paper that will be available later this year will summarize several engine and aftertreatment technology combinations along with calibration and dosing strategies that show great promise in achieving the Proposed Option 1 standards as well as an intermediate useful life standard of 0.02 g/bhp-hr at 435,000 miles. [EPA-HQ-OAR-2019-0055-1320-A1, pp.4-5]

[3] J. McCarthy, Jr., A. Matheaus, B. Zavala, C. Sharp and T. Harris, 'Meeting Future NOx Emissions Over Various Cycles Using a Fuel Burner and Conventional Aftertreatment System (SAE-2022-01-0539),' SAE WCX, April 2022.

[4] T. Harris, R. Bellard, M. Muhleck and G. Palmer, 'Pre-Heating the Aftertreatment System with a Burner (SAE 2022-01-0554),' SAE WCX, April 2022.

[5] A. Matheaus, G. Neely, C. Sharp, J. Hopkins and J. McCarthy, Jr., 'Fast Diesel Aftertreatment Heat-up Using CDA and an Electric Heater (SAE 2021-01-0211),' SAE WCX, April 2021.

New aftertreatment architectures, that employ a close-coupled selective catalytic reduction (SCR) catalyst before the diesel oxidation catalyst (DOC) and diesel particulate filter (DPF) in a twin SCR system arrangement with dual urea dosing, can meet future FTP/RMC NOx limits of 0.02 g/bhp-hr after 435,000 miles by 2027. Several potential future aftertreatment layouts have been demonstrated in the SwRI test program. MECA has published two white papers that outline the technologies and models used to design catalyst, substrate and architectures to meet ultra-low NOx levels [16] [15]. Over the past 8 years of demonstration work at SwRI, testing has confirmed MECA's modeled results while also showing the need for modest enhancement of emissions control durability to provide margin for the FTP and RMC cycles over extended useful life. Over the next five years, industry will embrace any remaining challenges as suppliers continue to optimize their components and engine manufacturers hone their calibrations to exceed what has been demonstrated to date. This continued improvement work is why MECA believes that an intermediate limit of 0.02 g/bhp-hr is a technologically achievable up to 435,000 miles for a national program by 2027. [EPA-HQ-OAR-2019-0055-1320-A1, p.10]

> [15] MECA, 'Technology Feasibility for Heavy-Duty Diesel Trucks in Achieving 90% Lower NOx Standards in 2027,' 2020. Online at https://www.meca.org/wp-content/uploads/resources/MECA_2027_Low_NOx_White_Paper_FINAL.pdf.

> [16] MECA, 'Technology Feasibility for Model Year 2024 Heavy-Duty Diesel Vehicles in Meeting Lower NOx Standards,' 2019. Online at https://www.meca.org/wp-content/uploads/resources/MECA_MY_2024_HD_Low_NOx_Report_061019.pdf.

EPA has used intermediate standards previously in the Tier 2 passenger car regulation to keep marginally designed emission control systems out of the market so only the most robust designs remain on the roads for their useful life. This is particularly important in trucks that can last 20 to 30 years with multiple owners and duty cycles. [EPA-HQ-OAR-2019-0055-1320-A1, p.10]

Finally, we encourage continued collaboration and discussion between EPA and CARB to study impacts of proposed warranty and durability requirements as the rule is implemented, given the lack of information on warranty and failure modes past today's FUL of 435,000 miles. Such efforts could be designed by working with truck fleets to survey field aged parts on in-use trucks to examine real-world deterioration from a representative cross-section of vehicle age, state of repair and ownership status. This would provide useful information to OEMs and suppliers working to meet Omnibus warranty and durability requirements and lead to emission controls with higher durability, lower warranty claims, and ultimately reduced emissions. A recent CARB-funded project where CE-CERT conducted testing to inform a future heavy-duty I/M program could serve as a model for a research program that identifies field aged parts in various conditions for retrieval and analysis. [EPA-HQ-OAR-2019-0055-1320-A1, pp.20-21]

As we previously commented, there is considerable uncertainty about the state of vehicles during the time of operation beyond today's 100,000 mile warranty. Much of the data on warranty claims and repairs as well as vehicle use characteristics originate from the time when the first owner operates a vehicle while data from repairs made by second and third owners is very limited. Many suppliers do not have data on the durability, replacement or diagnostics of their parts past the warranty because the dealer network is not required to share that information. This lack of information leads to challenges for suppliers who are trying to design parts that will meet the extended durability requirements out to 800,000 miles. Without warranty claim information beyond 100,000 miles, it is difficult for suppliers to estimate the cost impact of the proposed extended 2031 warranty and challenges suppliers trying to design to the much longer 2031 durability periods. The lack of data also challenges suppliers trying to design to longer durability periods. MECA members manufacture durable parts according to the specifications demanded by their customers, the OEMs, as part of individual business agreements. The individual component specifications provided to the supplier may not include a correlation between the specification and how that relates to mileage durability on the vehicle. Finally, besides the engineering design time needed to design components to longer durability requirements, the testing out to the long mileage durability requirements (such as 800,000 miles for class 8 engines), especially for on-engine components whose aging cannot be accelerated, takes months to years on dynamometers. [EPA-HQ-OAR-2019-0055-1320-A1, p.21]

Aftertreatment parts deterioration can be accelerated through well-known means such as engine exhaust exposure at higher temperature and higher oil consumption to represent longer hours of operation as described in the DAAAC protocol developed under a consortium at SwRI. As noted above, wear of on-engine emission critical parts such as EGR, turbochargers, fuel injectors or CDA is not able to be accelerated and must be run for the full duration of the useful life period. Understanding the wear mechanism is also more challenging because parts are rarely returned in their used state, but only after failure when it may be difficult to assess how deterioration progressed over the life of the part. Furthermore, there is no way to properly account for and/or accelerate the years of useful life, as this may be reached in many different types of duty cycles and environments. [EPA-HQ-OAR-2019-0055-1320-A1, p.21]

Consistent with the current requirements for evaporative emission and refueling emission controls for all lighter weight vehicles, MECA supports EPA's proposal to apply a useful life of 15 years/150,000 miles to the HHDGV refueling emission standard. The Tier 3 evaporative emission standard useful life for all HDGVs is currently 15 years/150,000 miles. Given that integrated ORVR/evaporative control system designs share hardware such as the activated carbon canister and purge valve and functions such as vapor transport and canister purge, a common requirement for evaporative and refueling emission standard useful life is logical and necessary. [EPA-HQ-OAR-2019-0055-1320-A1, p.22]

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

MEMA urges EPA to reduce the proposed warranty requirements and the full useful life timelines for all vehicles. The warranty increases of a factor of four or more are based on specific and limited laboratory testing that does not reflect complex, real-world use. Additionally, more data and analysis of second and third vehicle owner usage should be conducted before proposing significantly longer warranties and FUL timelines. [EPA-HQ-OAR-2019-0055-1322-A1, pp. 3 - 4.]

MEMA Supports Option 1 with Modifications to Warranty Time Period/Mileage, Covered Warranty Parts, and FUL [EPA-HQ-OAR-2019-0055-1322-A1, p. 5.]

MEMA urges EPA to reduce the proposed warranty requirements and the full useful life timelines for all vehicles. The warranty increases of a factor of four or more are based on specific and limited laboratory testing that does not reflect complex, real-world use. Additionally, more data and analysis of second and third vehicle owner usage should be conducted before proposing significantly longer warranties and FUL timelines. [EPA-HQ-OAR-2019-0055-1322-A1, p. 5.]

In addition, MEMA recommends an hours limit on all implemented standards in addition to mileage. [EPA-HQ-OAR-2019-0055-1322-A1, p. 7]

MEMA urges EPA to reduce the proposed factor of four increase in warranty requirements and the full useful life timelines for all vehicles until more data is available to justify such a substantial increase. More testing and validation of assumptions is necessary before increasing the FUL and this is especially true for vocational vehicles. [EPA-HQ-OAR-2019-0055-1322-A1, p. 9.]

Organization: *Moving Forward Network (MFN)*

Heavy-duty engines can last up to 1.2 million miles before a rebuild, yet the current warranty extends to just 100,000 miles, and the useful-life period is only 435,000 miles. The proposed changes to the warranty and useful-life periods for heavy-duty vehicles more closely mirrors the real-world operation of these engines and would help maintain working emissions controls while diminishing any costs incurred by the operators. [EPA-HQ-OAR-2019-0055-1277-A1, p. 27]

The useful life is critical to ensure adequate testing such that emissions controls are functional for the life of the engine. The warranty period, however, is more important to minimize tampering or disrepair, and shifts the cost of failures onto the manufacturer rather than the driver. Currently, the market allows manufacturers to profit from producing less durable products– increasing warranty requirements thus helps shift the responsibility for creating more durable emissions controls back to the entity with design control. [EPA-HQ-OAR-2019-0055-1277-A1, p. 27]

EPA's two-step approach to useful life and warranty matches that of the Omnibus rule. However, the Omnibus approach was limited, in part, to uncertainty in the research at SwRI, which forced CARB to linearly extrapolate data on reduced aging of the emissions control system.116 Since then, the SwRI research has continued, and the most recent data shows that the emissions controls at the 2031 FUL of 800,000 indeed perform as expected, with compliance margin—in fact, for the LLC and RMC cycles, the Stage 3RW shows quite wide compliance margins of 60 percent and 22 percent, respectively, eliminating any question of uncertainty in the longevity and durability of the system.117 Given the increased data on the viability of the technology and the need to ensure robust emissions reductions as quickly as possible from the largest swath of vehicles, EPA cannot justify delayed requirements on useful life and warranty, and must pull forward its proposed 2031 Option 1 values to 2027. [EPA-HQ-OAR-2019-0055-1277-A1, p. 28]

116. https://ww2.arb.ca.gov/sites/default/files/barcu/board/rulemaking/hdomnibuslownox/fsor.pdf, pp. 163-4.

117. EPA-HQ-OAR-2019-0055-1082.

Organization: *National Propane Gas Association (NPGA) and Propane Education & Research Council (PERC)*

We suggest the following modifications to the Proposed Option 1:

1. **Useful Life:** The Useful Life specifications that are included in the rulemaking under Proposed Option 1 (155,000 miles/12 years for MY2027-2030 and 200,000 miles/ 15 years for MY2031 and later) over the FTP duty cycle are in line with CARB's 2027 Ultra-Low NOx standards (Heavy-Duty Engine and Vehicle Omnibus Regulation) for Otto cycle engines with a Gross Vehicle Weight Rating (GVWR) greater than 14,000 pounds.8 This would increase the complexity and cost of the product for propane industry manufacturing partners, which will be ultimately passed on to vehicle fleets. This may also limit the agency's goal to achieve desired emissions levels from these engines.
   As such, we recommend that EPA modify the Useful Life requirements to 10 years/150,000 miles. This modification would align with engines in the Class 2b/3 applications, and is consistent with typical usage of these vehicles. [EPA-HQ-OAR-2019-0055-1263-A1, pp.2-3]

8 Supra note 1, at 17424.

Organization: *PACCAR, Inc (PACCAR)*

PACCAR supports extending regulatory Useful Life (UL) to more accurately represent Heavy Duty Commercial vehicle operations. However, EPA must ensure that its UL proposal is cost effective, technically feasible, and that it does not require aftertreatment component replacement. [EPA-HQ-OAR-2019-0055-1346-A1, pp.16-17]

PACCAR supports a 600,000 miles UL standard as technically achievable in commerce. The UL and the emissions standard will dictate whether OEMs will need to replace the aftertreatment system during an engine's UL to maintain compliance. Emission system drift and variation will increase as the useful life extends, making it increasingly difficult to comply with increasingly stringent emissions standards. If replacing aftertreatment components is the only way to ensure compliance with these stringent emissions standards over the course of the proposed extended useful life, unreasonable cost increases for new HDOH engines and vehicles are inevitable. The stringency of EPA's proposed Option 1 standard, coupled with (i) the significant uncertainties regarding durability and in-field performance of the new Stage 3 emission-system componentry over the extended useful life periods (up to 700,000 miles) and (2) the strict liability risks under the under the new pass criteria for in use testing, make it likely that OEMs would need an aftertreatment component replacement strategy to maintain compliance. Simply put, the risk of recalls – perhaps multiple recalls – and the significant associated costs, would be too great for OEMs not to have the option to have an aftertreatment component replacement strategy. [EPA-HQ-OAR-2019-0055-1346-A1, p.17]

PACCAR provides for EPA's awareness the following additional observations that influence OEMs' ability to meet extended useful life requirements:

- The SwRI demonstration tested emissions on a nominal demonstration engine in a test lab with an artificial aging procedure. In reality, however, vehicles likely will encounter conditions that lead to higher aging than was demonstrated during the SwRI test, such as specific vehicle duty cycles that lead to higher regeneration frequencies, additional aging due to use of lower quality fuels, and specific engines that have higher oil consumption, etc.
- OEMs must certify their nominal demonstration engines far below the legal limit to have sufficient margin for part-to-part, lab-to-lab and aging variation.
- The SwRI program shows that the available aftertreatment technology is not capable of controlling drift in emission performance sufficiently to a full useful life of 800,000 miles.
- Either the full useful life should be limited to a value well below 800,000 miles, or the emission limit must be increased to have sufficient margin between the SwRI demonstration testing and the regulated limit. [EPA-HQ-OAR-2019-0055-1346-A1, pp.17-18]

PACCAR supports an extended UL demonstration in the lab to ensure aftertreatment system robustness, combined with other flexibilities to reduce the liability of UL in commerce. A viable UL approach should include the following elements:

- Demonstration Standard: laboratory demo (DF) out to 700,000 miles
- Verification of DF: out to 600,000 mile (in-use)
- In-commerce Liability for Recall: less than or equal to 600,000 miles [EPA-HQ-OAR-2019-0055-1346-A1, p.18]

Under this scenario, an OEM would be subject to recall up to 600,000 miles UL. Between 600,000 miles and certification demonstration at 800,000 miles, OEMs would be responsible for: · SEA and · Confirmatory; · But not in commerce. [EPA-HQ-OAR-2019-0055-1346-A1, pp.18-19]

PACCAR does not support the proposed intermediate useful life (IUL) standard. Adding a separate IUL emission limit would add a significant burden because it would double the pass requirements for two separate emission limits. This limits strategies designed to meet UL that may not result in linear degradation of performance but are fully capable of maintaining compliance. [EPA-HQ-OAR-2019-0055-1346-A1, p.19]

The proposed regulation defines IUL in MY 2031 as 435,000 miles / 10 years / 22,000 hours. However, CARB reduced the 10 years to eight years based on 435,000 miles being 72.5% of the 600,000 miles final useful life and eight years being 72.5% of the 11 years final useful life. Consequently, EPA's standard would be more stringent than CARB's already non-feasible standard if EPA adopts the IUL as proposed. [EPA-HQ-OAR-2019-0055-1346-A1, p.19]

In sum, PACCAR supports a single step useful life standard at 600,000 miles for in-commerce vehicles and DF validation at MY 2027 and does not support an IUL standard. [EPA-HQ-OAR-2019-0055-1346-A1, p.19]

PACCAR summarizes below the major issues that EPA should take into account as it moves forward with this rulemaking:

- PACCAR supports an extended UL demonstration in the lab, combined with other flexibilities to reduce the UL liability in commerce and proposes the following elements:
    - Demonstration Standard: laboratory demonstration (DF) out to 700,000 miles using accelerated aging methods
    - Verification of DF: in commerce out to 600,000 miles
    - In-Commerce Liability for Recall: less than or equal to 600,000 miles [EPA-HQ-OAR-2019-0055-1346-A1, p.59]

Organization: *Retail Industry Leaders Association (RILA)*

RILA is broadly supportive of EPA's proposed changes to the regulatory useful life and emissions-warranty requirements but urges EPA to build a stronger consensus with market participants around the cost elements involved in this area to avoid any excessive cost-increases. EPA should work with manufacturers and other relevant stakeholders to support a clearer understanding of the various factors included in EPA's regulatory impact analysis (e.g., technology costs, warranty costs, and truck maintenance costs) that may not be immediately apparent to market participants. [EPA-HQ-OAR-2019-0055-1189-A2, p.3]

The technologies used to reduce emissions from heavy-duty engines are expected to deteriorate in effectiveness over each engine's full operating life. To ensure a reasonable longevity of the emissions controls, EPA's existing regulations should include minimum useful life periods over which these technologies are required to operate adequately. Such regulations around regulatory useful life are vital to ensure that the initial standards persist across a reasonable duration and provide the intended environmental and societal benefits. [EPA-HQ-OAR-2019-0055-1189-A2, p.3]

In this context, EPA's proposal to extend the regulatory useful life of heavy-duty engines has the potential to ensure that the emissions controls within these engines continue to protect communities from pollution are designed for longer into its operational life. [EPA-HQ-OAR-2019-0055-1189-A2, p.3]

However, improvements to emission controls longevity and extended warranty periods are likely to carry additional costs to be passed on to purchasers of vehicles that use these engines. Even though the proposed increase to emissions warranty period and regulatory useful life could potentially lead to reduced operating costs over an engine's operating life, any increase to a vehicle's up-front cost could function as a barrier to adoption of new vehicles using engines covered in the scope of this proposed rule. Such a barrier may have unintended consequences that run counter to the intended aims of this proposed rule, as it might keep older and more-polluting vehicles in service for longer than they otherwise might be. [EPA-HQ-OAR-2019-0055-1189-A2, p.4]

Organization: *Truck and Engine Manufacturers Association (EMA)*

It is important to highlight from the outset that while there are various details of EPA's rulemaking proposal (particularly with respect to Option 1) that EMA and its members fundamentally disagree with, there are multiple major points of substantial agreement. In that regard, EMA agrees with EPA that:

> (iii) The current emission warranty and useful life periods for HDOH engines and vehicles should be revised to increase the durability and efficacy of in-use emissions compliance; [EPA-HQ-OAR-2019-0055-1203-A1, p. 5]

In order to ensure the adoption of fully achievable and cost-effective HDOH low-NOx regulations, and notwithstanding our broader agreement, the Agency should revise the proposed standards in the following manner: The proposed extended useful life ("UL") requirements should be reduced sufficiently to ensure that manufacturers are not required to assume that they will need to replace aftertreatment systems during the extended UL periods, which necessary replacements would result in substantial and unreasonable cost increases for new HDOH engines and vehicles starting in the MY 2027. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 6 - 7]

On top of that, the almost doubling of the FUL period over which compliance with the already infeasible NOx standard would be required could force OEMs to include the cost of aftertreatment replacement as an assumed component of regular maintenance, while also leading to undue and unreasonable risks and costs stemming from potentially increased recall liability. [EPA-HQ-OAR-2019-0055-1203-A1, p. 12]

The Agency asserts, without support, that the "proposed useful life periods are feasible and would not require manufacturers to adopt component replacement as a part of their critical emissions-related maintenance strategies." (87 FR at p. 17496.) We disagree. As an initial matter, EPA does not yet have the final analysis of the Stage 3 RW emission results at the 800,000 mile benchmark; nor has EPA shown that all of the Option 1 certification standards and Bin 3 standards are even feasible. [EPA-HQ-OAR-2019-0055-1203-A1, p. 12]

As a consequence, and given (i) the significant uncertainties regarding the durability and in-field performance of all of the new Stage 3 emission-system componentry over the extended useful life periods (up to 800,000 miles), (ii) the lack of the Stage 3 prototype's fully demonstrated compliance with the Option 1 standards, and (iii) the strict liability risks under the new 3B-MAW protocols, manufacturers likely will need to adopt aftertreatment component replacement strategies. The risks and costs of recalls, perhaps multiple recalls, would be too great for manufacturers to do otherwise. [EPA-HQ-OAR-2019-0055-1203-A1, p. 12]

EPA proposes to significantly extend the emissions useful life periods for all primary intended service classes starting in MY 2027. For example, EPA proposes to almost double the UL requirement for HHDE (435,000 miles today, increased to 800,000 miles by 2031) and to require a 2.5x increase for LHDE (110,000 miles today, increased to 270,000 miles by 2031). [EPA-HQ-OAR-2019-0055-1203-A1, p. 44]

EMA does not support EPA's proposal to extend the useful life periods. The proposed changes will force manufacturers to adopt new emissions-related maintenance recommendations to replace aftertreatment systems rather than accept the significant risk of a non-compliance determination and the expense of one or multiple recalls late in the useful life. Because EPA will require manufacturers to pay for the aftertreatment replacement, manufacturers will necessarily recoup those significant costs at the only available opportunity, the point of purchase. Extending the useful life as proposed also will compel manufacturers to enhance the design of many emissions-related components, imposing even more costs on the buyer. The result would be a substantial increase to the initial purchase price of heavy-duty vehicles. (See Section 16 for more details about the cost implications of EPA's proposal.) The expected cost increases invariably will lead to deferred purchases, delaying the adoption of the latest, cleanest vehicles. EMA stands ready to work with EPA to finalize more appropriate useful life requirements in the final rule. [EPA-HQ-OAR-2019-0055-1203-A1, p. 44]

EPA proposes to continue the practice of including hours in the regulated useful life period for the heavy heavy-duty engine (HDE) class to account for engines "that operated frequently, but accumulated relatively few miles due to lower vehicle speeds" (87 FR 17501), based on a 20 mile per hour speed threshold consistent with today's heavy HDE useful life criteria of 435,000 miles and 22,000 hrs. EPA has requested comment on the need for a useful life hours criterion for all heavy HDE, and whether they should include hours criterion for the other primary intended service classes. EMA supports continuing to include useful life hours for Heavy HDE as well as adding useful life hours for the other primary service classes of Medium HDE, Light HDE, and SI HDE. Just as in Heavy HDE, and perhaps even more so, there are applications within the other classes that accumulate relatively few miles due to lower vehicle speeds. It is also appropriate to use an average speed of 20 miles per hour in determining useful life hours for those other classes. [EPA-HQ-OAR-2019-0055-1203-A1, p. 44]

The Agency is proposing this suite of new technical requirements while also proposing to nearly double the mileage over which compliance will be required. In that regard, the extended Useful Life requirements will very likely compel replacement of major emissions control systems costing well over $10,000 within the required compliance period. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 170 - 171]

EPA Summary and Response

The summary and response for this section includes a listing of the topics raised, then the comments are summarized by category and the responses follow each summary.

Comments relating to useful life fell into the following general categories

- Support or opposition
    - General support for or opposition to lengthening useful life
    - Support for proposed Option 1 or Option 2
    - Support for useful life periods longer or shorter than proposed
- Need for more information
- Increased purchase price, delayed effectiveness of the rule, and aftertreatment replacement

- Projected operating costs
- Intermediate useful life
- Hours-based useful life periods
- Useful life for refueling standards
- Alternate useful life periods

Support or opposition

Several commenters expressed general support for or opposition to EPA's proposal to lengthen useful life periods, without addressing numeric values. Clean Fuels, GREL/DSCC, and RILA commented with general support for longer useful life periods but did not specifically support a proposed option. EMA expressed support for revising the useful life periods, but did not support EPA's proposed useful life values. EMA suggested EPA reduce the proposed useful life requirements to avoid aftertreatment replacement and the associated "substantial and unreasonable cost increases". Cummins did not support EPA's proposal to increase useful life periods, commenting that even proposed Option 2 included significant increases in useful life that would increase the purchase price of vehicles. Cummins noted that either option's increase in useful life in conjunction with new standards will further add costs and add to uncertainty and variability in the field that would require additional compliance margin for all standards. While MEMA supported proposed Option 1 generally, they suggested EPA reduce the useful life periods citing a need for more data. Similarly, AVE expressed support for proposed Option 1 standards with modified useful life timelines.

Some organizations expressed support for the proposed options. Commenters supporting Option 1 included CARB and Consumer Reports. CARB cited the analysis they used to justify the same useful life periods adopted in their Omnibus rulemaking and EPA's CI engine test program that evaluated the engine's performance to 800,000 miles. Consumer Reports supported the useful life periods of proposed Option 1, suggesting that Option 2 did not capture enough of the operational life of the engines. Allison supported the useful life periods of proposed Option 2 and suggested that opting for the less stringent of EPA's proposed options does not prevent the agency from revisiting useful life periods in a future rule after observing the implementation of the Option 2 periods.

Four organizations suggested EPA adopt useful life periods longer than the proposed options. American Lung Association et al. requested that EPA extend the useful life period beyond proposed Option 1 to 1 million miles in order to capture the full operational life of the vehicle. Clean Air Task Force et al. requested that EPA adopt useful life periods at least as stringent as proposed Option 1 noting EPA's statutory obligations and their preference that EPA align with CARB's Omnibus program. They noted EPA's rebuild data that indicated some engines may be driving on the road more than twice the mileage of today's useful life and that manufacturers have little incentive to ensure emission controls function properly when useful life only covers a fraction of the operational life of the engine. Clean Air Task Force et al. recommended EPA consider useful life periods longer than proposed Option 1 if feasible with the final standards. MFN requested that EPA pull forward the useful life periods of the MY 2031 step of proposed Option 1 to begin in 2027. MFN noted the long operational life of the engines and the SwRI CI technology demonstration program as reasons EPA cannot delay the longest proposed useful life periods to MY 2031. Clean Air Board of Central Pennsylvania suggested that the useful life should cover the full life of the vehicle.

Several organizations suggested specific useful life periods shorter than the proposed options. DTNA requested useful life periods of 10 years/500,000 miles for Heavy HDE and 10 years/250,000 miles for Medium HDE with equivalent hours criterion. DTNA noted that EPA's proposed options are "cost prohibitive and impractical" to design their engines with certainty, especially when new technology will be required to meet the standards. NPGA/PERC recommended EPA adopt a useful life of 10 years/150,000 miles for Spark-ignition HDE to match the useful life periods of Class 2b/3 vehicles. They indicated that the proposed Option 1 useful life periods would add complexity and cost to propane products and those costs would be passed to the purchasers. PACCAR supported a 600,000 mile useful life, indicating that stringent standards will be increasingly difficult to meet at longer useful life periods due to "emission system drift and variation". PACCAR proposed that useful life vary for certification and in-use, with a DF demonstration out to 700,000 miles at certification in the laboratory, DF verification out to 600,000 in the field, and recall liability limited to 600,000 miles.

Response:

- We appreciate the expressed support from certain commenters for our proposal to lengthen useful life periods and acknowledge the concerns raised by other commenters.
- A key objective of our proposal was to adopt useful life periods that cover a larger portion of the operational life of the engine. We retain that original objective, and are modifying our proposal to finalize useful life periods that cover a significant portion of the engine's operational life while also giving appropriate consideration to the relationship between the useful life and the stringency of the final numeric standards and considering comments and additional information on uncertainties and potential corresponding costs.
- As explained in the preamble for this rule, we are finalizing a single-step program for the new useful life periods to begin in Model Year 2027. For Spark-ignition HDE, Light HDE, and Medium HDE, we are finalizing useful life mileages that match the MY 2031 step of proposed Option 1. For the heaviest engine class (Heavy HDE), the final useful life mileage matches proposed Option 2. See preamble section IV.A for a discussion of the basis of our final useful life periods.
- We disagree with commenters recommending that we finalize useful life periods below the mileages of the less stringent proposed Option 2, since we specifically indicated that Option 2 represented the lower bound of the range of mileages we would consider finalizing for each engine class and the EPA test programs demonstrated that low emission levels can be maintained at mileages at least as long as Option 2 for all engine classes.
- We did not propose and do not believe it is appropriate at this time to finalize useful life periods beyond proposed Option 1 as requested by American Lung Association et al., Clean Air Task Force et al., and Clean Air Board of Central Pennsylvania. As noted in the NPRM, proposed Option 1 represented the upper bound of the range of mileages we would consider finalizing for each engine class due to the effect of useful life on the

feasibility of meeting the standards and lack of data on emission performance at mileages approaching the rebuild and replacement mileages. Chapter 2 of the final RIA presents the rebuild and replacement mileages for CI and SI engines, respectively, that were used to estimate the average operational life of each engine class and inform our proposed useful life mileages.

- EPA's analysis and test programs demonstrated it is appropriate and feasible for the smaller engine classes to maintain emission control at the final emissions standards over useful life periods matching proposed Option 1 for those engines. We are less certain on the feasibility of finalizing proposed Option 1 at the national level for Heavy HDE at this time. Commenters listed uncertainties at the distinctly higher mileages proposed for the largest engines, provided additional information on costs, and expressed concern over potential economic impacts (we respond to comments related to costs in Section 18 and related to economic impacts in Sections 25 and 26 of this document). As noted in responses below, we considered comments, additional analysis, and all of our engine demonstration data in setting the final useful life values in this rule.
- Our combined final useful life of 650,000 miles and lengthened durability demonstration to an equivalent of 750,000 miles for Heavy HDE addresses many of the concerns behind PACCAR's suggested useful life approach. See section III.B of the preamble for more information.

Need for more information

Several organizations commented on suppliers' ability to develop technologies to meet the proposed useful life periods. Allison commented that even proposed Option 2 would be challenging for suppliers to design, test, validate, produce, and distribute in the four year lead time. Allison also commented that either proposed option would result in higher upfront engineering and material costs and that EPA should consider that manufacturers need "head room" to ensure compliance. Eaton commented that the components they produce (CDA hardware, power management devices for electrical and fuel heaters, and EGR pumps) are designed to last the life of the vehicle, which typically exceeds the useful life of the engine. AVE commented that in order for many technology suppliers to assess the durability of their products at the proposed useful life periods, they need more information related to extended distances, time in-service, and use patterns (including beyond the first owner). AVE recommended re-evaluating the full useful life timeline when more engine test data is available. BorgWarner commented that "it is impossible to design a system" to meet the proposed useful life periods because EPA's CI engine test program, which used accelerated aging of the aftertreatment system, did not demonstrate the degradation of the engine components over the extended useful life periods or account for use patterns of multiple owners or vocational applications that these HD engines may experience. MECA encouraged EPA to continue to work with CARB to study the impacts of the rule's implementation of the warranty and useful life updates in this rule and to gather more information on the deterioration of field-aged parts. MECA noted that while the durability of aftertreatment systems can be evaluated using accelerated aging tests, some technologies, such as CDA, are not able to be aged and must tested over the full useful life period to understand its deterioration. MEMA indicated that additional data and analysis on use (relating to 2nd and 3rd owners and vocational vehicle applications) is needed before proposing longer useful life and warranty periods.

Response:

- While we appreciate Eaton's comment that their technologies are designed to last beyond the useful life periods of current engines, we recognize the concern from other technology suppliers that stated it would be a challenge to design components for very high mileages since there is limited durability data available at mileages beyond today's warranty periods and even less beyond today's useful life periods. As noted by Allison, and discussed in Section III of the preamble to this final rule, we have taken into consideration manufacturer "head room" in the final standards by considering compliance margin within the context of this final program.
- We recognize the concerns expressed by the four technology suppliers that they need more information on component failures and use patterns of the range of vehicles that use these HD engines. We understand that there is limited engine and aftertreatment data at 800,000 miles, which could make it costly to adequately design components to maintain the emissions levels proposed for Heavy HDE at the useful life mileages in the MY 2031 step of Option 1. As noted in section IV.A of the preamble, we are finalizing a useful life mileage for Heavy HDE of 650,000 miles, which is within the range of manufacturers' extended warranty offerings for those engines. We expect manufacturers will share data relating to component failures and use from warranty claims at their extended mileages as they work with their suppliers to develop engine configurations to meet the new useful life mileages (e.g. 650,000 miles for Heavy HDE).
- We are not planning to conduct any formal programs to collect durability data in the near-term, as requested by MECA, but will continue to monitor test results from certification and in-use and expect to coordinate with CARB to evaluate any new information.

Increased purchase price, delayed effectiveness of the rule, and aftertreatment replacement

Many commenters noted that longer useful life will increase purchase price and several indicated that the higher purchase price may delay effectiveness of the rule. ATA cautioned that, while fleets want durable products that may result from longer useful life periods, that durability comes at a cost to the fleets that purchase the vehicles. RILA requested EPA work with manufacturers and other stakeholders to clarify and "build a stronger consensus" on the costs outlined in the RIA. RILA also notes that costs of improved durability, even if they reduce operating costs, can lead to up-front costs that may unintentionally keep older, more-polluting vehicles in service.

Several organizations specifically expressed concern over aftertreatment replacement. ATA noted that useful life periods as long as 800,000 miles may lead manufacturers to sell their vehicles with warranty packages that cover expensive component replacements within the useful life, which is another cost incurred by the fleets. DTNA commented that the combination of the proposed useful life periods and standards will require an aftertreatment efficiency that may lead many manufacturers to replace catalysts under warranty to ensure emission control is maintained, and that the cost of that component replacement would be added to the purchase price of the vehicle. PACCAR stated that stringent standards, uncertainty on durability, and liability risks for in-use testing, make it likely that some manufacturers would replace aftertreatment components within the useful life to ensure compliance, which would cause "unreasonable cost increases". EMA suggested that manufacturers would likely adopt aftertreatment component replacement due to the risks and costs of recalls considering durability and in-field performance uncertainties, EPA's incomplete demonstration out to 800,000 miles at the time of the comment, and liability risks under the proposed updates to the in-use test procedures. Since aftertreatment replacements are required to be covered by the manufacturer under this rule, the costs (that they estimate would be over $10,000) would necessarily increase the purchase price even more than the increases due to the new technologies added to meet the standards. EMA suggested that the increased purchase prices would cause customers to defer purchases and delay adoption of cleaner vehicles.

Response:

- We recognize that manufacturers will need to make investments in the durability of their emission control components in order to meet the longer useful life periods we are finalizing. We also acknowledge that some of those costs will be passed on to customers as an increased purchase price and that increase in purchase price has the potential to have sales impacts. Our final cost analysis in Chapter 7 of the RIA uses the final useful life periods to calculate updated indirect R&D costs to manufacturers. The cost updates reflect our consideration of comments from manufacturers and others, and include a clearer description of the factors we analyzed as requested by RILA. The updated cost analysis informed our updated economic analysis. As outlined in chapter 10 of the RIA and section 25 of this document, our updated economic analysis projects that sales effects due to increased costs would be minimal and short-lived.
- Our current regulations require that manufacturers cover the cost of any scheduled replacement of catalysts, and we note that the requirement to cover costs would not be restricted to catalyst replacements scheduled within a warranty period. We agree with commenters that any manufacturers opting to schedule catalyst replacement would likely recoup those costs by increasing the purchase price of their vehicles. We also recognize the general risk expressed by commenters that a significant increase in purchase price may prevent some customers from purchasing new vehicles with the latest technologies, delay fleet turnover, and reduce the effectiveness of the rule. However, as noted above, our updated economic analysis projects that sales effects due to increased costs of this final rule would be minimal and short lived.
- In section IV.A of the preamble, we describe how the uncertainties expressed by commenters informed our final useful life mileages. As explained in the preamble, we also project that the final standards and corresponding useful life periods will not require manufacturers to plan for the replacement of the entire catalyst system as a part of their compliance strategy and we have not included a catalyst system replacement in our cost analysis.

Projected operating costs

The proposed cost analysis included operating costs and the proposal projected that the longer useful life and warranty would reduce owner costs over the life of the vehicles. ATD disagreed with EPA's cost analysis that projects reduced repair costs due to the longer useful life and warranty periods, and instead suggests that higher costs of "unreasonably longer useful life mandates" would undermine feasibility of the rule. Clean Fuels agreed that a longer useful life would reduce costs to customers. Clean Air Task Force et al. commented that a longer useful life will shift the costs and risks of designing emission controls to be borne by the manufacturers instead of the operators.

Response:

- In the cost analysis for this final rule, we updated operating costs for owners and operators, including updated repair costs, based on the final standards and useful life periods. For more information on the methodology and results, see our updated assessment of costs RIA Chapter 7.

Intermediate useful life

Several organizations commented on EPA's proposed intermediate useful life. CARB and MECA supported EPA adopting an intermediate useful life at 435,000, as proposed in Option 1. MECA cited three publications achieving NOx levels below 0.02 g/hp-hr using CDA, supplemental heat, or advanced aftertreatment and noted that passenger vehicle regulations have included intermediate useful life standards. CARB further recommended that EPA adopt an intermediate useful life for 2027 as well, using the same numeric values at 435,000 miles as proposed for 2031, indicating that CARB's early adoption of an intermediate useful life as part of the Omnibus requirements for MY 2027 provided additional lead time for the industry. In Section 3.1, several other organizations expressed support for alignment with CARB's Omnibus program, including an intermediate useful life standard in MY 2027.

Allison did not support intermediate useful life due to added certification costs that would be shared by all customers, regardless of whether the vehicle they purchase would reach that 435,000-mile threshold, such as vocational vehicle applications. Allison disagreed with the need for an "intermediate check on emissions performance deterioration" noting that the full useful life standard should be the measure of compliance and in-use standards are the more appropriate check. Allison further noted that the full useful life and warranty requirements are direct incentives to meet the requirements and the intermediate useful life is an added regulatory layer and cost. PACCAR also did not support an intermediate useful life standard due to the burden of separate standards and the fact that some systems may not have the linear degradation but would maintain compliance with a single standard. PACCAR notes that the 10-year intermediate useful life age value proposed by EPA does not match 8-year value finalized for CARB's intermediate useful life.

Response:

- We proposed to include an intermediate useful life for Heavy HDE in the MY 2031 step of proposed Option 1. While our CI test program did achieve a 20 mg/hp-hr NOx level at the 435,000-mile point of the test, we proposed to allow more lead time for manufacturers to achieve the 20 mg/hp-hr standard and we did not include an intermediate useful life for the proposed MY 2027 step. We also note, in response to CARB's comment on additional lead time, that the CAA section 202(a)(3)(C) minimum lead time requirement for an EPA criteria pollutant standard under CAA section 202(a)(3) is based on the date of promulgation of such standard.
- We are not finalizing intermediate useful life standards at this time. We are finalizing a single-step program, in part, to limit complexity. We do not believe the additional complexity of separate standards at an intermediate useful life for Heavy HDE is appropriate at this time. Our final standards, in combination with the final durability and in-use testing requirements, will ensure engine manufacturers design systems compliant for the full useful life.
- While some commenters indicated support for requiring manufacturers to meet lower standards early in an engine's operational life, our primary focus with this final rule is to establish feasible standards at full useful life for all engine service classes. Results from the EPA technology demonstration program did not show a drastic increase in deterioration after 435,000 miles that would support the need for an intermediate standard. In addition, while we have tested catalyst and engine strategies to demonstrate the feasibility of the standards finalized in this action, EPA standards are performance-based and we do not wish to restrict or hamper a manufacturer's use of technologies that may use different deterioration or calibration strategies to achieve the full useful life standards. We acknowledge PACCAR's concern that an intermediate useful life may unnecessarily limit manufacturers' compliance strategies.

Hours-based useful life periods

Three commenters supported the proposal to include hours-based useful life periods. MEMA supports adding an hours limit for useful life. Cummins and EMA supported continued use of the hours criterion for Heavy HDE useful life periods and requested that EPA add hours to the useful life periods for other engine classes. Cummins specifically noted that smaller classes are often used in low speed applications where an hours-based useful life may apply. Cummins and EMA also supported the proposed 20-mph conversion factor to calculate the hours-based useful life values for all engine classes.

<u>Response</u>:

- We received no adverse comments for hours-based useful life periods and are finalizing hours as a useful life criteria for all engine classes. As described in Section IV.A of the preamble to this final rule, we are applying a 20-mph conversion factor, as proposed, to calculate the hours values from the final mileage values.

Useful life for refueling standards

AVE, Ingevity, and MECA supported the proposal to apply a useful life of 15 years or 150,000 miles for the proposed refueling emission standard for incomplete vehicles greater than 14,000 lb GVWR.

Response:

- We are finalizing the refueling emission standard to apply for a useful life of 15 years or 150,000 miles, as proposed.

Alternate useful life periods

Cummins requested that EPA allow an alternate useful life period as specified in the current 40 CFR 86.004-2.

Response:

- Our proposed migration did not include the portion of the useful life definition in 40 CFR 86.004-2 that allows manufacturers to request an alternative useful life period. Manufacturers have not used this provision in recent years and we believe the addition of new hours-based useful life values for all engine classes will cover the range of applications for which manufacturers may consider requesting an alternative useful life. Our final updated useful life provisions in 40 CFR 1036.104(c) will not include an allowance for manufacturer to request an alternative useful life periods.

3.9 Closed Crankcase

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

Closing crankcase emissions is important in controlling significant PM emissions as well as unaccounted methane emissions emitted with the blowby gases. CARB staff supports the proposed requirements to close crankcase ventilation system for all CI HDEs to prevent crankcase emissions from being emitted directly to the atmosphere starting with MY 2027 engines. [EPA-HQ-OAR-2019-0055-1186-A2, p.47]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

The current open crankcase breather system has allowed turbocharger and engine manufacturers to invest continuously in turbocharger technology and manufacturing precision over the years, to maintain high compressor efficiency over the lifetime of an engine. This has proven to be very successful in ensuring the fuel efficiency of today's HD diesel engines. Such efficiencies are achieved only by maintaining a clean and contamination-free air inlet system to the turbocharger for engine combustion. [EPA-HQ-OAR-2019-0055-1168-A1, p.94]

EPA's proposal to require a closed crankcase ventilation system will have numerous adverse impacts on engine performance and efficiency. With the addition of an engine closed crankcase breather, the combustion vapors are made up of oil particles that are drawn into the turbocharger compressor housing and that attach to the hot internal surfaces of the turbocharger. This condition leads to an oil build-up that effects airflow and thereby reduces compressor housing efficiency. As illustrated in Figure 36 below, this loss of compressor efficiency along with the reduced width of the compressor efficiency map leads to reduced engine performance, surge margin, and engine braking performance. [EPA-HQ-OAR-2019-0055-1168-A1, p.94]

Figure 36 (green lines) shows the compressor efficiency of a new baseline turbocharger with 0 hours on a turbocharger Hot Gas Test Stand (HGTS). Daimler Truck introduced a close crank case ventilation (CCV) system on this turbocharger using a mule engine on a durability test bench for 144 hours. The test cycle used is a representative alternating load cycle, typical of a line haul vehicle, alternating between 1050 rpm and 1450 rpm sweeping the full load points. After 144 hours, the turbocharger was taken off from the durability engine test stand and tested on the turbocharger gas stand for compressor efficiency. The results are shown in the blue lines of Figure 36; compressor efficiency decreased by 4.5% at rated torque. The turbocharger was further placed on the durability mule engine and test continued for 200 hours with the same cycle listed above. The turbocharger was taken out from the durability mule engine and tested on a turbocharger gas stand; the results were a loss of 8.2 % compressor efficiency at rated torque as shown in red lines of Figure 36. [EPA-HQ-OAR-2019-0055-1168-A1, p. 95]

Based upon this test, we concluded that with the current closed breather system installed on a heavy duty engine running at a customer representative high duty cycle, up to 7-8% compressor efficiency can be expected to be lost in as little as 200 hours of high load operation. Since 7-8% compressor efficiency loss was significant, further testing was not performed on this system. Figure 37 below shows a picture of the compressor housing after 200 test hours.
Severe compressor coking was observed, leading to this compressor efficiency loss. During the 200 hours run, data in Figure 38 also shows decreasing compressor pressure outlet (CPO), i.e., the engine boost deterioration, which is in line with the compressor coking as observed in the compressor photo: [EPA-HQ-OAR-2019-0055-1168-A1, pp.95-96]

Daimler Truck also performed this testing on improved crankcase breather technology (such as an electrically driven crankcase breather, with HEPA filtration), which produces less oil fouling and reduces compressor efficiency losses. Figure 39 shows the impact on compressor efficiency loss with this advanced crankcase filtration system. This results in a slight improvement, but compressor fouling or coking was still observed with a compressor efficiency drop of up to 4% in as little as 200 hours. The test was further continued to 400 hours and observed further degradation in compressor efficiency of up to 6% as shown in the red color lines of Figure 39. [EPA-HQ-OAR-2019-0055-1168-A1, pp.96-97]

Significant design and engineering efforts have been invested to reduce the coking of the oil mist in the compressor housing by reducing internal surface temperatures at the compressor housing with the addition of water cooled compressor stage. The reduced wall temperatures to below 160 degrees Celsius is expected to provide some reduction in the rate of contamination in the compressor stage. Daimler Truck has further performed testing on reduced wall temperatures to below 160 degrees Celsius and the results (discussed later in this section) shows that even with reduced compressor inlet wall temperature, a reduction can be expected, but is unlikely to completely eliminate the oil coking build-up. [EPA-HQ-OAR-2019-0055-1168-A1, p.97]

Daimler Truck has investigated several approaches to improve crankcase separation performance, including using an electric drive system to reduce oil content. The new improved electric drive systems work on the basic principle of removing or reducing the mass of the oil droplets in the crankcase vapor before the vapor is sent to the turbocharger inlet. The new innovative electric drive systems have approximately 2 to 3% improved oil particle separation efficiency over the current oil pressure driven system. Even with increased efficiency of removing the mass of the oil droplets (mainly larger sizes > 0.3 μm), the oil contamination affecting the turbocharger compressor efficiency loss can still be measured within 200 hours on an engine dyno durability test. The results are slight improvement in a reduction of compressor coking, but even with the new electric drive technologies, the compressor efficiency loss of 5-6% is still obse1ved in the data (shown later in Figure 42). Figure 40 shows the ove1view of various current and upcoming future new crank case ventilation technologies evaluated in the test program. The results for these new technologies will be discussed later in this section. [EPA-HQ-OAR-2019-0055-1168-A1, pp.97-98]

Research studies 118 have shown that removing the larger oil droplets can have a significant reduction in total oil mass and effect the rate of coking buildup . However, the smaller oil particles below 0.5 μm (Figure 41a) that are not removed are still present contributing to the coking buildup and compressor efficiency loss, as shown in the research studies of Sumi N. et al. 119 (Figure 4 1). [EPA-HQ-OAR-2019-0055-1168-A1, p.98]

118 See Sumi, N., Hirano, S., Fujimoto, K. , Nakajima, T. et al., ' Influence of Engine Oil Properties on Soot Containing Deposit Fo1mation in Turbocharger Compressor,' SAE Technical Paper 2013-01-2500, 2013.

119 See id

Daimler Truck further conducted a study of various current and future closed crankcase breather technologies on a 15 liter heavy duty on highway engine running a customer representative duty cycle. The various technologies investigated as shown in Figure 42 are: (42a.) current Alfdex production system, (42b.) electric eAlfdex system, 3nine with HEPA filters (42c.), breather discharge into the vehicle air filter (42d.). The durability cycle ran was described previously in this section and the periodic examination of the compressor housing was done every 24 to 50 hrs. The baseline turbocharger with zero hours compressor efficiency test was performed on Hot Gas test Stand (HGTS). After 200 hours of durability cycle, the turbocharger assembly was tested again on the HGTS and also examined for the soot build up. The results of this study are shown in Figure 42 with the soot build up and the compressor efficiency losses. [EPA-HQ-OAR-2019-0055-1168-A1, p.99]

Daimler Truck concluded that current and future crankcase breather technologies are not sufficient to eliminate oil contamination in the compressor housing. This contamination leads to a significant rate of fouling, affecting compressor efficiency loss, even with the best available technology. [EPA-HQ-OAR-2019-0055-1168-A1, p.99]

With the closed breather system, the engine air induction system can be contaminated by introducing crankcase gases into the engine filtered air induction system. This can produce a significant contamination of the entire engine air system including the vehicle charge air cooler. [EPA-HQ-OAR-2019-0055-1168-A1, p.100]

Within hours of on engine testing, Daimler Truck results show the effects of engine pe1fonnance; such effects can also be detected with measurement and visual inspection of the entire air system. These effects include fouling of the charge air cooler, engine induction system including intake manifold, cylinder head intake runner, intake valves, valve seats and critical port areas that can reduce port volume and disrupt critical port flow. The long term effects of the oil contaminated air and combustion deposits within the combustion chamber are still unknown. Downstream of the exhaust ports and exhaust manifold are also of concern with EGR cooler effects on cooler fouling and afte1treatment contamination. [EPA-HQ-OAR-2019-0055-1168-A1, p.100]

Daimler Truck conducted a further study in a test cell using a DD 15 Gen 5 current production engine over the FTP, RMC, fuel maps and the engine brake performance of a clean turbocharger (as a baseline) and a back-to-back study with a turbocharger that has undergone 200 hours of closed crank case ventilation system (as shown in Figure 42a for mechanical oil pressure driven system). A DD15 durability engine was used to age the turbocharger using a closed crank case ventilation system in the same manner described above. The turbocharger was removed from the mule engine after 200 hours and placed on the test cell engine for this back-to-back study. The effects on fuel consumption of a closed crank case turbocharger over the baseline turbocharger (using open crank case ventilation) are shown in Table 14 below. The fuel consumption results show that with a closed crank case system, there is an increase in fuel consumption of 1.13% over composite FTP cycle, an increase of 0.9% over the RMC cycle with up to a 1.5 % increase over the entire 10x10 Fuel map. This fuel economy loss with only 200 hours of closed crank case ventilation is substantial. [EPA-HQ-OAR-2019-0055-1168-A1, pp.100-101]

Daimler Truck also ran an engine braking torque evaluation of the turbocharger and the results are shown in Figure 43. A 7% to 10% loss in engine brake power is documented. This is a substantial loss of engine braking power after only 200 hours of aging. This potentially has safety implications, requiring the need to increase vehicle mechanical braking power to maintain adequate braking performance. [EPA-HQ-OAR-2019-0055-1168-A1, p.101]

The impact to fuel economy for an electrical oil pressure driven system (as shown in Figure 44) can be estimated based on the significant compressor efficiency loss recorded over 200 engine hours. As shown in Figure 43, at the 200 hours test point, the future electric closed crankcase breather compressor efficiency loss is 4%. Engine fuel economy degradation based on compressor efficiency loss of 4% is estimated to be 0.7%. Apa1t from 0.7% fuel efficiency loss, the closed crank case system has other adverse impacts on the engine pe1f01mance, including increased particulate emissions leading to a shortened filter regeneration interval (i.e., more

IRAF), as well as increased aftertreatment aging and poisoning, which further increases the likelihood of increased tailpipe emissions. The reduced compressor efficiency leads to lower boost, increasing the potential for low boost OBD monitor codes, and the need to replace emissions relevant parts as they degrade from exposure to oil mist. [EPA-HQ-OAR-2019-0055-1168-A1, p.102]

Significant progress has been made over the years to improve compressor efficiency, resulting in a direct improvement in fuel economy and reduced CO2 emissions. As shown in Figure 44, the testing shows that intake air contaminated with crankcase breather gases even at reduced levels can decrease overall engine fuel economy. [EPA-HQ-OAR-2019-0055-1168-A1, p.102]

As shown the above two sets of tests, fuel efficiency loss is significant since OEMs would have to introduce more and more engine efficient technologies to offset this GHG loss to meet GHG Phase 2, 2027 step which EPA did not consider during the Phase 2 rule making. Apart from this, the need to compensate for increased GHG emissions caused by close crank case ventilation, will lead to increased engine out NOx. More info1mation on NOx/GHG emission tradeoffs that could occur under the Proposed Rule is provided in Section II.B.3 of these comments. [EPA-HQ-OAR-2019-0055-1168-A1, p.102]

Daimler Truck also conducted a visual inspection of intake side components after 1600 hours with active closed crank case ventilation systems on a DD 15 Gen 5 engine test. The impact of the intake side components is shown in Figure 45 and include the following:

- **Charge air cooler outlet:** Oil at the bottom and also top flange (picture #1 below). The oil was seeping through the joint.
- **Charge air cooler outlet to the intake boost pipe:** The hose connection before boost pipe shows evidence of liquid oil (picture #2).
- **Intake air inlet pipe to the engine:** Inlet sludge/ wet accumulation observed as shown in (picture #3). [EPA-HQ-OAR-2019-0055-1168-A1, pp.102-103]

Introduction of crankcase breather gases into the induction air upstream of the compressor housing of the turbocharger will potentially increase warranty liability and introduce risk in meeting the compliance targets for full useful life. As highlighted in the previous sections, the first component to be affected in performance, fuel economy, and eventually in service replacement is the turbocharger. A turbocharger is a non-serviceable component, therefore, any degradation of performance will need to be corrected with a complete replacement. Other vehicle and engine parts that could suffer the same fate are vehicle charge air coolers, intake and exhaust components including EGR coolers and aftertreatment systems. [EPA-HQ-OAR-2019-0055-1168-A1, pp.103-104]

With the routing of crankcase gases directly into the turbocharger inlet, the risk of increased secondary damage to engine components is high. Any engine condition that causes increased blowby gases with increased debris contamination—including soot and material debris—will end up overloading the crankcase breather and passing into the intake system of the engine. This increased contamination of the entire engine intake system will need to be serviced during the engine repair and increases the service cost, service time, customer downtime, and OEM warranty cost. The increased contamination will also lead to the entire turbocharger replacement. [EPA-HQ-OAR-2019-0055-1168-A1, p.104]

Introducing a closed breather into the induction system airstream will negatively impact engine warranty, service, as well as both the OEM and customer costs of the final product. Service costs in downtime and material will also be significant. [EPA-HQ-OAR-2019-0055-1168-A1, p.104]

More efficient crankcase breather technology will add to the cost of the engine and, most significantly, the costs of other components to mitigate oil contamination to the turbocharger, such as a water-cooled turbocharger compressor. This will have a significant impact by increasing the complexity of the crossover coolant tube on the turbocharger, specifically by requiring a dedicated compressor housing for each vehicle application due to compressor outlet angle and orientation. The inevitable results will be significantly increases cost and manufacturing complexity along with customer and service complexity. [EPA-HQ-OAR-2019-0055-1168-A1, p.104]

Cold weather condensation and ice formation risk to the turbocharger compressor wheel is also a concern and could impede crankcase breather function for the engine, as well as create the potential for added contamination and failure to the compressor stage of the turbocharger. [EPA-HQ-OAR-2019-0055-1168-A1, p.104]

Daimler Truck has some experience with cold weather operation using the closed crank case breather. There was evidence of condensation and ice formation at the breather outlet/inlet to the airstream to the turbocharger. This has devastating results to the compressor inlet blades and function of the crankcase breather system. With the introduction of ice particles, the risk of compressor wheel damage is extremely high as shown in Figure 46.[EPA-HQ-OAR-2019-0055-1168-A1, p.104]

Potential solutions to this would be heated systems, which adds significant additional cost and electrical system demand from an already high demand for engine accessory electrical power (i.e. grid heater). [EPA-HQ-OAR-2019-0055-1168-A1, p.104]

Without the advantage of a throttle-controlled induction system, the safety risk of a runaway engine increases with the addition of closed crankcase breather system. In certain failed conditions, the breather can deliver fuel in the form of diesel fuel or motor oil to the inlet of the turbocharger. This fuel delivery is uncontrolled, and can result in unintended acceleration events. The nature of diesel combustion cycles limit an engine manufacturer's ability to control these events. Since diesel engines are 'fuel-controlled' (as opposed to 'air-controlled' for gasoline engines), an uncontrolled fueling event will lead to rapid, runaway engine acceleration with no possibility for control systems to prevent such a condition. One typical example of such a condition might be engine oil overfilling. If enough oil is added to the crankcase, it can be drawn through the crankcase ventilation system, introduced into the combustion air, and lead to an uncontrolled safety-relevant condition of a runaway engine in the field, and/or hydro-locking of the engine as liquid oil is introduced into the cylinders. Such risks are not present on systems with closed crankcase ventilation systems. [EPA-HQ-OAR-2019-0055-1168-A1, p.105]

As shown in the above sections, the 200 hour coking testing above was performed with new oil for consistent test-to-test oil condition. Therefore, oil degradation in customer usage and extended oil changes lead to increased oxidation leading to increased tendency of coking. Testing and analysis will need to be performed to determine the closed breather impact to oil quality and coking behavior. [EPA-HQ-OAR-2019-0055-1168-A1, p.105]

Closed crankcase breather systems for HD engines would be technically challenging and unduly demanding for the transportation industry. As detailed in this section, current breather technology cannot achieve the level of oil separation and filtration required to maintain peak engine performance throughout the required emission compliance mileage. A closed crank case breather system is expected to cause compressor efficiency loss, reduced fuel economy, reduced engine brake performance, increased CO2 emissions, increased service routines including turbocharger replacement, and unscheduled truck downtime. EPA’s proposal would also increase customer dissatisfaction and cost increases for manufacturers and customers, in addition to the increased safety risk presented by the possibility of an oil-fueled engine runaway condition. [EPA-HQ-OAR-2019-0055-1168-A1, pp.105-106]

These challenges are present with all engines – but are especially problematic for heavy duty engines, which have much longer service lives in which these effects will accumulate, and are more likely to experience duty cycles which will exacerbate these challenges. [EPA-HQ-OAR-2019-0055-1168-A1, p.106]

Based on our investigation, future electrically-controlled breather technology can significantly improve discharged oil mass and is preferable to a closed breather system. When compared to today’s engine oil pressure driven units, the discharged emissions from the future open crank case electric breather technologies will be reduced, while continuing to maintain a high efficient charge air circuit. [EPA-HQ-OAR-2019-0055-1168-A1, p.106]

Daimler Truck thus recommends that EPA continue to allow open crankcase ventilation with robust diagnostics. We recommend that, at least for heavy-heavy duty engines, EPA set a performance-based requirement rather than prescribing what it believes it appropriate technology for manufactures to use. Manufactures are capable of designing highly effective open crank case ventilation systems and demonstrating their continued emission control through deterioration testing and in-use emissions validation. Additionally, manufacturers could be required to diagnose the degradation in filtration efficiency and or system disconnections and leaks. In fact, EPA’s proposal to adopt CARB’s latest OBD regulations would incorporate such diagnostics requirements in the federal regulations automatically starting in MY 2024 (see CA 13 CCR 1971.1 (g)(2)). [EPA-HQ-OAR-2019-0055-1168-A1, p.106]

Organization: *Truck and Engine Manufacturers Association (EMA)*

Open crankcase ventilation systems have evolved over the years, now incorporating very effective vapor separation systems. EPA is proposing to require manufacturers to close those crankcase systems. (§1036.115(a)). EMA believes this is an unnecessary development expense to add to this already tremendously challenging and costly regulation, and in fact, could be harmful to engine and aftertreatment durability, contrary to EPA’s goal to extend useful life requirements. [EPA-HQ-OAR-2019-0055-1203-A1, p. 118]

Closed crankcase ventilation ("CCV") systems can foul turbochargers, leading to degraded performance and turbo efficiency (increasing CO_2 emissions), as well as potential secondary damage including fouled intercoolers and, as boost is reduced, increased engine-out PM. Increased engine-out PM has multiple undesirable consequences, including increased CO_2 and other emissions levels due to increased regeneration frequencies, as well as accelerated aging of aftertreatment systems. EPA acknowledges many of these potential impacts in the preamble to the NPRM. [EPA-HQ-OAR-2019-0055-1203-A1, p. 118]

The types of failures that can be experienced with CCV systems are more severe than those that can occur with open crankcase systems. Consider a failure of the system that filters the blowby gas. With an open ventilation system, a failure results in a MIL and/or puddling oil on the ground, which both will lead to relatively rapid repair, with no significant impact to emissions before the repair is performed. If, however, the filtration system fails with a CCV system, it can damage the turbocharger, intercooler, and downstream components (if vented to the compressor inlet) or the aftertreatment system (if vented to the exhaust, as EPA suggests). This can turn one relatively simple failure into several more significant and expensive ones, that can directly impact emissions. In fact, the core issue at hand may not even be noticeable or detectable until more serious collateral damage has occurred. [EPA-HQ-OAR-2019-0055-1203-A1, p. 118 - 119]

Compressor coking can occur in diesel CCV applications. Coking is most likely to develop with high compressor outlet temperatures under high load. Although CCVs are common in lighter duty engines, including diesels, heavy-duty engines, especially heavy heavy-duty engines, are much more likely to experience these conditions than passenger cars. Experience with lighter-duty products does not amount to a sufficient feasibility demonstration for heavy-duty engines. The images below show examples of downstream damage to the turbocharger, and the resultant impact to engine boost: [EPA-HQ-OAR-2019-0055-1203-A1, p. 119]

There also is a slight safety risk for closed crankcase systems that cannot be adequately controlled. Creating a path from the crankcase to the engine intake risks introduction of a potentially uncontrolled fuel source, potentially leading to an engine runaway condition. [EPA-HQ-OAR-2019-0055-1203-A1, p. 120]

More generally, today's open crankcase systems have very little emissions impact. Some manufacturers have evaluated end of useful-life crankcase emissions and found no material impacts. Manufacturers are required to include crankcase emissions in their certification results (either by measuring separately and adding to tailpipe emissions, or plumbing the crankcase ventilation into the exhaust upstream of emissions measurement sampling). The fact that these emissions are measured and accounted for renders any theoretical environmental benefits moot, which means an obligation to close the crankcase introduces only risk, with potential emissions increases as already noted. There is, then, no sound basis for EMA [*sic*] to propose this design-based (not performance-based) requirement. [EPA-HQ-OAR-2019-0055-1203-A1, p. 120]

The arguments in the Preamble supporting the requirement for closed crankcase systems include concerns about CH_4 emissions from natural gas engines. EPA directly acknowledges that this is only a concern for natural gas engines, a small fraction of the HD market. Increasing the risks described earlier on all HD engines to reduce CH4 emissions from a small fraction of heavy-duty engines is not practical or reasonable. [EPA-HQ-OAR-2019-0055-1203-A1, p. 120]

EPA should continue the practice of setting performance-based standards, and this is no less true with respect to crankcase ventilation systems. The emissions contribution at issue is fully accounted for, including FUL impacts through the DF testing process. Robust diagnostics could also be implemented to ensure ventilation system efficiency in-use, consistent with the CARB OBD requirements effective with MY 2024. [EPA-HQ-OAR-2019-0055-1203-A1, p. 120]

In sum, EPA should eliminate the requirements to implement closed crankcase systems on HD diesel engines in the final rule. EPA is effectively proposing to implement a solution to a problem that does not exist, at the risk of creating new emissions-elevating problems. There are no effective emissions benefits, simply unwarranted risks, introduced by this proposed requirement. [EPA-HQ-OAR-2019-0055-1203-A1, p. 120]

Organization: *Moving Forward Network (MFN)*

Because of the progress made on tailpipe particulate matter emissions, PM emissions from open crankcases have become a dominant source of the remaining operating PM emissions from heavy-duty trucks. Manufacturers of emissions controls estimated that "crankcase PM can represent over 60 percent of the total PM footprint of a 2007 DPF equipped truck."147 EPA appropriately notes that a substantial share of the market has already adopted closed crankcases, indicating the technological feasibility of this new requirement. Suppliers support this requirement, noting that "closed crankcase technology is readily available."148 [EPA-HQ-OAR-2019-0055-1277-A1, p. 36]

147. MECA 2020, https://www.regulations.gov/comment/EPA-HQ-OAR-2019-0055-0365, p. 17.

148. MEMA 2020, https://www.regulations.gov/comment/EPA-HQ-OAR-2019-0055-0462, p. 6.

As a significant source of harmful particulate emissions, crankcase blowby gases pose an obvious health risk to all communities in which heavy-duty trucks operate. However, crankcase emissions can also provide an acute problem to the truck drivers most directly and repeatedly exposed to such emissions.149 It is no wonder that both industry and regulators support containing such harmful emissions.150 [EPA-HQ-OAR-2019-0055-1277-A1, p. 36]

149. EPA-HQ-OAR-2019-0055-0987

150. MECA 2020, MEMA 2020, and ODEQ 2020 (https://www.regulations.gov/comment/EPA-HQ-OAR-2019-0055-0464).

Given the wide availability of the technology and the broad harm that these emissions cause, we support EPA's proposal to require closed crankcases on all heavy-duty vehicles, for all fuels. [EPA-HQ-OAR-2019-0055-1277-A1, p. 36]

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

Finally, regardless of which option it ultimately selects, EPA should revise the proposed durability demonstration, strengthen the proposed anti-tampering and inducement provisions, reject exemptions for vocational vehicles, and finalize the proposed PM standard and closed crankcase requirements. [EPA-HQ-OAR-2019-0055-1302-A1, p.49]

Finally, Commenters support EPA's proposals to adopt a revised PM standard and to require closed crankcase ventilation systems for compression-ignition engines, both of which will achieve important reductions in PM pollution. 87 Fed. Reg. at 17,461–62, 17,466–67. The proposed PM standard of 5 mg/hp-hr is unquestionably feasible (even allowing for measurement variability), as manufacturers are already certifying engines well below this level. Id. at 17,462. Finalizing a PM standard at least that low will preserve these gains by preventing backsliding in the future. Similarly, given that a sizable portion of the market has already embraced closed crankcases, see id. at 17,466, EPA should require this eminently feasible technology on all compression-ignition engines. Crankcase emissions comprise a significant portion of the direct PM (and other pollutant) emissions from HDVs,245 exposing communities and vehicle operators to unnecessary health risks. EPA must carry out its duty to protect public health and welfare by requiring manufacturers to eliminate these harmful emissions by adopting this readily available and affordable technology. See DRIA at 139 (estimating initial technology cost of $37 per engine). [EPA-HQ-OAR-2019-0055-1302-A1, p.64]

> 245Michael Gerhardt et al., Crankcase Emissions for MY2007+ Heavy-Duty Diesel Trucks 12, EPA (2020), https://www.epa.gov/sites/default/files/2021-01/documents/04-moves3-crankcase-hd-diesel-trucks-2020-10-14.pdf

EPA Summary and Response

Summary:

The California Air Resources Board (CARB, Moving Forward Network (MFN), Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association and Sierra Club all support closed crankcase ventilation systems for compression-ignition engines as originally proposed. MFN commented that such technology is readily available (referencing MECA and MEMA in their comment), and these commenters suggest that technology is affordable for manufacturers. They also commented that the proposed PM standard of 5 mg/hp-hr is feasible and would support public health by reducing harmful PM emissions and currently unaccounted for methane gas.

Daimler Truck North America LLC (DTNA) and Engine Manufacturers Association (EMA) oppose EPA requiring closed crankcases and support a performance-based standard with a method of compliance that allows leaving the crankcase open with additional robust diagnostics.

DTNA conducted various studies to assess impacts of coking of the oil mist in the compressor housing using various closed crankcase technologies. On a closed crankcase ventilation system with a new baseline turbocharger, DTNA tested a cycle that was typical of a line haul vehicle with results showing compressor efficiency loss up to 7-8% in as little as 200 hours. Compressor efficiency loss can lead to reduced engine and engine braking performance. Another test DTNA ran was on the same cycle but with electrically driven crankcase breather technology. Results improved but compressor efficiency loss was still seen up to 4% in 200 hours. For another test, DTNA added a water-cooled compressor stage to reduce internal surface temperatures at the compressor housing, which reduced coking but did not eliminate it. Finally, a new electric drive system that removes mass of the oil in the crankcase vapor before sending it to the turbocharger inlet was investigated by DTNA but an efficiency loss of 5-6% was still observed. DTNA concluded that crankcase breather technologies do not eliminate oil contamination. Fouling of the charge air cooler and engine induction system components were observed within hours of testing in DTNA's tests. DTNA voiced concern that the long term effects of oil contaminated air and combustion deposits are unknown.

Additionally, further studies by DTNA done over the FTP, RMC, fuel maps and engine brake performance with a clean turbocharger compared with a turbocharger that has undergone 200 hours with a closed crankcase, resulted in increased fuel consumption across all cycles. DTNA conducted an engine braking torque evaluation of the turbocharger resulting in 7-10% engine brake power loss, which DTNA stated poses a potential safety risk. Estimations on the impact to fuel economy for an electrical oil pressure system were provided by DTNA. Approximately 4% compressor efficiency loss and 0.7% engine fuel economy degradation were estimated by DTNA. DTNA stated that this could lead to increased particulate emissions, increased aftertreatment aging and lower boost. After 1600 hours, a visual inspection was done by DTNA on an active closed crankcase ventilation system and oil and sludge accumulation were observed. Other concerns DTNA noted based on these studies include the difficulty of achieving warranty and useful life compliance due to the addition of crankcase breather gases into the induction air upstream of the compressor housing of the turbocharger, secondary damage to engine components, increased service cost, increased service and customer downtime, OEM warranty costs, potential damage to the compressor wheel due to cold weather condensation and runaway engine risk.

DTNA commented that EPA did not consider the complexity of adding closed crankcase technologies for OEMs during the Phase 2 rulemaking or how compensating for increased GHG emissions caused by closed crankcases will lead to increased NOx.

DTNA recommends EPA include an allowance of leaving the crankcase open with additional deterioration determination and in-use emissions validation of the open crankcase ventilation system.

EMA lists similar concerns of closing the crankcase as DTNA, including coking, degraded performance and turbo efficiencies leading to increased CO_2 emissions, secondary damage to components, increased engine-out PM, and risk of engine runaway condition. EMA commented that due to closing the crankcase, severe damage can occur if the filtration system fails which would not be the case if the crankcase is left open. EMA stated that open crankcases have very little emissions impact and recommend allowing the crankcase to remain open with additional robust diagnostics, consistent with CARB OBD requirements.

Response:

After consideration of these comments, EPA is finalizing a standard that is technology neutral with respect to closing the crankcase or keeping it open, which manufacturers may comply with through either closing the crankcase or meeting certain measurement requirements and including accounting for emissions from an open crankcase in demonstrating compliance with the standards in 40 CFR 1036.104 (see Preamble section III Crankcase Emissions for further details).. EPA conducted a HD Chassis Crankcase test on an open crankcase that showed THC and CO crankcase emissions to be a significant fraction of total emissions from recent model year heavy-duty diesel trucks. As EPA explained in the proposed rule, closing the crankcase would prevent crankcase emissions from being vented directly to the atmosphere by routing the emissions back into the intake air system or routing them upstream of the aftertreatment in the exhaust.

After consideration of DTNA's and EMA's concerns, we are providing an additional method of compliance as an alternative option to a closed crankcase. While we understand the safety concerns that DTNA and EMA have raised, we do not believe that those concerns are unresolvable, nor do we believe that they should serve as the sole barrier to the introduction and use of closed crankcase systems. We believe that both closed and open crankcase systems are comparably effective at emissions reductions as both pathways require the manufacturer to meet the same emission standard. Using an open crankcase is an appropriate way for manufacturers to meet the overall purpose of the proposed closed crankcase requirements if they have durability and safety concerns with impacts of future closed crankcase technologies. Manufacturers that elect to follow this method of compliance may have an open crankcase, but those manufacturers must account for the contribution of crankcase emissions to the total tailpipe emissions from the engine at the time of certification and throughout the engine's useful life. Determination of deteriorated crankcase emissions and accounting for any crankcase emissions during manufacturer run in-use testing will be included in overall engine compliance (see Preamble Section III.B regarding crankcase emissions for further details).

3.10 Additional technology pathways to meet proposed criteria pollutant standards

Comments by Organizations

Organization: *Achates Power, Inc.*

Achates Power developed and demonstrated a 10.6L heavy duty opposed-piston (OP) diesel engine in a project supported by the California Air Resources Board, the South Coast Air Quality Management District, the San Joaquin Valley Air Pollution Control District and other organizations1. [EPA-HQ-OAR-2019-0055-1216-A1, p. 1]

1. https://achatespower.com/wp-content/uploads/2021/04/Achates-Power-HD-Demo-Technical-Review-1.pdf

Achates Power tested the heavy-duty OP engine against the established (Federal Test Procedure, Supplement Emissions Test) and new (low-load, idle) dynamometer test protocols. The engine demonstrated the ability to comply with the most stringent CARB (2027) NOx regulations. These tests used engine measurements with full-aged (450,000) aftertreatment system models from BASF. [EPA-HQ-OAR-2019-0055-1216-A1, p. 1]

Even at the fully aged point, the engine had a compliance margin of 30% or more against all cycles2. [EPA-HQ-OAR-2019-0055-1216-A1, p. 2]

> 2. Salvi, A., Redon, F., Youngren, D., and Fromm, L., "Low CO2, Ultralow NOx Heavy Duty Diesel Engine: Experimental Results," SAE Technical Paper 2022-01-0426, 2022, https://doi.org/10.4271/2022-01-0426. https://achatespower.com/wp-content/uploads/2021/06/Achates-Power-Ultralow-NOx-at-Low-Loads-and-Idle.pdf [[See table on p.2 of EPA-HQ-OAR-2019-0055-1216-A1]]

Achates Power continues to test and develop the engine. It is the process of testing tailpipe emissions with an aftertreatment system aged to 800,000 miles by Southwest Research Institute's Exhaust Composition Transient Operation Laboratory using the Diesel Accelerate Aging Cycles3 to confirm emissions compliance with a fully aged aftertreatment system. These results will be reported later this year. [EPA-HQ-OAR-2019-0055-1216-A1, p. 2]

> 3. https://www.swri.org/press-release/ecto-lab-epa-cleaner-trucks-initiative-emissions

One of the engines was installed in a Peterbilt 579 truck and operated in service by a major retailer. In-use tailpipe emissions were measured by researchers at the University of California Riverside (UCR) using a Portable Emissions Measurement System. While the demonstration is continuing, an initial set of tailpipe measurements met the most stringent in-use NOx limits from CARB and proposed by EPA (2031) with a compliance margin of 52% or greater to the most stringent proposed EPA limit4. Kent Johnson, the Principal Investigator for UCR said "The Achates Power 10.6L heavy duty opposed-piston engine demonstrated NOx emissions control far better than other diesel engines we have tested. This first round of measurements…showed between a 99% and 50% margin to the most stringent EPA 2031+ in-use NOx proposed Regulations, which is outstanding." [EPA-HQ-OAR-2019-0055-1216-A1, p. 2]

> 4. https://achatespower.com/wp-content/uploads/2022/04/Achates-Power-Heavy-Duty-Diesel-In-Use-Testing-Results.pdf

Importantly, all these tailpipe measurements only included conventional underfloor aftertreatment systems. The latest results use a one-box DOC/DPF/SCR/ASC system currently used by one of the Class 8 tractor market leaders. No additional emissions control technology is utilized or is required for the opposed piston engine to meet ultralow NOx levels over an extended full useful life. [EPA-HQ-OAR-2019-0055-1216-A1, p. 2]

The heavy-duty diesel OP engine also demonstrated the ability to meet the fully phased (2027) EPA Green House Gas II regulations, with a margin of 4% or more5. [EPA-HQ-OAR-2019-0055-1216-A1, p. 3]

> 5. https://achatespower.com/wp-content/uploads/2020/12/Achates-Power-Opposed-Piston-Heavy-Duty-Diesel-Engine-Demonstration-Performance-Results-Ultralow-NOx-without-additional-hardware.pdf [[See table on p.3 of EPA-HQ-OAR-0055-1216-A1]]

Moreover, the fleet operator measured a 10%+ fuel economy advantage of the Peterbilt truck with the heavy duty OP engine vs. a model year 2021 reference truck operating the same routes with similar loads6. [EPA-HQ-OAR-2019-0055-1216-A1, p. 3]

> 6. https://achatespower.com/wp-content/uploads/2022/04/Achates-Power-Heavy-Duty-Diesel-In-Use-Testing-Results.pdf

We commissioned FEV, a leading independent engineering firm and expert in this field, to prepare an independent, detailed cost analysis of a commercial vehicle OP engine vs. a conventional engine of the same power and torque. FEV’s conclusion is that with everything else being equal – volume, sourcing strategy, machining rates, overhead rates – that the OP engine costs 7% less than the conventional engine considering the base engine only7. And since – as discussed above – the aftertreatment system does not to grow in cost or complexity – the ultralow emissions OP engine will cost less than current conventional engines. [EPA-HQ-OAR-2019-0055-1216-A1, p. 3]

> 7. https://achatespower.com/wp-content/uploads/2020/03/Achates-Power-Cost-Study-White-Paper_March-2020.pdf

Achates Power is confident a heavy-duty diesel opposed piston engine can be in volume production by 20298, following a normal 6-year industrialization cycle. One path to market is with established engine companies/OEMs as they manufacture, distribute, and service engines under license from us, as we do on other projects, like the Advanced Combat Engine for the U.S. Army developed by Cummins and Achates Power. Another path to market is for Achates Power to work with a series of established partners to manufacture, distribution, and service the engine. There is ample capacity and capital at all levels. [EPA-HQ-OAR-2019-0055-1216-A1, p. 3]

> 8. https://achatespower.com/wp-content/uploads/2022/05/Achates-Power-Opposed-Piston-Engine-Commercialization-Pathway.pdf

Beyond diesel fuel, the opposed-piston engine can operate cleanly and efficiently on renewable diesel, and Achates Power is developing hydrogen combustion capability on the engine platform. A common engine platform can operate in a near-zero manner with diesel and renewable diesel in the short term; and with renewable and zero carbon fuels in the long-term. [EPA-HQ-OAR-2019-0055-1216-A1, pp. 3 - 4]

Organization: *Alliance for Vehicle Efficiency (AVE)*

AVE asks EPA to consider the proven capabilities of the cost-effective technologies that exist today to meet EPA's proposed Option 1 and the most stringent standards. [EPA-HQ-OAR-2019-0055-1280-A1, p. 3]

More than two-years ago, EPA began extensive research to analyze the performance of available technologies to meet more stringent emission standards. Since then, ongoing, and recently published data confirms that a 0.02 g/bhp-hr NOx standard can be met by manufacturers. Examples of available technologies include: Advanced Engine Architecture: The10.6L heavy-duty opposed piston diesel engine has been tested in a demonstration project supported by the California Air Resources Board, the South Coast Air Quality Management District, the San Joaquin Valley Air Pollution Control District, and other organizations.2 [EPA-HQ-OAR-2019-0055-1280-A1, p. 3]

2. https://achatespower.com/wp-content/uploads/2021/04/Achates-Power-HD-Demo-Technical-Review-1.pdf

More than two-years ago, EPA began extensive research to analyze the performance of available technologies to meet more stringent emission standards. Since then, ongoing, and recently published data confirms that a 0.02 g/bhp-hr NOx standard can be met by manufacturers. Examples of available technologies include: Advanced Aftertreatment: Since 2010, emission control systems have advanced greatly. Today's applications are significantly smaller, lighter, and less expensive. By 2027, further improvements in aftertreatment technologies, engine calibration and thermal management are expected to help meet the 0.02 g/bhp-hr NOx standard over the FTP and also meet the NOx standards for the Low-Load Cycle.3 [EPA-HQ-OAR-2019-0055-1280-A1, p. 3]

3. MECA Technology Feasibility for Heavy-Duty Diesel Trucks in Achieving 90% Lower NOx Standards in 2027

More than two-years ago, EPA began extensive research to analyze the performance of available technologies to meet more stringent emission standards. Since then, ongoing, and recently published data confirms that a 0.02 g/bhp-hr NOx standard can be met by manufacturers. Examples of available technologies include: Active thermal management: To assist with cold-start emissions, active thermal management technologies such as fuel burner and electric heaters have been developed and can be deployed to further help meet the 2027 standards.[EPA-HQ-OAR-2019-0055-1280-A1, p. 3]

More than two-years ago, EPA began extensive research to analyze the performance of available technologies to meet more stringent emission standards. Since then, ongoing, and recently published data confirms that a 0.02 g/bhp-hr NOx standard can be met by manufacturers. Examples of available technologies include: Cylinder Deactivation: Data shows cylinder deactivation is a technology able to reduce fuel consumption and increase exhaust temperature to facilitate improved NOx conversion. Combined with close-coupled selective catalytic reduction, this will further help with low-NOx compliance.4 [EPA-HQ-OAR-2019-0055-1280-A1, p. 3]

4. Matheaus, A., Neely, G., Sharp, C., Hopkins, J. et al., "Fast Diesel Aftertreatment Heat-up Using CDA and an Electrical Heater," SAE Technical Paper 2021-01-0211, 2021, doi:10.4271/2021-01-0211.

More than two-years ago, EPA began extensive research to analyze the performance of available technologies to meet more stringent emission standards. Since then, ongoing, and recently published data confirms that a 0.02 g/bhp-hr NOx standard can be met by manufacturers. Examples of available technologies include: Particulate Filters: Existing diesel applications which use diesel particulate filters (DPFs) provide sufficient margin for meeting the lowered PM limit. [EPA-HQ-OAR-2019-0055-1280-A1, p .3]

Numerous pathways exist to meet stringent standards: Supporting all pathways gives the U.S. an opportunity to reach its environmental goals faster while supporting the automotive industry. The chart below outlines available technologies to greatly reduce NOx and PM emissions from HD trucks. [EPA-HQ-OAR-2019-0055-1280-A1, p. 4]

Organization: *Allison Transmission, Inc.*

EPA should keep in mind several additional perspectives when determining the final standards to apply to MY 2027 and later HDVs:

- EPA should adopt a regulatory pathway that will allow for the use of emerging low-carbon fuels, such as hydrogen. As EPA recognizes, there are certain uses where it is currently difficult to fully electrify all product offerings. Renewable liquid fuels may be effectively required for certain vehicles for the foreseeable future. Compliance flexibility will therefore be necessary to allow manufacturers to both meet the new NOx standards as well as the need to make longer-term investments in low-carbon fuels. Apart from hydrogen, other low-carbon intensity fuels such as natural gas and propane may be used as well as higher octane gasoline in certain HDV commercial applications. While EPA has considered these fuels to some degree in its supporting analysis, EPA should not foreclose their further development and potential use by adopting standards that would effectively restrict the ability of the market to pursue different fueling options for the medium-duty and heavy-duty sectors. [EPA-HQ-OAR-2019-0055-1231-A1 pp.9-10]

Organization: *California Association of Sanitation Agencies (CASA)*

Of utmost concern is that an electrification-only approach will take significantly longer to implement than an approach that allows NZEVs. Also, renewable non-fossil biogas produced at publicly owned treatment works (POTWs) will need a long-term home in the national effort to decarbonize the economy, which is not addressed in this proposed rulemaking. [EPA-HQ-OAR-2019-0055-1301-A1, pp.1-2]

Essential public services must operate at all times to protect public health and the environment. As essential public service providers and fellow dedicated environmental stewards, CASA members provide reliable wastewater treatment to protect public health and the environment. CASA members are public, local agencies responsible for providing wastewater conveyance and treatment to over 90 percent of the sewered population across California. While our primary objective is to reliably convey and treat wastewater and residual biosolids to state and regional standards, CASA's members also support the state and nation's clean air goals, which rely heavily on clean vehicles. To support these goals, many of our members produce renewable wastewater biogas as an inherent component of wastewater treatment, and via co-digestion, that can be used as a low carbon transportation fuel (reducing GHGs, NOx, and PM relative to diesel options), which can also support specialty vehicles that must be deployed to meet increasingly frequent mutual aid and critical response demands due to natural disasters (e.g., wildfires, extreme weather events, etc.) and other types of emergencies and routine functions.[EPA-HQ-OAR-2019-0055-1301-A1, p.2]

CASA members operate medium-and heavy-duty vocational trucks that perform maintenance and repair operations. On any given day they are required to travel long distances (to maintain over 110,000 miles of public sewers and facilities), overcome rough terrain, and provide extended operation of auxiliary equipment via power-take off (PTO) devices at project sites. It is critical to consider the high level of energy and hours of operation required while at worksites and the need for certain trucks to be outfitted with equipment driven by PTO devices. Vehicles are often called upon to tow equipment such as generators or pumps, perform welding operations, power onboard pumps, vacuums, welding machines and air compressors, and other tasks that require long duty cycles. We also utilize heavy duty vehicles to transport biosolids to agricultural fields for beneficial recycling via land application. At this point in time, there are no ZEV options available that provide the level of service required to maintain reliable service to protect public health and the environment, as well as remain in compliance with existing State Water Board and Regional Water Board regulations and permit requirements, while providing critical and timely response services. CASA strongly supports EPA's approach, to balance ZEV and NZEV development to ensure we meet existing air quality standards, while also providing vehicle options that can support critical response needs of our communities and our core functions. [EPA-HQ-OAR-2019-0055-1301-A1, p.2]

NZEVs are not only critical for supporting community resilience, but also reducing NOx emissions to remain in compliance with the Clean Air Act.
Our members have already begun purchasing ultra-low emission natural gas powered on-road heavyduty vehicles (supported by Cummins-Westport engines) to comply with restrictive local air quality regulations (e.g., SCAQMD Rule 1196). These vehicles are immediately available and emit 90 percent fewer NOx emissions relative to current standards for heavy-duty vehicles – comparable to emissions from an equivalent all-electric heavy-duty vehicle when the emissions associated with the electricity production are taken into account. Under CAA section 202(a)(3)(A), standards for emissions of NOx, PM, HC, and CO emissions from heavy-duty vehicles and engines are to ''reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology.'' When fueled by renewable biogas, the Cummins-Westport ISX12N engine can provide even greater GHG emissions reductions than ZEVs by also reducing the emissions from renewable waste sources (i.e., fugitive methane emissions from landfills). Some of our members have recently invested significant capital into co-digestion and biogas conditioning infrastructure, as well as compressed natural gas (CNG)

vehicles – all in support of California mandates for achieving GHG emission reductions by 2030 and carbon neutrality, as well as complying with local regulations. Additionally, specialty and critical response vehicles must be able to travel long ranges that include the individual service territory as well as assisting with regional and remote disaster efforts and other types of emergencies. CASA strongly supports including the use of NZEVs fueled by non-fossil, renewable biogas, especially where ZEVs are not feasible or available, allowing for immediate emissions reductions while meeting critical demands reliably across large regions. [EPA-HQ-OAR-2019-0055-1301-A1, pp.2-3]

Wastewater biogas is a non-fossil, renewable, low carbon transportation fuel that should continue to be used to support community resilience and critical response – not wasted!
Regulations under California's Senate Bill 1383 began implementation in 2022 (requiring diversion of organic waste from landfills to achieve methane reduction) and significantly more renewable biogas will be produced at POTWs through the co-digestion of wastewater sludge with methane producing organic waste diverted from landfills. Co-digestion is a proven approach of economically producing renewable energy/fuel, as well as a soil amendment (biosolids) to improve California's soil ecosystem. In fact, more than 90 percent of California's wastewater flow is treated through anaerobic digestion, generating biogas and will continue to do so. As quantified in the SWRCB's Co-Digestion Capacity Analysis (released by the Governor's office in August 2020), POTWs can utilize available existing infrastructure in the form of anaerobic digestion to receive and co-digest all of the divertible food waste across the state thereby removing a major source of fugitive methane from landfills (which account for about 20 percent of the state's methane inventory). Co-digestion also further advances two initiatives undertaken at USEPA - the joint challenge with the Department of Energy to expand renewable resources at POTWs and the "Winning with Food Waste" initiative to divert food waste away from landfills. Both initiatives favor codigestion of food waste at wastewater treatment plants. Utilizing co-digestion, California's POTWs can significantly increase biogas production to provide, among other benefits, a source of low carbon fuel, on- and/or off-site renewable energy production, and biosolids which help mitigate climate change when land applied. [EPA-HQ-OAR-2019-0055-1301-A1, p.3]

Accordingly, CASA strongly supports:
-EPA's approach, to balance ZEV and NZEV development to ensure we meet existing air quality standards, while also providing vehicle options that can support critical response needs of our communities.
-Continued beneficial use of wastewater-derived biogas for the production of a low carbon fuel.
-The use of NZEVs fueled by non-fossil, renewable wastewater biogas, especially where ZEVs are not feasible or available, allowing for immediate emissions reductions to comply with federal standards for ozone while meeting critical demands reliably across large regions. [EPA-HQ-OAR-2019-0055-1301-A1, p.3]

Organization: *CALSTART*

Manufacturers should be given flexibility in meeting NOx emission targets through accelerated deployments of battery and fuel cell technologies. [EPA-HQ-OAR-2019-0055-1313-A1, p.26]

Organization: *Clean Energy (CE)*

Near-zero engines can be powered by RNG thereby achieving both significant NOx reductions and net-negative carbon emissions. What truly sets near-zero trucks apart from other alternatives is they have similar power, range, and refueling times as their diesel counterparts. Thus, further technological development is not needed for these engines to perform the duty-cycles required by America's trucking and bus fleets as evidenced by Amazon, United Parcel Service (UPS), Waste Management and LA Metro's large-scale deployments. [EPA-HQ-OAR-2019-0055-1350-A1, pp.1-2]

We urge EPA to amend the greenhouse gas regulations to incorporate the benefits of renewable natural gas as part of the medium and heavy-duty engine and vehicle certification regulations. Under California's Low Carbon Fuel Standard, RNG is the lowest carbon intensity fuel available based on the weighted average. EPA should reinstate the 0.15 factor for calculating GHG emissions for natural gas vehicles to reflect RNGs increasing utilization. RNG is now the dominant fuel used in on-road natural gas vehicles throughout the country. In 2021, RNG made up 64 percent (up from 53 percent in 2020) of the fuel used in natural gas vehicles in the United States.12 We see no reason why the GHG reduction benefits of NGVs should be excluded given the surge in RNG production and use and the GHG benefits of electric trucks recently being questioned. An ATRI study released in May of 2022 '*found that while electric trucks have no direct tailpipe emissions, CO2 production associated with vehicle, battery and electricity production would only result in a 30 percent decrease in CO2 emissions when compared to a standard diesel truck.*'13 According to ATRI, '*the marginal environmental benefits of electric trucks are due, in large part, to lithium-ion battery production – which generates more than six times the carbon of diesel truck production.*' [EPA-HQ-OAR-2019-0055-1350-A1, p.4]

12 https://ngvamerica.org/wp-content/uploads/2022/05/NGV-RNG-Decarbonize-2022-5.2.22.pdf

13 https://truckingresearch.org/2022/05/03/understanding-the-co2-impacts-of-zero-emission-trucks/

EPA's regulatory programs should be designed to accelerate the production of trucks and engines that reduce carbon emissions – they should not be designed to favor or support one technology over others. EPA has indicated that electric vehicles are a game changer and therefore warrant treatment that other technologies do not. But near-zero engines that are capable of achieving carbon net-negative emissions right now are also a game changer, and they too should be encouraged. [EPA-HQ-OAR-2019-0055-1350-A1, pp.5]

Organization: *Clean Energy Ventures et al.*

We also believe that the Agency needs to embrace an innovation-driven, data-driven, 'all-of-the-above' approach to achieve rapid decarbonization this decade. We are very concerned that EPA is proposing to provide technology-specific incentives to only two of the many technologies that are being developed to decarbonize the nation's trucks and buses, rather than continuing the fuel-neutral, technology-neutral, performance-based approach that has proven to be so successful for more than five decades of Clean Air Act mobile source regulations. [EPA-HQ-OAR-2019-0055-2339-A2, p.2]

Instead of providing incentives that are limited to specific technologies, we urge EPA to establish fuel-neutral, technology-neutral, performance-based standards and incentives that will allow all effective technologies to be recognized for their contributions and that does not stifle innovation by companies that are developing non-BEV or non-FCEV technology solutions or biofuels-based decarbonization strategies. [EPA-HQ-OAR-2019-0055-2339-A2, p.2]

Organization: *Clean Fuels Alliance America (Clean Fuels)*

The biodiesel and renewable diesel industry is on a path to sustainably double the market to 6 billion gallons annually by 2030, eliminating at least 35 million metric tons of CO2 equivalent greenhouse gas emissions annually. With advancements in feedstock, use will reach 15 billion gallons by 2050 or sooner. These fuels are among the cleanest and lowest-carbon fuels available today to help tackle the climate challenge. Biodiesel and renewable diesel are helping companies drive decarbonization in their supply chains and should continue to be viewed as a primary tool of the Administration to reduce greenhouse gas (GHG) emissions now and to meet President Biden's near- and long-term climate goals, particularly in hard to decarbonize sectors. 2 [EPA-HQ-OAR-2019-0055-1248-A1, p.1]

> 2 Executive Office of the President. Executive Order 14008: Tackling the Climate Crisis at Home and Abroad, 86 FR 7619 (February 1, 2021), available at https://www.federalregister.gov/d/2021-02177

We would like to first thank you for recognizing the progress in fuel quality made by the biomass-based diesel industry and its producers. With advancements in production technology, a greater understanding of fuel performance issues, and the BQ-9000 quality management system, we believe that the industry is now a leading example of how biofuels can offer performance benefits beyond just the reduction in GHG emissions. [EPA-HQ-OAR-2019-0055-1248-A1, pp.1-2]

In addition to reducing greenhouse gas emissions, advanced biofuels also reduce particulate matter emissions. This benefits all populations including minority, low-income, and indigenous populations. For every 100 million gallons of U.S. biodiesel used today in place of petroleum, particulate matter is cut by approximately 252 tons. According to EPA and the California Air Resources Board, biodiesel and renewable diesel significantly reduce criteria pollutants from diesel transportation and heating oil. [EPA-HQ-OAR-2019-0055-1248-A1, p.4]

Last year, the National Biodiesel Board, now Clean Fuels Alliance America, launched a report prepared by Trinity Consultants that quantifies the health benefits and corresponding economic savings from converting petroleum-based diesel to B100.10 The report estimated that displacing diesel with biodiesel in communities with high diesel emissions rates could result in significantly improved health outcomes for the local population. In the 13 sites analyzed throughout the country, Trinity estimated that a switch from diesel to 100 percent biodiesel would avoid or lessen 240,000 asthma attacks, recover 46,000 lost workdays, and avert 1,100 cases of cancer –

among other key benefits – generating a societal value of $3 billion dollars a year.11 [EPA-HQ-OAR-2019-0055-1248-A1, p.4]

10 Trinity Consultants. (March 2021). Assessment of Health Benefits from Using Biodiesel as Residential Heating Oil. https://www.biodiesel.org/news-resources/health-benefits-study.

11 Id.

In the transportation sector, benefits included a potential 44 percent reduction in cancer risk when heavy-duty trucks such as semis use B100, resulting in 203,000 fewer or lessened asthma attacks for the communities studied. When biodiesel is used for home heating oil, the study found an 86 percent reduced cancer risk and 17,000 fewer lung problems for the communities studied. [EPA-HQ-OAR-2019-0055-1248-A1, p.4]

The American Lung Association has found that major trucking corridors, warehouse distribution centers and other diesel hot spots can inflict serious harms to human health and often highlight disparities in the impacts of transportation pollution.12 Biodiesel can make a difference now in reducing harmful tailpipe emissions that have this adverse impact. Biodiesel is one the simplest sustainability solutions available right now. Continuing to use cleaner, better fuels today can lower health impacts and costs for cities and transportation corridors into the future. [EPA-HQ-OAR-2019-0055-1248-A1, p.5]

12 American Lung Association. (2020). The Road to Clean Air.

The immediacy of these potential health benefits is even more critical when one considers the years, possibly decades, it will take for states to pursue electrification and other deep decarbonization strategies. Further, the economic impact of utilizing biomass-based diesel in today's diesel technologies is more achievable with current fleet financial constraints and limited access to other immature technologies. [EPA-HQ-OAR-2019-0055-1248-A1, p.5]

Original Equipment Manufacturers (OEM)
In addition to recognition from the EPA and other regulatory agencies, Clean Fuels is also discussing higher blend approvals and support from several engine manufacturers. We realize that not every Original Equipment Manufacturer (OEM) supports biodiesel at higher levels, but those that do support higher blends of biodiesel recognize its ability to support their fleet customers and users and their commitments towards climate change and immediate decarbonization when compared to longer term solutions. [EPA-HQ-OAR-2019-0055-1248-A1, p.2]

For example, New Holland recognizes the importance of biodiesel as an alternative source of energy and the opportunities that it brings to their customers. They were the first agricultural equipment brand to fully embrace the potential of biodiesel and support their customer's fuel choices. As a result, New Holland provides products with the flexibility to confidently run on everything from petroleum diesel to 100% biodiesel.5 [EPA-HQ-OAR-2019-0055-1248-A1, p.2]

5 https://www.newholland.com/Pages/splash.html

These new proposed Heavy-Duty Engine and Vehicle Standards are an important part of our country's continued push for cleaner air and a cleaner environment. The new Ultra-Low Emissions Diesel Engines (ULEDEs) produced under these regulations will be substantially cleaner than New Technology Diesel Engines (NTDE) in the market today and will approach near-zero regulated emissions of PM, NOx, unburned hydrocarbons, and carbon monoxide. [EPA-HQ-OAR-2019-0055-1248-A1, p.3]

Utilization of increasing volumes of ultra-low carbon liquid fuels like biodiesel and renewable diesel will provide the one important environmental aspect that these new regulations do not directly address—reduction of GHG emissions from the existing fuel supply. [EPA-HQ-OAR-2019-0055-1248-A1, p.3]

Biodiesel is a solution that reduces carbon now. Specifically, when compared to electric vehicles (EVs), utilizing biomass-based diesel now will allow the United States to meet our carbon reduction goals earlier than if we were to rely on EVs alone. It has been shown that the immediate investment in a mature, currently commercialized biomass-based diesel fuel yields higher annual greenhouse gas emissions reductions than waiting for a technology that is still considered immature, such as EVs.7 The benefits of using and increasing the use of biomass-based diesel now will not only provide immediate greenhouse gas reductions, but also will have a positive impact on health in disadvantaged communities. [EPA-HQ-OAR-2019-0055-1248-A1, p.3]

7 Frank, Jenny & Brown, Tristan & Haverly, Martin & Slade, Dave & Malmsheimer, Robert. (2020). Quantifying the comparative value of carbon abatement scenarios over different investment timing scenarios.

When considering options to help reduce greenhouse gas emissions from vehicles and equipment, there are two essential elements to consider: the amount of the reduction and when it happens. This is because carbon emissions are persistent and accumulate. The resulting increased levels of GHGs in the atmosphere contribute to global warming now and for decades to come. A reduction in GHG emissions now can avoid decades of associated heating, thus having significantly more value than carbon reductions made in the future. The time value of carbon is key, and the next decade is critical.8 [EPA-HQ-OAR-2019-0055-1248-A1, pp.3-4]

8 National Biodiesel Board. Biodiesel.org. (2021). Cutting Carbon: Comparing Biomass-Based Diesel & Electrification for Commercial Fleet Use.

The immediate reductions achieved by biodiesel and renewable diesel are crucial to reach our near- and long-term carbon reduction goals. The importance of increasing biomass-based diesel and reducing carbon cannot be understated as the Intergovernmental Panel on Climate Change (IPCC) clearly reaffirmed in their Sixth Assessment Report: Carbon reductions today are more important than carbon reductions in the future.9 [EPA-HQ-OAR-2019-0055-1248-A1, p.4]

9 Intergovernmental Panel on Climate Change. (2021) Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.

The most recent update to the Greenhouse Gases, Regulated Emissions, and Energy Use in Technologies (GREET) model published in October of 2021 estimates that the *average* gallon of biodiesel and renewable diesel reduces emissions by approximately 74%, considering the U.S. biodiesel feedstock mix published by EIA. Additionally, since 2010, use of these fuels has avoided 143.8 million metric tons of carbon. [EPA-HQ-OAR-2019-0055-1248-A1, p.4]

In addition to reducing greenhouse gas emissions, advanced biofuels also reduce particulate matter emissions. This benefits all populations including minority, low-income, and indigenous populations. For every 100 million gallons of U.S. biodiesel used today in place of petroleum, particulate matter is cut by approximately 252 tons. According to EPA and the California Air Resources Board, biodiesel and renewable diesel significantly reduce criteria pollutants from diesel transportation and heating oil. [EPA-HQ-OAR-2019-0055-1248-A1, p.4]

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11 Id.

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12 American Lung Association. (2020). The Road to Clean Air.

The immediacy of these potential health benefits is even more critical when one considers the years, possibly decades, it will take for states to pursue electrification and other deep decarbonization strategies. Further, the economic impact of utilizing biomass-based diesel in today's diesel technologies is more achievable with current fleet financial constraints and limited access to other immature technologies. [EPA-HQ-OAR-2019-0055-1248-A1, p.5]

Organization: *CleanAirNow (CANKC)*

CANKC does NOT support the false solutions that come from non-renewable and heavy polluting sources like natural gas and biomass in the Heavy Duty Truck Rule and other emission standards. Our communities do not need the false promises of 'cleaner trucks,' we need zero emissions. [EPA-HQ-OAR-2019-0055-1239-A1, p.2]

CANKC supports the following recommendations from the Moving Forward Network:

- The Heavy Duty Truck Rule **must not include false solutions like natural gas**, which only further environmental and public health harms for EJ communities [EPA-HQ-OAR-2019-0055-1239-A1, p.2]

Organization: *ClearFlame Engine Technologies (ClearFlame), Remora, and SixWheel*

As you update the Agency's Phase 2 GHG standards for certain heavy-duty vehicles and as you develop EPA's expected proposal for new Phase 3 GHG standards that will apply to all heavy-duty engines and vehicles, we strongly urge you to adapt EPA's successful fuel-neutral, technology-neutral "systems approach" to reducing greenhouse gas (GHG) emissions from all of the nation's heavy-duty engines and vehicles. [EPA-HQ-OAR-2019-0055-1261-A1, p. 3]

An innovation-driven, all-of-the-above approach will lead to more rapid carbon mitigation than pre-selecting particular technologies. The current Proposal includes provisions that reward BEVs and FCEVs that are not available to other technologies, including but not limited to ours. This approach will delay –and ultimately reduce – the overall GHG benefits of the program, an unintended consequence with real-world climate impacts. [EPA-HQ-OAR-2019-0055-1261-A1, p. 3]

We strongly urge EPA to revise these provisions in its final rule to enable all technologies to qualify under these provisions, thereby sending a market signal that encourages all innovations that may achieve the same – or even greater – emissions benefits when upstream and other indirect emissions are considered, at greater speed, scale, and/or cost-effectiveness. [EPA-HQ-OAR-2019-0055-1261-A1, p. 3]

We strongly urge EPA to revise its definition of "Fuel" and other provisions that will be necessary to ensure that a ClearFlame engine can be certified and operate using any high-blend ethanol or biofuel, including E85 and E98. [EPA-HQ-OAR-2019-0055-1261-A1, p. 3]

The Proposal lists ethanol only as a blend option for gasoline. It is critical that EPA sends the right market signal here – that an ethanol-fueled compression-ignition engine can receive the appropriate EPA certification and any incentives that it qualifies for, by virtue of its emissions performance. [EPA-HQ-OAR-2019-0055-1261-A1, p. 3]

EPA Should Maintain its Historic Fuel-Neutral, Technology-Agnostic Performance-Based Approach in the Proposal's Final Rule and Next Year's Expected Phase 3 GHG Proposal.

For the reasons outlined above, a fuel-neutral, technology-neutral, "systems approach" is still critically necessary – both for this Proposal and for next year's expected proposal to reduce GHGs from all heavy-duty engines and vehicles. [EPA-HQ-OAR-2019-0055-1261-A1, p. 4]

Here are just a few reasons why: [EPA-HQ-OAR-2019-0055-1261-A1, p. 4]

First, diesel engines will continue to emit a significant portion of the transportation sector's NOx and GHG emissions inventories in 2050. Even in states that have adopted California's Advanced Clean Truck Rule, up to 60% of the truck tractor sales market will still be diesel in 2035.5 These engines are likely to remain on the roads for decades thereafter. In other words, diesel engines that are sold in 2035 will still be in use deep into mid-century. [EPA-HQ-OAR-2019-0055-1261-A1, p. 4]

> 5. California's Advanced Clean Truck Rule, which has been adopted by New York and other states, requires 55% of Class 2b-3 truck sales, 75% of Class 4 – 8 straight truck sales, and 40% of truck tractor sales to be zero-emission by 2035.

Second, EPA's Heavy-Duty Highway Engine and Vehicle Rule of 20016 (the "2001 Diesel Rule") showed that a fuel-neutral, technology-neutral, performance-based "systems approach" reduced emissions and related health harms at scale, faster and most cost-effectively that any approach that picked specific technology winners. Indeed, when the 2001 Diesel Rule was finalized, it was widely anticipated that NOx adsorbers would be the "technology winner" that would enable diesel engines to meet the NOx standard in that rule. A competing technology, Selective Catalytic Reduction (SCR), was considered impractical and unlikely to succeed, due to the logistical hurdles posed by the need for SCR-equipped engines to use urea to operate cleanly. By 2010, SCR had become the industry standard, and NOx adsorbers never reached widespread use in the heavy-duty truck market. The lesson from that rule is clear: despite pressure to anoint NOx adsorbers as the technology "winner," the final Rule was drafted in a fuel-neutral, technology-neutral, performance-based manner, which enabled the market to innovate and then shift quickly to a technology solution that enabled implementation at scale, in the most cost-effective and fastest way possible, within a decade. [EPA-HQ-OAR-2019-0055-1261-A1, p. 5]

> 6. EPA, Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements, Regulatory Announcement, accessed on May 15, 2002 at https://nepis.epa.gov/Exe/ZyPDF.cgi/P1001CXZ.PDF?Dockey=P1001CXZ.PDF.

We encourage the EPA to establish objective and transparent emissions-based criteria that qualify a technology as zero or near-zero emissions. Any and all technologies that demonstrate proper emissions reductions should be able to qualify. It is essential for market fairness and to send the appropriate market signal to technology developers. [EPA-HQ-OAR-2019-0055-1329-A2, p. 4]

In sum, we strongly urge EPA to adopt a final NOx and GHG program that is open to all demonstrated, cost-effective emissions-reduction solutions. Doing so is critical to achieve near-term and long-term goals. [EPA-HQ-OAR-2019-0055-1329-A2, p. 4]

It is important to avoid unnecessarily limiting innovation at this stage of decarbonization. Encouraging and rewarding innovation will be necessary to reduce emissions in hard-to-decarbonize sectors like heavy-duty transportation. Such an open approach should also yield technology development benefits that pay dividends later when EPA seeks to decarbonize the non-road diesel sector. [EPA-HQ-OAR-2019-0055-1329-A2, p. 4]

Ever since the first federal vehicle emission standards for heavy-duty engines were adopted, EPA has correctly assumed that compression-ignition engines would be fueled by diesel fuel. This assumption predates those first emission standards, and has been appropriate for more than a century. Indeed, most people simply call these engines “diesel engines,” and most people probably have never even heard the phrase “compression-ignition.” For most engines over this time, the diesel fuel powering these engines was a petroleum product; in recent years, biodiesel and renewable diesel has entered the fuel market, and those fuels have been integrated into EPA’s fuel and vehicle emissions regulatory architecture. [EPA-HQ-OAR-2019-0055-1261-A1, p. 8]

Similarly, EPA has historically assumed that ethanol would only be used in spark-ignition engines. Again, this has been the correct assumption for decades. Even within this Proposal, EPA considers the impacts of ethanol blends on the cost of emission control aftertreatment devices used in spark-ignition engines10 and discusses ethanol only in the context of current and proposed test procedures for spark-ignition engines.11 [EPA-HQ-OAR-2019-0055-1261-A1, p. 8]

10 See Proposal, at 17488.

11 See, e.g., Proposal at 17490, 17491, 17631, 17703, 17849, and 17866.

It is now time to update these assumptions, and to integrate the use of ethanol in a compression-ignition engine into the policy architecture that will govern future heavy-duty engines and vehicles. Thus, ClearFlame strongly urges EPA to finalize this Proposal in a way that explicitly anticipates that future compression-ignition engines may operate on high-blend ethanol fuels (e.g., E85 or E98). [EPA-HQ-OAR-2019-0055-1261-A1, p. 9]

As we have stated above, ethanol can play a major role in decarbonizing the hard-to-electrify segments of the highway and nonroad diesel engine and vehicle markets. In order for this to happen, EPA must remove any uncertainty surrounding whether or not ethanol can be used to certify future compression-ignition engines or whether this fuel must be used thereafter throughout the useful life of such future engines. [EPA-HQ-OAR-2019-0055-1261-A1, p. 9]

Organization: *Coalition for Renewable Natural Gas (RNG Coalition)*

As EPA recognizes, '[h]eavy-duty vehicles and engines are important contributors to concentrations of ozone and particulate matter and their resulting threat to public health, which includes premature death, respiratory illness (including childhood asthma), cardiovascular problems, and other adverse health impacts.' 87 Fed. Reg. at 17,414. In the proposal, EPA seeks to reduce emissions of nitrogen oxides ('NOx') and other pollutants, as well as proposing further greenhouse gas ('GHG') emissions starting for model year 2027. RNG submits these comments because, while it appears EPA considered natural gas vehicles ('NGVs') technologies in developing the proposed standards, see, e.g., id. at 17,430, it does not appear to have considered the benefits of using RNG. RNG is increasingly being used in NGVs and also can be used in the production of hydrogen. We believe this is a lost opportunity for EPA to achieve greater emissions reductions, including GHG emissions, from the heavy-duty sector. [EPA-HQ-OAR-2019-0055-1204-A1, p.1]

RNG is biogas-derived fuel that has been captured from organic waste streams—including agricultural wastes, municipal wastewater, and municipal solid waste in landfills—and upgraded to achieve quality standards necessary to blend with or substitute for geologic natural gas. Every community in America produces waste. As that waste breaks down, it emits methane, which is a naturally occurring, but potent and harmful GHG. RNG projects capture this methane from existing food waste, animal manure, wastewater sludge and garbage, and redirect it away from the environment, repurposing it as a clean, green energy source. As such, RNG can produce carbon-negative results when fueling on-road vehicles like short- and long-haul trucks, transit buses, and refuse and recycling collection vehicles.1 [EPA-HQ-OAR-2019-0055-1204-A1, pp.1-2]

> 1 Decomposition of wastes in landfills was identified by EPA as a major source of methane emissions in the United States. See EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020, at ES-7 (2022), available at https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2020.

RNG can be used in the same applications as conventional natural gas, including in transportation, industrial, and heating/electricity applications. RNG is currently sold in the transportation fuel market as renewable compressed natural gas ('CNG') and renewable liquefied natural gas ('LNG'), and RNG makes up over 95 percent of our nation's cellulosic biofuel production under the Renewable Fuel Standard ('RFS') program. During power outages, RNG can also be tapped to provide reliable, sustainable energy. This dependability is also why it is already being used to power essential services for food storage, airports, universities, hospitals, and other important facilities. [EPA-HQ-OAR-2019-0055-1204-A1 ,p.2]

Heavy-duty vehicles are the fastest growing segment of U.S. transportation in terms of energy use and emissions.2 Ultra-low NOx, medium- and heavy-duty natural, gas-powered trucks and buses are on the road today and perform at levels that are 95 percent below the current NOx standard and 98 percent below the particulate matter standard.3 They provide cost-effective emissions reductions in the heavy-duty sector compared to electric options still in development.4 [EPA-HQ-OAR-2019-0055-1204-A1, p.2]

2 NGVAmerica, Breathe Cleaner Air Right Now, https://ngvamerica.org/environment/?msclkid=787e309ece7411ecacf726e33f83661d (last visited May 13, 2022).

3 NGVAmerica, A First, California Fleets Fueled with Bio-CNG Achieve Carbon-Negativity, June 2, 2021, https://ngvamerica.org/2021/06/02/a-first-california-fleets-fueled-with-bio-cng-achieve-carbon-negativity/; see also 87 Fed. Reg. at 17,433 (noting that only natural gas and liquified petroleum gas engines have been certified to meet California's more stringent, optional standards).

4 NGVAmerica, Breathe Cleaner Air Right Now, https://ngvamerica.org/environment/?msclkid=787e309ece7411ecacf726e33f83661d (last visited May 13, 2022).

According to EPA's GHG Inventory, the largest source of carbon dioxide ('CO2'), and of overall GHG emissions, is fossil fuel combustion primarily from transportation and power generation.5 RNG is key to reducing these emissions and meeting this Administration's climate change goals. In 2021, 64 percent of all on-road fuel used in NGVs was RNG.6 Using California Air Resources Board data, the average carbon intensity value of RNG in its Low Carbon Fuel Standard program was carbon negative at -44.41 gCO2e/MJ for calendar year 2021. Based on this data, RNG use in transportation fuel displaced 3.8 million metric tons of CO2 equivalent in 2021, which is equivalent to removing CO2 emissions from more than 427 million gallons of gasoline consumed. [EPA-HQ-OAR-2019-0055-1204-A1, p.2]

5 See EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020, at ES-7 (2022), available at https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2020.

6 NGVAmerica and RNG Coalition, Decarbonize Transportation with Renewable Natural Gas, May 2022, available at https://ngvamerica.org/resource-center/.

Importantly, RNG use can provide significant GHG emissions reductions today. NGVAmerica reports that 74 percent of heavy-duty trucks are not certified to the latest NOx emission standard.7 Fleet turnover is important to ensuring the emissions reductions being sought are actually achieved. 'Technological and commercial maturity of medium- and heavy-duty natural gas vehicles have encouraged adoption of natural gas for commercial vehicle fleets, with reported reductions in the total cost of ownership through fuel cost savings and reduced maintenance, in addition to substantial emission reductions.'8 'RNG availability enhances the economic value of converting trucking and municipal fleets from diesel to natural gas, which in turn supports investments in supply infrastructure, increasing the value and viability of further conversions.'9 EPA's proposal should ensure that it is supporting these conversions and increased use of RNG in the transportation fuel sector. A large part of EPA's focus, however, appears to be to transition to electric vehicles, which is much more difficult to accomplish in the heavy-duty sector and is likely on a much longer time frame. [EPA-HQ-OAR-2019-0055-1204-A1, p.3]

7 NGVAmerica, Breathe Cleaner Air Right Now, https://ngvamerica.org/environment/?msclkid=787e309ece7411ecacf726e33f83661d (last visited May 13, 2022).

8 Bates White Economic Consulting, Renewable Natural Gas: Transportation Demand, at 4 (2022), available at https://static1.squarespace.com/static/53a09c47e4b050b5ad5bf4f5/t/626c52a437caa619cddf533b/1651266213212/Bates+White+RNG+Transpo+Demand+Study+Feb+2022+plus+April+2022+Supplement.pdf.

9 Id. at 3.

EPA recognizes that development of electric vehicles and hydrogen fuel cell heavy-duty vehicles, while considered to be zero emissions, may be more challenging. 87 Fed. Reg. at 17,562. While we believe EPA should recognize all the available technologies to reduce emissions and ensure that NGVs are equally supported (not just electric vehicles),10 it should be noted that RNG can be used to produce renewable hydrogen. Renewable hydrogen at scale could significantly reduce carbon emissions from the heavy-duty transportation sector where electrification is difficult or impossible, such as in the heavy-duty transportation sector. When renewable hydrogen production is paired with carbon capture and sequestration, the RNG process is ultimately carbon-negative. Therefore, the material used for RNG today can be deployed as renewable hydrogen, providing another avenue for zero-carbon and carbon-negative renewable gas in the energy, transportation, and industrial sectors. [EPA-HQ-OAR-2019-0055-1204-A1, p.3]

10 Nonetheless, we agree that EPA should not provide multipliers for electric vehicles to meet the NOx emissions standards. See, e.g., 87 Fed. Reg. at 17,426. In light of the numerous benefits of NGVs today and the incentives already included for electric vehicles, it is unclear why electric vehicles should receive additional incentives to meet any of the standards being proposed, particularly where NGVs provide similar emissions profiles, and, when using RNG, can provide even better lifecycle GHG emissions reductions. Because of the various sources of biogas, RNG can be an available (and abundant) fuel across the entire country. Nonetheless, much of the use in the transportation fuel sector is concentrated in California due to that state’s low-carbon fuel standard, and NGVs similarly could benefit from incentives for increased investment in infrastructure, such as fueling stations, nationally.

In short, this Administration’s decarbonization and clean air goals will only be achieved by focusing on a multi-technology approach. RNG provides a cost-effective, carbon-negative solution, that can provide carbon reductions right away. EPA’s proposal should take this into account and, as appropriate, support continued production and expansion of NGVs and hydrogen fuel cell vehicles, not just electric vehicles. [EPA-HQ-OAR-2019-0055-1204-A1, p.3]

Organization: *Cummins Inc. (Cummins)*

Internal combustion engines fueled by hydrogen (H2 ICE) are under development at Cummins (see Hydrogen Engines). H2 ICE offers the potential for significant near-term emissions reductions because it is an affordable zero carbon, low NOx technology that can be produced at scale at existing manufacturing facilities. However, more regulatory clarity is needed for manufacturers to certify such engines to applicable criteria pollutant and GHG emissions standards. Regulation updates may be needed to address emissions measurement and testing, OBD, DF testing, etc., to recognize this advanced technology. In addition, regulatory incentives that would recognize H2 ICE as a ZEV-like zero carbon technology would help drive demand for H2 ICE, which in turn would accelerate the development of the hydrogen refueling infrastructure that will be needed to support the future implementation of hydrogen fuel cell vehicles. Cummins would like to work with EPA as this rule is finalized and during the Phase 3 GHG rulemaking to address specific needs. [EPA-HQ-OAR-2019-0055-1325-A1, p. 20]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

Hydrogen-Fueled Internal Combustion Engines (H2-ICEs) provide an important pathway to rapid penetration of vehicles with effectively zero CO2 emissions and near-zero NOx emissions. This rulemaking presents an opportunity for EPA to encourage innovation in alternate fuel engine development generally, and H2-ICEs specifically. Currently H2-ICE new technology is in the primitive proof-of-concept stage of innovation, and regulatory pathways are needed to bring this new near-zero CO2 and NOx technology to the market. Such technology could bring carbon neutral transportation to sectors that are not currently ripe for battery or fuel-cell applications, given the current state of technology development. It could also create a use-case for widespread hydrogen fueling, which could spur the development of hydrogen infrastructure and lay the groundwork for future fuel cell vehicles, which would rely on the same infrastructure. We also believe that H2-ICE is a favorable technology, even in the long term, for vehicles with high power demands and high daily mileage requirements (which BEVs and FCEVs may not serve well). Daimler Truck's vision for H2-ICE applicability in a zero-emissions future is illustrated in Figure 47 below: [EPA-HQ-OAR-2019-0055-1168-A1, p.125]

Importantly, this technology can be implemented rapidly, using existing products, processes, and technical expertise. In concept, H2-ICEs are very similar to existing combustion engines and can leverage the extensive technical expertise manufacturers have developed with existing products—in many cases, using the same components for many key systems. Similarly, these products can be built on the same assembly lines, by the same workers and with existing supply chains already in place, preventing costly plant retooling and American manufacturing job losses. H2-ICEs thus have an important role to play in facilitating the ZEV transition with minimal supply chain and economic disruptions. [EPA-HQ-OAR-2019-0055-1168-A1, p.126]

Although H2-ICE technology is promising, it is in an infant state, and near-term penetration potential is relatively low. By developing a regulatory framework that facilitates H2-ICE development, EPA could speed the adoption of such technology and help revolutionize certain applications in the HD transportation sector that are otherwise difficult to decarbonize. This could be achieved by eliminating regulatory obstacles to market introduction of H2-ICEs.

Specifically, EPA should use the opportunity presented in this rulemaking to create a favorable regulatory environment for these engines by providing relief in areas such as DF testing, GHG certification and testing requirements (under Parts 1036 and 1037), and expensive diagnostic requirements. [EPA-HQ-OAR-2019-0055-1168-A1, p.126]

Daimler Truck has performed a concept study of H2-ICE by converting a diesel engine to adapt all the relevant hardware components to accommodate H2 combustion. The results are shown in Figure 48. Along with effectively zero CO2 emissions, near-zero NOx emissions are also possible with H2-ICE innovative technology. Engine-out NOx levels are extremely low when compared to diesel emissions, and the temperatures created are extremely favourable for adapting existing SCR aftertreatment technologies—leading to further NOx reductions. [EPA-HQ-OAR-2019-0055-1168-A1, p.126]

Similarly, when measured at the tailpipe, CO2 emissions from these vehicles are extremely low—two orders of magnitude lower than a conventionally-fueled heavy duty engine. Figure 49 below shows a typical breakdown of CO2 emissions as measured at the tailpipe of an H2-ICE. Most of these emissions are ambient in nature (e.g., from the ambient air, or from the carbon content of urea) and do not represent a net increase of CO2 to the environment. EPA already allows the removal of background CO2 from emissions calculations; in these conditions, H2-ICE engines are as close as practical to zero, and are competitive with BEVs and FCEVs from a total carbon lifecycle perspective. [EPA-HQ-OAR-2019-0055-1168-A1, pp.126-127]

As manufacturers move aggressively towards decarbonization, global consistency in the regulatory approach to ZEVs is essential to provide the certainty and predictability necessary to spur investment, especially in markets that are likely to adopt such technologies first. European Union (EU) regulators have already recognized the advantages of H2-ICE engines, and the EU framework provides a path for these engines to be certified as ‘zero-emission heavy-duty vehicles’ by defining such vehicles as follows: ‘Zero-emission heavy-duty vehicle’ means a heavy-duty vehicle without an internal combustion engine, or with an internal combustion engine that emits less than 1 g CO 2 /kWh as determined in accordance with Regulation (EC) No 595/2009 and its implementing measures, or which emits less than 1 g CO 2 /km as determined in accordance with Regulation (EC) No 715/2007 of the European Parliament and of the Council and its implementing measures.138 [EPA-HQ-OAR-2019-0055-1168-A1, p.127]

138 See Regulation (EU) 2019/1242, Art. 3(11) (June 20, 2019).

It is also expected that the EU regulations will be further updated to more explicitly recognize these engines as a zero-emission technology. Such recognition provides significant benefits for manufacturers by reducing regulatory burdens, as well as development and certification costs, and by otherwise incentivizing commercialization. [EPA-HQ-OAR-2019-0055-1168-A1, p.128]

Similarly, CARB ZEV standards for passenger cars and light-duty trucks already recognize extremely low-emissions from H2-ICEs, providing a mechanism for manufacturers to generate credits for producing such vehicles that can be applied towards their ZEV sales obligations: (E) Credit for Hydrogen Internal Combustion Engine Vehicles. A hydrogen internal combustion engine vehicle that meets the requirements of subdivision 1962.2(c)(2) and has a total range of at least 250 UDDS miles will earn an allowance of 0.75, which may be in addition to allowances earned in subdivision 1962.2(c)(3)(A), and subject to an overall credit cap of 1.25.139 [EPA-HQ-OAR-2019-0055-1168-A1, p.128]

139 See 13 CCR 1962.2(c)(3)(E).

We recommend that EPA recognize, as CARB and the EU have, the potential of H2-ICE engines to play an important role in the zero-emission transition, and to take steps to reduce regulatory burden and incentivize manufacturers to introduce this technology. As a global manufacturer with deep roots in U.S. and European market, Daimler Truck recommends global alignment in recognizing H2-ICE as a zero-emission technology. [EPA-HQ-OAR-2019-0055-1168-A1, p.128]

EPA could reduce manufacturer burden, and thereby accelerate the penetration of zero-CO2 technologies in the commercial truck sector, by regulating HDVs with H2-ICEs as ZEVs, or, at a minimum, by removing the most costly and onerous engine certification requirements. [EPA-HQ-OAR-2019-0055-1168-A1, p.128]

Currently the market for H2-ICE technology, especially in the near-term, is limited. Since H2 infrastructure does not exist in any significant quantity, it is expected that manufacturers will face difficulties recouping their H2-ICE investment costs, and a high regulatory burden may prevent manufacturers from bringing these technologies to market. [EPA-HQ-OAR-2019-0055-1168-A1, p.128]

By making several changes to how H2-ICE vehicles are certified, EPA could regulatory burdens in a manner that would help to ensure the success of these new technologies, enabling immediate carbon reductions at low cost and with few lost jobs. [EPA-HQ-OAR-2019-0055-1168-A1, p.128]

First, we recommend that EPA recognize vehicles powered by H2-ICEs as effectively zero emission, placing them in a category similar to BEVs and FCEVs, which do not require costly certification, demonstration, diagnostic, and compliance requirements. We do not believe such compliance obligations have any value with respect to H2-ICE emissions performance, since the engines already emit effectively no CO2, NOx, PM, and other constituent pollutants of concern— even in degraded or failed states, based on the fundamental physics governing this combustion cycle and fuel. ZEV recognition for these products would significantly incentivize their production, as they would qualify for emissions credits and advanced credit multipliers in the same manner as BEVs and FCEVs. [EPA-HQ-OAR-2019-0055-1168-A1, p.128]

Alternatively, if EPA decides to continue to require H2-ICEs to be certified under its program for traditional combustion engines, we recommend that EPA significantly reduce the certification burden by making the following modifications to its certification requirements:

- ***Reduced DF validation burden and Durability requirements***.
    - DF validation is extremely expensive and burdensome, and carries a several-year lead-time to complete for new technologies.

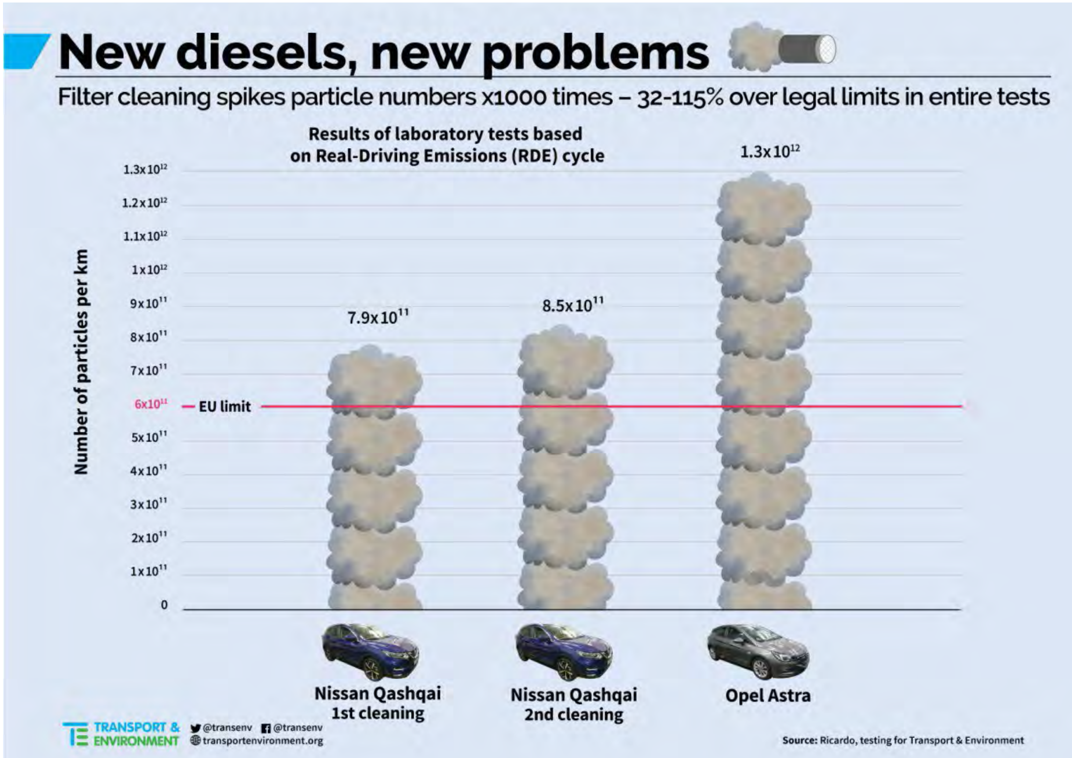
- EPA could allow manufacturers to attest to durability and useful life requirements (as proposed for ZEV durability and useful life requirements in the NPRM).
- EPA could consider a reduced Useful Life standard for H2-ICE in the HHD category - consistent with how SI engines in the LHD and MHD categories are treated.

- ***Simplified OBD regulation***.
  - The development and demonstration of an OBD system, as required in EPA's proposed Section 1036.110, is extremely time consuming, expensive, and risky for manufacturers.
  - It also drives significant material cost to the engine, as sensors are added purely for the purpose of diagnostic requirements.
  - The combustion mechanisms of an H2-ICE mean that, even in a failed condition, increased emission potential is extremely limited. CO_2, PM, and hydrocarbon emissions are effectively zero in any combustion regime with H_2 fuel, and even in the case of a failed catalyst, engine-out NO_x emissions are extremely low with this technology. The value of an OBD system in an H2-ICE-powered vehicle is extremely limited—especially when considered in light of its cost.
  - EPA could reduce this burden by requiring the OBD system only to detect circuit faults—which make up the vast majority of real world failures—and avoid requirements for threshold diagnostics and rationality checks which add cost and complexity and are onerous to develop and demonstrate.
- ***Simplified GHG regulation and certification.***
  - Current certification procedures and demonstration requirements are not necessary for the demonstration of an engine that does not use carbon as a fuel.
  - EPA could declare such engines to emit zero CO_2 for the purposes of GEM inputs for vehicle certification under 40 C.F.R. Part 1037 and allow a default FCL/FEL of zero g/hp-hr for engine GHG certification under 40 C.F.R. Part 1036. [EPA-HQ-OAR-2019-0055-1168-A1, p.129]

EPA has an important opportunity in this rulemaking to encourage the development of technologies with effectively zero CO_2 emissions today, in applications that would not otherwise be ripe for ZEV penetration in the foreseeable future. Daimler Truck recommends that EPA work with manufacturers to determine the best path to enable these technologies. [EPA-HQ-OAR-2019-0055-1168-A1, p.129]

Organization: *David Pedersen*

Furthermore, as the Federal Register document for this proposed rule explains, the existing emissions controls – most notably the DPF (a euphemistic term which conceals the true name PTOX, or particulate-trapping oxidizer) and SCR systems – are known to cause not only downtime and in-use de-rating problems[2]; they are also emissions sources in their own sense. When regenerating, DPFs emit 1000 times the legal soot limit for up to 15 kilometres (ca. 9.3 miles) or more[3], often in populated areas where soot accumulates more rapidly due to lower engine RPMs and thus cooler combustion:



https://www.transportenvironment.org/wp-content/uploads/2021/07/New-diesels-new-problems-filters.png

This essentially deletes (no pun intended) the purpose of the DPF, which is to trap and neutralize diesel particulate matter before it escapes into the ambient air where it poses a risk to all living things in the vicinity. SCR also suffers from a similar issue, in which raw ammonia is released from the exhaust due to the inherent inefficiencies in the thermal decomposition of the urea and subsequent reaction between the ammonia and exhaust-stream NOx. Such a problem can be life-threatening, as was tragically demonstrated by the death of the worker at the arena in Fernie British Columbia. I will point out here that diesel soot is also a climate issue, as the IPCC has repeatedly noted that soot – a short-lived climate forcer – must be significantly reduced in order to meet the Paris Accord's target of keeping the global average temperature anomaly (increase) to below 1.5 degrees Celsius (2.7 degrees Fahrenheit).[4] As such, it is clear that continuing to try to clean up diesel emissions is futile and dangerous, and that expedited electrification is the clear winner and a necessity in order for America to meet its public-health obligations (both legally and morally). [EPA-HQ-OAR-2019-0055-1059]

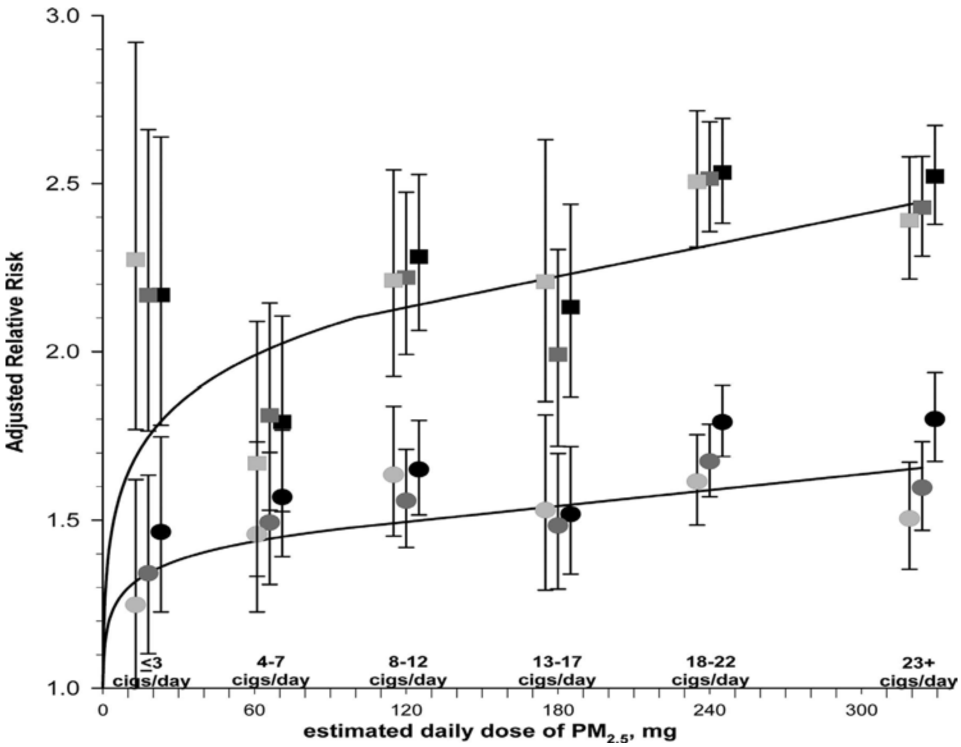
It is bad enough that truck and non-road machinery owners and operators are forced to endure the problems associated with and caused by DPFs and SCR – technologies that I believe should never have been mandated, which the science increasingly agrees with me on. However, it is also inexcusable that so many people are forced to breathe diesel exhaust (and its constituent components) against their will, as it is clearly a violation of their constitutional rights (including the rights to life, liberty, and security of the person). [EPA-HQ-OAR-2019-0055-1059]

There is also a golden opportunity for mandating electric vehicles; the technology is advancing so rapidly that there will easily be all-electric trucks and buses, and off-road vehicles and machinery, available and market-ready by as early as 2025, so the Agency can and should take a hard look at where things stand and set the *earliest* date for the phase-out of sales of new diesel vehicles and machinery. The sooner such a mandate is implemented, the sooner the suffering will stop. [EPA-HQ-OAR-2019-0055-1059]

In summary, I urge the Agency to abandon its proposed rulemaking unless it is willing to mandate electric trucks as soon as possible AND eliminate the need for DPFs and SCR to decrease the burden on owners and operators and increase the safety of the public. [EPA-HQ-OAR-2019-0055-1059]

[2] https://downloads.regulations.gov/EPA-HQ-OAR-2019-0055-0983/content.pdf
[3] https://www.transportenvironment.org/discover/new-diesels-particle-emissions-spike-1000-times-normal-levels-tests/
[4] https://www.ipcc.ch/site/assets/uploads/2019/02/1805_Expert_Meeting_on_SLCF_Report.pdf

There are also 2 attachments: screenshot of T&E article and this:



Organization: *Eaton Vehicle Group (Eaton)*

2. **The regulations need to be based on data that evaluates recent technologies developed to address the NOx challenges, accounting for major improvements achieved since the data used in the NPRM was created.** The EPA evaluations of Aftertreatment-focused technologies recently published show marginal feasibility of Option 1. However, Eaton and other suppliers have developed an array of technologies, 6 years ahead of the new regulations, that show in a certification test environment that CARB limits are achievable through <u>multiple pathways</u>, with <u>compliance margins well in excess of 40%</u>, with <u>less fuel consumed (CO2 neutral or better)</u>,

based on conventional, robust and very cost-effective components. [EPA-HQ-OAR-2019-0055-1252-A1, p.2]

Eaton and other suppliers, in collaboration with Southwest Research Institute (SwRI), have tested a significant array of NOx reduction technologies using the same certification-oriented test rig as the work in support of developing both the Omnibus and EPA standards. The data from these investigations showed in 2021 that the Omnibus 2027 NOx levels are achievable with margins in excess of 40%, while contributing to lower CO2 emissions, at reasonable cost increments that are offset by fuel savings, and with robust technologies designed for the life of the truck. We have recently supplied the relevant data to the EPA for consideration. Below are a few salient examples: [EPA-HQ-OAR-2019-0055-1252-A1, p.2]

- In a recent memo1, the EPA showed results of an advanced Aftertreatment system that achieved 20mg NOx on the Composite FTP cycle at 435,000 miles, which is the exact limit of the Omnibus and Option 1 proposed limit in 2027. Eaton added Cylinder Deactivation (CDA) as an active thermal management technology, and in the new configuration, we demonstrated 18 mg in 20192 with a 0.5% CO2 improvement, and then further improved to 15 mg NOx in 20203, while maintain lower CO2 emissions. On the LLC cycle, the EPA measured 29mg, well within the Omnibus and Option 1 limit of 50mg. The addition of CDA technology, further reduced the LLC emissions to 24mg. Thus, the addition of the CDA technology enables achieving the most stringent targets of the Omnibus rule and Option 1 with a 25% margin on the FTP cycle and 50% margin on the LLC cycle seven years ahead of actual implementation using a technology that has been used in gasoline engines for over two decades. [EPA-HQ-OAR-2019-0055-1252-A1, p.2]

  1 Test Results from EPA Diesel Engine Demonstration, May 3rd 2022, Docket EPA-HQ-OAR-2019 0055

  2 Neely, G., Sharp, C., Pieczko, M., and McCarthy, J. Jr., 'Simultaneous NOx and CO2 Reduction for Meeting Future CARB Standards Using a Heavy-Duty Diesel CDA-NVH Strategy,' SAE Int. J. Engines 13(2):2020, https://www.sae.org/publications/technical-papers/content/03-13-02-0014/, first published online Dec. 10, 2019

  3 Matheaus, A., Neely, G. A., Sharp, C. A., Hopkins, J. and McCarthy, J. Jr., 'Fast Diesel Aftertreatment Heat-up Using CDA and an Electrical Heater,' SAE 2021-01-0211, April 6, 2021.

- In addition, Eaton and other suppliers examined the effects of using alternative active heating, implemented through either electrical heaters or fuel burners. The addition of the electrical heater achieved 16 mg on the Composite FTP cycle (and 0.9% CO2 improvement) and 12mg on the LLC cycle (with an additional 1.8% CO2 savings). Further refinements in calibrations4 achieved 12mg on the FTP cycle, while saving 1.5% CO2. Together these configurations show that the compliance margins are significant: 40% on FTP and 50%-75% on LLC (while also improving CO2 by 2.9%). Noteworthy is that tests of the Beverage cycle produced 1 mg/hp-hr NOx, which would be considered near-zero and less than 10% of the LLC certification value. [EPA-HQ-OAR-2019-0055-1252-A1, p.3]

4 Zavala, B., McCarthy Jr., J., Matheaus and Sharp, C. A., 'Fast Diesel Aftertreatment Heat-up Using CDA and an Electrical Heater between 1.2 and 5.0 kW,' Accepted in Frontiers In Mechanical Engineering, April 11, 2022

- Eaton and other suppliers also evaluated active heating using a fuel burner5. Together with the advanced Aftertreatment system aged at 435,000 miles and CDA, the NOx emissions achieved were 12 mg on the Composite FTP and under 10 mg on the LLC cycle, demonstrating 40% and 80% compliance margin to Option 1 and Omnibus levels. [EPA-HQ-OAR-2019-0055-1252-A1, p.3]

5 Thomas Harris, James McCarthy, Jr., Chris Sharp, Bryan Zavala and Andrew Matheaus, Meeting Future NOx Emissions Limits with Improved Total Fuel Efficiency, ATZ live: Heavy-Duty, On- and Off-Highway Engines 2021, Heavy-Duty_2021_Paper_14, 12/1/21

- The results above led us to explore eliminating the need of the Light-Off Catalyst and achieve the emissions using a conventional Aftertreatment architecture and active heating. In this configuration (CDA engine, heater and conventional Aftertreatment), we achieved 6mg on the LLC cycle (an 88% compliance margin) and near-zero (1 mg) on realistic drive cycles (beverage truck cycle)6. Updated calibrations recently achieved 11 mg on the LLC and 20mg on the Composite FTP. These results are not yet optimized but are encouraging as they achieve the Omnibus and Option 1 levels for the FTP and an 80% margin on the LLC. Further optimization of calibrations is expected to recover margin on the FTP cycle as well. However, these results are significant because they achieve the NOx targets using conventional Aftertreatment, while the additional technologies (CDA and burners) are designed for the life of the truck and not subject to the high initial cost and degradation of the catalysts when using a Light-Off SCR. [EPA-HQ-OAR-2019-0055-1252-A1, p.3]

6 McCarthy, J. Jr., Matheaus, A., Zavala, B., Sharp, C. and Harris, T., 'Meeting Future NOx Emissions Over Various Cycles Using a Fuel Burner and Conventional Aftertreatment System, SAE 2022-01-0539, 3/29/2022

- A different approach to achieving low NOx is afforded by the Exhaust Gas Recirculation (EGR) pump, which in conjunction with advanced turbomachinery, helps achieve a 4% reduction in CO27. However, the EGR pump also is capable of reducing the engine-out NOx by 40-60% while raising exhaust temperature at low load and idle. Using a similar approach, Achates Power (on a different engine architecture but using the same physics principles) also demonstrated better than 50% compliance margin with Option 1 and the Omnibus limits. While the EGR pump is a new technology, it relies on conventional Roots rotor technology that Eaton has manufactured for over 50 years. [EPA-HQ-OAR-2019-0055-1252-A1, p.3]

7 Nilesh Bagal, Chris Bitsis, Analytical and Experimental Evaluation of Next Generation High Efficiency Powertrains with 48V EGR Pump, Vienna Engine Symposium, 2022

The key results to date (5 years ahead of proposed implementations) based on Aftertreatment systems aged at 435,000 miles, can be summarized as follows: [EPA-HQ-OAR-2019-0055-1252-A1, p.3]

In conclusion, we recommend the Agency adopts a modification of Option 1 that aligns with the CARB Omnibus limits because:

- This approach achieves a single national standard that includes the needs of states with non-attainment issues, hence it is a long-term solution that provides stability and incentives to invest.
- The limits are in fact achievable with significant compliance margin, with multiple technology pathways, based technologies that are robust (in fact modifications of existing technologies) and designed for the life of the truck.
- The incremental costs of these technologies are minimal (approximately 3% of the truck or less) and many options also reduce CO2 (and thus also achieve fuel savings), as illustrated in the surveys by National Renewable Energy Lab, CARB, and Manufacturers of Emissions Controls Association (representing the suppliers that actually design, produce and sell the technologies above). [EPA-HQ-OAR-2019-0055-1252-A1, p.4]

4. **The regulations should drive simultaneous NOx and CO2 reduction**. There are multiple pathways for internal combustion-based powertrains to achieve stringent NOx levels, together with 5-10% CO2 reduction. [EPA-HQ-OAR-2019-0055-1252-A1, p.5]

As shown above, there are several technology pathways to achieve the low NOx limits proposed in the Omnibus rule and Option 1. Some of these also reduce CO2, and thus have value in both achieving the 2027 GHG limits as well as real fuel efficiency benefits that translate in transportation fuel cost reductions, which further helps reduce the modest incremental costs of the additional technologies. To illustrate this point we submit the following examples: [EPA-HQ-OAR-2019-0055-1252-A1, p.5]

- CDA has an immediate CO2 benefit at low load (5-20%, but also 1% on GHG cycles). However, the CDA function is a significant part of high efficiency engine braking, thus its incremental costs are in fact small and they enable higher power engine brakes as well.
- Electric heaters typically require 48V power. Once installed on the vehicle, this is the basis of micro- and mild-hybridization, with benefits in the range of 2-3% (micro) and 5-8% (mild).
- Furthermore, the additional electrical power has non-emission benefits such as power for advanced computing needed for ADAS applications or power for electrical HVAC that improves driver comfort through faster cabin cooling.
- Heavy Duty electrical diesel hybrids have potential as vocational powertrains with 15%-25% CO2 reduction, while providing full heater capability for the Aftertreatment function

- EGR pumps enable better breathing and efficient turbo machinery with a 4% CO_2 benefit but also 40%-60% engine-out NOx, and up to 90C temperature increase that reduces the load on the Aftertreatment system. [EPA-HQ-OAR-2019-0055-1252-A1, p.5]

We recommend the following:

- The Agency should take into consideration the system-level effects of combining the low NOx and low CO_2 technologies when calculating the impact and cost of compliance. [EPA-HQ-OAR-2019-0055-1252-A1, p.5]

Organization: *Environmental Defense Fund (EDF) (1265 and 2855)*

Current zero-emission technologies are capable of dramatically reducing NOx emissions. In fact, the White Paper EDF has submitted along with these comments finds that ZEV deployment in the 2027-2029 timeframe can deliver 840,000 tons of NOx reductions beyond EPA's proposed option 1 through 2050 and 2.2 million tons of NOx reductions beyond a 2026 baseline through 2050. Accordingly, in both these and future standards, we prefer that EPA adopt multipollutant standards that achieve reductions in both criteria and climate pollution and drive zero-emitting technologies. A multipollutant approach is firmly grounded in EPA's authorities under 202(a)(1), discussed above, and 202(a)(3), which, directs the Administrator to establish standards for NOx and particulate matter reflecting the 'greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology.' [EPA-HQ-OAR-2019-0055-1265-A1, p.22]

Setting standards in this manner would allow both a heavy-duty NOx engine standard and a heavy-duty GHG standard to be set in a way that incorporates the dual criteria and climate benefits of zero-emission vehicles and ensure there are not pollution trade-offs between two different sets of standards and between ICE vehicles and ZEVs. As addressed in more detail in our comments on EPA's proposed adjustments to the Phase 2 GHG standards, it is clear that a rapid increase in the market share of zero emission vehicles has begun and will continue in the coming years. Neither EPA's proposed NOx nor GHG standard adequately account for this market shift. While EPA has estimated that ZEVs will comprise 1.5 percent of the fleet during the period of these standards, analysis conducted by ERM projects ZEV sales of up to 34 percent in 2027-29.99 [EPA-HQ-OAR-2019-0055-1265-A1, p.22]

99 See supra fn 72.

Organization: *Fuel Cell and Hydrogen Energy Association (FCHEA)*

Hydrogen has significant potential to promote environmental justice. Using hydrogen as a fuel or energy source in combination with fuel cells produces no NOx, SOX, and particulate matter that directly affect corridor adjacent communities. For example, replacing heavy-duty trucks, port equipment, buses, vans, and other vehicles with zero-emission fuel cell electric options would significantly reduce harmful pollutants and noise in these communities, improving local air quality and public health. These medium– and heavy-duty vehicles are especially important from an environmental justice standpoint as our nation's highways often cut through disadvantaged and minority communities. [EPA-HQ-OAR-2019-0055-1187-A2, p. 2]

Organization: *International Council on Clean Transportation (ICCT)*

Major suppliers continue to develop and test technologies that can be used to simultaneously achieve lower NOx emissions and reduced CO2/fuel consumption. An example is the Eaton Corp development of a 48- volt electric heater to increase catalyst inlet temperatures at low loads. The heater combined with cylinder deactivation cut low load NOx emissions in half compared to cylinder deactivation alone, while reducing CO2 and fuel consumption by nearly 2 percent. FTP CO2/fuel consumption was reduced by slightly less than 1 percent.10 Another example is use of an EGR pump to optimize turbocharger and EGR flow. Testing at SwRI indicates a fuel consumption reduction of approximately 3 percent on the hot FTP.11 [EPA-HQ-OAR-2019-0055-1211-A1, pp. 8 - 9]

10. SAE paper 2021-01-0211, Tables 8 and 17a, April 6, 2021.

11. Int'l Vienna Engine Symposium 2022 – Session: Latest results in engine and component development

Another promising option for compliance with the proposed Option 1 standards is the opposed piston diesel engine being developed by Achates Power in San Diego, CA. On the dynamometer the demonstration engine met the proposed 2031 NOx standards using a current, conventional aftertreatment system. More importantly, this 400 hp, 10.6-liter diesel engine has been installed in a Peterbilt class 8 tractor and placed into fleet service by Walmart. Recent PEMS testing of this truck performed by UC Riverside demonstrated NOx emissions over 50 percent below the proposed in-use limits. Walmart also compared fuel consumption of the Achates/Peterbilt truck to a comparable truck with a Detroit Diesel 15-liter engine. The Achates-powered truck had 10 percent better fuel economy. An independent study showed the cost of volume production of the opposed piston engine including compliance with the proposed standards will cost no more and possibly less than current diesel engines.12 This technology provides a second feasible pathway for engine manufacturers to meet the proposed standards. [EPA-HQ-OAR-2019-0055-1211-A1, p. 9]

12. https://achatespower.com/wp-content/uploads/2022/04/Achates-Power-Heavy-Duty-Diesel-In-Use-Testing-Results.pdf

Organization: *Loren Marz*

There should be some provision for use of renewable/synthetic diesel fuels in any future regulatory action regarding GHG emissions. In some scenarios, these non-fossil diesel fuels are more effective in reducing overall GHG emissions than electrification. See, e.g., https://pubs.acs.org/doi/10.1021/acs.est.0c05893, https://www.velocys.com/2019/10/10/negative-emission-fuel-agreement/. [EPA-HQ-OAR-2019-0055-1394]

Organization: *Mass Comment Campaign sponsored by Climate Action Campaign (22,659)*

- Cleaner trucks are not only available and ready now, they also are projected to deliver critical cost savings for operators and drivers. [EPA-HQ-OAR-2019-0055-1193, p.1]

- Across nearly every vehicle class, zero-emission electric trucks and buses are projected to be cheaper to own and operate than their combustion engine counterparts within five years. [EPA-HQ-OAR-2019-0055-1193, p.1]

Organization: *Mass Comment Campaign sponsored by Union of Concerned Scientists - 2 (959)*

Lastly, in addition to phasing out diesel engines, the rule should make clear that natural gas-powered engines are not the solution. Studies have shown that trucks running on methane can be as polluting as diesel, and we need to be driving investments in cleaner energy sources, not deploying more fossil fuel infrastructure.4 [EPA-HQ-OAR-2019-0055-1608-A1, p.1]

> 4 https://theicct.org/publication/a-comparison-of-nitrogen-oxide-nox-emissions-from-heavy-duty-diesel-natural-gas-and-electric-vehicles/

Organization: *Manufacturers of Emission Controls Association (MECA)*

In addition to on engine and aftertreatment technology innovation over the course of the demonstration program, a new engine architecture has been developed and tested. The engine has been commercialized by Achates Power and is a 400 hp, 10.6L opposed-piston configuration. Besides being tested on an engine dynamometer, the engine has been installed in a Peterbilt 579 tractor that is current in fleet service with Walmart. The results from the test program show that the opposed piston engine combined with current commercially available aftertreatment systems can achieve NOx emissions of 0.007 g/bhp-hr on the FTP cycle, 0.014 g/bhp-hr on the SET, 0.02 g/hr on the clean idle cycle and 0.021 g/bhp-hr on the LLC after 435,000 equivalent aging. These values offer substantial margin (30-65%) relative to the 2031 limit of the Proposed Option 1 standards with greater than 50% margin under all operating modes [14]. [EPA-HQ-OAR-2019-0055-1320-A1, p.8]

> [14] A. Salvi, F. Redon, D. Youngren and L. Fromm, 'Low CO2, Ultralow NOx Heavy Duty Diesel Engine: Experimental Results (SAE 2022-01-0426),' SAE WCX, April 2022.

Another promising technology that is being explored to both reduce the NOx and GHG footprint of heavy-duty vehicles is the hydrogen internal combustion engine (H2ICE). These engines, when coupled with advanced NOx aftertreatment, have the potential to meet the proposed NOx limits while emitting zero tailpipe carbon emissions when operated on any hydrogen fuel and zero lifecycle carbon emissions when operated on renewable green hydrogen. There is broad industry support for internal combustion engines fueled with clean hydrogen, including most engine manufacturers and component suppliers conducting significant development work and on-road demonstration in trucks. H2ICE are attractive options in commercial trucking where challenges exist in applying current BEV technology, with one of the main benefits being the opportunity to leverage existing investments in manufacturing capacity in engines and aftertreatment while growing the market for on-board hydrogen storage technology and infrastructure. [EPA-HQ-OAR-2019-0055-1320-A1, pp.8-9]

H2ICE vehicles share many components with today's diesel and natural gas powered vehicle fleet, including the base engine, installation parts, powertrain components and aftertreatment system architectures. Furthermore, H2ICE can borrow technology from currently available natural gas engines, such as cylinder heads, ignition systems, fuel injection, turbochargers, cooled exhaust gas recirculation (EGR), and engine control unit/software, among others. Nearly all on-road and off-road engine OEMs, along with their suppliers, are developing H2ICE for commercial introduction in the MY 2025-2027 time frame. [EPA-HQ-OAR-2019-0055-1320-A1, p.9]

Engines and aftertreatment systems can be designed and optimized for simultaneous reductions in NOx and CO2 emissions. [EPA-HQ-OAR-2019-0055-1320-A1, p.10]

The penetration of fuel-saving technologies into the heavy-duty fleet has been spurred by U.S. EPA's Heavy-Duty Greenhouse Gas Phase 1 and Phase 2 Standards. At the same time, research undertaken by multiple teams as part of the Department of Energy's SuperTruck I program has demonstrated how these technologies can be combined to achieve a 16% boost in fuel economy and improved freight efficiency. Participants in the SuperTruck II program have been demonstrating even greater gains in fuel and freight efficiency, with engines achieving 55% brake thermal efficiency through the use of technologies like waste heat recovery. Last year DOE awarded five OEMs funding to develop electric powertrains in SuperTruck III. [EPA-HQ-OAR-2019-0055-1320-A1, pp.10-11]

Component suppliers have continued to innovate, and many technologies that were not even considered as compliance options in the Phase 2 rule are now likely to be deployed on limited engine families in 2024 and more broadly in 2027. Furthermore, engine efficiency technologies – such as cylinder deactivation, advanced turbochargers, and hybridization – have also been demonstrated in combination with advanced aftertreatment technologies on heavy-duty diesel engines. Testing has shown the ability of several advanced engine technologies to be optimized to improve fuel efficiency while increasing exhaust temperature in diesel engine exhaust, which improves SCR NOx reduction performance. [EPA-HQ-OAR-2019-0055-1320-A1, p.11]

The calibration of internal combustion engines is a delicate balance that has to deal with trade-offs to optimize performance and emissions. For example, there is an inverse relationship between PM and NOx emissions that engine manufacturers applied to meet emission standards up through the 2006 heavy-duty highway regulations. In 2007, the requirement to reduce both PM and NOx emissions caused OEMs to install DPFs on diesel vehicles, which allowed engine calibrators to optimize the combustion in the engine to meet lower NOx emissions while relying on the DPF to remediate the resulting higher PM emissions. This example of effective emission regulations provided a technology solution to overcome the traditional barriers of engine thermodynamics. In 2010, SCR systems were installed on most trucks in response to a further tightening of NOx limits. SCR allowed calibrators to not only reduce the soot load on DPFs (and in turn provide a better NOx-to-soot ratio to promote passive soot regeneration) as a way of improving fuel efficiency but also to take advantage of another well-known trade-off in combustion thermodynamics between fuel consumption (or CO2 emissions) and NOx emissions from the engine. [EPA-HQ-OAR-2019-0055-1320-A1, p.11]

Since 2010 the predominant technologies to reduce tailpipe NOx from diesel engines have been EGR from the engine and SCR in the exhaust, and every generation of SCR system has led to improvements in catalyst conversion efficiency. In 2011, U.S. EPA adopted federal GHG standards for heavy-duty trucks that were implemented in 2014 through 2020. The Phase 2 regulation was adopted in 2016 to cover trucks from 2021 through 2027. Engine manufacturers quickly recognized SCR as a very effective technology option that has allowed them to meet the first phase of heavy-duty GHG standards while still achieving NOx and PM reduction targets from the engine. OEMs have accomplished this by calibrating new engines to burn less fuel and rely on the SCR system to remediate the additional NOx emissions that result from such calibration. [EPA-HQ-OAR-2019-0055-1320-A1, p.11]

The portfolio of technology options available to reduce GHG emissions from heavy-duty trucks and engines is continually growing in response to federal GHG standards. In fact, a review of heavy-duty engine certifications from 2002 to 2019 shows that once emission control and efficiency improving technologies were required on engines in 2010-2011, the inverse relationship between CO2 and NOx emissions at the tailpipe was overcome and both were reduced simultaneously (see Figure 1). Several engines certified since 2010 have shown the ability to achieve 0.1 g/bhp-hr or lower NOx emissions over the composite FTP certification cycle, which is 50% below the current standard. Of those engines, several have demonstrated the ability to meet future Phase 2 GHG regulation limits for vocational engines that go into effect in 2021, 2024 and 2027. Setting stringent emission targets for both CO2 and NOx through realistic regulations has caused engine calibrators to expand their toolbox from the engine to the powertrain to enable simultaneous NOx reductions and engine efficiency improvements. [EPA-HQ-OAR-2019-0055-1320-A1, pp.11-12]

Advances in thermal management, air handling and electrification technologies enable high catalyst performance required to reduce NOx to meet the proposed emission standards. [EPA-HQ-OAR-2019-0055-1320-A1, p.12]

Thermal management of the SCR system is critical to achieving low NOx emissions during low load operation. Traditionally, under colder exhaust operating conditions, engines would be calibrated to run hotter via higher idle speeds, late fuel injection into cylinders or by injecting fuel over the DOC to keep aftertreatment hot, both of which result in additional fuel consumption and CO2 emissions. Recent emission control packaging architectures have included innovations in materials and designs to minimize thermal losses from the exhaust system. Double-walled exhaust pipes and canning designs with either air gaps or ceramic fiber insulation – as well as packaging exhaust components close together in a compact space, referred to as a 'one-box system' – help retain exhaust heat over long periods. [EPA-HQ-OAR-2019-0055-1320-A1, p.12]

In addition to passive ways to retain heat in the exhaust system, technologies can be installed on engines that deliver exhaust heat when needed. It is possible to use bypass hardware to minimize heat loss in turbochargers or EGR coolers, upstream of the exhaust system. All modern diesel engines include turbochargers to provide boost and increased fuel economy and EGR systems to control NOx emissions. These can both contribute to lower exhaust temperatures by either converting the heat into useful boosting work or reducing the combustion temperature for in-cylinder NOx control, which results in lower heat energy in the exhaust stream through their operation. During low-speed operation and low exhaust flow, a turbocharger offers limited boost. Therefore, in the future, engines may employ turbocharger and EGR bypass valves that can be activated at times when it is more desirable to deliver hot exhaust to downstream catalysts for warm-up and stay-warm operation. Transient response challenges that may result from bypass systems can be resolved with electric assist motors built into the turbocharger or by the addition of an electric or mechanically driven boost compressor. [EPA-HQ-OAR-2019-0055-1320-A1, p.13]

At low load, a bypass alone may not yield enough heat using standard diesel engine combustion techniques. Several advanced thermal management strategies will provide options for engine manufacturers to calibrate engines to simultaneously heat up exhaust and save fuel, which can offset the costs of the technologies to their customers. Technologies such as fuel burners and electric heaters in combination with cylinder deactivation and advanced aftertreatment systems have been demonstrated to achieve ultra-low NOx levels without increasing CO2 emissions [3] [4] [5]. The reason for this is due to their efficiency in generating heat compared to traditional methods of late post-injection of fuel across a DOC. In fact, these technologies have been tested across several drive cycles in conjunction with the systems in the SwRI demonstration program. Results for the FTP show the ability to meet 0.012 g/bhp-hr with a 1.6% reduction in CO2. Depending on the actual calibration and control of the heat source, the system can be optimized to reduce both NOx and CO2 or favor one of these for greater reductions while holding the other neutral. [EPA-HQ-OAR-2019-0055-1320-A1, p.13]

[3] J. McCarthy, Jr., A. Matheaus, B. Zavala, C. Sharp and T. Harris, ‘Meeting Future NOx Emissions Over Various Cycles Using a Fuel Burner and Conventional Aftertreatment System (SAE-2022-01-0539),’ SAE WCX, April 2022.

[4] T. Harris, R. Bellard, M. Muhleck and G. Palmer, ‘Pre-Heating the Aftertreatment System with a Burner (SAE 2022-01-0554),’ SAE WCX, April 2022.

[5] A. Matheaus, G. Neely, C. Sharp, J. Hopkins and J. McCarthy, Jr., ‘Fast Diesel Aftertreatment Heat-up Using CDA and an Electric Heater (SAE 2021-01-0211),’ SAE WCX, April 2021.

Cylinder deactivation (CDA) is an established technology on light-duty vehicles, with the primary objective of reducing fuel consumption and CO2 emissions. This technology combines hardware and software computing power to, in effect, 'shut down' some of an engine’s cylinders, based on the power demand, and keep the effective cylinder load in an efficient portion of the engine map without burning more fuel. Based on decades of experience with CDA on passenger cars and trucks, CDA is now being adapted to heavy-duty diesel engines. On a diesel engine, CDA is programmed to operate differently than on gasoline engines, with the goal of the diesel engine running hotter in low load situations by having the pistons that are firing do more work. This programming is particularly important for vehicles that spend a lot of time in creep and idle operation modes. During low load operation, CDA has resulted in exhaust temperatures increasing by 50°C to 100°C when it is most needed to maintain effective conversion of NOx in the SCR. In some demonstrations, CDA has been combined with a 48V mild hybrid motor with launch and sailing capability to extend the range of CDA operation over the engine, and this may deliver multiplicative CO2 reductions from these synergistic technologies [15]. [EPA-HQ-OAR-2019-0055-1320-A1, p.13]

[15] MECA, 'Technology Feasibility for Heavy-Duty Diesel Trucks in Achieving 90% Lower NOx Standards in 2027,' 2020. Online at https://www.meca.org/wp-content/uploads/resources/MECA_2027_Low_NOx_White_Paper_FINAL.pdf.

The use of variable valve actuation (VVA) is another approach for active thermal management. VVA approaches include: early exhaust valve opening (EEVO), early intake valve closing (EIVC) or late intake valve closing (LIVC), all considered active thermal management strategies. Both EIVC and LIVC reduce the amount of air trapped at valve closing. Both methods reduce the effective compression ratio and volumetric efficiency, resulting in lower NOx emissions and reduced air-fuel ratio, and in turn, hotter exhaust temperature. EEVO results in hotter exhaust gas to heat-up aftertreatment; however, more fueling is needed to maintain brake power output. This results in a CO2 emissions penalty that must be accounted for in calibrating for better fuel economy and higher engine-out NOx during hot operation when the SCR can be used to remediate NOx emissions. VVA offers some potential cost savings and is therefore used in some medium-duty applications as a fast heat-up strategy. OEMs will have multiple pathways at varying costs to achieve their thermal management objectives and achieve ultra-low NOx emissions in low-load and low-speed operation. [EPA-HQ-OAR-2019-0055-1320-A1, p.14]

Modern turbochargers have a variety of available design options enabling lower CO2 emissions by improving thermal management capability, such as: i.) state of the art aerodynamics, ii) electrically-actuated wastegates that allow exhaust gases to by-pass the turbocharger to increase the temperature in the aftertreatment, and iii.) advanced ball bearings to improve transient boost response. These and other technologies are available to support further reductions in CO2 and emissions. More advanced turbochargers are designed with a variable nozzle that adjusts with exhaust flow to provide more control of intake pressure and optimization of the air-to-fuel ratio for improved performance (e.g., improved torque at lower speeds) and fuel economy. These variable geometry turbochargers (VGT), also known as variable nozzle turbines (VNT) and variable turbine geometry (VTG), also enable lower CO2 emissions through improved thermal management capability to enhance aftertreatment light-off. Finally, modern turbochargers have enabled engine and vehicle manufacturers the ability to downsize engines, resulting in fuel savings without sacrificing power and/or performance. The latest high-efficiency turbochargers are one of the more effective tools demonstrated in the DOE SuperTruck program [17]. In addition to affecting the power density of the engine, turbochargers play a significant role in NOx and CO2 regulations compliance. Continuous improvement in turbocharger technology is making it possible to run very lean combustion (high air/fuel ratios), which is efficient. This improvement allows for very low particulate generation and even low engine-out NOx. [EPA-HQ-OAR-2019-0055-1320-A1, p.14]

> [17] Navistar, 'Final Scientific/Technical Report for SuperTruck Project: Development and Demonstration of a Fuel-Efficient, Class 8 Tractor & Trailer Engine System,' 2016.

Turbo-compounding is a variant of turbocharger technology that allows for the mechanical energy from the exhaust gas to be extracted and added to the engine crankshaft through a transmission. Mechanical turbo-compounding has been employed on some commercial diesel engines, and EPA estimated penetration to reach 10% in the U.S. by the time the Phase 2 GHG Regulation is fully implemented in 2027 [18]. An early 2014 version of a turbo-compound-equipped engine was used during the first stage of testing at SwRI under the CARB HD Low NOx Test Program, and the results from this engine with advanced aftertreatment have been summarized in several SAE technical papers [10, 8, 9]. While turbo-compounding has the potential to reduce fuel consumption, it can result in lower exhaust temperatures that can challenge aftertreatment performance. Therefore, it is important to consider turbo-compound designs that incorporate bypass systems during cold start and low load operation or electrically driven turbo-compounding systems where the unit can be placed after the aftertreatment system. [EPA-HQ-OAR-2019-0055-1320-A1, pp.14-15]

> [8] C. Sharp, C. C. Webb, G. Neely, M. Carter, S. Yoon and C. Henry, 'Achieving Ultra Low NOx Emissions Levels with a 2017 Heavy-Duty On-Highway TC Diesel Engine and an Advanced Technology Emissions System - Thermal Management Strategies (SAE 2017-01-0954),' SAE International Journal of Engines, vol. 10, no. 4, pp. 1697-1712, 2017.
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> [9] C. Sharp, C. C. Webb, S. Yoon, M. Carter and C. Henry, 'Achieving Ultra Low NOx Emissions Levels with a 2017 Heavy-Duty On-Highway TC Diesel Engine - Comparison of Advanced Technology Approaches (SAE 2017-01-0956),' SAE International Journal of Engines, vol. 10, no. 4, pp. 1722-1735, 2017.
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> [10] C. Sharp, C. C. Webb, G. Neely, J. V. Sarlashkar, S. B. Rengarajan, S. Yoon, C. Henry and B. Zavala, 'Achieving Ultra Low NOx Emissions Levels with a 2017 Heavy-Duty On-Highway TC Diesel Engine and an Advanced Technology Emissions System - NOx Management Strategies (SAE 2017-01-0958),' SAE International Journal of Engines, vol. 10, no. 4, pp. 1736-1748, 2017.
>
> [18] U.S. EPA, 'Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles -- Phase 2,' Federal Register, pp. 73478-74274, 25 October 2016.

Driven turbochargers can be used to control the speed of the turbomachinery independently of the engine's exhaust flow and vary the relative ratio between engine speed and turbo speed. Driven turbochargers may be utilized for several reasons, including performance, efficiency, and emissions. Considered an 'on-demand' air device, a driven turbocharger also receives transient power from its turbine. During transient operation, a driven turbocharger will behave like a supercharger and consume mechanical or electrical energy to accelerate the turbomachinery for improved engine response. At high-speed operation, the driven turbocharger will return mechanical or electrical power to the engine in the form of turbo-compounding, which recovers excess exhaust power to improve efficiency. This cumulative effect lets a driven turbocharger perform all the functions of a supercharger, turbocharger, and turbo-compounder. NOx emission control uniquely benefits from the application of driven turbochargers in several ways, including the ability to decouple EGR from boost pressure, reduce transient engine-out NOx, and improve aftertreatment temperatures during cold start and low load operation. Bypassing a driven turbine can provide quick temperature rises for the aftertreatment while still delivering the necessary boost pressure to the engine through supercharging, which also increases the gross load on the engine to help increase exhaust temperature [19]. Testing has shown that routing engine exhaust to the aftertreatment by bypassing a turbocharger is one of the most effective methods to heat up the aftertreatment [15]. [EPA-HQ-OAR-2019-0055-1320-A1, p.15]

> [15] MECA, 'Technology Feasibility for Heavy-Duty Diesel Trucks in Achieving 90% Lower NOx Standards in 2027,' 2020. Online at https://www.meca.org/wp-content/uploads/resources/MECA_2027_Low_NOx_White_Paper_FINAL.pdf.
>
> [19] J. Brin, J. Keim, E. Christensen, S. Holman and T. Waldron, 'Applying a Driven Turbocharger to Improve Diesel NOx Conversion,' in SAE WCX, Detroit, MI, 2022.

48-volt mild hybrid electrical systems and components are expected to make their way onto heavy-duty vehicles in the near future. These 48-volt systems can be found on many light-duty vehicle models (primarily in Europe) from Mercedes, Audi, VW, Renault and PSA. In the U.S., FCA is offering a 48-volt system on the RAM 1500 pick-up and the Jeep Wrangler under the eTorque trademark. Because the safe voltage threshold is 60 volts, which is especially important when technicians perform maintenance on the electrical system, 48-volt systems are advantageous from an implementation standpoint. From a cost perspective, 48-volt systems include smaller starter and wire gauge requirements, offering cost savings from a high voltage architecture of a full hybrid. The U.S. Department of Energy's SuperTruck II program teams employed 48-volt technologies on their vehicles to demonstrate trucks with greater than 55% brake thermal efficiency. A recent study demonstrated through model-based simulations that a 48-volt technology package combined with advanced aftertreatment can achieve a composite FTP emission level of 0.015 g/bhp-hr [20]. [EPA-HQ-OAR-2019-0055-1320-A1, p.15]

> [20] F. Dhanraj, M. Dahodwala, S. Joshi, E. Koehler, M. Franke and D. Tomazic, 'Evaluation of 48V Technologies to Meet Future CO2 and Low NOx Emission Regulations for Medium Heavy-Duty Diesel Engines (2022-01-0555),' in SAE WCX, Detroit, MI, 2022.

Similar to the passenger car fleet, truck OEMs are considering replacing traditionally mechanically-driven components with electric versions to gain efficiency. Running accessories off of 48-volt electricity rather than 12-volts is more efficient due to reduced electrical losses and because components that draw more power, such as pumps and fans, have increased efficiency when operating at higher voltages. The types of components that may be electrified include, electric turbos, electronic EGR pumps, AC compressors, electrically heated catalysts, electric cooling fans, oil pumps and coolant pumps, among others. Another technology that 48-volt systems could enable is electric power take-offs rather than using an engine powered auxiliary power unit or idling the main engine during hoteling while drivers rest. MECA members supplying commercial 48V components for commercial vehicles believe that the technology may be feasible to apply to a limited number of engine families by 2024, and it is likely to see greater penetration by 2027, especially on Class 8 line-haul where full hybridization is less practical. [EPA-HQ-OAR-2019-0055-1320-A1, pp.15-16]

Mild hybridization covers a range of configurations, but a promising one includes an electric motor/generator, regenerative braking, electric boost and advanced batteries. Stop/start deployment also provides a thermal management benefit to the aftertreatment by preventing cooling airflow through the aftertreatment during hot idle conditions. In this way, 48-volt mild hybridization is complementary technology to CDA and start-stop capability, allowing the combination of multiple technologies on a vehicle to yield synergistic benefits and justify the cost. By shutting off the engine at idle or motoring using start/stop, micro hybrid technology can help to maintain aftertreatment temperature by avoiding the pumping of cold air through the exhaust. Capturing braking energy and storing it in a small battery for running auxiliary components when the engine is off offers another CO2 reducing strategy for OEMs to deploy. [EPA-HQ-OAR-2019-0055-1320-A1, p.16]

In lighter medium-duty applications, advanced start-stop systems have been developed that use an induction motor in a 48-volt belt-driven starter-generator (BSG). When the engine is running, the motor, acting as a generator, will charge a separate battery. When the engine needs to be started, the motor then applies its torque via the accessory belt and cranks the engine instead of using the starter motor. The separate battery can also be recharged via a regenerative braking system. In addition to the start-stop function, a BSG system can enhance fuel economy even during highway driving by cutting off the fuel supply when cruising or decelerating. Such systems can also be designed to deliver a short power boost to the drivetrain. This boost is typically 10 to 20 kW and is limited by the capacity of the 48V battery and accessory belt linking the motor to the crankshaft. New designs are linking the BSG directly to the crankshaft and allowing additional power boost of up to 30kW to be delivered, giving greater benefits to light and medium commercial vehicles [15]. [EPA-HQ-OAR-2019-0055-1320-A1, p.16]

> [15] MECA, ‘Technology Feasibility for Heavy-Duty Diesel Trucks in Achieving 90% Lower NOx Standards in 2027,’ 2020. Online at https://www.meca.org/wp-content/uploads/resources/MECA_2027_Low_NOx_White_Paper_FINAL.pdf.

Full hybrid configurations are currently found on several models of light-duty passenger cars and light trucks in the U.S. and a limited number of medium-duty trucks. These include models that can also be plugged-in to enable some all-electric operation, usually described as all-electric range (AER). A full hybrid can enable electrification of many of the components described above for mild hybrid vehicles, but the higher voltages allow for more parts to be electrified and to a larger degree. Full hybrids implement larger electric motors and batteries, which support greater acceleration capability and regenerative braking power. Mild hybridization is well-suited to heavy-duty vehicles used for long-haul transportation because of the limited fuel economy of a full hybrid at highway speeds. Full hybridization and electrification are more practical for small heavy-duty vehicles (e.g., Class 4-6) that do not travel long distances or operate for long periods without returning to a central location. Full hybrid vehicles have made the highest penetration into parcel delivery, beverage delivery and food distribution vehicles because they can take advantage of regenerative braking in urban driving [21]. We expect to see some application of strong hybrids combined with a low NOx engine to reduce CO2 emissions in several vocational applications. Integrated electric drivetrain systems, consisting of a fully qualified transmission, motor and power electronics controller, are now commercially available. With power levels of over 160kW and the ability to meet high torque requirements, these systems enable electrification of medium-duty commercial vehicles. There is also an increasing number of electric drivetrain solutions up to 300kW that are suitable for Class 8 vehicles that can be used with either battery or fuel cell power sources [15]. [EPA-HQ-OAR-2019-0055-1320-A1, pp.16-17]

> [15] MECA, 'Technology Feasibility for Heavy-Duty Diesel Trucks in Achieving 90% Lower NOx Standards in 2027,' 2020. Online at https://www.meca.org/wp-content/uploads/resources/MECA_2027_Low_NOx_White_Paper_FINAL.pdf.
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> [21] CARB, 'Draft Technology Assessment: Heavy-Duty Hybrid Vehicles,' 2015.

As noted above, the types of technologies that enable electrified heavy-duty vehicles are already commercially available with more anticipated by 2027. MECA supports EPA's proposal to revise the Phase 2 vehicle GHG limits for MY 2027 based on EPA's analysis in this rule of the projected penetration of heavy-duty electric vehicles. Some barriers that remain, such as infrastructure needs, should be addressed through state and national efforts. MECA supports EPA revisiting projections of heavy-duty electric vehicle penetration, as challenges to electrification of the heavy-duty sector are overcome. [EPA-HQ-OAR-2019-0055-1320-A1, p.17]

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

MEMA strongly discourages any technology mandates (i.e., avoid ZEV mandates). [EPA-HQ-OAR-2019-0055-1322-A1, p. 8]

Organization: *Moving Forward Network (MFN)*

EPA's rule stringencies do not fully reflect the technological capability to reduce emissions of nitrogen oxides from conventionally powered vehicles in the timeframe of this rule. The co-proposed options considered by EPA (Options 1 and 2) are not reflective of the full range of emissions reductions technology potential for diesel engines. Below, we outline ways in which the proposal must be strengthened to reflect the best available evidence. [EPA-HQ-OAR-2019-0055-1277-A1, p. 23]

Mild hybridization is an emissions reduction strategy that is synergistic with the VVA strategy mentioned previously. Mild hybridization can offer a lower cost opportunity for emissions reductions than strong hybrids, particularly with increasing movement towards 48V electrification. Higher voltage allows for more efficient power distribution, and shifting the number of hydraulically or mechanically-driven accessories to electric operation has benefits not just for efficiency but also packaging of the engine compartment. A 48V mild hybrid system simply builds upon these already existing rationale for moving to a 48V electric system and uses it for better regenerative braking and more responsive stop-start. [EPA-HQ-OAR-2019-0055-1277-A1, p. 25]

Many strategies would benefit from 48V mild hybridization—for example, a 48V electrical system is an enabler for devices like an electrically driven turbocharger,103 an electrically heated catalyst,104 or an electrified EGR pump.105 Recent analysis shows such a system deployed in a medium-duty application is capable of simultaneously meeting both a 20 mg/bhp-hr standard on the FTP cycle and its 2027 GHG target.106 A recent study by Eaton at SwRI showed that an electric heater connected to a 48V system worked synergistically with CDA, further reducing fuel use while improving NOx reduction at low-load conditions.107 According to the paper, this system, too, is broadly applicable to a range of heavy-duty classes and operating conditions. [EPA-HQ-OAR-2019-0055-1277-A1, p. 25]

103. MECA. 2020. Technology feasibility for heavy-duty diesel trucks in achieving 90 percent lower NOx standards in 2027. February 2020. Online at http://www.meca.org/resources/MECA_2027_Low_NOx_White_Paper_FINAL.pdf.

104. Dorobantu, M. 2019. Commercial Vehicle Powertrains in the Era of Simultaneous NOx and CO2 Reduction. (Presentation). 16th SAE Brasil forum on diesel and alternative technologies for commercial and off-road vehicles, September 4, 2019.

105. McCarthy 2019b

106. Dhanraj et al. 2022

107. Matheaus et al. 2021

The cost-competitiveness of these 48V systems is well established. One analysis projected that 48V systems in line-haul operation would cost less than $7,000 for up to 4 percent fuel savings in 2025.108 A recent report by the National Academies estimated 2022 costs for a 48V mild hybrid system to range from $4,584- 5,010 (Class 4) up to $10,080-11,700 (Class 8 vocational), noting that “costs will likely come down in the 2022 and 2030 timeframes,” with fuel savings ranging from 16-22 percent depending on the duty cycle.109 These costs are substantially reduced compared to those previously used by EPA.110 [EPA-HQ-OAR-2019-0055-1277-A1, p. 25]

108. Tarnutzer, S.A. 2017. New and Emerging Energy Conversion Opportunities. (Presentation). SAE Commercial Vehicle Engineering Conference, Chicago, Sept. 2017.

109. NRC. 2020. Reducing Fuel Consumption and Greenhouse Gas Emissions of Medium- and Heavy-Duty Vehicles, Phase Two: Final Report. Washington, DC: The National Academies Press. Online at https://doi.org/10.17226/25542. p. 230.

110. Compare to EPA-420-R-16-900, p. 2-175.

EPA noted the potential for opposed-piston engines to play a significant role in emissions reductions:

“Opposed-piston engine technology has not yet been proven feasible in Class 8 on-highway applications, but if feasibility is shown, then the technology could provide another pathway to ultralow NOx, high efficiency engine technology for heavy-duty vehicle fleets. If the demonstration project cited above is successful, then it may lead to early-commercial deployment of opposed piston diesel engines for heavy-duty on-highway applications in the near-term. As such, it may be reasonable to anticipate commercialization of heavy-duty opposed-piston diesel engine technology by model year 2027.” (EPA Draft RIA, p. 22) [EPA-HQ-OAR-2019-0055-1277-A1, p. 26]

Recent data from Achates Power confirms the success of the cited demonstration program, with wide margins for compliance. Lab test results confirm that this engine design is capable of meeting simultaneously EPA’s greenhouse gas engine emissions requirements for 2027 and the Omnibus rule, “in a cost-effective and robust manner.”111 [EPA-HQ-OAR-2019-0055-1277-A1, p. 26]

111. Salvi, A., Redon, F., Youngren, D., and Fromm, L., “Low CO2, Ultralow NOx Heavy Duty Diesel Engine: Experimental Results,” SAE Technical Paper 2022-01-0426, 2022, doi:10.4271/2022-01-0426.

Not only has this novel design been confirmed in the lab, but this engine is now being deployed in real world operation, pulling freight for Wal-Mart. Early test results indicate compliance with EPA’s proposed in-use requirements.112 [EPA-HQ-OAR-2019-0055-1277-A1, p. 26]

112. https://achatespower.com/wp-content/uploads/2022/04/Achates-Power-In-Use-Emissions-Measurements.pdf

It is vital that EPA avoid incentivizing natural gas vehicles, which perpetuate reliance on fossil fuels whose production and use—from drilling to transporting to refining to storage—is rife with emissions that adversely impact communities, public health, and the environment.175 Moreover, supporting combustion technologies, particularly where additional fueling infrastructure is required, locks in long-term fossil fuel investments that risk becoming stranded assets. [EPA-HQ-OAR-2019-0055-1277-A1, p. 44]

175 https://envhealthcenters.usc.edu/infographics/infographic-natural-gas

Beyond the financial and stranded cost risks, there is also risk that natural gas vehicles will not achieve their claimed emission levels. Preliminary results from an on-going study of 200 medium- and heavy-duty vehicles show that natural gas vehicles emit well above their certification when tested in the real world.176 Thirty natural gas vehicles certified at the current NOx standard of 0.2 grams per brake horsepower hour (g/bhp-hr) and 15 natural gas vehicles certified at the optional low NOx standard of 0.02 g/bhp-hr were tested using a Portable

Emission Measurement System (PEMS). The results were alarming, with 0.2- certfied vehicles emitting, on average, roughly double their certification rate, and the 0.02-certified vehicles emitting roughly triple (Figure 7). [EPA-HQ-OAR-2019-0055-1277-A1, pp. 44 - 45]

> 176 https://ww2.arb.ca.gov/sites/default/files/2021-04/Natural_Gas_HD_Engines_Fact_Sheet.pdf

The study also found that “[a]s vehicles age and accumulate mileage, emission control systems can deteriorate as a result of natural degradation or mal-maintenance, which can lead to emissions that are often much higher than their certification standard.” A related study comparing technology specific emission control system deterioration found that as natural gas vehicles age, they can and do pollute more than their diesel counterparts and, by extension, exponentially more than EVs.177 [EPA-HQ-OAR-2019-0055-1277-A1, p. 45]

> 177 Marc Besch et al., In-use emissions and chassis dynamometer emissions rates of heavy-duty diesel and alternative fueled vehicles operating in Southern California, 30th CRC Real World Emissions Workshop (Mar. 2021) [hereinafter “30th CRC Real World Emissions Presentation”].

Organization: *National Association of Clean Water Agencies (NACWA)*

NACWA asks that EPA include NZEVs that are fueled by biogas produced by POTWs. Utilities across the country are expanding their efforts to recover the resources available from wastewater, including biogas that is produced from the anaerobic digestion of biosolids. Biogas production can be increased through co-digestion of biosolids and food waste, which is becoming more common as communities and states encourage or require the diversion of food waste from landfills. Since the disposal of food waste in landfills increases the fugitive methane emissions from landfills, co-digestion and use of biogas as a vehicle fuel can result in significant greenhouse gas emission reductions. EPA should therefore provide incentives for renewable biogas – whether produced from anaerobic digestion of biosolids alone or co-digestion with food waste – to be used as a vehicle fuel for NZEVs. [EPA-HQ-OAR-2019-0055-1343-A1, p.2]

Organization: *National Center for Health Research (NCHR)*

Lastly, in addition to phasing out diesel engines, the rule should make clear that natural gas-powered engines are not the solution. Research has shown that trucks running on methane can be as polluting as diesel, and any future investments should ensure cleaner energy sources, rather than incentivize the extraction, transportation or use of fossil fuels. [4] [EPA-HQ-OAR-2019-0055-1227-A1, p.1]

> [4] The International Council on Clean Transportation. A Comparison of Nitrogen Oxide (NOx) Emissions from Heavy-Duty Diesel, Natural Gas, and Electric Vehicles. https://theicct.org/publication/a-comparison-of-nitrogen-oxide-nox-emissions-from-heavy-duty-diesel-natural-gas-and-electric-vehicles/.
> September 2021.

Organization: *National Propane Gas Association (NPGA) and Propane Education & Research Council (PERC)*

The current propane vehicle market as well as the evolution of renewable propane are evidence of the industry's abilities to meet the environmental goals of the agency. Renewable propane has entered the U.S. and European markets, unveiling new opportunities to transition from conventional fuel and equipment to renewable fuel produced from vegetable oil, used cooking oil, animal tallow and biomass waste. 14 Renewable propane maintains all the advantages of conventional propane, but with even greater reductions in lifecycle carbon dioxide emissions.15 One domestic operation based in Louisiana produces approximately 75 million gallons/year of renewable fuels including renewable propane.16 Starting this year, a new biorefinery in California is slated to produce 13 million gallons/year of renewable propane.17 The produced renewable propane is currently utilized in the propane market throughout the U.S. with a carbon intensity of 20.5 – 43.5 gCO2e/MJ.18 Further, renewable propane is identical in chemical composition to conventional propane, which means that it is a drop-in replacement for conventional propane applications and engines and equipment do not require add-ons or modification to utilize renewable propane or a blend of renewable and conventional propane, in contrast to diesel and electric alternatives. [EPA-HQ-OAR-2019-0055-1263-A1, pp.3-4]

14 REG, REG Renewable Autogas – Brining 'Bio' to Propane, https://www.regi.com/products/transportation-fuels/reg-renewable-propane; see also NESTE, Products, Renewable Propane, https://www.neste.com/companies/products/renewable-fuels/renewable-propane.

15 REG, REG Renewable Autogas – Brining 'Bio' to Propane, https://www.regi.com/products/transportation-fuels/reg-renewable-propane.

16 Supra note 15.

17 Press Release, UGI Corporation, UGI and Global Clean Energy Announce Partnership to Distribute Renewable LPG (Feb. 15, 2022), https://www.ugicorp.com/news-releases/news-release-details/ugi-and-global-clean-energy-announce-partnership-distribute.

18 LCFS Pathway Certified Carbon Intensities, California Air Resources Board, https://ww2.arb.ca.gov/resources/documents/lcfs-pathway-certified-carbon-intensities.

We ask the agency to consider the modifications and advantages shared through this comment in order to present the most beneficial landscape for all alternative fuels. We recognize the value of uniform nationwide standards to relieve burdens for our manufacturing partners. Under Option 1 of the proposal, the propane industry is best positioned to assist the agency in reaching its environmental goals. We encourage the agency to revise the maximum butanes standard to yield further benefits. Also, we emphasize the innovation of the propane industry in the research, development, and deployment of renewable propane to progress the advantages the industry offers. [EPA-HQ-OAR-2019-0055-1263-A1, p.4]

Organization: *Natural Gas Vehicles for America (NGVAmerica)*

Ultra-low NOx medium- and heavy-duty natural gas-powered trucks and buses are on the road today and perform at levels that are 95 percent below the current federal NOx standard and 98 percent below the federal particulate matter standard. When fueled by renewable natural gas (RNG) recovered from landfills, wastewater treatment facilities, and food and agricultural waste digesters, these trucks and buses produce greenhouse gas emissions that are up to 331 percent lower than diesel powered vehicles and deliver carbon neutral or carbon negative emissions in even the most specialized real-world applications. [EPA-HQ-OAR-2019-0055-1330-A1, p.1]

The latest data from California's Low Carbon Fuel Standard program demonstrates how clean and low carbon RNG fueled heavy-duty vehicles truly are. The most recent data (Q4, 2021) confirms that the average carbon intensity (CI) value of California's bio-CNG mix is -62.3 gCO2e/MJ and has had a negative CI value for the last six reporting quarters. California fleets that fueled with bio-CNG in 2020 achieved carbon negativity for the first time ever, with an annual average CI score of -5.85 gCO2e/MJ. The 2021 annual average CI was -44.41 gCO2e/MJ as a result of more, lower-carbon fuel coming into the mix.1 [EPA-HQ-OAR-2019-0055-1330-A1, p.2]

1https://ww2.arb.ca.gov/resources/documents/low-carbon-fuel-standard-reporting-tool-quarterly-summaries

Based on data available from 2021, NGVAmerica and the Coalition for Renewable Natural Gas calculate that domestically produced, low-carbon, renewable natural gas now accounts for 64 percent of natural gas used in on-road transportation.2 This important milestone is made possible by the U.S. EPA's implementation of the Renewable Fuel Standard, and other important regulatory programs that encourage the production of low-carbon fuels and the deployment of advanced clean technology vehicles. [EPA-HQ-OAR-2019-0055-1330-A1, p.2]

2 https://ngvamerica.org/wp-content/uploads/2022/05/NGV-RNG-Decarbonize-2022-5.2.22.pdf

We fervently believe that the Administration's decarbonization and clean air goals will only be achieved by focusing on a multi-technology approach that includes cost-effective carbon-negative solutions like RNG trucks that can begin accruing and compounding significant clean air and carbon reductions right away. We, therefore, respectfully request that EPA build on the incentives it has proposed in this rulemaking to included additional incentives for natural gas vehicles and engines. [EPA-HQ-OAR-2019-0055-1330-A1, p.2]

Many state and local authorities have requested that EPA adopt a new limit of 0.02 grams per brake-horsepower-hour (0.02 g/bhp-hr), a level that is 90 percent more demanding than the current federal limit of 0.20 g/bhp-hr. California state authorities have adopted new engine standards that require moving to the 0.02 NOx level beginning in 2027. [EPA-HQ-OAR-2019-0055-1330-A1, p.3]

Engine manufacturers that produce EPA and California Air Resources Board (CARB) certified natural gas-powered engines already meet the 0.02 NOx standard, and more, even cleaner natural gas engines are on the way as a result of research and development programs that include additional development of lower-polluting engines and also hybridization of natural gas platforms. Businesses that produce lower polluting natural gas engines and vehicles can deliver the benefits this rulemaking seeks without waiting for new developments or the statutory lead time requirements imposed on EPA. Natural gas-powered vehicles also provide significant reductions of greenhouse gas emissions due to the fact that an increasingly larger percentage of natural gas used in the on-road transportation market is renewable natural gas, sourced from renewable feedstock. [EPA-HQ-OAR-2019-0055-1330-A1, p.3]

In this rulemaking, EPA can lead the way for new, cleaner emission standards; but EPA also could have a more immediate impact on emissions if it accelerates efforts to turn over the legacy fleet of older, more polluting vehicles, and ensures that natural gas vehicles and other cleaner fueled vehicles are given full consideration. The Bipartisan Infrastructure Law provides billions in new funding to accelerate use of low- and zero-emission technologies. To ensure that the benefit of this funding is maximized, it is critical that policy makers give full consideration of all available options and evaluate technologies based on cost-effectiveness as opposed to trying to ensure that one technology is selected. [EPA-HQ-OAR-2019-0055-1330-A1, p.3]

There is no reason to wait to act until new standards are developed and implemented since vehicles and engines powered by natural gas are already available today, delivering significant emission reductions across every on-road application. In the near term, EPA could have a significant impact on the market for commercially available, natural gas vehicles by leveling the playing field in incentives and ensuring fair regulatory treatment relative to other technologies. EPA’s notice is extremely frank about the reasons that it has provided significant regulatory credits for electric vehicles. Pertinent parts of that discussion are provided here:

As stated in the HD GHG Phase 2 rulemaking, our intention with these multipliers was to create a meaningful incentive to those considering adopting these qualifying advanced technologies into their vehicles. The multipliers are consistent with values recommended by California Air Resources Board (CARB) in their supplemental HD GHG Phase 2 comments.802 CARB’s values were based on a cost analysis that compared the costs of these technologies to costs of other conventional GHG-reducing technologies. Their cost analysis showed that multipliers in the range we ultimately promulgated would make these technologies more competitive with the conventional technologies and could allow manufacturers to more easily generate a viable business case to develop these technologies for heavy-duty vehicles and bring them to market at a competitive price. As we stated in the 2016 HD GHG Phase 2 final rule preamble, we determined that it was appropriate to provide such large multipliers for these advanced technologies at least in the short term, because they have the potential to provide very large reductions in GHG emissions and fuel consumption and advance technology development substantially in the long term. However, because the credit multipliers are so large, we also stated that we should not necessarily allow them to continue indefinitely. Therefore, they were included in the HD GHG Phase 2 final rule as an interim program continuing only through MY 2027. [EPA-HQ-OAR-2019-0055-1330-A1, pp.3-4]

The above restated passages appear on pages 17594 and 17595 of the Federal Register notice. It is noteworthy that the credits are not based on current emission benefits. The credits are based on cost with the intent on making electric vehicles 'more competitive' with conventional technologies. We are mindful that EPA has sought to balance the use of credits with other safeguards, but it is also important to note that these incentives are anti-competitive when it comes to natural gas vehicles because they create an unlevel playing field. Natural gas vehicles involve significant cost (like hydrogen fueled vehicles) due to their low-volume and the cost of the storage vessels and systems. Like electric vehicles operating on a renewable grid,3 natural gas vehicles when powered by RNG have the potential to deliver significant greenhouse emission reductions and therefore should be similarly encouraged. Thus, EPA has every reason to treat natural gas vehicles like electric vehicles when providing regulatory incentives – moreover, since natural gas has largely not qualified for these incentives, it is reasonable to extend similar size incentives for natural gas technology at least for a period of time to allow natural gas trucks to increase in market share. [EPA-HQ-OAR-2019-0055-1330-A1, p.4]

> 3 According to the U.S. Energy Information Administration, in 2020 renewable energy sources accounted for about 12.6% of total U.S. energy consumption and about 19.8% of electricity generation.

It is important to note that these Ultra-Low NOx natural gas engines – commercially available, scalable and supported by a mature infrastructure of fuelers and suppliers today – perform at or below certification standards during a full range of duty cycles. A report by the University of California Riverside's College of Engineering – Center for Environmental Research and Technology found that while natural gas technology was cleaner than certified standards across duty cycles, its heavy-duty diesel counterparts emitted higher levels of NOx than their certification standards in the same duty cycle.4 [EPA-HQ-OAR-2019-0055-1330-A1, pp.4-5]

> 4 'Ultra-Low NOx Natural Gas Vehicle Evaluation,' University of California Riverside, CE-CERT, November 2016. Available at: https://cngvc.org/wp/wp-content/uploads/2017/03/UCR-UltraLow-NOx_NGV-Evaluation_Final-Report.pdf.

Further, a November 2019 study by the International Council on Clean Transportation found that a disproportionate amount of NOx emissions from heavy-duty diesel vehicles is emitted during low-speed operation characteristic of urban driving.5 By contrast, natural gas engines thrive in such operational environments. [EPA-HQ-OAR-2019-0055-1330-A1, p.5]

> 5 'Current state of NOx emissions from in-use heavy-duty diesel vehicles in the United States,' International Council on Clean Transportation, November 2019. Available at: https://theicct.org/publications/nox-emissions-us-hdv-diesel-vehicles.

Natural gas vehicles also offer significant climate change benefits. Compared to diesel, natural gas engines fueled with geologic natural gas provide marginal greenhouse gas emission reductions, that like diesel fueled vehicles will be reduced by improvements in engine efficiency and power-train efficiencies. When fueled with renewable natural gas (RNG or biomethane) captured from agricultural, food, landfill or wastewater, even greater CO_2 and greenhouse gas benefits are achieved, up to 331 percent lower than diesel.6 Renewable natural gas supplies can be delivered to customers for direct use or blended with supplies of conventional natural gas either as CNG or LNG as needed to provide low emissions. [EPA-HQ-OAR-2019-0055-1330-A1, p.5]

6 Dependent upon RNG source. Reductions of 45% up to 331% compared to diesel; values based on CARB LCFS program data under CA-GREET 3.0.

RNG currently accounts for an estimated 64 percent of the fuel used in on-road vehicles, and many fuelers are committed to ensuring much higher levels in the near future. The latest data from California's Low Carbon Fuel Standard program demonstrates how clean and low carbon these heavy-duty, high fuel use vehicles truly are. The most recent data (Q4, 2021) confirms that the average carbon intensity (CI) value of California's bio-CNG is below zero at -62.3 gCO2e/MJ and has had a negative CI value for last six reporting quarters. California fleets that fueled with bio-CNG in 2020 achieved carbon negativity for the first time ever, with an annual average CI score of -5.845 gCO2e/MJ. 2021's annual average CI was -44.41 gCO2e/MJ as a result of increased supplies of dairy gas.7 [EPA-HQ-OAR-2019-0055-1330-A1, p.5]

7 https://ww2.arb.ca.gov/resources/documents/low-carbon-fuel-standard-reporting-tool-quarterly-summaries

RNG benefits the whole country. Based on a review of California and U.S. EPA data, it appears that current allocation of RNG across the country is roughly split with 50 percent in California and the remainder outside California. It is expected that, as more states move to incentivize RNG production either through low-carbon fuel standards or clean-fuel standards, the uptake of RNG outside California will continue to increase. In addition, we currently anticipate that RNG will replace most if not all conventional natural gas in the on-road market. Last year, NGVAmerica members committed that 80 percent of natural gas motor fuel dispensed through their operations will be from renewable sources by 2030. Given accelerating production, we now project that our industry will meet that goal by 2025. This projection is based on recent annual growth and the desire of large transit agencies and trucking fleets to maximize the environmental benefit of using natural gas vehicles. [EPA-HQ-OAR-2019-0055-1330-A1, pp.5-6]

Investments in Ultra Low-NOx and Near Zero emission natural gas vehicle technologies can greatly benefit communities, especially the underserved and marginalized communities in metropolitan and industrial areas. With vehicle costs closer to that of diesel than other competing technologies, and fuel price differentials of up to $1.50 (more in recent months as diesel prices continue to spike) less than diesel fuel per diesel gallon equivalent, natural gas transportation provides the largest and most cost-effective reductions in transportation-related pollutants than other powertrain options commercially available today or near-term.8 Based on our estimates, natural gas is at least twice as cost-effective as electric power-trains in offsetting NOx emissions. [EPA-HQ-OAR-2019-0055-1330-A1, p.6]

8 https://www.ngvamerica.org/environment/.

Natural gas is a viable transportation fuel for a variety of applications from medium- and heavy-duty on-road vehicles, including short-haul and regional trucking, refuse trucks, school buses, utility and other work trucks, and transit buses of all types. With the advent of the Cummins 15-liter9 and Westport's HPDI10 technology, natural gas is well poised to tackle the largest of Class 8 trucks including trucks that operate in the most demanding conditions. Hyliion's hybrid and hyper truck offer significant emission reductions, uncompromised 1,000-mile range, and power, and in the case of the hyper truck, an all-electric range of up to 75 miles.11 For these reasons, natural gas as a transportation fuel provides the most significant near-term and long-term opportunity to deliver meaningful and cost-effective emission reductions for fleets and communities. Despite these advantages, regulatory treatment and the lack of incentives for natural gas vehicles continues to limit the market penetration of new natural gas vehicles. [EPA-HQ-OAR-2019-0055-1330-A1, p.6]

> 9 https://www.cummins.com/news/releases/2021/10/14/moving-heavy-duty-trucking-down-path-zero-emissions
>
> 10 https://www.greencarcongress.com/2022/05/20220504-h2hpdi.html
>
> 11 https://www.hyliion.com/

As recognized in the Biden Administration's 'Long Term Strategy,' released during the COP26 policy discussions, achieving net-zero emissions will require focusing on a variety of strategies beyond just electrification. The plan states that the Administration will 'prioritize clean fuels like carbon-free hydrogen and sustainable biofuels where electrification is challenged.' The plan elsewhere specifically calls attention to the limitations of electrification and the need to expand efforts to promote the use of low-carbon biofuels and hydrogen: 'Accelerated research, development, demonstration, and deployment of lower-carbon fuels, such as clean hydrogen and sustainable biofuels, will contribute to the decarbonization of applications that may be more difficult to electrify including aviation and *marine transportation and some medium- and heavy-duty trucking segments*.' (emphasis added).12 [EPA-HQ-OAR-2019-0055-1330-A1, pp.6-7]

> 12 https://www.whitehouse.gov/wp-content/uploads/2021/10/US-Long-Term-Strategy.pdf

In comments to the previous administration, NGVAmerica has consistently advocated that renewable natural gas should be a key part of any inclusive mix of technologies and fuels. Today, renewable natural gas is the dominant fuel used in on-road natural gas vehicles. In 2021, RNG made up 64 percent (up from 53 percent in 2020) of the fuel used in natural gas vehicles in the United States.21 In California with its Low Carbon Fuel Standard Program, 92 percent of natural gas motor fuel consumed in 2020 was produced from renewable sources.22 Based on recently released data from CARB, we believe that RNG will make up about 98 percent of fuel consumed in NGVs in California in 2021. Renewable natural gas is already helping to achieve significant reductions in carbon emissions. As noted earlier, bio-CNG sold in California now has an average carbon intensity that is negative. [EPA-HQ-OAR-2019-0055-1330-A1, pp.9-10]

> 21 https://ngvamerica.org/wp-content/uploads/2022/05/NGV-RNG-Decarbonize-2022-5.2.22.pdf

22 NGVAmerica and Coalition for Renewable Natural Gas. Available at: https://ngvamerica.org/wp-content/uploads/2021/05/NGV-RNG-CA-Decarbonize-2020-FINAL-6.2.21.pdf.

In the coming years, the carbon intensity of renewable natural gas is expected to be even lower as greater amounts of extremely, low-carbon biomethane is produced and used in natural gas vehicles. A recent analysis estimates that by 2024, the average carbon intensity of renewable natural gas in California will be -101.74.23 Our industry fully expects and is committed to ensuring that renewable natural gas use will continue to increase in the coming years. NGVAmerica's members recently endorsed a commitment that by 2030, 80 percent of natural gas on-road motor fuel in the United States will be derived from renewable sources, rising to 100 percent by 2050.24 [EPA-HQ-OAR-2019-0055-1330-A1, p.10]

23 https://www.gladstein.org/gna_whitepapers/an-assessment-californias-in-state-rng-supply-for-transportation-2020-2024/

24 NGVAmerica Statement on Climate Change, July 29, 2021. Available at: https://ngvamerica.org/wp-content/uploads/2021/08/NGVAmerica-Climate-Change-Statement-FINAL-7.29.21.pdf.

NGVAmerica agrees that climate change is cumulative; the longer we wait, the harder it gets to solve. We also believe that there is no single perfect, affordable, and immediate solution to addressing transportation related climate change emissions. Some of us are old enough to remember the promises of the past: methanol will be the dominant alternative fuel, soon everyone will drive a car that gets 65 miles to the gallon (Al Gore's PNGV Program), MTBE in gasoline, an 18-year-old born today will drive a hydrogen fueled vehicle (George Bush 2002). Today, the big promise is electrification of everything. But as former Energy Secretary Ernest Moniz recently opined, 'full electrification of the economy is simply not an achievable goal.'25 He went on to remark that hard to decarbonize sectors of the economy will require a fuel source, such as low-carbon fuels and carbon negative fuels. [EPA-HQ-OAR-2019-0055-1330-A1, p.10]

25 https://www.spglobal.com/platts/en/market-insights/latest-news/oil/091521-moniz-wants-to-turn-more-focus-to-clean-alternative-fuels-negative-emissions

We support electrification where it makes sense and even anticipate that in the near future an increasing larger share of heavy-duty natural gas vehicles will employ hybrid electric powertrains.26 Significant investments are being made to bring natural gas/hybrid powertrains to market. Light-duty natural gas fueled vehicles could someday employ similar hybrid-electric powertrains as hybrid vehicles become more prolific. [EPA-HQ-OAR-2019-0055-1330-A1, p.10]

26 https://www.truckinginfo.com/10150691/hyliion-launches-improved-hybrid-truck-powertrain-all-electric-hypertruck-erx

EPA's motor vehicle certification standards should be used to support vehicles that operate on low-carbon fuels. If there are no vehicle incentives, technologies with higher upfront costs will continue to struggle. They will struggle even more if other more expensive technologies are given generous incentives or are mandated. We ask that EPA provide NGVs with the same level of support and incentive as it does electric vehicles in order to encourage manufacturers to ramp up production and achieve economies-of-scale. [EPA-HQ-OAR-2019-0055-1330-A1, p.11]

Such incentives are needed to encourage the commercialization of a greater variety of vehicle models and technologies in the US market and stimulate competition. For example, the Westport HPDI technology has now been successfully deployed for heavy-duty trucks in Europe for about five years, providing significant GHG emission reductions thanks to its diesel-like performance, but is currently not commercialized in North America. The availability of both compressed and liquefied natural gas vehicles (CNG and LNG), using either spark ignition or compression ignition engine technologies, together with the continuous deployment of CNG and LNG refueling infrastructure27 and increasing share of biomethane28, are all important factors that encourage fleets to invest in CNG and LNG trucks29. As a result, over 10,000 CNG and LNG trucks have been registered in Europe in 2021, accounting for 3.6 percent of all new trucks registered in 2021 and representing over 40 percent increase compared with 2020.30 [EPA-HQ-OAR-2019-0055-1330-A1, p.11]

27 https://www.ngva.eu/medias/500-lng-stations-in-europe-new-gas-refuelling-infrastructure-milestone-reached/

28 https://www.ngva.eu/medias/2510-biocng-in-2020-new-data-proves-rapid-growth-of-biomethane-in-transport/

29 Examples include: https://www.gnvmagazine.com/en/sandahls-logistik-completes-the-largest-order-for-biogas-trucks-in-sweden/ - https://www.commercialfleet.org/news/truck-news/2022/01/26/dhl-supply-chain-adds-new-volvo-bio-lng-trucks-to-fleet - https://www.volvotrucks.co.uk/en-gb/news/press-releases/2020/december/asda-scales-gas-fleet-fast-with-huge-volvo-fh-lng-order.html - https://www.globalgasmobility.com/60-volvo-lng-trucks-for-cargo-service-europe-cse/ - https://www.hzlogistics.eu/en/nieuws/30-volvo-lng-trucks-for-hz-logistics

30 https://www.acea.auto/files/Trucks-by-fuel-type-full-year-2021.pdf

For greenhouse gas emissions, we previously have requested that EPA use the 0.15 factor for greenhouse gas emissions as a way to reward manufacturers for RNG use and to create an efficient method of calculating the benefit of renewable natural gas until EPA moves to adopt a well-to-wheels regulatory approach for all fuels, or until EPA is prepared to come up with a detailed assessment and emission factor specific to RNG use. A benefit of the 0.15 factor is that it is consistent with the fuel efficiency credits and has been used in the past in EPA's regulations. Importantly such factors must be in place for sufficient number of years to allow automakers to incorporate them into their production plans, which typically require 2 – 3 years lead-time. [EPA-HQ-OAR-2019-0055-1330-A1, pp.11-12]

The concept of adjusting the regulatory framework to encourage low-carbon fuels is explained in much greater detail in a recent NGVA Europe study, which we urge EPA to review.31 [EPA-HQ-OAR-2019-0055-1330-A1, p.12]

> 31 https://www.ngva.eu/wp-content/uploads/2021/04/Frontier-Economics-Study-for-NGVA-Carbon-abatement-costs-260421-stc.pdf

EPA's regulatory programs should be designed to accelerate the production of trucks and engines that reduce carbon emissions – they should not be designed to favor or support one technology over others. EPA famously indicated that electric vehicles are a game changer and therefore warrant treatment that other technologies do not. But low-carbon fuels that achieve carbon neutrality or carbon negative emissions right now are also a game changer, and they too should be encouraged. [EPA-HQ-OAR-2019-0055-1330-A1, p.12]

There is no reason not to provide an incentive for natural gas trucks operating on low-carbon biofuel, when the alternative is that fleets will continue to rely on petroleum fueled vehicles if not provided a cleaner alternative. [EPA-HQ-OAR-2019-0055-1330-A1, p.12]

Organization: *Neste US, Inc*

Renewable diesel is a safe, proven, and affordable solution that is ready to play a larger role in the country's energy mix to address climate change. Neste's renewable diesel is fully compatible with all diesel engines and, because it has similar chemical composition to fossil diesel, can be used as a drop-in replacement fuel. Unlike fossil diesel, however, Neste's renewable diesel contains near-zero aromatics or impurities, has a high cetane number to ensure efficient and clean combustion, and can significantly reduce life-cycle greenhouse gas (GHG) emissions. [EPA-HQ-OAR-2019-0055-1225-A1, p.1]

EPA should acknowledge Renewable Diesel's role in climate policy

PA should acknowledge the utility of renewable diesel and encourage its use in heavy-duty vehicles as a method of GHG emissions without relying on EVs. While electrifying heavy-duty vehicle fleets may eventually significantly reduce GHG emissions across the country, by overlooking the use of renewable diesel in favor of full electrification, EPA is missing a quicker and similarly effective way to reduce such emissions. [EPA-HQ-OAR-2019-0055-1225-A1, p.4]

The Renewable Fuel Standard is the cornerstone of the U.S. climate policy

Neste is concerned by other commenters urging the Agency 'to establish standards requiring 100 percent of all new heavy-duty vehicles be zero-emission no later than 2035.3 While EPA has stated this rulemaking is not considering that action, it is worth noting that any EV mandate is inconsistent with the statutory mandate of the Renewable Fuel Standards (RFS), which incorporates the congressional assumption that de-carbonization of liquid fuel will remain a cornerstone of the United States' climate policy for the foreseeable future.4 Because Congress directed EPA to implement the RFS program, EPA cannot promote the substantial or exclusive use of another technology that will frustrate Congress’ RFS goals. [EPA-HQ-OAR-2019-0055-1225-A1, p.4]

3 Id. at 17420.

4 Americans for Clean Energy v. EPA, 864 F.3d 691, 697 (D.C. Cir. 2017) (quoting the Energy Independence and Security Act, Pub. L. No. 110-140, 121 Stat. 1492 (2007) (noting that Congress enacted requirements in the Renewable Fuels Program in order to 'move the United States toward greater energy independence and security, [and] to increase the production of clean renewable fuels').

The majority of heavy-duty vehicles run on diesel. As noted above, Neste’s renewable diesel, because it has the same chemical composition of fossil fuel, can be used as a one-to-one replacement in vehicles already built to run on diesel. Renewable diesel is significantly cleaner than fossil fuel and today can reduce GHG emissions by up to 75% over the fuel’s life cycle today, with the potential to improve as producers reduce GHG emissions from their own operations and additional lower carbon intensity feedstock are developed. In fact, in California, the use of renewable diesel in the transportation sector accounted for 30% of the state’s GHG emissions reductions.5

5 California Energy Commission. 2020. Low Carbon Fuel StandardDashboard. Available at https://www.dieselforum.org/images/dmImage/StandardImage/biofuel-co2-reductions-2021.png

Organization: *Northwest Alliance for Clean Transportation*

[*From Hearing Testimony, April 12, 2022; Alex Schay*] I take this opportunity to point out that renewable natural gas engine technology, or RNG technology, is currently the only technology that, A, meets the 0.02 grams per braking horsepower NOx requirement, the requirement that is proposed as the 90-percent reduction via this draft rule; and, B, RNG technology is the only currently commercially-available technology that enables payloads of 105,000 pounds with a range of 600 to 700 miles, thereby meeting most duty cycles for nearly all trucking fleets. With that context in mind, I suggest to those on the call and those taking testimony that RNG technology is the most appropriate technology at present both for reducing NOx emissions and for making significant near-term reductions in greenhouse gas emissions. With that backdrop in mind, I would ask the EPA to consider providing incentives that enable fleet owners to cover the additional vehicle costs and the additional costs associated with setting up a fueling station that can fuel RNG vehicles and/or provide incentives for making alterations to maintenance bays that enable safe maintenance of vehicles that use a gaseous fuel rather than a liquid fuel. If you should have additional questions about the Northwest Alliance For Clean Transportation, please feel free to visit us at www.nwalliance.net, and with that, I yield my time. [EPA-HQ-OAR-2019-0055-2867]

Organization: *Odyne Systems, LLC (Odyne)*

Methods to eliminate or abate high NOx emissions during PTO operation: There are various methods to provide zero emissions PTO operation. The PTO receives power from the traction engine of a medium or heavy-duty vehicle to typically power equipment mounted to the vehicle. [EPA-HQ-OAR-2019-0055-1264-A1, p.7]

Manufactures of powertrains can use known methods that reduce NOx such as cylinder deactivation (CDA), dual-SCR aftertreatment configuration and heated diesel exhaust fluid (DEF) dosing during PTO operation. [EPA-HQ-OAR-2019-0055-1264-A1, p.7]

Electrification is a different method that can be used to eliminate NOx and GHG emissions during PTO operation, by enabling the engine to be turned off. A plug-in electric Power Take-Off system (ePTO) is recharged by the grid and then operated in a charge depleting mode of operation when equipment requires power typically provided through a PTO by the chassis engine. Since the battery is recharged by the grid, the emissions during PTO operation are zero if the battery has sufficient capacity to provide all the energy required to operate the truck mounted equipment. [EPA-HQ-OAR-2019-0055-1264-A1, p.7]

Sometimes an ePTO battery system is not of sufficient capacity to provide the needed energy to keep the truck engine off until the battery can be recharged by the grid. In those situations, such as during double shift operations, mutual assistance during emergencies, or if the grid is unavailable or down, the engine can be used in a hybrid ePTO mode of operation to prevent the high emissions associated with a conventional PTO. Such a hybrid ePTO mode operates the engine under a higher load that quickly recharges the batteries using the engine while continuing to power equipment. Once the batteries are recharged to a predetermined levels with the engine, the engine is then turned off, eliminating the low load mode of PTO operation that produces high NOx. [EPA-HQ-OAR-2019-0055-1264-A1, p.8]

NREL tested the ePTO in a charge sustaining mode (hybrid ePTO mode) rather than a charge depleting mode to measure a worst-case scenario. The hybrid ePTO mode begins with a certain battery state of charge (SOC), then as truck equipment requires power, depletes the battery, and then the ePTO system uses the chassis engine to recharge the battery while continuing to power the PTO load, resulting in a net-zero change in the battery SOC. During recharging of the battery, the engine is under a higher load, resulting in much better NOx abatement than an engine running continuously to supply power to a PTO. See Page 54: Text and graph from the published report 75782. https://www.nrel.gov/docs/fy20osti/75782.pdf [EPA-HQ-OAR-2019-0055-1264-A1, p.8]

A previously published report by SCAQMD using measured field data showed that more than half of an average workday is composed of a combination of idling and PTO based on a large sample of trucks operating at worksites, resulting in high emissions. [EPA-HQ-OAR-2019-0055-1264-A1, p.8]

Page 48: text from NREL report ’Results indicate that the hybrid vehicle produces roughly an order of magnitude less NOx exhaust emissions and consumes 4~5 times less fuel than the conventional vehicle while operating a PTO work cycle.' [EPA-HQ-OAR-2019-0055-1264-A1, pp.8-9]

NREL report Page 54: text from the published report 'This is calculated by assuming all the energy used by the electric PTO system will be recharged back to the batteries via the vehicle engine, so no plug-in capabilities were considered here (e.g. if the vehicle PTO used 1kW-hr of energy then 1kW-hr of energy would be put back on the battery packs by engine recharging mode operation). The vehicle is a plug-in hybrid so in reality vehicle out emissions for this scenario could effectively go down even lower. Also, emissions during charging of the batteries could potentially be optimized to have lower NOx emissions as shown in the engine mapping section discussed previously. Figure 54 demonstrates that the Odyne electric PTO system can have a dramatic impact of an order of magnitude on NOx emissions from utility vehicles when performing stationary PTO work. [EPA-HQ-OAR-2019-0055-1264-A1, p.9]

NREL report page 57, figure 56, shows much lower total NOx output with ePTO in hybrid mode in comparison to a conventional PTO in which the engine is on continuously during PTO worksite operation. [EPA-HQ-OAR-2019-0055-1264-A1, p.9]

There are PTO electrification systems (ePTOs) in production for a wide range of heavy-duty truck PTO applications that eliminate NOx emissions for typical duty cycles and are capable of reducing NOx by up to 90% and GHGs by 80% even if not grid recharged, per testing performed by NREL and paid for by CARB. [EPA-HQ-OAR-2019-0055-1264-A1, p.10]

Organization: *Renewable Energy Group*

[*From Hearing Testimony, April 13, 2022, Ezra Finkin*] I'm the senior manager for corporate affairs and development with Renewable Energy Group. Renewable Energy Group operates 11 bio refineries in the U.S. and Europe. Last year, REG produced 480 million gallons of cleaner fuel including biodiesel, enabling 4.1 million metric tons of carbon reduction. I would like to state our support for EPA in its finding included in this proposed rule that the pool of biodiesel available to fleets across the country is of very high quality and that biodiesel blends about 5 percent, or B5, are expected to operate in future catalysts and filters developed to meet this proposed standard. Through this proposed rule, future emission control technologies are expected to generate closer to zero tailpipe emissions, to deliver cleaner air benefits to communities in need of cleaner air. When fueled with high blends of biodiesel, we can expect significant climate benefits alongside expected clean air benefits from the heavy-duty vehicles equipped with these next-generation emission control technologies. Today, biomass-based diesel, including biodiesel, plays a large role in decarbonizing the heavy-duty on and offroad fleets. Just over 3 billion gallons of biomass-based diesel were supplied to the U.S. market last year and, according to the Energy Information Administration, substantial growth is expected this year and next. EPA's proposed renewable volume obligation for 2022 recognizes the availability of feedstock and production capacity to expand volumes of biomass-based diesel this year. Three billion gallons of biomass-based diesel equates to about 21 million tons of greenhouse gas emission reductions. In a single year the benefits of the switch to biomass-based diesel represents the emissions generated from nearly 4.5 million passenger vehicles or switching them overnight to a truly zero-emission option, according to EPA's greenhouse gas equivalencies calculator. We recognize that the climate crisis is a code red emergency, to use President Biden's own words. A crisis requires immediate action and with growing volumes of biomass-based diesel we have a ready to go option to reduce emissions today from the heavy-duty fleet. Analysis included in this proposed rule provides evidence for the need to support the use of higher biodiesel plans by engine manufacturers. Many engine makers already approve the use of 20 percent biodiesel, or B20, and those that currently do not approve B20 should consider evidence presented in this proposal to do so. We encourage other engine manufacturers to consider support for higher blends above 20 percent, or B20. Widespread access to high-quality biodiesel across the country, the use of higher blends of biodiesel may contribute significantly to immediate term greenhouse gas emission reductions while also allowing next-generation emission control technologies to function properly to deliver air quality benefits to those communities most in need of cleaner air. Thank you very much for the opportunity to present our views and suggestions at this public hearing. REG will also be submitting written topics. [EPA-HQ-OAR-2019-0055-2867]

[*From Hearing Testimony, April 13, 2022, Martin Haverly*] I'm the senior manager of research and development and innovation with Renewable Energy Group. As you've already heard from my colleague earlier, Renewable Energy Group is an industry leader delivering high-quality low-carbon biodiesel and renewable diesel fuel to markets in the U.S. and abroad. I would like to reiterate our support for the EPA and its finding that the pool of biodiesel available to vehicle and equipment operators across the country is of very high quality while biodiesel blends above 5 percent, or B5, are not expected to impede the performance of next-generation after treatment, devices developed to meet this proposed new tailpipe standard. According to findings, including the proposed rulemaking, EPA reports that the presence of metals and other quality metrics has greatly improved. These findings are derived from a robust fuel sampling survey conducted by the agency, the California Air Resources Board, and the National Renewable Energy Laboratory. The vast majority of fuel samples show the presence of impurities far below specified and allowable levels. We support EPA in its proposal to require engine manufacturers to provide detailed evidence to document claims of off-spec biodiesel when seeking an exemption of test results as part of an end-use compliance. Decades ago, REG developed processes to produce and deliver to the marketplace the highest quality biodiesel. As the industry leader, we are encouraged to know that our competitors have also stepped up to develop and deliver high-quality low-carbon bio-based diesel fuel including biodiesel, and that plays a disproportionate role in reducing transportation sources of greenhouse gas emissions. Evidence in this proposed rule demonstrates that access to high-quality biodiesel is prevalent and that higher blends of biodiesel are not expected to impede the performance of after treatment devices. Through the renewable fuel standard, the EPA has proposed growth in bio-based diesel volumes in 2022 and we believe that even more fuel may be delivered to the market this year and beyond. Blends of 20 percent biodiesel, or B20, should be the norm and we encourage engine manufacturers to work alongside fuel producers like Renewable Energy Group to support blends above B20. The diesel commercial trucks of the future can deliver cleaner air through the next-generation after treatment devices while delivering even greater climate benefits when operating using higher blends of low-carbon bio-based diesel fuels. Thank you very much for this opportunity to present our views and suggestions at this public hearing. As already noted, Renewable Energy Group will also be submitting written comments and we look forward to supporting the EPA as you continue your important mission to fight global warming and increase investment in renewable fuels while improving air quality and reducing emissions. [EPA-HQ-OAR-2019-0055-2867]

Organization: *State Soybean Associations (SSA)*

While we appreciate EPA's efforts to reduce nitrogen oxide ('NOx') and greenhouse gas ('GHG') emissions from heavy-duty vehicles, we are concerned with EPA's reliance on electric vehicles ('EVs') to justify more stringent emission standards from such vehicles, while failing to fully recognize the emissions reductions that renewable fuels provide. In terms of GHG reductions, the rule also understates the greenhouse gas lifecycle analysis from EVs and gives short shrift to the potential role that renewable fuels play in advancing the administration's climate change objectives. [EPA-HQ-OAR-2019-0055-2035-A1, p.1]

The State Soybean Associations urge EPA to better reflect the importance of biodiesel and renewable diesel in reducing tailpipe emissions from heavy-duty vehicles. While EVs are a valuable tool for emissions reduction, they require replacing full fleets, which is costly and could take decades, especially in the heavy-duty vehicle industry. Biodiesel and renewable diesel, on the other hand, can be used immediately in place of traditional diesel in existing vehicles while producing a significantly reduced level of emissions. [EPA-HQ-OAR-2019-0055-2035-A1, p.1]

Increased EV penetration into the heavy-duty market is not required for emissions reduction. Where more stringent standards need to be justified or met, increased use of biodiesel and renewable diesel, which can be used immediately and is compatible with current fleets, can help EPA achieve those goals. [EPA-HQ-OAR-2019-0055-2035-A1, p.2]

EV mandates also are inconsistent with the statutory mandate of the Renewable Fuel Standard ('RFS'), which employees a market-forcing approach to creating annual standards. This is true for the partial EV mandate in the proposal and would be increasingly true for higher EV penetration rates, if adopted. Indeed, in the Proposed Rule EPA notes that it has received comments requesting that the agency 'establish standards requiring 100 percent of all new heavy-duty vehicles be zero-emission no later than 2035.'2 EPA cannot meet Congressional intent behind the RFS to increase the volume of renewable fuels in the transportation sector while implicitly mandating vehicles that do not run on any type of liquid fuel. When Congress enacted the RFS, it signaled that the decarbonization of liquid fuel should and would remain a cornerstone of the United States' climate policy. EPA cannot promote the exclusive use of a technology that will frustrate these Congressional mandates. [EPA-HQ-OAR-2019-0055-2035-A1, p.2]

2 Id. at 17420.

Moreover, EPA fails to acknowledge that electrification is not the most economically or technologically feasible option for achieving its desired emission reductions. As CARB has recognized in its 2022 Draft Scoping Plan Update, which recognizes the importance of continued use of liquid fuels, the 'transition to complete ZEV technology will not happen overnight. ICE vehicles from legacy fleets will remain on the road for some time, even after all new vehicle sales have transitioned to ZEV technology.'3 For that reason, CARB concluded that, '[i]n addition to building the production and distribution infrastructure for zero-carbon fuels, the state must continue to support low-carbon liquid fuels during this period of transition….'4 [EPA-HQ-OAR-2019-0055-2035-A1, p.3]

3 Cal. Air Resources Bd., '2022 Draft Scoping Plan Update' (May 10, 2022), at 152.

4 Id.

Given the significant benefits associated with renewable fuels and the uncertainties regarding the benefits of EVs, EPA should not favor EVs over other vehicles that can run on renewable fuels in planning for the decarbonization of the U.S. transportation sector. [EPA-HQ-OAR-2019-0055-2035-A1, p.3]

Organization: *Tenneco*

In this white paper, Tenneco highlights the feasibility of meeting that level of NOx emission standards with a burner as a "drop-in addition" to existing ATS. Additionally, the Tenneco recommended solution promotes DPF durability and the data demonstrates "CO2 neutrality" can be achieved.[EPA-HQ-OAR-2019-0055-1284-A1 p.1]

In Stage 3 of the CARB Low-NOx Demonstration, one technology package was shown to be feasible for meeting the NOx limit of 0.02 g/hph on the FTP [1-3]. This package included a market available 15-liter engine, otherwise known as the Stage 3 engine, up-fitted with cylinder de-activation (CDA) and recalibrated to provide hotter exhaust during a cold start, as well as a dual-dosing aftertreatment system that included advanced catalyst formulations. [EPA-HQ-OAR-2019-0055-1284-A1 p.1]

1. Zavala, B., Sharp, C., Neely, G., and Rao, S., "CARB Low NOx Stage 3 Program - Aftertreatment Evaluation and Down Selection", SAE Technical Paper 2020-01-1402, 2020.

2. Neely, G., Sharp, C., Pieczko, M., and McCarthy, J. Jr., "Simultaneous NOx and CO2 Reduction for Meeting Future CARB Standards Using a Heavy-Duty Diesel CDA-NVH Strategy," SAE Int. J. Engines 13(2):2020.

3. Sharp, C., Neely, G., Zavala, B., and Rao, S., "CARB Low NOx Stage 3 Program - Final Results and Summary," SAE Technical Paper 2021-01-0589, 2021.

Tenneco is developing an exhaust burner for an alternative technology package that offers several advantages relative to the "Stage 3 system". A cut-away image of the burner and an illustration of the complete technology package are provided below. The package utilizes the "classic" heavy-duty aftertreatment system (ATS) in production today, which includes a diesel oxidation catalyst (DOC), a diesel particulate filter (DPF), a selective catalytic reduction (SCR) catalyst, and an ammonia slip catalyst (ASC). The exhaust burner is located upstream of the DOC; it is relatively small (not to scale in the figure) and thus can be located within the engine compartment, adjacent to the turbocharger outlet.[EPA-HQ-OAR-2019-0055-1284-A1 p.1]

To demonstrate the technical feasibility of the burner-based technology package, Tenneco and Eaton (supplier of a Roots blower that provides combustion air to the burner) funded testing at SwRI [4,5]. This testing utilized a production market available 15-liter engine (i.e. not up-fitted with CDA) running on its production calibration. The ATS utilized was of the classic architecture (illustrated above) and included catalyst formulations similar to those in the Stage 3 system, in the hydrothermally-aged state. The exhaust burner was located immediately downstream of the turbocharger. The downpipe between the burner and DOC was insulated. [EPA-HQ-OAR-2019-0055-1284-A1, p.2]

4. Harris, T., McCarthy Jr., J., Sharp, C., Zavala, B., Matheaus, A., "Meeting Future NOx Emissions Limits with Improved Total Fuel Efficiency", presented at the ATZ Heavy-Duty, On- and Off-Highway Engines 2021 Conference, Rostock, Germany, December 1, 2021.

5. McCarthy, Jr., J., Matheaus, A., Zavala, B., Sharp, C. et al., "Meeting Future NOx Emissions Over Various Cycles Using a Fuel Burner and Conventional Aftertreatment System," SAE Technical Paper 2022-01-0539, 2022.

NOx and CO2 results from several FTP tests (Federal Test Protocol – for heavy duty engines) carried out during this testing campaign are shown in the table below [4]. The "burner on" cases differed in terms of the burner control strategy, specifically with respect to an "on/off switch" associated with the DPFout temperature. The best NOx result obtained, 0.023 g/hph, does not quite meet the standard of 0.02 g/hph, but it is worth emphasizing that this result was obtained without any modification of the engine's calibration; co-optimization of the engine and aftertreatment calibrations should enable the 0.02 g/hph NOx emissions limit to be achieved. [EPA-HQ-OAR-2019-0055-1284-A1, p.2]

4. Harris, T., McCarthy Jr., J., Sharp, C., Zavala, B., Matheaus, A., "Meeting Future NOx Emissions Limits with Improved Total Fuel Efficiency", presented at the ATZ Heavy-Duty, On- and Off-Highway Engines 2021 Conference, Rostock, Germany, December 1, 2021.

It can be noted in the table that "CO2 neutrality" was also achieved in the test with the lowest NOx. This surprising result was realized because a) the burner took over some of the responsibility for exhaust thermal management from the engine, and b) the burner is more efficient than the engine at converting fuel energy into exhaust heat. Data collected during this study provided clues to the engine's behavior, indicating that the engine transitioned from thermal management mode (extra exhaust heat-producing) to fuel economy mode much sooner when the burner operated (see illustration below). Therefore, the engine consumed less fuel over the cycle, and this amount of fuel saved was almost equal to that consumed by the burner. In addition, an energy balance analysis conducted on the data indicated that the efficiency of the burner at converting fuel into exhaust heat is ~85%, with a majority of the ~15% inefficiency associated with heating up the combustion air utilized by the burner. In comparison, the efficiency of current engine measures for converting fuel into extra exhaust heat is ~60% [6]. [EPA-HQ-OAR-2019-0055-1284-A1, p.2]

6. Kovacs, D., Rauch, H., Rezaei, R., Huang, Y. et al., “Modeling Heavy-Duty Engine Thermal Management Technologies to Meet Future Cold Start Requirements”, SAE Technical Paper 2019-01- 0731, 2019.

The burner testing at SwRI also included vocational and low-load engine test cycles [5]. On the beverage cycle, tailpipe NOx was reduced from 2.15 g/hph to near zero (0.001 g/hph), while an additional 13.5% CO2 was emitted. On the new low-load cycle (LLC) compliance test, tailpipe NOx was reduced from 0.918 to 0.006 g/hph, while CO2 increased by 9.0%. Once again, these results were obtained with a prototype burner and controls along with a production engine and calibration, so better results can be expected from continuing development. [EPA-HQ-OAR-2019-0055-1284-A1, pp.2-3]

5. McCarthy, Jr., J., Matheaus, A., Zavala, B., Sharp, C. et al., “Meeting Future NOx Emissions Over Various Cycles Using a Fuel Burner and Conventional Aftertreatment System,” SAE Technical Paper 2022-01-0539, 2022

It is worthwhile to compare these results with those from the Stage 3 technology package also tested at SwRI [2, 3]. As noted above, this package included a market available 15L engine up-fitted with cylinder de-activation (CDA), and a dual-dosing ATS (i.e. an ATS similar to that employed in the Tenneco-Eaton study, but that also included a light-off SCR). On the LLC, the burner system achieved much lower NOx (0.006 g/hphr) compared to the Stage 3 package (0.024 g/hphr), but produced an additional 8.4% CO2. It can be concluded that while the burner is more efficient than a conventional engine at converting fuel energy into exhaust heat, it is not as efficient as an engine equipped with CDA. [EPA-HQ-OAR-2019-0055-1284-A1, p.3]

2. Neely, G., Sharp, C., Pieczko, M., and McCarthy, J. Jr., "Simultaneous NOx and CO2 Reduction for Meeting Future CARB Standards Using a Heavy-Duty Diesel CDA-NVH Strategy," SAE Int. J. Engines 13(2):2020.

3. Sharp, C., Neely, G., Zavala, B., and Rao, S., “CARB Low NOx Stage 3 Program - Final Results and Summary,” SAE Technical Paper 2021-01-0589, 2021.

The test results detailed above identify two remaining challenges for the burner technology package. First, on the FTP cycle, engineering margin is required for the NOx emissions value; even 0.020 g/hph is not sufficient, but 0.016 g/hph might be acceptable. Second, on the LLC, the burner is consuming too much additional fuel. The testing and simulation studies described below address both of these issues. [EPA-HQ-OAR-2019-0055-1284-A1, p.3]

One means of providing NOx margin on the FTP is to use the burner to pre-heat the ATS before the engine is started. Pre-heating was investigated in a separate testing study conducted at Tenneco [7]. This study used the same burner as in the SwRI testing, a 13L engine, and a classic ATS with substrates similarly sized to those used in the SwRI testing described above. Important learning from this study included:

- Using lean combustion conditions for pre-heating results in low CO, HC and NOx emissions, and rapid warming and activation of the DOC drives the CO and HC to zero after only a few seconds.
- An air flow rate greater than that required to sustain combustion within the burner enables it to be operated at a higher power without over-heating the DOC (in the figure below, the DOC-in temperature is being limited to ~500°C by the burner's controls); this means that a higher-capacity air pump will be required if pre-heating is desired.
- Most of the heat produced by the burner during pre-heating is stored in the DOC and DPF, but this heat is rapidly transferred to the SCR once the engine is turned on and begins to produce exhaust (see DPF-out temperature plot below).
- Pre-heating for 300s enabled the DPF-out temperature to exceed the 300°C before 60s of the cold FTP cycle has elapsed; pre-heating for 180s was nearly as effective. Once the engine has been turned on, the burner can be operated at higher average power to compensate for a shorter preheating period (this strategy was employed in the 3-min pre-heating case).[EPA-HQ-OAR-2019-0055-1284-A1, p.3]

7. Harris, T., Bellard, R., Muhleck, M., and Palmer, G., "Pre-Heating the Aftertreatment System with a Burner," SAE Technical Paper 2022-01-0554, 2022.

To connect these results to the Tenneco-Eaton-SwRI test results described above, a "1D" model of the SwRI test system was developed using the software GT-POWER. This model included nearly all of the relevant physics and chemistry needed to predict accurately the NOx emissions at the tailpipe. Data from the cold FTP tests (with and without the burner operating) run at SwRI were used to calibrate the model; it validated well against LLC test results (see plots below). [EPA-HQ-OAR-2019-0055-1284-A1, p.4]

This model was used first used to investigate the effect of pre-heating on NOx emissions. The simulation results presented below correspond to cases for 3, 1, and 0 minutes of pre-heating. It can be seen that even 1 minute of pre-heating can significantly increase the DPF-out temperature at 100s into the cold-start FTP cycle relative to operating the burner only when the engine is running. More importantly, this temperature increase translates into lower NOx emissions at the tailpipe (TP); the 1-min pre-heating provided a 20% reduction in NOx relative to the no-pre-heating case. A similar improvement was observed on the hot-start FTP as well. Collectively, a 20% reduction in NOx on both the cold and hot cycles would enable the 0.023 g/hph NOx emissions test result noted above to be reduced to 0.019 g/hph. [EPA-HQ-OAR-2019-0055-1284-A1, p.4]

Next, the model was used to consider substituting an SCR-on-DPF (SCRF) for the DPF in the classic ATS. An SCRF is simply a DPF with higher porosity walls that can be coated with some amount of SCR catalyst. With an SCR-on-DPF, some of the SCR catalyst will warm up and become active for NOx reduction much sooner in the FTP test, because that material does not have to wait for the DPF substrate itself to be heated by the burner. In the plot below, simply deleting the DPF from the ATS is shown as the limiting case. Substituting an SCRF for the DPF does not provide NOx emissions as low as that limiting case, but the impact is still positive. The positive effect is strongly dependent on the "loading" of SCR catalyst on the SCRF (i.e. the number of catalytic sites), as well as on the amount of ammonia (NH_3) stored on the catalyst at the beginning of the FTP. [EPA-HQ-OAR-2019-0055-1284-A1, p.5]

Finally, the model was used to consider the burner's fuel consumption by the burner during the LLC. The on/off control of the burner that was utilized in the Tenneco-Eaton-SwRI testing produced a large oscillation in the DPF-out temperature (apparent in the simulation results below). A new control strategy was developed that provided much tighter control of that temperature. More importantly, this new strategy provided a 35% reduction in fuel consumed by the burner for an equivalent level of NOx at the tailpipe. In addition, this control strategy only requires the calibration of a single parameter to achieve the desired trade-off between NOx emissions and fuel consumed (this parameter is being varied in the plot on the right).[EPA-HQ-OAR-2019-0055-1284-A1, p.5]

In conclusion, we believe that the alternative technology package considered here (i.e. burner plus classic ATS) optimizes the lowest NOx emissions performance without compromising CO_2 emissions and eases the integration into the vehicle. The test results from SwRI supports the conclusion; the additional test and simulation results presented above indicate that the remaining challenges can be overcome. Furthermore, this package provides some clear advantages relative to the Stage 3 technology package:

- The burner is a "drop-in addition" to existing ATS, with the potential to minimize re-design and revalidation of the ATS itself.
- The burner (as well as the electrically-powered air pump) readily fits within the existing engine compartment space; this means that re-arranging components on the engine, or re-designing the hood, will not be necessary.
- The burner promotes DPF durability in two different ways. First, it reduces DPF active regeneration frequency by enhancing passive regeneration, building upon the reasonable amount of passive regeneration afforded by the classic ATS as a result of its action to raise the exhaust temperature when the engine is experiencing low-load conditions. Second, the burner can improve DOC temperature control when the DOC is receiving fuel to produce heat for active regeneration of the DPF.
- The burner, along with the DEF dosing system, can be operated to "post-load" NH_3 onto SCR after the engine has been turned off. This additional amount of NH_3 on the catalyst will facilitate NOx conversion during the next cold start, and will eliminate the need for extraordinary hardware (e.g. a heated DEF doser, or electrically heated mixer) that would enable DEF dosing to begin sooner during that start.[EPA-HQ-OAR-2019-0055-1284-A1, pp.5-6]

Organization: *Westport Fuels Systems (WFS)*

Long-haul road freight is recognized as one of the most challenging transport sectors to decarbonize due to the demanding use profiles, and the pressures of cost competitiveness. [EPA-HQ-OAR-2019-0055-1278-A1, p.1]

There is considerable expectation that Battery Electric and Hydrogen Fuel Cell technologies can provide the solutions to a future sustainable road freight sector, and the trajectory of many proposed rulemaking initiatives is presumptive of these technologies being ubiquitous across the freight fleet. [EPA-HQ-OAR-2019-0055-1278-A1, p.1]

While battery electric and fuel cell technologies can play a role, this commentary highlights why the options to decarbonizing freight must also include cost-effective approaches that include a central role for Internal Combustion Engines (ICEs), fueled by renewable natural gas and/or hydrogen (H2). [EPA-HQ-OAR-2019-0055-1278-A1, p.1]

ICE solutions using the WFS HPDI™ fuel system can significantly reduce emissions both at the tailpipe and across the lifecycle. As such, changes to policy frameworks that recognize more than the singular metric of zero tailpipe emissions will enable a greater diversity of solutions. This approach will better suit the diverse needs of the freight sector, and deliver faster, larger, CO2 reductions, at the lowest cost. [EPA-HQ-OAR-2019-0055-1278-A1, p.1]

As policymakers create frameworks to both encourage and support the deployment of new technologies, RNG and Hydrogen ICEs should be given equal footing to Fuel Cell Electric Trucks and battery electric trucks. [EPA-HQ-OAR-2019-0055-1278-A1, p.1]

Some policy considerations laid out in the EPA rulemaking docket referenced above prioritize battery electric and fuel cell trucks (ZEV). These technologies can certainly play a key role in transitioning to a sustainable, decarbonized heavy-duty road freight sector, but limiting the spectrum of options means missing an opportunity to accumulate reductions faster, particularly in the next 10-15 years. A holistic perspective of technology, environmental metrics and economics show that a broader range of solutions is not only required but is equally compelling and necessary if we are to reach CO2 reductions targets in a timely manner. [EPA-HQ-OAR-2019-0055-1278-A1, p.2]

Advances in ICE technology have already led to growing market adoption of ICEs using ultra low carbon biomethane. Increasing attention is being focused on the potential of Hydrogen ICE for heavy-duty vehicles. Many vehicle manufacturers, Tier 1 automotive suppliers, consultancies and academic institutes have disclosed R&D programs centered on hydrogen ICEs for heavy-duty, including Cummins, Deutz, Scania, Ricardo, AVL, Mahle, to name a few. These programs largely examine Spark Ignition ICE technology. Westport's HPDI Fuel System has been successfully integrated in commercial heavy-duty LNG trucks which in turn have been adapted for use with Hydrogen or 'H2 HPDI'. Engines optimized with H2 HPDI overcome many of the challenges of either spark ignited ICEs, or fuel cell and battery electric options, to deliver the attributes needed for sustainable freight operations: highest power density, highest efficiency, manufacturability and cost-effective CO2 abatement. [EPA-HQ-OAR-2019-0055-1278-A1, pp.2-3]

EPA's motor vehicle standards should be used to support vehicles that operate on low-carbon fuels. If there are no vehicle incentives, technologies with higher upfront costs will continue to struggle. They will struggle even more if other more expensive technologies are given generous incentives. We ask that EPA provide NGVs with the same level of support and incentive as it does electric vehicles in order to encourage manufacturers to ramp up production and achieve economies-of-scale. [EPA-HQ-OAR-2019-0055-1278-A1, p.2]

Such incentives are needed to encourage the commercialization of a greater variety of vehicle models and technologies in the US market and stimulate competition. For example, the Westport HPDI technology has now been successfully deployed for heavy duty trucks in Europe for about five years, providing significant GHG emission reductions thanks to its diesel-like performance, but is currently not commercialized in North America. The availability of both compressed and liquefied natural gas vehicles (CNG and LNG), using either spark ignition or compression ignition engine technologies, together with the continuous deployment of CNG and LNG refueling infrastructure1 and increasing share of biomethane2, are all important factors that encourage fleets to invest in CNG and LNG trucks3. As a result, over 10,000 CNG and LNG trucks have been registered in Europe in 2021, accounting for 3.6% of all new trucks registered in 2021 and representing over 40% increase compared with 20204. [EPA-HQ-OAR-2019-0055-1278-A1, p.2]

1 https://www.ngva.eu/medias/500-lng-stations-in-europe-new-gas-refuelling-infrastructure-milestone-reached/

2 https://www.ngva.eu/medias/2510-biocng-in-2020-new-data-proves-rapid-growth-of-biomethane-in-transport/

3 Examples include: https://www.gnvmagazine.com/en/sandahls-logistik-completes-the-largest-order-for-biogas-trucks-in-sweden/ - https://www.commercialfleet.org/news/truck-news/2022/01/26/dhl-supply-chain-adds-new-volvo-bio-lng-trucks-to-fleet - https://www.volvotrucks.co.uk/en-gb/news/press-releases/2020/december/asda-scales-gas-fleet-fast-with-huge-volvo-fh-lng-order.html - https://www.globalgasmobility.com/60-volvo-lng-trucks-for-cargo-service-europe-cse/ - https://www.hzlogistics.eu/en/nieuws/30-volvo-lng-trucks-for-hz-logistics

4 https://www.acea.auto/files/Trucks-by-fuel-type-full-year-2021.pdf

Frontier Economics in their study 'CO2 Emission Abatement Costs of Gas Mobility and Other Road Transport Options'5 considered a 2030 timeframe, and examined ICEs using liquefied natural gas (LNG) and liquefied biomethane (LBM), and fuel cell electric vehicles (FCEV). The target vehicle segment is Heavy Duty Vehicles (HDV), with 40-tonne gross vehicle weight capability, for use in long haul operation. [EPA-HQ-OAR-2019-0055-1278-A1, p.3]

5 https://www.frontier-economics.com/media/4643/carbon-abatement-costs.pdf

Compared to a reference diesel heavy-duty truck, analysis of purely tailpipe CO2 (Tank-To-Wheel, TTW) yields the expected 100% reduction via FCEV. The H2 HPDI ICE exhibits very high tailpipe CO2 reductions (97%) but falls short of the zero tailpipe CO2 metric due to the use of small quantities of diesel for ignition, the use of which is fundamental to the high efficiency and power density of H2 HPDI compared to H2 spark ignition ICE. On a Tank-to-Wheel basis the HPDI Liquified Biomethane (LBM) options produce ~20% CO2 reductions since they use fuel containing elemental carbon; the large benefits of biomethane are derived from the Well-To-Tank portion. [EPA-HQ-OAR-2019-0055-1278-A1, p.3]

On a Well-to-Wheel (WTW) basis, including vehicle manufacturing emissions, it is evident that there is a far greater range of CO2 reductions, and clearly the relationship between tailpipe CO2 and total CO2 reductions is not directly correlated to a simple tailpipe only perspective. [EPA-HQ-OAR-2019-0055-1278-A1, p.3]

Due to the high efficiency of HPDI, H2 HPDI can deliver equivalent CO2 reductions as fuel cell vehicles, though even with green hydrogen neither technology results in zero CO2. Indeed, the 40% biomethane option delivers similar CO2 reductions as the hydrogen pathways. Only the 100% biomethane pathway achieves zero WTW CO2. [EPA-HQ-OAR-2019-0055-1278-A1, p.3]

Acknowledging that most, if not all, decarbonization strategies represent added cost, the cost of CO2 abatement is a critical differentiating factor between technologies and should be carefully considered in any rulemaking, especially where there is broad parity in environmental performance. [EPA-HQ-OAR-2019-0055-1278-A1, p.3]

Both biomethane and hydrogen ICEs are strongly advantaged in this aspect due to their commonality with high volume diesel powertrains, resulting in lower capital cost estimates. Consequently, they result in far more cost-effective abatement strategies than fuel cell only strategies. Such is the economic advantage of HPDI that it is more cost effective to deploy H2 HPDI with 100% green hydrogen than it is to deploy fuel cell with the lower cost option of blue hydrogen. [EPA-HQ-OAR-2019-0055-1278-A1, p.3]

What is also evident is that while it is disadvantaged by a proposed policy focus on tailpipe CO2 emissions, the HPDI fuel system with biomethane is the most cost-effective pathway, offering the greatest overall CO2 reductions. This simply cannot be overlooked and must be strongly supported in any balanced road freight decarbonization strategy. [EPA-HQ-OAR-2019-0055-1278-A1, p.3]

The cost-effectiveness of the HPDI approach translates into far greater CO2 reductions for every dollar of public and private investment. [EPA-HQ-OAR-2019-0055-1278-A1, p.3]

One of the dimensions of sustainability laid out at the beginning of this commentary is energy efficiency. Efficiency translates into operating economics due to fuel costs and is increasingly important when considering the need to maximize the supply capacity of precious low-carbon renewable energy sources. [EPA-HQ-OAR-2019-0055-1278-A1, p.4]

It is acknowledged that full battery electric powertrains are the most energy efficient options available, and where they are suited to the operational demands of road freight they represent a valuable solution to decarbonization. However, concerns over their cost, weight, range and charging requirements mean there is considerable uncertainty about their suitability to long-haul, heavy-duty trucking. [EPA-HQ-OAR-2019-0055-1278-A1, p.4]

Given that 'grey hydrogen' should not be used in transport (produces no CO2 reduction, or even increases total CO2), hydrogen fueled options are reliant on blue or green hydrogen, that is not readily available at scale and is subject to competing demands for other industrial sectors. To this end, comparing energy efficiency remains an important aspect of comparing hydrogen vehicle options. [EPA-HQ-OAR-2019-0055-1278-A1, p.4]

The analysis presented so far demonstrates that while fuel cell solutions for heavy-duty trucks do provide 100% reduction in tailpipe CO2, this is a very narrow and misleading perspective. On a Well-To-Wheels basis, fuel cells produce no incremental CO2 reductions, no discernible increase in energy efficiency, and are a far more cost intensive approach to decarbonization compared with hydrogen internal combustion engines. [EPA-HQ-OAR-2019-0055-1278-A1, p.4]

Fuel cell solutions do offer an advantage over ICE – the absence of tailpipe sources of air pollutants (disregarding water vapor, and other vehicle pollutant sources such as tire and brake wear). [EPA-HQ-OAR-2019-0055-1278-A1, p.4]

To illustrate, consider the marginal cost-benefit analysis of the NOx abatement of fuel cell compared to hydrogen ICE with HPDI in the European Union context. For simplicity, we used illustrative NOx emissions of Euro VI trucks as the baseline6, recognizing that future Euro VII NOx levels are likely to be lower. [EPA-HQ-OAR-2019-0055-1278-A1, p.4]

6 TNO 2019 R10193

The most common technical approach to H2 ICE is spark ignition (SI), lean burn or stoichiometric. SI solutions are typically burdened with challenges surrounding lower compression ratio (knock limited) and high wall heat transfer losses, that impact both power density and efficiency. [EPA-HQ-OAR-2019-0055-1278-A1, p.4]

The HPDI fuel system is a unique ICE approach, successfully deployed in natural gas heavy-duty trucks. When adapted to hydrogen, the HPDI technology delivers significant performance advantages compared to spark ignition H2 ICE namely: higher BMEP and power density, and increased thermal efficiency. [EPA-HQ-OAR-2019-0055-1278-A1, p.4]

H2 HPDI has shown an ability to exceed the efficiency and power density of current diesel engines with recent simulations showing 52.5% BTE. High efficiency HPDI leads to lower WTT emissions than Spark Ignition and lower cost of CO2 abatement [EPA-HQ-OAR-2019-0055-1278-A1, p.4]

An important consideration for differentiating between different hydrogen technology options is fuel quality sensitivity. Because of the highly sensitive catalysts used in FCEVs, the hydrogen they use must be extremely pure or they risk permanently damaging/disabling the vehicle. FCEVs require hydrogen of purity 99.97% and furthermore contaminants at volumes as low as <0.00000004% sulphur or <0.0002% CH4 can destroy the catalyst. [EPA-HQ-OAR-2019-0055-1278-A1, p.4]

Transitioning heavy road freight to a sustainable, decarbonized, future is a clear societal need. It is also well understood to be a very challenging prospect. A number of potential powertrain / fuel / energy solutions exist, including battery electric, fuel cell electric, hydrogen ICEs and biomethane fueled ICEs. There is a large array of attributes that defines sustainable freight, and there are equally numerous trade-offs between different solutions; trade-offs that in all likelihood have different optima when seen from the differing perspectives of policy and end user. [EPA-HQ-OAR-2019-0055-1278-A1, p.5]

Westport Fuel Systems believes that an optimal pathway to sustainable road freight requires keeping all these options available, recognizing that different technical pathways are at different stages of technical and commercial viability, and that there will be segments of the road freight sector where, for example, battery electric may prove to be an ideal solution, but for heavier vehicles, in long haul operation, hydrogen and biomethane have a stronger set of attributes. [EPA-HQ-OAR-2019-0055-1278-A1, p.5]

Vehicle CO2 regulation should take account of carbon intensity of fuel/energy production. The extremely strict definition of HDZEV (from a CO2 perspective) as referenced in many sections of the EPA proposal rulemaking should be restated to encompass ICE options that are near-zero tailpipe CO2 and deliver equivalent or greater WTW CO2 reductions. Other pieces of legislation should encourage investment in all options that deliver urgently needed CO2 reductions while moving away from fossil fuels. As well, regulatory instruments used in the certification and type approval of vehicles should accommodate both spark ignition and dual-fuel HPDI hydrogen ICEs. [EPA-HQ-OAR-2019-0055-1278-A1, p.5]

Hydrogen fuel approved for use in transport should not be restricted to the same, extremely high purity, grades required for fuel cells. Hydrogen ICEs are much more tolerant to lower specification hydrogen, making them more robust in the marketplace, increasing compatibility with distribution systems, and eliminating some of the cost components of fuel cell grade hydrogen. [EPA-HQ-OAR-2019-0055-1278-A1, p.5]

US policy, regulation, investment and R&D funds/incentives should consider the highly competitive, cost-effective option of hydrogen and biomethane fueled ICEs among the suite of options to decarbonize the heavy-duty freight sector in the U.S. [EPA-HQ-OAR-2019-0055-1278-A1, p.5]

Key WFS commentary/observation highlights include:

- Internal Combustion Engine (ICE) powertrains fueled with hydrogen or biomethane (RNG) can achieve equal (or greater) CO2 reductions to fuel cells. [EPA-HQ-OAR-2019-0055-1278-A1, p.6]
- Hydrogen ICEs with the HPDI fuel system can be as energy efficient as fuel cell pathways. [EPA-HQ-OAR-2019-0055-1278-A1, p.6]
- While fuel cells will produce zero tailpipe NOx emissions, the marginal cost of NOx abatement is extremely high, and will only be further exacerbated by the future North American emissions standards. [EPA-HQ-OAR-2019-0055-1278-A1, p.6]
- Hydrogen ICEs are far less sensitive to fuel quality than fuel cells and can offtake hydrogen from diverse sources. [EPA-HQ-OAR-2019-0055-1278-A1, p.6]

Organization: *William F. Limpert*

EPA should also consider increased use of “green” hydrogen for transportation needs. This is hydrogen that is produced only with renewable energy. EPA should not consider hydrogen that is produced by the combustion of fossil fuels, or any other method that emits greenhouse gases. The green hydrogen should be produced as locally as possible to avoid long transmission pipes that create environmental damage, take away property rights, have an extreme explosion potential, and are vulnerable to terrorist acts. [EPA-HQ-OAR-2019-0055-1190]

Organization: *Valero Energy Corporation*

Neither the structure of the rule nor EPA's assessment of benefits and impacts should arbitrarily favor a single technology or fuel source. Just as we noted in comments on EPA's proposal for Revised 2023 and Later Model Year Light-Duty Vehicle GHG Emission Standards, EPA should not favor one technology over all others in designing standards to reduce air pollution particularly when doing so EPA disregards the pollution and other adverse impacts of that favored technology. Valero incorporates those comments as part of these comments and asks that EPA take those comments into consideration for this proposed rule. The comments are attached to these comments as Attachment A. [EPA-HQ-OAR-2019-0055-1328-A2, pp.6-7]

EPA Summary and Response

Summary:

Several commenters urge the EPA to establish standards that support neutrality and flexibility in fuel and technology options such that the standards do not limit innovation. One commenter specifically lists concerns regarding EPA providing incentives that are limited to specific technologies, and states that they would like all effective technologies to be recognized for emissions improvement contributions. Another commenter states that they would like EPA to revise the definition of “fuel” and other provisions to encourage all innovations that may achieve the same, or greater, emissions benefits beyond BEVs and FCEVs. These commenters suggest that for market fairness, any and all technologies that demonstrate proper emissions reductions should be able to qualify as zero or near-zero emissions.

Many commenters also discuss alternative fuel options. For example, several of commenters state their support for using hydrogen fuel in heavy-duty internal combustion engines (H2ICE). They state that EPA standards should support vehicles that operate on low-carbon fuels, and H2ICEs should be given equal consideration as fuel cell and battery electric trucks. One commenter states that their HPDI Fuel System has been adapted for use with hydrogen and has been integrated in commercial heavy-duty trucks; they further state that these trucks deliver sustainable freight options that are cost effective and achieve CO_2 reduction. Another commenter also suggests that there is wide industry support for hydrogen fuel in meeting NO_X limits while emitting zero tailpipe carbon emissions.

In addition, a subset of commenters further expressed their support for the widespread use of low carbon fuels. Some commenters urge the EPA to send what they characterize as “the right signal" by allowing certification of an ethanol-fueled compression ignition engine based on its emissions performance. Other commenters discussed the benefits of renewable natural gas and urge EPA to amend the greenhouse gas regulations to incorporate these benefits. One commenter also requested that EPA incentivize renewable natural gas. A subset of these commenters stated their support for renewable biogas produced at publicly owned treatment works (POTWs). They support near-zero emissions vehicles that are fueled by renewable biogas when ZEVs are not feasible as a way to comply with federal ozone standards. Still other commenters provided information on what they characterize as the benefits of biodiesel and renewable diesel. They state that these fuels will provide immediate greenhouse gas reductions. One commenter suggests EPA should acknowledge renewable diesel in their climate policy and any EV mandate is inconsistent with the Renewable Fuel Standards (RFS). Another commenter is concerned that the focus on EVs takes away from the emissions reductions renewable fuels provide. Finally, other commenters discussed renewable propane and the CO_2 emissions reductions from this fuel. They state that under proposed Option 1, the propane industry is best positioned to help the EPA achieve its environmental goals. In contrast, other commenters do not support the use of natural gas as an emissions solution; they mention studies that show that methane can be as polluting as diesel.

Still other commenters provided perspectives on other types of engine technologies, in addition to or in lieu of discussion on specific fuel types. For instance, some commenters stated their support for the opposed-piston (OP) diesel engine technology. One commenter described tests they have conducted on an OP engine; they state that the test results demonstrate that OP engine technology can be used to comply with the proposed standards. The commenter also discussed how the engine can operate on renewable diesel.

Several commenters also discuss thermal management technologies, such as fuel burners and electric heaters. They comment that these technologies can assist with cold start emissions. One commenter demonstrated CO_2 improvement with the use of alternative active heating. They mention the regulations should simultaneously drive NO_X and CO_2 reductions. Another commenter submitted comments on the feasibility of meeting NO_X emissions standards with a burner as a drop-in addition to existing aftertreatment technology; they stated that they are currently working on a technology package including this burner component.

Two commenters stated their support of variable valve actuation (VVA) for heavy-duty vehicles. They go into detail on early exhaust valve opening (EEVO), early intake valve closing (EIVC) and late intake valve closing (LIVC) as examples of strategies to utilize VVA. Cylinder deactivation (CDA) is another strategy listed to address low-load emissions and fuel consumption. One of these commenters also discusses how mild hybridization is an emissions reduction strategy that is synergistic with VVA and is low cost but still creates movement towards 48V electrification.

Finally, one commenter provided information on a plug-in electric power take-off system (ePTO) and how this system can be used to eliminate NO_X and greenhouse gases due to the engine being turned off. They stated there are currently ePTO systems in production for a wide range of heavy-duty truck applications.

Response:

EPA appreciates the comments and supporting information regarding alternative technology pathways for complying with heavy-duty engine emissions standards. Several commenters stated that EPA should not rely on electrification to achieve the standards and should instead consider the emissions reductions achievable from alternative fuels. Other commenters stated that for many vehicle applications, ZEV technologies are projected to be cheaper to own and operate within five years. Several other commentors stated their support for biogas, RNG, RNP, and other low-carbon fuels, while other commentors expressed concerns with the use of these fuels. Finally, other commenters urged the EPA to establish standards that support neutrality and flexibility in fuel and technology options that do not limit innovation.

As discussed in preamble Section III.A.3, while we have referenced a technology pathway for complying with our final heavy duty engine criteria pollutant standards (Chapter 3 of the RIA), which is consistent with CAA section 202(a)(3), there are other technology pathways that manufacturers may choose in order to comply with the final performance-based standards. We did not rely on alternative technology pathways in our assessment of the feasibility of the final standards, however, manufacturers may choose from any number of technology pathways to comply with the final standards (e.g., alternative fuels, including biodiesel, renewable diesel, renewable natural gas, renewable propane, or hydrogen in combination with relevant emissions aftertreatment technologies, and electrification, including plug-in hybrid electric vehicles, battery-electric or fuel cell electric vehicles). We acknowledge that in some cases such alternative technology pathways may further address manufacturers' concerns regarding compliance margin and/or offer a lower cost alternative, or other advantages such as simultaneous reductions in GHG emissions, and as such offer additional pathways to feasibly meet the final standards. See also our responses to general comments regarding the level and feasibility of the final standards in section 3.1.1 of this document.

In response to comments on providing incentives for alternative technology pathways, or treating certain technology pathways as near-zero or zero emissions technologies, we note that we are not finalizing the proposed allowance for manufacturers to generate NO_X emissions credits from heavy-duty ZEVs, or any credit multipliers that were included in the proposed NO_X ABT program (see preamble Section IV.G and section 12 of this Response to Comments document for additional details). In response to comments related to GHG emissions standards and the use of alternative technology pathways to meet GHG emissions standards, EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards). Section 28 of this Response to Comments document details the comments we received specific to the proposed revisions to the GHG Phase 2 standards. Finally, in response to comments related to criteria or GHG emissions that occur upstream of a vehicle (e.g., from production of fuel or energy), we point to section 19.3 of this document.

In response to comments requesting regulatory relief (e.g., DF testing, GHG certification and testing requirements, diagnostic requirements) for H2ICE or other technology pathways, we did not propose or request comment on such revisions and are not including them in the final rule.

As discussed immediately above in this response, manufacturers may choose from any number of technology pathways to comply with the final standards, including H2ICE. Should manufacturers or other stakeholders continue to want regulatory relief for H2ICE products, or other technology pathways, then EPA encourages manufacturers to continue working with EPA on these matters separate from this final rulemaking process.

3.11 Other comments on criteria pollutant standards

Comments by Organizations

Organization: *Allison Transmission, Inc. (Allison)*

Allison supplies transmissions for many vocational vehicle applications which are utilized in a variety of different applications; many of these vocational vehicles accumulate mileage much more slowly than long-haul freight vehicles. Apart from mileage, vocational vehicles may also have vastly different utilization, from school buses with regular routes to beverage delivery trucks, utility vehicles, refuse trucks, construction and/or specialized agricultural or silvicultural vehicles. Applying the same broad standard for criteria pollutants, like NOx, for these vehicles varies from the treatment of such vehicles pursuant to the Phase 2 GHG rule wherein vocational vehicles have 18 different separate subcategories.17 EPA has not provided a rationale why similar subcategorization of these vehicles with regard to “criteria” air pollutant standards like NOx should not apply. [EPA-HQ-OAR-2019-0055-1231-A1, pp.10-11]

17 81 Fed. Reg. at 74,242-3 (Oct. 26, 2016).

Organization: *American Bus Association (ABA) (1070 and 1308)*

As EPA points out, the Clean Air Act (CAA) framework has provided significant advances in improving air quality, through cleaner burning fuels and emission control standards – and this is not to suggest additional improvements cannot be made. As stated by the Truck and Engine Manufacturers Association (EMA) in 2018, “Over the past 20 years EMA manufacturers have innovated and implemented advanced clean technologies to reduce NOx emissions by over 90% and particulate emissions by over 98%.” But there needs to be a balance, accounting for all of the actual costs and benefits associated with the motorcoach industry and the impact of the emissions control program on these businesses and weighing what is truly feasible and makes sense over a reasonable time horizon. It does not serve to increase the stringency of the emission control standards and testing, if the result is fewer motorcoaches on the road due to an excessive increase in cost to purchase a new vehicle, the weight of the new vehicle exceeding federal limits, or the new emission control system on the engine further degrading the reliability of the vehicle. EPA must consider all heavy-duty vehicles users, including bus and motorcoach operators, and take into account the unique challenges and federal laws beyond the environmental arena, when considering this rule. Further, the proposed rule leaves major open questions about its impact on engine size and weight. Any significant increase in either the size or weight of engines could counter-productively serve to potentially reduce the number of passengers that could be transported on a motorcoach. For example, both under federal and state laws buses are subject to strict weight limits (23 USC 127). However, the proposed rule contains no useful analysis of its bus weight implications. Vehicle redesign costs to accommodate any increased weight to the engine or emissions control system components should have also been considered in the Regulatory Impact Analysis. [EPA-HQ-OAR-2019-0055-1308-A1, p.4]

The Proposal, in its current form, and in particular Option 1, raises several concerns for ABA. Most notably, ABA is concerned about the feasibility, weight, cost and resulting reliability of implementing the proposed stringent emission control standards and testing protocols, along with the extension of the engine useful life and engine manufacturer warranty. If EPA proceeds with the Proposal, ABA strongly advocates for pursuing Option 2, under the proposed standards and test procedures. ABA also notes that EPA could alleviate a number of concerns raised by the motorcoach industry by expanding the Relief Measures provided to engine manufacturers in 2012, that allow for modifications to emission control systems to prevent reducing engine performance, to engines manufactured for use in motorcoaches. Based on EPA's current time schedule for this rulemaking, if no relief from the proposed requirements is provided, EPA does not appear to be interested in ensuring the motorcoach industry remains a viable option of travel. Under the Proposal the motorcoach industry will face increased safety risks and exorbitant increases in costs to operate. In turn, those communities most reliant on motorcoach services, including disadvantaged and rural communities, emergency responders and the military, will all note a reduction in service capacity across the national transportation network. As previously noted, ABA will supplement these comments as appropriate.[EPA-HQ-OAR-2019-0055-1308-A1,p.12]

Organization: *RV Industry Association (RVIA)*

RVIA supports EPA's objective of reducing the negative health effects associated with the pollution from motor vehicles and we recognize that the proposed regulation will have benefits relating to improved air quality. These benefits, however, are directly correlated to vehicle miles traveled and the benefits to those in disadvantaged communities are tied to vehicles that tend to operate in those communities. As detailed in our Oct. 1, 2015 comments to EPA's Phase 2 GHG NPRM8, annual VMT for motorhomes has been determined to be 4,290 miles9. This is about 1/3 the VMT of a typical delivery truck10 and about 1/16 the VMT of a typical Class 8 truck11. This means that benefits linked to motorhomes will be about 1/3 those of the typical delivery truck and 1/16 of Class 8 truck benefits. In urban communities most negatively affected by truck pollution, the relative benefit tied to motorhomes will be even less, given that motorhomes are generally not operating in these communities. [EPA-HQ-OAR-2019-0055-1270-A1, p. 4]

- 8. Letter from Dianne Farrell to EPA Docket No. EPA-HQ-OAR-2014-0827, Oct. 1, 2015, page 6.
- 9. This figure is based on a survey of odometer readings taken from 987 three-year old motorhomes sold in calendar years 2012-2014.
- 10. Average annual vehicle miles traveled for a delivery truck is 10,309 miles. Averagewww.afdc.energy.gov/data/10309
- 11. Average annual vehicle miles traveled for Class 8 truck is 62,751 miles. Averagewww.afdc.energy.gov/data/10309

The cost benefit relationship described above necessitates EPA doing more than simply putting in place 'one-size fits all' standards applicable to all categories of vehicles covered by the regulation. [EPA-HQ-OAR-2019-0055-1270-A1, p. 4]

Unlike most vehicles subject to this rulemaking, motorhomes are not generally used for commercial purposes and are not providing the end user a source of revenue. Motorhome owners do not benefit financially from motorhome ownership. This reality makes the cost/benefit ratio seen for commercial trucks even further from reality for motorhomes. [EPA-HQ-OAR-2019-0055-1270-A1, p. 4]

For motorhomes, the cost/benefit ratio is magnitudes of order worse than it is for the commercial trucks that are responsible for the overwhelming majority of the pollution for which this regulation seeks to curtail. [EPA-HQ-OAR-2019-0055-1270-A1, p. 4]

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

MEMA is also concerned about the lack of data regarding vocational applications and the difficulties that this will cause. Vocational applications could also be regulated as a separate category. [EPA-HQ-OAR-2019-0055-1322-A1, p. 5]

EPA Summary and Response

Summary:

Some commenters urged EPA not to finalize 'one-size fits all' standards applicable to all categories of vehicles covered by the regulation, but rather consider setting separate standards or requirements for different vehicles types. EPA recognizes the concerns raised by commenters, but consistent with the current criteria pollutant standards, we are not finalizing vehicle-specific standards in this rulemaking. Rather, we are finalizing standards specific to the heavy-duty engine categories used in the existing criteria pollutant standards (i.e., Heavy HDE, Medium HDE, Light HDE, SI). We think the current categorization is a reasonable exercise of our discretion, that sufficiently accounts for differences in vehicle type and emissions performance.

Response:

Preamble Section III.A.2 includes additional discussion on the factors we considered when setting the final standards; as discussed in preamble Section III and RIA Chapter 3, our technical assessment demonstrated feasibility of the final standards over several different duty-cycles, which reflect real world operations of a variety of different vehicle types. In setting the final emission standards, EPA appropriately assessed the statutory factors specified in CAA section 202(a)(3)(A), including giving appropriate consideration to the cost associated with the application of technology EPA determined will be available for the model year the final standards apply (i.e., cost of compliance for the manufacturer associated with the application of such technology). EPA’s assessment of the relevant statutory factors in CAA section 202(a)(3)(A) justify the final emission standards. We also evaluated additional factors, including factors to comply with E.O. 12866; our assessment of these factors lend further support to the final rule. See also our response to similar comments in section 18.9 of this document. We note that the final provisions for engine derating, or inducements, which one commenter notes, are discussed in preamble Section IV.D, with additional information included in section 8 of this Response to Comments document.

4 Warranty

Comments by Organizations

Organization: *Alliance for Vehicle Efficiency (AVE)*

AVE supports EPA's proposed Option 1 standard, with a modification of the proposed full useful life timelines and warranty requirements, as the best option for driving more rapid adoption of advanced engine and emission control technologies. [EPA-HQ-OAR-2019-0055-1280-A1, p. 2.]

AVE asks EPA to modify the proposed full useful life timelines and warranty requirements.

Currently, suppliers are not provided the necessary data (and certain data may not exist) nor information to design for a reasonable warranty and to determine if the proposed full useful life (FUL) timelines are feasible. Suppliers lack the data necessary, beyond the current goals to extended distance, time-in-service and beyond the first owner/user of vehicle, to make accurate assessments about the durability of many products. More research on engine wear and use patterns that result in degradation is needed before proposing longer warranties and extending FUL timelines. As such, AVE recommends several changes to EPA's proposed warranty requirements and FUL timelines: [EPA-HQ-OAR-2019-0055-1280-A1, p. 2.]

- Engine-related warranty regulations apply only when a vehicle has full maintenance records of required servicing and shows no sign of abusive use;
- Exclude from a longer warranty standard parts that will be replaced by routine maintenance and identify which vehicle systems and/or specific parts should be covered by longer warranties; and
- ...

The proposed longer warranties for new vehicles are intended to protect consumers and ensure emission systems work properly throughout the life of new heavy-duty trucks. Due to unknown risks to suppliers and manufacturers, these extended warranties, as proposed, will add extensive, unknown costs to vehicles. This added cost could disincentivize new vehicle purchases, thereby undermining the goals of the Proposal. [EPA-HQ-OAR-2019-0055-1280-A1, p. 2.]

Organization: *Allison Transmission, Inc. (Allison)*

- Overly aggressive extension of emissions warranties associated with Option 1 will also drive up cost of technology, exacerbating difficulties for individual vehicle sectors in meeting the standards and exacerbating the difficulty in turning over fleets reliant on old technology. This is another reason that Allison believes a single-phase approach, as in Option 2, is a better long-term strategy. The focus on mileage in repair cost analysis associated with tractor application underestimates the cost of seven-to-ten-year warranty structures, particularly with respect to demanding vocational vehicle applications. Allison's own data (see Table 1) shows that vocational vehicle usage differs substantially from tractor usage, meaning that hours of operation may be the operative factor with respect to the extent of warranty coverage. EPA data utilized to develop warranty periods does not adequately take these very real differences in utilization into account. EPA should therefore consider alternative warranty concepts that it first advanced last year in the 2021 Advance Notice of Proposed Rulemaking ("ANPR").4 [EPA-HQ-OAR-2019-0055-1231-A1, pp.5-6]

4 Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine Standards, 85 Fed. Reg. 3,306 (Jan. 21,2021).

- Neither Option 1 or Option 2 reflects concepts EPA introduced in the 2021 ANPR to tailor emissions warranties by component and vocation. We would like to encourage EPA to reconsider those concepts given one size does not fit all for diverse uses and unique customer needs in commercial vehicle. [EPA-HQ-OAR-2019-0055-1231-A1, p.6]

In the proposed rule, EPA states that it will give "full consideration" to the useful life and warranty periods that it has proposed for Options 1 and 2, including "the full range of options between them."23 For the reasons stated below, Allison believes that EPA should finalize Option 2 regulatory periods. In our analysis, Option 2 more appropriately balances the costs and benefits of extended useful life and warranty periods and better takes into consideration the real-life dynamics concerning these periods and customer behavior. [EPA-HQ-OAR-2019-0055-1231-A1, p.12]

23 87 Fed. Reg. at 17,421.

As a vendor to vehicle OEMs, Allison recognizes that longer warranty periods required of a vehicle manufacturer will inevitably filter into contract negotiations affecting the cost of components which will need to be designed for longer periods and may require increased material costs. OEMs will need to additionally project the costs of future repairs under warranty, even while its testing of vehicle systems may not be conclusive of future issues. This tends to result in companies making conservative estimates going forward to reduce risk of large-scale and unanticipated financial exposure; these estimates in turn directly impact pricing to the ultimate purchaser. [EPA-HQ-OAR-2019-0055-1231-A1, p.12]

Balanced against these cost increases, EPA makes several projections and assumptions: EPA believes longer emissions warranty coverage will reduce the overall costs of heavy-duty commercial vehicles over the long-term.25 This is based on forecasting that longer emissions warranty coverage encompassing a greater percentage of a vehicle's extended useful life period will result in the most efficient behavior across the manufacturing process. This, in turn, will result in lower lifetime costs attributable to the servicing and maintenance of vehicles in-use. EPA's theory appears to be that because more of future repair costs would be covered by the manufacturer, rather than operator, manufacturers will have the incentive to design covered parts and systems in a manner that will result in lower repair costs. [EPA-HQ-OAR-2019-0055-1231-A1, p.12]

25 87 Fed. Reg. at 17,428.

While Allison appreciates the logic of this argument, there are several issues that serve to challenge EPA's conclusions. Specifically, while component and system validation can serve to identify issues that may occur in the future, testing has limited ability to accurately predict how frequently such conditions will be experienced in real world operation. This is particularly true with respect to durability issues given the range of operations involved for different vehicle types as well as the actual behavior of customers in their use and maintenance of vehicles and equipment over time. In addition: [EPA-HQ-OAR-2019-0055-1231-A1, pp.12-13]

- Testing limitations mean that manufacturers have limited data available to inform how prices may be set to fully account for lengthened useful life and warranty periods. This situation will tend to cause companies to set prices conservatively (in this context, higher) to address the inherent risk involved in accounting for extended warranties and increased periods for potential liability. It may take several years of experience addressing longer useful life/warranty periods before more accurate projections can have a lower or more realistic price impact.
- At the same time, under EPA's proposed emission warranty periods, which distinguish between vehicles solely on the basis of whether they are spark-ignition or light, medium or heavy heavy-duty engines (”HDEs”),26 the supply chain structure of the North American Heavy-Duty manufacturing sector will tend to limit individualized pricing. That is, the broad categories utilized by EPA will tend to drive similar pricing of components for all vehicles in each of the four different intended service classes. A component supplier may or may not know the precise end use for which a component will be used, leading to a natural inclination to default to assumptions based on end uses with potentially high exposure to emissions warranty claims. Again, this would not produce the most efficient result in obtaining EPA's expressed policy goals.
- Due to all these factors, the initial price of longer warranties when combined with the initial price of new emissions control technology will tend to increase incentives for customers to engage in "pre-buy" activities. This, in turn, will directionally delay projected emissions benefits and increase incentives for fleet owners and others to keep older, repaired and rebuilt technology vehicles on the road. In the context of this rulemaking, EPA should at minimum, examine this issue as part of its planned analysis of pre-buy and low-buy activities which is not yet complete.27 [EPA-HQ-OAR-2019-0055-1231-A1, p.13] 27 Id. at 17,590-1.

26 Table IV-9, 87 Fed. Reg. at 17,508.

Allison appreciates EPA's objectives in proposing to extend both the useful life and warranty periods and the policy goals that have been articulated: promotion of better engine maintenance, less tampering and maintaining emission performance over time.28Allison also does not contest that other indirect results could occur, e.g., that longer useful life and warranty periods could lead manufacturers to "simplify repair processes and make [manufacturers] more aware of system defects that would be tracked and reported to EPA over a longer period of time."29 These are valid policy goals. EPA, however, should be reticent to push out such periods too far even while it seeks to harmonize standards with California programs. [EPA-HQ-OAR-2019-0055-1231-A1, p.13]

28 See, e.g., 87 Fed. Reg. at 17,497, 17,505.

29 Id.at 17,424, 17,505-6.

It seems clear that EPA intends this proposed rule to incentivize the deployment of new emissions technology as well as deliver substantial public health and environmental benefits. But if useful life and warranty periods are extended too far into the future, these regulatory requirements will tend to inhibit, rather than incentivize, the development of new emissions control technology given that the longer periods will inherently favor the deployment of emission controls systems which can best be verified in the near-term. EPA should also consider that it has the legal ability to revisit useful life and warranty issues in a future rulemaking; it should therefore avoid the conclusion that it must finalize each and every component of the proposed rule at the high end of stringency in order to obtain intended benefits. Rather, EPA could move to finalize Option 2 useful life and warranty provisions now and assess at a later date how these provisions worked, or did not, work in practice and whether these periods should be extended in future years. Having the benefit of seeing how Option 2 requirements are actually complied with could only help to inform EPA's analysis of the proper length and extent of the useful life and warranty provisions. [EPA-HQ-OAR-2019-0055-1231-A1, pp.13-14]

When EPA solicited comments on the Clean Truck Initiative in early 2020, Allison indicated that the Agency should explore mechanisms which would "vary the length of warranty coverage across different types of components."37 As Allison commented at the time, it may not be possible in all cases to design, or cost-effectively design, every emission related component to reach the same useful life period required with respect to a new engine. Both EPA and CARB have explored different concepts to, among other options, prorate parts and labor through more limited coverage, or to limit warranty to include only the most expensive components.38 [EPA-HQ-OAR-2019-0055-1231-A1, p.17]

37 85 Fed. Reg. 3,306, 3,325 (Jan. 21, 2020).

38 CARB Post-September 26 [2019] Workshop presentation at 7.

Allison recognizes that EPA has articulated somewhat different goals in connection with this proposed rule. In broad brush, EPA appears to have adopted the view that more expansive useful life and longer warranty periods are an unmitigated good. While it has refrained from proposing the longest theoretical periods based on data that it reviewed regarding rebuilds,39 EPA has not sought to further explore any of the concepts contained in the ANPRM. Rather, EPA is proposing useful life periods from 10 to 15 years that incrementally vary only with respect to whether a vehicle is spark ignition, or in the case of compression-ignition, only with respect to weight. Alternative standards that are proposed only vary with respect to increased mileage. [EPA-HQ-OAR-2019-0055-1231-A1, p.17]

39 See, e.g., mileage for Class 8, out-of-frame rebuild periods. 87 Fed. Reg. at 17,498, Table IV-1.

Similarly, under the Proposed Rule, warranty periods may be subject to exponential extension in terms of mileage and will be subject to a concurrent hours of operation limitation, but are not further segmented as between different vehicle types or different portions of emissions-related equipment.40 Hours limitations are based on the use of a static 20 mile per hour average vehicle speed across all vehicle service classes.41 EPA has requested comment on whether the existing regulatory list of emission-related components should be expanded to include additional more specific components or systems,42 but not whether useful life and/or warranty periods might be differentiated as between such specific components or systems. This approach contrasts with EPA's 2021 ANPRM which sought comment on alternative warranty approaches.43 [EPA-HQ-OAR-2019-0055-1231-A1, p.17]

40 Table IV-9, Id. at 17,508.

41 Id. at 17,508.

42 Id.

43 85 Fed. Reg. at 3,325.

In addition to the proposed alternatives, EPA should consider the following options:

- EPA should consider taking a targeted approach to emission warranties that focuses on components with the highest emissions impact or known degradation concerns. While EPA is taking comment on expanding the current list of warrantable parts, it should, as part of that analysis, consider the incremental value of adding any new systems as well as the incremental value of focusing on parts that more directly impact emissions. Blanket approaches, such as "anything that lights the MIL" should be avoided. Focusing on the most essential components could have multiple benefits, including ensuring that issues with large emission impacts are promptly identified and, in the end, recalled and/or repaired. More is not necessarily better if compliance efforts are spread among numerous subsystems with only incremental emissions impact.
- EPA should also consider tailoring emissions warranties to different vehicle classes and vocations, rather than just relying on the type of engine involved and weight class. Vocational markets tend to value warranties based on years and hours of use -- whereas freight and tractor trailers tend to value warranties that cover more mileage. While EPA has proposed both mileage and hours as parameters, the Agency could utilize a finer-targeted system that prioritizes miles in some sectors such as long-haul freight, while prioritizing time/hours in vocational segments. A more focused and tailored approach to emissions warranties obviously will have the downside of increased complexity and additional reliance on warranty tracking systems. But at the same time, the costs of extended warranty periods could be better contained through a targeted approach. Allison has included Table 3 below so that EPA may review the 2022 vocational models Allison uses to differentiate warranty terms and pricing to meet customer needs based on

different customer usage. Within the vocational market applications vary in use and how end- users value different coverage terms beyond base warranty [EPA-HQ-OAR-2019-0055-1231-A1, pp.17-18]

Organization: *American Lung Association et al.*

To realize the maximum health benefits, US EPA recognizes the need to establish standards that look beyond the stringency levels and proposes updated test procedures, truck 'useful life' requirements and warranty provisions to support achieving pollution reductions across real-world driving conditions throughout the useful life of the truck. We believe that Option 1 provides a strong foundation, and offer the following recommendations to protect public health: [EPA-HQ-OAR-2019-0055-1271-A1, p.2]

Strengthen warranty provisions to match full useful life. Again, we appreciate that Option 1 proposes strengthening the emissions control warranty provisions to cover a greater period of a truck’s operational life, but recommend full warranty coverage for emissions controls to ensure repair and replacement throughout the life of the vehicle. Warranty coverage provides a level of certainty to the owner of a new or used truck that the vehicle emission controls will function properly or be repaired by the manufacturer, therefore restoring emission benefits in the event of failure. US EPA also notes that warranty coverage reduces the likelihood of tampering or delayed maintenance of emission controls, which must remain the case in the later stages of vehicle life. [EPA-HQ-OAR-2019-0055-1271-A1, p.3]

Organization: *American Truck Dealers (ATD)*

ATD supports reasonable revisions to existing HDE/CMV emissions warranty periods. The proposal acknowledges that longer emission warranty periods are likely to increase the purchase price of new CMVs.14 By definition, an emission warranty is included in the price a first purchaser pays when buying a new CMV. However, given that CMV and HDE OEMs must “pass on” the costs associated with emission warranty (and useful life) mandates, the practical result will be an increase above the prices first purchasers would otherwise pay for the new CMVs and HDEs they buy. ATD also is concerned that new CMV purchasers with short trade cycles will not value and want to “pay for” the incremental cost of lengthy emissions warranties. [EPA-HQ-OAR-2019-0055-1321-A1, p. 6]

14. Id.

Organization: *American Trucking Associations (ATA)*

While ATA cannot address every aspect of HD2027, we are supportive of the underlying environmental objectives and several of the elements being proposed. ATA’s areas of support include:

Current emission warranty and useful life periods for heavy-duty engines and vehicles should be revised from the current requirements to increase the durability and efficacy of in-use emissions compliance. [EPA-HQ-OAR-2019-0055-1326-A1, p. 3.]

Requiring the purchase of costly extended warranties does not prevent tampering or the purchase of illicit emission defeat devices. Enforcement of emission standards under the Clean Air Act ("CAA") does. [EPA-HQ-OAR-2019-0055-1326-A1, p. 15]

The CAA prohibits tampering with emissions controls, as well as manufacturing, selling, and installing aftermarket devices intended to defeat those controls. EPA's National Compliance Initiative began in FY 2020 and focused on stopping the manufacture, sale, and installation of defeat devices on vehicles and engines used on public roads as well as on nonroad vehicles and engines. In FY 2021 alone, EPA settled 40 civil enforcement cases, the greatest number of resolutions for tampering and aftermarket defeat devices for any one year in the agency's history – thereby stopping the manufacture or sale of devices intended to defeat required emissions controls on vehicles and engines used on public roads. [EPA-HQ-OAR-2019-0055-1326-A1, p. 15]

Enforcement Alerts, such as the December 2020 EPA "Aftermarket Defeat Devices and Tampering are Illegal and Undermine Vehicle Emissions Controls," are widely distributed by trade associations representing truck dealers and fleets.11 While rates of tampering with emission control systems and the installation of illicit emissions defeat devices have plummeted, nothing can prevent rogue trucking operations from circumventing the law better than enforcement and the detection of devices which enable such behaviors. Longer, more expensive warranty packages are not justified to curtail unscrupulous activities on the part of some. [EPA-HQ-OAR-2019-0055-1326-A1, p. 15]

11. EPA Enforcement Alert, "Aftermarket Defeat Devices and Tampering are Illegal and Undermine Vehicle Emissions Controls", EPA 300-F-20001, December 2020.

Organization: *BBU Environmental Services*

As small trucking business owner I can state that the def systems are not reliable. I not only loose money to repair costs i also lose productive time of the unit. I think these systems should be warrantied by the manufacturer for life of the unit and there should be a penalty for down time while they are being worked on. [EPA-HQ-OAR-2019-0055-1020, p. 1]

Organization: *BorgWarner*

1. BorgWarner is in favor of forward progress to consistently reduce NOx, CO2 and other emissions, but we have concerns with the proposal's full useful life (FUL) and emissions warranty provisions. [EPA-HQ-OAR-2019-0055-1234-A1, p. 1.

To help mitigate unknown and unquantified risks that would be placed on suppliers, the EPA could consider identifying specific parts and systems that should carry longer warranties and ensure that evidence is collected to demonstrate that any life limits are feasible. Due to vehicle ownership patterns, automotive suppliers have neither visibility nor access to the information and data required to design for an appropriate warranty for the mileage and temporal limits being proposed. [EPA-HQ-OAR-2019-0055-1234-A1, p. 1]

BorgWarner recommends adjusting engine-related warranty regulations such that they apply only when the vehicle has full maintenance records according to service schedules and there is no evidence of abuse leading to failures. Owner/Operator maintenance and repair can have a significant impact on engine and emission systems' performance and life. [EPA-HQ-OAR-2019-0055-1234-A1, p. 2]

When truck components or systems experience failure, the root cause needs correct diagnosis as failure can be the result of mechanical failure elsewhere within the engine system. Inadequate or incomplete service diagnostic routines might incorrectly identify faults in the wrong components. Therefore, it is important that poor or incomplete protocols in the service shops do not manifest themselves with replacement of good parts, repeat symptoms and inflated costs. [EPA-HQ-OAR-2019-0055-1234-A1, p. 2]

Some components and systems require routine maintenance or replacement during the service life of a vehicle. It is important to correctly determine these intervals and define these by component. A manufacturer's warranty exposure can be limited by having a FUL definition for each system component. [EPA-HQ-OAR-2019-0055-1234-A1, p. 2]

Organization: *California Air Resources Board (CARB)*

The NPRM requested comments on the proposed warranty mileage values.

CARB staff strongly supports Option 1, which is consistent with the Omnibus Regulation's warranty periods. It is important that warranty periods be uniform throughout the nation. As discussed in the proposed rule, the longer warranty periods are critical in encouraging vehicle owners to repair their vehicles and providing incentives to manufacturers to improve their products to minimize the repair costs to reduce emissions. During the Omnibus Regulation rulemaking process, industry stakeholders raised concerns regarding the potential cost impact of warranty requirements. In response, the Board directed CARB staff to engage with affected stakeholders to conduct a warranty cost study. Accordingly, CARB staff convened an industry stakeholder work group to analyze and study the various differences in the cost estimate methodologies used for estimating warranty costs. The work group met a total of 16 times over a period of nine months. The details of the study are available in the final report.172 Based on what was learned from the workgroup process and study, CARB staff believes that our methodology provides reasonable and defensible estimates of the average incremental warranty cost ($1,104 for a heavy heavy-duty diesel engine with a 600,000 mile, 10 year, 30,000 hours warranty for 0.02 g/bhp-hr at 435,000 miles and 0.04 g/bhp-hr at 800,000 miles) that affected parties will face under the Omnibus Regulation. Although U.S. EPA's warranty cost estimation method is significantly different than the CARB staff methodology and we comment on the warranty cost estimation method in comment b of this section, U.S. EPA's estimated per-engine warranty costs of Option 1 are reasonable and comparable to those of Omnibus Regulation. [EPA-HQ-OAR-2019-0055-1186-A2, p.109]

172 California Air Resources Board Staff Report on the Warranty Cost Study for 2022 and Subsequent Model Year Heavy-Duty Diesel Engines, December 2021, https://ww2.arb.ca.gov/sites/default/files/2022-01/warranty_cost_study_final_report.pdf

U.S. EPA requested comment on applying a different conversion speed for all classes or a unique speed to each engine class to calculate the hours-based periods. CARB staff supports the use of a consistent 20 miles per hour conversion factor, which is consistent with the approach taken by CARB's Omnibus Regulation. [EPA-HQ-OAR-2019-0055-1186-A2, p.112]

The 20-mph average speed was derived from a 2017 CARB-funded study conducted by the Bourns College of Engineering, Center for Environmental Research & Technology175 that collected in-use activity data for 90 on-road HD diesel vehicles. The different types of vehicles that were included in the study spanned several vocational areas, such as shuttle buses, refuse haulers, utility repair vehicles, etc. The average speed derived from the study inherently takes into account the different environmental factors and engine loads experienced by vocational vehicles and is a reasonable value to use to determine the operational hours period for the proposal. Assigning a unique speed to each engine class would require additional data. [EPA-HQ-OAR-2019-0055-1186-A2, p.112]

175 Collection of Activity Data from On-Road Heavy-Duty Diesel Vehicles, ARB Agreement No. 13-301, May 2017, https://ww2.arb.ca.gov/sites/default/files/classic//research/apr/past/13-301.pdf

CARB staff have significant concerns regarding the proposed components covered by emission warranty. U.S. EPA requested comment on whether it is appropriate to expand the list of components covered by emission warranty to include any component whose failure causes the vehicle's OBD MIL to illuminate, as adopted by CARB. The proposed rule states, 'If we were to finalize a link between warranty and OBD MILs, we expect the cost of expanding the list of warrantable components to include all components that may trigger an OBD MIL, regardless of their direct impact on emissions, would be unreasonable.' CARB staff disagree with this statement and suggest linking the warranty to OBD MILs as adopted by CARB Omnibus. [EPA-HQ-OAR-2019-0055-1186-A2, p.112]

Emission-related components are monitored by OBD because they provide necessary input for the monitoring of other components and systems, which can directly affect emissions (e.g., engine misfire monitoring, fuel system monitoring, SCR, etc.), and because they can be used to enable AECD operations. These components shown in Table 10-1 from the CARB staff report 176 can contribute to severe emissions increases due to the improper monitoring of components and systems. [EPA-HQ-OAR-2019-0055-1186-A2, pp.112-113]

176 Appendix C, Economic Impact Analysis / Assessment, page C-15, https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/hdwarranty18/appc.pdf?_ga=2.100296222.1089019171.1648488649-859068364.1628622434

In CARB staff's analysis, the additional cost due to linking warranty to OBD was small. For example, for HHDD, CARB staff estimated that the additional OBD-related repair cost would only be $7.33 per engine (in 2017$) as shown in Table 10-1. U.S. EPA staff should carefully consider and publicly share their estimates of associated cost increase estimate before concluding the additional cost would be unwarranted and unreasonable. [EPA-HQ-OAR-2019-0055-1186-A2, p.113]

Furthermore, the proposed 1068.120(c) states that '*The emission-related warranty covers **all components whose failure would increase an engine's emissions of any regulated pollutant,** including components listed in 40 CFR part 1068, appendix A, …'* Therefore, even if a certain component is not directly related to emission control, if the failure indirectly increases the emission, it should be covered by the emission-related warranty. Since OBD monitors emission-related engine systems or components, it is illogical not to link warranty and OBD MILs because defects in such components contribute to increases of emissions. [EPA-HQ-OAR-2019-0055-1186-A2, pp.113-114]

CARB staff is providing data regarding the following request for comment: *'… on the extent to which emissions warranty period is an important aspect of purchasers' business decisions, and the specific impacts purchasers anticipate for the range of emissions warranty periods we are considering in this rule. For instance, we are interested in how a longer regulatory emissions warranty may impact the timing of an engine or truck purchase, how long an engine or vehicle is kept, and/or how well an engine is maintained.'* [EPA-HQ-OAR-2019-0055-1186-A2, p.114]

Relevant data is available in Section V (Goal #2) of CARB staff's final report of the recently conducted HD warranty cost study.177 As the regulatory warranty periods are lengthened in California through the Step 1 (equivalent to Option 2) warranty and Omnibus Regulation, it is likely that more vehicles produced under these newer warranty requirements will be later re-sold in the secondary market as used vehicles with a portion of the lengthened warranty period coverage remaining (i.e., residual warranties). To better understand the secondary market value of such residual warranties, CARB staff conducted an online survey in April 2021 as part of Goal #2, and collected 694 responses from fleets and owner/operators and from five dealers. The survey results indicate that the remaining residual warranties do in fact add value to vehicles sold in the secondary market, with the value increase averaging approximately $2,000 for a 2 years/200,000 miles period of residual warranties, and $4,000 for a 4 years/400,000 miles residual period. The survey did not evaluate the impact of different year-to-mile ratios (e.g., 6 months/200,000 miles, etc.) because it would have added complexity to the survey process. [EPA-HQ-OAR-2019-0055-1186-A2, p.114]

> 177 California Air Resources Board Staff Report on the Warranty Cost Study for 2022 and Subsequent Model Year Heavy-Duty Diesel Engines, December 2021, Section V, https://ww2.arb.ca.gov/sites/default/files/2022-01/warranty_cost_study_final_report.pdf

These results suggest that higher initial vehicle purchase prices which offset later repair costs will likely be passed on with their attendant benefits to the subsequent vehicle owners to some extent, which potentially will reduce the cost impact that the Omnibus Regulation warranty amendments may have on first owners as seen in the increased value recognized by subsequent vehicle owners. CARB staff expects the same impact would occur with lengthened warranty requirements finalized nationally by U.S. EPA. [EPA-HQ-OAR-2019-0055-1186-A2, pp.114-115]

CARB staff have significant concerns regarding the effectiveness of graduated warranties being considered (not proposed). U.S. EPA asked for comments related to graduated warranties on page 17512:

'We are not proposing and did not analyze a graduated warranty approach for this proposal. However, we may consider a graduated warranty as a viable alternative to our proposed warranty periods if we receive additional information that would support such an approach. A graduated warranty approach could extend beyond our proposed warranty periods in mileage, hours, and years, to cover more of the operational life of the engine, but it could be based on different phases of varying coverage. These could include, for example:

- *Phase 1: Full parts and labor coverage for all emission-related components,*
- *Phase 2: Parts and labor coverage for limited emission-related components, and*
- *Phase 3: Parts-only coverage for limited emission-related components.'* [EPA-HQ-OAR-2019-0055-1186-A2, p.115]

CARB staff do not believe graduated warranties are necessary. CARB staff believes that the warranty period should remain applicable to the entire engine and its emissions control systems, and not vary by component. If the warranty period were to vary by component, this could be confusing for vehicle owners and manufacturers. Instead, CARB staff recommends linking OBD to warranty, which in turn would avoid the needing to rely on separate parts lists and would simplify the process. The full parts and labor coverage for all emission-related components of Option 1 provides the greatest emission benefit, and its cost is reasonable and defensible (as discussed above in comment 10.a of this section). [EPA-HQ-OAR-2019-0055-1186-A2, p.115]

Organization: *Clean Air Board of Central Pennsylvania*

EPA is proposing two regulatory options for NOx. We support Option 1, which will implement stronger NOx standards in two steps. The first improvement would be required in 2027 with a second more stringent standard 2031 (a NOx standard that would be 90% lower than today's standards). We support Option 1 with longer useful life and warranty periods. Ensuring that the warranty and useful life requirements meet 100% of the expected life of these vehicles will ensure health benefits throughout the life of the vehicles. [EPA-HQ-OAR-2019-0055-1305-A1, p.1]

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

The warranty period is the period during which the Clean Air Act requires a manufacturer to warrant to the purchaser that an engine will conform with applicable Section 202 regulations. 42 U.S.C. 7541(a)(1); 40 C.F.R. 1068.115. As the Proposal notes, warranty periods have remained the same since 1983, even as useful life has increased, so that today the emissions warranty periods range from 22–54% of regulatory useful life. 87 Fed. Reg. at 17,505. With EPA's proposed changes to lengthen the useful life, this gap would grow even larger if warranty periods are not correspondingly increased. [EPA-HQ-OAR-2019-0055-1302-A1, p.60]

As the Proposal notes, extending the warranty period to cover a greater fraction of an engine's regulatory useful life and operational life provides important incentives for behaviors and actions that lead to reduced NOx emissions. Because a warranty is voided if operators do not properly maintain the engine, an increased warranty period would incentivize proper maintenance for a longer period of time. 87 Fed. Reg. at 17,505. Owners similarly would be incentivized not to install emissions control defeat devices that would void the engine warranty. Id. Manufacturers would be incentivized to simplify repair processes and better train technicians if they are responsible for the costs of repairs for a longer period. Id. Because manufacturers investigate possible defects whenever warranty claims are submitted, 40 C.F.R. 1068.501(b), a longer warranty period would provide more information and greater opportunity to identify defective parts, 87 Fed. Reg. at 17,506. [EPA-HQ-OAR-2019-0055-1302-A1, p.60]

Commenters support increasing the useful life mileage values for HDEs and extending the warranty period to cover a larger portion of the engines' operational lives. Because the current useful life and warranty periods cover only a fraction of the real-world operational life of trucks, older trucks on the road are very likely emitting higher levels of NOx, and neither truck operators nor manufacturers have the proper incentives to ensure that emissions controls on those older trucks are functioning properly. Useful life and warranty periods covering a greater fraction of HDEs' expected operational life will help to protect people from dangerous NOx, ozone, and particulate matter pollution, and will shift more of the costs and risks of designing functional pollution control equipment to engine manufacturers, who have control over design, rather than effectively requiring operators to bear those costs. [EPA-HQ-OAR-2019-0055-1302-A1, p.60]

Specifically, we urge EPA to adopt useful life and warranty periods at least as long as those proposed in Option 1. EPA notes that it 'could justify proposing useful life requirements equivalent to the operational life data presented in Section IV.A.2 [of the Proposal], but [is] proposing somewhat shorter (less stringent) values in proposed Option 1 considering the effect of useful life on the feasibility of meeting the proposed Option 1 standards.' 87 Fed. Reg. at 17,500. As the Proposal also notes, the Option 1 useful life periods generally align with those in the Omnibus. Id. EPA proposes in Option 1 to adopt warranty periods covering close to 80% of useful life, which would align with the MY 2027 and MY 2031 warranty periods adopted by CARB. 87 Fed. Reg. at 17,508. The fact that many manufacturers must comply with the Omnibus standards when they take effect supports the technological feasibility of setting useful life and warranty periods at a level approximately as stringent as the Omnibus. Given the Clean Air Act's command that EPA set regulations reflecting the 'greatest degree of emission reduction achievable,' 42 U.S.C. 7521(a)(3)(A)(i), and EPA's statement that it could justify even longer useful life periods equal to operational life, we urge EPA to consider setting useful life periods more stringent than those proposed in Option 1 if the Agency determines that longer periods would be feasible in combination with the emissions standards it finalizes. Additionally, we urge EPA to adopt new warranty and useful life values in a single step, finalizing its proposed Option MY 2031 values as standards applicable to MY 2027 in order to achieve the emissions reductions from these changes as swiftly as possible. [EPA-HQ-OAR-2019-0055-1302-A1, p.61]

Organization: *Cummins Inc. (Cummins)*

As shown in the table in Section I of Cummins' comments, EPA proposes to significantly lengthen emission warranty periods across all primary intended service classes. The two-step emission warranty periods proposed in Option 1 would drive excessive increases to the initial purchase price of the vehicle, as manufacturers would need to build in additional cost to cover longer warranty and therefore should not be finalized. Even Option 2, the generally less stringent of EPA's two options, will result in significant increases to the initial purchase price of the vehicle. EPA's proposed Option 2 aligns with the warranty periods finalized by CARB for MY 2022-2026 diesel engines, also known as CARB Step 1 warranty. The price increases associated with CARB's Step 1 longer warranty periods are known for current technologies because manufacturers are selling those products this year. Cummins provided our engine pricing for CARB's Step 1 warranty to EPA in May 2021 as CBI. That information shows that EPA has underestimated the cost impact of lengthening emission warranty and should reconsider its proposals. [EPA-HQ-OAR-2019-0055-1325-A1, p. 6]

EPA requests comment on whether it is appropriate to expand the list of components covered by emission warranty to include any component whose failure causes the vehicle's OBD MIL to illuminate, as adopted by CARB. EPA has not proposed this expansion, citing "concerns that not all OBD MILs are tied directly to an emission-related component" and "the cost of expanding the list of warrantable components to include all components that may trigger an OBD MIL, regardless of their direct impact on emissions, would be unreasonable" (87 FR 17509). Cummins agrees with EPA's reasoning and supports EPA's proposal not to expand the list of covered components. [EPA-HQ-OAR-2019-0055-1325-A1, p. 8]

EPA proposes to add hours-based warranty periods based on a 20 mile per hour average vehicle speed threshold to convert from the proposed mileage values. EPA requests comment on applying a different conversion speed for all classes or a unique speed to each engine class to calculate the hours-based periods. Cummins supports the addition of hours to warranty periods across all engine classes (SI HDE, Light HDE, Medium HDE, Heavy HDE) in recognition that some applications within those classes accumulate relatively few miles due to lower vehicle speeds. Similar to useful life periods, Cummins again supports using an average speed of 20 mph for determining the hours limit across all engine classes. As mentioned above, Cummins has submitted average vehicle speed data and run hours to EPA for numerous vehicles and applications operating in-use, which supports hours limits based on the 20- mph speed threshold. [EPA-HQ-OAR-2019-0055-1325-A1, p. 8]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

EPA should change useful life and emissions warranty periods to be more reasonable, specifically: 95

- Class: Heavy HDEs
  - Useful Life Period: 10 years/500,000 miles
  - Emissions Warranty Period: 5 years/350,000 miles
- Class: Medium HDEs
  - Useful Life Period: 10 years/250,000 miles
  - Emissions Warranty Period: 5 years/175,000 miles [EPA-HQ-OAR-2019-0055-1168-A1, p.71]

95 Daimler Truck also supports adding appropriate equivalent standards for the number of hours of engine operation.

A significant portion of the infeasibility, cost, uncertainty, and risk in the Proposed Rule derives from EPA's proposed extensions of the useful life and emissions warranty programs. It is cost prohibitive and impractical for manufacturers to adequately design components and be certain of their reliability for these extended periods, especially since EPA's rule proposals drive the development of new technology with only four years of lead-time and three years of stability between programs. 96 [EPA-HQ-OAR-2019-0055-1168-A1, p.71]

> 96 While Daimler Truck's comments in this section focus primarily on increased technology costs and compliance burdens associated with EPA's useful life and emission warranty period proposals, we also note that EPA's proposals will mean significantly increased information collection costs and burdens on manufacturers, which are relevant to OMB's review of the Proposed Rule under the Paperwork Reduction Act, see 44 U.S.C. 3501 et seq. Increased useful life times, for example, will translate to increased durability testing, which will add burden to manufacturers in terms of costs and man hours. We anticipate that the incremental burden increase for collecting aging data alone (as compared to current useful life periods) would amount to thousands of hours.

In Section 11.B. l of these comments, Daimler Truck explains why EPA's cost estimates for the Proposed Rule are inaccurate. Much of that inaccuracy comes from EPA's insistence that warranty costs will only increase slightly, and linearly. Several independent studies suggest that such assumptions are grossly incorrect, as we note in Sections 11.B. l and II.B.3 of these comments. [EPA-HQ-OAR-2019-0055-1168-A1, p.71]

Failure rates are likely to increase exponentially in the periods EPA considers, especially as these periods further tax manufacturers' ability to validate before production, and as engines typically experience increasing rates of ‘wear-out.’ Additionally, EPA underestimates the impact of new technology on warranty rates; new technology will always experience a period of increased failure rates as manufacturers’ experience in the field leads to more robust and mature technology. [EPA-HQ-OAR-2019-0055-1168-A1, pp.71-72]

EPA can limit these exorbitant warranty costs by limiting the extended useful life to reasonable values so that manufacturers can realistically design and validate their products. By setting the useful life to 500,000 miles for a HHD truck, and 250,000 miles for a MHD truck, EPA can avoid costly replacement of aftertreatment components (which would have extremely limited emissions benefit and significant uncertainty. [EPA-HQ-OAR-2019-0055-1168-A1, p.72]

Daimler Truck’s proposed useful life and emissions warranty periods (set forth above) would still achieve EPA’s objective of ensuring that warranty mileage would cover ‘at least half’98 of the useful life mileage for Heavy and Medium HDEs, as Daimler Truck’s proposed warranty mileages would be 70% of the useful life mileage for Heavy HDEs and 87.5% of the useful life mileage for Medium HDEs. Thus, the Company’s proposal would help to ensure that all of EPA’s envisioned emissions benefits are realized during useful life and that customers are incentivized to replace failed components because they will be covered by warranty.

> 98 Proposed Rule, 87 Fed. Reg. at 17,508.

Finally, Daimler Truck supports EPA's position that the emissions warranty coverage should not extend to all components which illuminate the malfunction indicator light (MIL). The Company agrees that many components that illuminate the MIL have no impact on emissions. Such examples include fuel level sensors, vehicle speed sensors, real-time clocks, and any number of other components that have an input to the diagnostics system (and are thereby required to light the MIL) but do not have any input to any emissions controls. Daimler Truck does not believe that these components should be considered emissions control components, and therefore should not be covered by the emissions warranty. [EPA-HQ-OAR-2019-0055-1168-A1, p.73]

Organization: *Great Rivers Environmental Law Center and Dutchtown South Community Corporation (DSCC)*

The undersigned support inclusion of the following requirements in the Final Regulation:

- Mandatory extended emissions warranties to improve engine maintenance and to help defeat tampering [EPA-HQ-OAR-2019-0055-1323-A1, p.6]

Organization: *Hyliion, Inc.*

Although it is understandable that EPA would seek extended emissions and useful life warranties, it is important to recognize the downsides of such enhanced performance guarantees. Extended warranties require OEMs to guarantee the performance of their products for longer times and more miles and are not without significant cost. It is like purchasing insurance for the engine. These costs will inevitably be passed through to the customer and thus are likely to dampen demand as both the cost of the warranty and the cost of the new, cleaner technology are included in the price of the engine. EPA must take this into account when considering the implementation of its draft rule. [EPA-HQ-OAR-2019-0055-1238-A1, p. 4]

Longer warranties put unknown and potentially massive risks on the motor vehicle parts manufacturing industry, which could result in significant price increases on vehicles. Increasing costs could impede momentum toward the replacement of the legacy fleet with desire for low emissions vehicles. [EPA-HQ-OAR-2019-0055-1238-A1, p. 4]

With this in mind, Hyliion supports Option 2 as it would match CARB's Step 1 warranty periods that will already be in effect beginning in Model Year 2022 for engines sold in California. We believe a consistent and uniform approach will provide the industry with greater predictability and thus increases the odds that OEMs will be able to rein in costs. [EPA-HQ-OAR-2019-0055-1238-A1, p. 4]

Organization: *Manufacturers of Emission Controls Association (MECA)*

We understand EPA's need to ensure that heavy-duty vehicles are meeting emission standards while in operation, which requires that emission critical components are durable and repaired quickly if a malfunction occurs. Based on several stakeholder meetings between EPA, CARB, and industry, we believe that EPA's Proposed Option 1 warranty and durability provisions have struck a suitable balance between stringency and phase-in time to allow suppliers to work with their customers to fill current information gaps and complete additional R&D to ensure future trucks continue to be durable and meet emissions warranty requirements. The phase-in approach will allow component suppliers to better understand the economic impact of longer warranty periods on their business as well as time to design longer durability into components. MECA supports hourly limits for vocational vehicles that may operate for thousands of hours at low speed or idle prior to reaching the mileage or year warranty clock threshold. [EPA-HQ-OAR-2019-0055-1320-A1, p.20]

As we previously commented, there is considerable uncertainty about the state of vehicles during the time of operation beyond today's 100,000 mile warranty. Much of the data on warranty claims and repairs as well as vehicle use characteristics originate from the time when the first owner operates a vehicle while data from repairs made by second and third owners is very limited. Many suppliers do not have data on the durability, replacement or diagnostics of their parts past the warranty because the dealer network is not required to share that information. This lack of information leads to challenges for suppliers who are trying to design parts that will meet the extended durability requirements out to 800,000 miles. Without warranty claim information beyond 100,000 miles, it is difficult for suppliers to estimate the cost impact of the proposed extended 2031 warranty and challenges suppliers trying to design to the much longer 2031 durability periods. The lack of data also challenges suppliers trying to design to longer durability periods. MECA members manufacture durable parts according to the specifications demanded by their customers, the OEMs, as part of individual business agreements. The individual component specifications provided to the supplier may not include a correlation between the specification and how that relates to mileage durability on the vehicle. Finally, besides the engineering design time needed to design components to longer durability requirements, the testing out to the long mileage durability requirements (such as 800,000 miles for class 8 engines), especially for on-engine components whose aging cannot be accelerated, takes months to years on dynamometers. [EPA-HQ-OAR-2019-0055-1320-A1, p.21]

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

EPA's proposed Option 1 should be modified to include a significant reduction of the proposed the warranty time periods and mileage requirements, a special consideration for vocational vehicles, and an exclusion of normal maintenance and wear parts from the warranty. Each of these modifications is described in further detail below. [EPA-HQ-OAR-2019-0055-1322-A1, p. 3]

These modifications are necessary because Option 1 significantly increases the Warranty period and Full Useful Life (FUL) for HD engines based on minimal testing. While we understand the desire to ensure that vehicles maintain their lower NOx performance throughout the FUL, the costs of implementing such long warranties are relatively unknown and will therefore increase the financial risk to component suppliers as OEMs push the longer warranty requirements on the supply base. In addition, many emissions components that have a shorter life and are routinely replaced due to wear should not be covered under by the warranty requirements. [EPA-HQ-OAR-2019-0055-1322-A1, p. 3]

MEMA urges EPA to reduce the proposed warranty requirements and the full useful life timelines for all vehicles. The warranty increases of a factor of four or more are based on specific and limited laboratory testing that does not reflect complex, real-world use. Additionally, more data and analysis of second and third vehicle owner usage should be conducted before proposing significantly longer warranties and FUL timelines. [EPA-HQ-OAR-2019-0055-1322-A1, pp. 3 - 4.]

Longer warranties on criteria emissions systems put unknown and potentially massive risks on the motor vehicle parts manufacturing industry, which could result in significant price increases on vehicles. [EPA-HQ-OAR-2019-0055-1322-A1, p. 4]

EPA's envisioned increases in warranties and full useful life requirements on vocational vehicles are less validated than other commercial vehicles, with little to no testing and verification conducted on these uses. The real-world uses for heavy-duty vocational vehicles are different and extremely complex because of the vast range of duty cycles, load configurations, and application demands. Thus, more testing and validation of assumptions is necessary before greatly increasing the warranty time periods/mileage and FUL on vocational vehicles. [EPA-HQ-OAR-2019-0055-1322-A1, p. 4.]

MEMA urges EPA to not require warranty coverage on parts that have a shorter life and are routinely replaced due to wear, such as sensors, injectors, rings, filters, and valves. Instead, such parts and components should be defined as standard maintenance or replacement items. We urge EPA to work with industry stakeholders, including suppliers, to develop a list of wear parts and components with these criteria in mind. [EPA-HQ-OAR-2019-0055-1322-A1, p. 4]

MEMA urges EPA to reduce the proposed warranty requirements and the full useful life timelines for all vehicles. The warranty increases of a factor of four or more are based on specific and limited laboratory testing that does not reflect complex, real-world use. Additionally, more data and analysis of second and third vehicle owner usage should be conducted before proposing significantly longer warranties and FUL timelines. [EPA-HQ-OAR-2019-0055-1322-A1, p. 5.]

MEMA is also concerned about the lack of data regarding vocational applications and the difficulties that this will cause. Vocational applications could also be regulated as a separate category. [EPA-HQ-OAR-2019-0055-1322-A1, p. 5]

EPA is essentially asking industry to design parts without clear functional requirements - well past their current state-of-the-art design life. Frequency of failure past the design life is relatively unknown and therefore, the costs are also unknown. MEMA recommends EPA not require warranty coverage on parts that have a shorter life and are routinely replaced due to wear, such as sensors, injectors, rings, filters, and valves. Instead, such parts and components should be defined as standard maintenance or replacement items. We urge EPA to work with industry stakeholders, including suppliers, to develop a list of wear parts and components with these criteria in mind. [EPA-HQ-OAR-2019-0055-1322-A1, p. 5]

MEMA members have concerns about the uncertainty regarding 7- and 10-year emissions warranties. MEMA strongly supports a phased-in approach as this helps address suppliers' need for adequate lead-time to understand and improve component durability. Suppliers would take on significant cost implications early in the timeline. They currently do not have access to the necessary data to assess and make improvements. EPA should provide data on HD vehicles on the road today including higher quality data on usage patterns. [EPA-HQ-OAR-2019-0055-1322-A1, p. 7]

In addition, suppliers also require drive and duty cycle data from second and third truck owners as well as vocational vehicles to more fully understand those use cases and successfully design components to meet them. However, MEMA does support incremental changes in the warranty time periods/mileage including a series of step changes based on additional data and with the assumption that normally replaceable emissions components would be left out of the warranty coverage. The lack of data on 2nd and 3rd truck users is especially concerning in terms of warranty coverage. Many older trucks that are repurposed into specialized vocational applications, like dedicated snowplow trucks, may sit for months before the next use. MEMA is concerned about using a one-size-fits-all approach to a very complex set of use cases. [EPA-HQ-OAR-2019-0055-1322-A1, p. 7]

MEMA is supportive of the EPA’s suggestion that their proposed provisions will increase the likelihood that emission controls will be properly diagnosed and maintained through more of the service life of heavy-duty engines as this seems logical. See comments above about designating more parts as service parts versus warranty parts. [EPA-HQ-OAR-2019-0055-1322-A1, p. 7]

MEMA urges EPA to reduce the proposed factor of four increase in warranty requirements and the full useful life timelines for all vehicles until more data is available to justify such a substantial increase. More testing and validation of assumptions is necessary before increasing the FUL and this is especially true for vocational vehicles. [EPA-HQ-OAR-2019-0055-1322-A1, p. 9.]

Wear items should be defined as standard maintenance or replacement items and therefore not covered by a warranty. We urge EPA to work with industry stakeholders, including suppliers, to develop a list of wear parts and components with these criteria in mind. [EPA-HQ-OAR-2019-0055-1322-A1, p. 9]

Organization: *Moving Forward Network (MFN)*

Heavy-duty diesel engines last well beyond the current useful lifetime, with 90 percent of engines lasting nearly double the current regulatory requirement, and 50 percent of Class 8 engines nearly triple (Figure 3). As a result, the regulatory 100,000-mile warranty requirement is only a very small fraction of the expected lifetime of the engine and is well behind typical warranties and extended warranties of 250,000 and 500,000 miles.113 [EPA-HQ-OAR-2019-0055-1277-A1, p. 26]

Heavy-duty engines can last up to 1.2 million miles before a rebuild, yet the current warranty extends to just 100,000 miles, and the useful-life period is only 435,000 miles. The proposed changes to the warranty and useful-life periods for heavy-duty vehicles more closely mirrors the real-world operation of these engines and would help maintain working emissions controls while diminishing any costs incurred by the operators. [EPA-HQ-OAR-2019-0055-1277-A1, p. 27]

The useful life is critical to ensure adequate testing such that emissions controls are functional for the life of the engine. The warranty period, however, is more important to minimize tampering or disrepair, and shifts the cost of failures onto the manufacturer rather than the driver. Currently, the market allows manufacturers to profit from producing less durable products– increasing warranty requirements thus helps shift the responsibility for creating more durable emissions controls back to the entity with design control. [EPA-HQ-OAR-2019-0055-1277-A1, p. 27]

Repair costs and downtime can be a significant burden for drivers, and survey data has shown that there is a significant interest in coverage that better reflects the operational lifetime of the vehicle.114 Nearly one-quarter of respondents in that study already opt for an extended warranty, with a substantial share of those respondents' choosing warranties that exceed the current useful-life requirements of the engine. A majority of owner-operators suggested future warranty coverage should meet or exceed 500,000 miles, well above the current minimum. This is borne out in more recent analysis of the market, which shows that 85 percent of the market already opts for an extended warranty, with just about half of those users opting for warranty coverage of at least 500,000 miles.115 [EPA-HQ-OAR-2019-0055-1277-A1, p. 27]

114. Kerschner, B., and D. Barker. 2017. Survey and analysis of heavy-duty vehicle warranties in California (15MSC009). Prepared by the Institute for Social Research for the California Air Resources Board, December 2017. Online at https://ww3.arb.ca.gov/regact/2018/hdwarranty18/apph.pdf.

115. https://ww2.arb.ca.gov/sites/default/files/2022-01/warranty_cost_study_final_report.pdf

Organization: *National Association of Chemical Distributors (NACD)*

Also, option 1's increased requirements on warranties will invariably increase the costs of new trucks more than option 2's lower standards. With longer term warranties, truck manufacturers will be forced to factor the costs of parts and labor that are covered by the warranties into the cost of a new truck. This forces fleet owners to pay a higher upfront cost when purchasing vehicles instead of allowing them to pay the cost farther down the line when maintenance is needed. With most fleet owners managing small operations, as according to the American Trucking Association over 97% of carriers operate fewer than 20 trucks, these increased upfront costs will not be something that all owners can cover.3 These increased warranties also dissuade fleet owners from purchasing newer trucks in the long term, resulting in older vehicles on the road. [EPA-HQ-OAR-2019-0055-1279-A1, p. 4]

3. American Trucking Association, 'Economics and Industry Data,' Trucking.org, ATA, https://www.trucking.org/economics-and-industry-data

Organization: *National Association of Small Trucking Companies (NASTC)*

Improved warranty coverage so more of emission system and parts failures' costs of servicing are borne by OEMs instead of truckers and carriers. We agree that enhanced, improved warranty coverage would help reduce truck owners' costs of servicing emission system-related problems. Also, explicit statements that manufacturers may not deny warranty claims based on the use of commonly available DEF would clarify responsibilities and balance the equities of manufacturers and commercial product owners and users. [EPA-HQ-OAR-2019-0055-1130-A1, p. 3]

Organization: *National Waste & Recycling Association (NWRA)*

NWRA member companies have a unique perspective in that the association represents the manufacturers of heavy-duty trucks and the haulers such as WM, Republic, GFL, and Waste Connections, along with over 700 other members. This enables NWRA to understand the impact that new air pollution regulations would have particularly on the short-haul trucking industry. Our drivers start and stop hundreds of times a day, averaging as low as 9 to 12 MPH throughout the day, equating to a run time of 4,500 hours over two years, instead of the 4,500-hour run time for one year used in the proposed regulation. NWRA asks that EPA consider using the maximum number of hours a driver could drive in a year based on FMCSA's hours of service regulations to calculate the warranty hours that are being proposed. [EPA-HQ-OAR-2019-0055-1242-A1, p. 1 - 2]

Organization: *Natural Gas Vehicles for America (NGVAmerica)*

NGVAmerica and its members submit the following recommendations for policies and programs that the EPA and other federal agencies can advance to encourage the use of cleaner trucks.

4) Address longer life vehicles and required warranties for vehicles and emission systems equally across all vehicle technologies as EPA has proposed; but, we express concern that the costs of providing new longer warranties will be passed along to suppliers and customers and could create an unintended barrier to entry to new and innovative technologies by increasing costs associated with those technologies and needed components. NGVAmerica believes that the proposed warranty provisions in Option 2 represent a more balanced approach that is likely to achieve much of what EPA intends without negative consequences placed upon suppliers and ultimate customers and on the acquisition and deployment of cleaner trucks; [EPA-HQ-OAR-2019-0055-1330-A1, p.13]

Organization: *Owner-Operator Independent Drivers Association (OOIDA)*

We also welcome improvements to vehicle warranties and believe all of these provisions must be included in any final rulemaking. [EPA-HQ-OAR-2019-0055-1266-A1, p.6]

OOIDA supports the NPRM's restructuring of current warranty offers. Given drivers' concerns about emissions technologies, sensible warranty programs are critical for encouraging investment and implementation. While the proposed warranty options would be an improvement over some current coverage policies, OOIDA recommends 500,000 miles as opposed to the 450,000 miles under option 1 or the 350,000 miles for option 2. 500,000 would be more aligned with fair-market warranty values. Additionally, OOIDA favors alternative programs that would offer longer, prorated warranties that provide different levels of coverage based on a vehicle's age or mileage. The warranty could be limited to include only certain parts after a certain amount of time, and/or not include labor for some, or even all, of the duration of coverage. [EPA-HQ-OAR-2019-0055-1266-A1, p.7]

Organization: *PACCAR, Inc (PACCAR)*

As discussed above, PACCAR supports EPA’s initiative to extend Heavy-Duty engine warranty periods to cover a greater portion of UL. We specifically support a single step in MY 2027, which is aligned with CARB Step 1 Warranty period, and EPA’s proposed Option 2 of 350,000 miles. This step would increase the UL warranty coverage from 22% to 58% of useful life based on a 600,000 commercial useful life. PACCAR also supports other approaches to ensure long-term in commerce-emissions performance and initiatives that work to incentivize fleet turn over to facilitate the adoption of the new low NOx technology. However, we have concerns about certain aspects of EPA’s proposal that addresses warranty and allowable maintenance. [EPA-HQ-OAR-2019-0055-1346-A1, p.52]

Proposed section 1036.120(c) addresses’[c]omponents covered’ and provides that ‘the emission-related warranty covers all components whose failure would increase an engine’s emissions of any regulated pollutant, including components listed in 40 CFR part 1068, appendix A, and components from any other system you develop to control emissions. The emission-related warranty covers *these components even if another company produces the component*.’ (emphasis added). This broadly worded section needs to revised. Manufacturers have invested billions of dollars developing their products to ensure and maintain emission systems compliance, while keeping pace with increasingly stringent emissions standards. However, as proposed, EPA’s provision conceivably could make OEMs liable for customers installing non- original manufacturer-produced components. OEMs are incapable of validating third-party produced components to ensure they comply with respect to emissions performance and durability as the original manufacturer’s components. OEMs accordingly should not be potentially liable for components produced by another company. [EPA-HQ-OAR-2019-0055-1346-A1, pp.52-53]

PACCAR summarizes below the major issues that EPA should take into account as it moves forward with this rulemaking: PACCAR supports EPA’s initiative to increase warranty to cover a greater percentage of useful life (currently at 22% of UL). PACCAR supports EPA’s proposal to extend the warranty period of at least 50% of Useful life, and would recommend EPA align with the CARB Step 1 warranty period of 350,000 miles (which is 58% of the proposed in-commerce useful life of 600,000 miles). [EPA-HQ-OAR-2019-0055-1346-A1, p. 60]

Organization: *Retail Industry Leaders Association (RILA)*

Additionally, EPA's separate proposal to extend the emissions-related warranty period for heavy-duty engines will likely lead to improved engine maintenance over each engine's lifetime and may even induce the development of simplified repair processes. [EPA-HQ-OAR-2019-0055-1189-A2, p.3]

Organization: *Truck and Engine Manufacturers Association (EMA)*

It is important to highlight from the outset that while there are various details of EPA's rulemaking proposal (particularly with respect to Option 1) that EMA and its members fundamentally disagree with, there are multiple major points of substantial agreement. In that regard, EMA agrees with EPA that:

> (iii) The current emission warranty and useful life periods for HDOH engines and vehicles should be revised to increase the durability and efficacy of in-use emissions compliance; [EPA-HQ-OAR-2019-0055-1203-A1, p. 5]
> (vi) The increase in manufacturers' costs to cover the proposed extended warranty requirements will be substantial, and necessarily will be passed on to purchasers at the point of sale. [EPA-HQ-OAR-2019-0055-1203-A1, p. 5]

Those elements of the low-NOx regulations will result in much higher warranty claims, maintenance costs, and recall liability, at least until the multiple new low-NOx technology systems are proven-out over a multi-year period following the implementation of the 2027 MY standards and compliance programs. More specifically, the substantially extended warranty periods will at least triple the cost of coverage on existing emissions-related components, while also adding warranty costs to cover the new emissions-related components that manufacturers will need to utilize to meet the new standards. [EPA-HQ-OAR-2019-0055-1203-A1, p. 12]

The proposed warranty provisions under §1036.120(c) require that, "The emission-related warranty covers all components whose failure would increase an engine's emissions of any regulated pollutant, including components listed in 40 CFR part 1068, appendix A, and components from any other system you develop to control emissions." That proposed expansion of warranty is overly broad. Current provisions allow that an emissions-related components' is one that has a "primary purpose to reduce emissions or whose failure would commonly increase emissions without significantly degrading engine/equipment performance." (See item IV in the referenced Part 1068 Appendix I, and definition of Critical Emissions-Related Component proposed in §1068.30.) EPA should not expand the universe of components to be covered under the emissions warranty provisions to include those components whose only relation to emissions control is that a failure would increase emissions. EMA agrees with EPA's assessment that, "the cost of expanding the list of warrantable components to include all components that may trigger an OBD MIL, regardless of their direct impact on emissions, would be unreasonable." (87 FR at p. 17509) EMA recommends that this aspect of §1036.120(c) be eliminated in the final rule. [EPA-HQ-OAR-2019-0055-1203-A1, p. 128]

Also of concern is the proposed requirement under §1036.120(b) that the emissions-related warranty should not be shorter in duration than any published warranty a manufacturer "offers with or without charge." EMA believes the use of the word "offers" could be misleading, as it does not directly reflect the warranty actually provided as part of a vehicle sale, whether with or without charge. EPA should clarify this language. [EPA-HQ-OAR-2019-0055-1203-A1, p. 128]

EPA Summary and Response

The summary and response for this section includes a listing of the topics raised, then the comments are summarized by category and the responses follow each summary.

Comments relating to emissions warranty fell into the following general categories

- Support or opposition
  - General support for or opposition to lengthening warranty periods
  - Support for proposed Option 1 or Option 2 warranty periods
  - Support for warranty periods longer or shorter than proposed
- Need for more information
- Potential costs and economic impacts of extending the warranty period
- Reactions to EPA's stated advantages of longer warranty periods
- Hours- and years-based warranty periods
- Components covered by emissions warranty
- Recommended changes to the structure of the emissions warranty program
- Miscellaneous regulatory changes

Support or opposition

ATD, ATA, Great Rivers, and RILA generally supported EPA taking action on lengthening emission-related warranty periods without addressing numeric values. ATD commented in support of "reasonable" revisions. EMA agreed that EPA should revise emissions warranty periods to increase the efficacy of in-use emissions compliance, but did not explicitly support or oppose the warranty periods of either proposed option.

ALA, CARB, and MECA supported the warranty periods of proposed Option 1. MECA and MEMA both supported a phase-in. AVE expressed support for proposed Option 1 standards with modified warranty requirements to limit coverage. Allison, Hyliion, NGVAmerica, and PACCAR supported the single-step proposed Option 2. Allison commented that Option 2 more appropriately balances the costs and benefits and takes into consideration the real-life dynamics and customer behavior. Allison also suggested that EPA could adopt Option 2 now and reevaluate warranty periods in a future rule. Hyliion commented that Option 2 matches CARB's Step 1 warranty, which would provide greater predictability that may limit costs. Cummins recommended that EPA not finalize Option 1 and noted that even Option 2 would result in significant cost increases.

Several organizations recommended warranty periods that differed from the proposed options. Clean Air Task Force et al and MFN suggested that EPA finalize a single-step program that pulls ahead the MY 2031 warranty periods of proposed Option 1 to start in MY 2027. BBU Environmental Services and Clean Air Board of Central Pennsylvania suggested that warranty period should cover the full life of the vehicle. OOIDA recommended a 500,000-mile warranty citing the preferences their members expressed in a recent owner-operator survey. DTNA suggested alternate warranty periods for two engine classes: 5 years/350,000 miles for Heavy HDE and 5 years/175,000 miles for Medium HDE.

Response:

- We appreciate the expressed support from certain commenters for our proposal to lengthen emission-related warranty periods and acknowledge the concerns raised by other commenters.
- We did not propose and do not believe it is appropriate at this time for the warranty periods to cover the full life of the engine, but we retain our proposed objectives to lengthen warranty periods to cover a larger portion of the operational lives and to be more consistent with the final useful life periods. See preamble section IV.B.1 for a discussion of the basis of our final warranty periods, including our consideration of comments on the advantages of longer warranty periods and concerns for the highest mileages in our proposal.
- As explained in section IV.B.1 of the preamble, we are finalizing a single-step program for the new warranty periods to begin in Model Year 2027. Clean Air Task Force, et al. and MFN recommended we pull ahead the proposed MY 2031 warranty periods from Option 1 to start in MY 2027. We agree on that approach for the smaller engine classes and our final warranty mileages match the MY 2031 step of proposed Option 1 for Spark-ignition HDE, Light HDE, and Medium HDE. We disagree on applying that approach for Heavy HDE and we are not pulling ahead the MY 2031 step (600,000 miles) for the Heavy HDE warranty mileage. Similar to our approach for useful life, we are finalizing a warranty mileage that matches the longest mileage proposed for MY 2027, which matches the mileage proposed for Option 2 (450,000 miles). See preamble section IV.B.1 for a discussion of the basis of our final warranty periods, including our consideration of comments on the advantages of longer warranty periods and concerns for the highest mileages in our proposal.
- Allison suggested that we could adopt Option 2 in this rulemaking and reevaluate warranty in a future rule; however, we believe warranty periods that are longer than Option 2 are justified in this rule, starting in MY 2027. A delay in implementing the longest warranty periods will delay the extra miles, years, or hours of coverage for owners and delay the extended emissions control assurance due to proper maintenance and repair for more of the life of heavy-duty engines.
- MECA and MEMA indicated that a phase-in would help suppliers prepare for the longer warranty periods. As we noted in the preamble section IV.B.1, we do not believe a phase-in is needed for suppliers to address data needs at the warranty mileages we are finalizing.

Need for more information

Several organizations commented on suppliers' ability to develop technologies to meet the proposed warranty periods. AVE commented that more research on engine wear and use patterns is needed. BorgWarner indicated that suppliers do not currently have access to data required to design to the proposed warranty provisions. MEMA suggested that EPA's proposal is asking industry to design parts without clear functional requirements and the rule needs more testing and validation specific to vocational vehicle applications and more data and analysis of subsequent owners' usage. MEMA specifically cautioned against applying a one-size-fits-all approach for warranty periods and recommended a separate category for engines intended for vocational applications. Allison also noted real world operational data is best and that validation testing in the design process may not accurately predict the frequency of failures, due to varying vehicle types, operations, maintenance, and use. Allison further commented that suppliers may not know the end-use of their components/systems, causing them to inefficiently design and price their components based on a worst-case assumption. DTNA commented that it is cost prohibitive to design components and be assured of their reliability, given 4 years lead time and 3 years of stability

Response:

- For Heavy HDE, where the highest mileage data is currently most limited, the final warranty mileage of 450,000 is similar to the current useful life mileage for those engines and we expect suppliers are currently designing to that mileage. We expect that suppliers and engine manufacturers will continue to collect additional warranty information, beyond today's federal requirements, from extended warranty packages available for current engines. We also note that the CARB Step 1 warranty may be an additional data resource.[19,20]
- We agree with MEMA that it is not appropriate to establish warranty periods that are one-size-fits-all. As noted in response to other comments in this section and preamble IV.B.1, we are finalizing three warranty thresholds (i.e., mileages, years, and hours) for each heavy-duty engine class, which we believe will lead to more appropriate warranty obligations across the range of possible vehicle applications for which a heavy-duty engine may be used. At this time we do not have sufficient information to establish application-based categories for engines beyond the primary intended service classes that currently apply.

Potential costs and economic impacts of extending the warranty period

Several organizations commented on the costs of lengthened warranty periods and potential economic impacts. CARB commented that EPA's costs are reasonable and comparable to the costs presented in their Omnibus program. CARB also indicated that the higher initial cost will be offset by lower repair costs and that they expect resale value of warranty will be maintained as first owners sell to subsequent owners. AVE commented that extended warranties as proposed will add extensive unknown costs to vehicles. ATD (and, similarly, ATA in section 18.3 of this document) expressed concern about cost impacts on first purchasers, with a specific mention of

[19] For more information on the California Air Resources Board HD Warranty 2018 rule see, "Proposed Amendments to California Emission Control System Warranty Regulations and Maintenance Provisions for 2022 and Subsequent Model Year On-Road Heavy- Duty Diesel Vehicles with Gross Vehicle weight Ratings Greater Than 14,000 Pounds and Heavy-Duty Diesel Engines in such Vehicles," June 18, 2019. Available online: https://ww2.arb.ca.gov/rulemaking/2018/hd-warranty-2018. Last accessed September 21, 2022.

[20] EPA is reviewing a waiver request under CAA section 209(b) from California for the Step 1 Warranty rule. See "California State Motor Vehicle Pollution Control Standards; Heavy-Duty Vehicle and Engine Emission Warranty and Maintenance Provisions; Request for Waiver of Preemption; Opportunity for Public Hearing and Public Comment" at 87 FR 35760 (June 13, 2022).

purchases whose current business model includes short trade cycles and would not keep their vehicles/engines through the longer warranty period to get the full value of the higher purchase price. Cummins noted that even the less stringent proposed Option 2 would significantly increase the initial purchase price, as indicated by the price increases due to CARB's Step 1 warranty program starting in MY 2022. Hyliion suggested that longer warranties would put unknown and potential massive risks on parts manufacturing industry that can lead to additional price increases. Allison, EMA, and DTNA noted the likelihood of high failure rates and warranty claims for new technology, especially in the early years of implementation. Allison commented that OEMs will likely be conservative in estimating costs of future repairs to reduce risks; those increased warranty projections will be passed to customers in the purchase price.

Many commenters indicated that purchase price increases due to the longer warranty periods may delay effectiveness of the rule. Allison suggested that "overly aggressive" warranties will drive up costs, incentivize pre-buy, and reduce turnover of old technology which would delay emissions benefits of the rule. Hyliion, NACD, and NGVAmerica also commented that the cost of extended warranties will be passed on to the customer and decrease demand for new trucks.

Allison, DTNA, EMA and several other organizations suggested EPA's cost analysis was inaccurate. Allison stated that EPA's repair cost analysis, which focused on tractor mileage-based repair cost, is not representative of vocational vehicle repair costs. EMA claimed that extended warranty will triple the cost of coverage on existing emissions-related components while also adding warranty costs to cover the new emissions-related components. DTNA also commented that a longer useful life would impact a manufacturer's decision to schedule maintenance to replace catalysts and the manufacturer may consider the catalyst replacement costs as warranty costs.

<u>Response</u>:

- We acknowledge comments highlighting increased purchase prices due to the lengthened warranty periods and note that, in the proposal for this rule, we described an expectation that manufacturers would continue their current practices of estimating warranty repair costs actuarially and adding the costs to the purchase price of the engine or vehicle. We received no comments that would change that expectation for the final rule.
- We also acknowledge comments indicating a risk of pre-buy and low-buy with increased purchases prices.
- In response to ATD's specific concern relating to purchasers with short trade cycles, we expect, to the extent that fleets currently base their short trade cycles on the time at which today's warranty periods expire, that these companies would consider adjusting their current business model to accommodate the longer warranties in this final rule.
- As explained in section 3.8 of this Response to Comments document and in preamble IV.A, we project the final standards and useful life periods will not require manufacturers to plan for the replacement of the entire catalyst system as a part of their compliance strategy, as DNTA suggests may occur. Since DTNA connected an extended useful life and potential aftertreatment replacement to "exorbitant warranty costs", we are clarifying here that the current and final requirement to pay for any replacement of catalyst beds or particulate filters as part of scheduled maintenance is independent of whether the

scheduled replacement interval falls within the warranty period. A manufacturer that opts to schedule replacement outside of the warranty period, but within useful life, would also be required to pay the cost of the replacement. We agree that, to the extent a manufacturer opts to schedule replacement of their aftertreatment system, they would likely add the cost to their purchase price whether is labeled a "warranty" or "maintenance" replacement. Again, as noted in preamble section IV.A, such replacement is not expected under the final rule.

- See section 18.3 of this document for a complete list of organizations that commented with additional information specific to our analysis of warranty costs. That section provides our responses, including our response to Allison's concern relating to our use of the tractor mileage-based repair cost, and a summary of updates we made for the final analysis.
- We updated our cost and economic impact analyses to reflect the final warranty periods. For more information, see our complete assessments of costs in Chapter 7 and economic impacts in Chapter 10 of the Regulatory Impact Analysis for this final rule.

Reactions to EPA's stated advantages of longer warranty periods

We discussed four potential beneficial outcomes of longer warranty periods in the proposal (see Section IV.B.1 of the NPRM preamble). Many commenters agreed that longer warranties would incentivize owners to maintain their engines over more of the life of the vehicle. Allison expressed support for our expectation that longer warranties may promote better maintenance, reduce tampering, maintain emission performance over time, improve awareness of defects, and encourage manufacturers to simplify repair processes. NASTC agreed that longer warranty would reduce owner costs of servicing emission-related problems. MFN agreed that the warranty period is important to minimize tampering or disrepair, and noted that warranty periods shift the cost of failures onto the manufacturer rather than the driver. Allison disagreed that manufacturers would be motivated to improve their component designs to reduce repair costs due to longer warranty periods. ATA noted that requiring all owners to pay for longer warranties would not prevent tampering, since there will always be "rogue" operations willing to tamper; instead, ATA indicates that enforcement of the CAA is a better tool for reducing tampering.

Response:

- We appreciate the expressed agreement from certain commenters on the possible beneficial outcomes of lengthened emission-related warranty periods and acknowledge the disagreement raised by other commenters.
- In response to NASTC, we clarify that, while repair costs will be covered by the manufacturer over a larger portion of the operational life of the engine and we believe a longer warranty period may incentivize manufacturers to reduce the costs of servicing their emission-related components, at least some of the repair costs will be paid upfront by the first purchaser of the engine. Similarly, in response to MFN, while the emission-related warranty does ensure manufacturers take responsibility for the repair of component failures, we expect they will continue to estimate the cost to address future

repairs under warranty and add that cost to the purchase price such that owners pay for the repairs upfront instead of throughout the life of the engine.

- We agree with ATA that enforcement is an effective deterrent for tampering and that longer warranty periods will not *eliminate* tampering. We disagree that a longer warranty would be ineffective, since we expect even "rogue" trucking operations would, at minimum, delay their tampering until the longer warranty period has ended to continue having repair costs covered by not voiding their warranty, thus providing many additional miles of ensured emission control.

Hours- and years-based warranty periods

Several organizations commented on the proposed years or hours criteria for useful life. MEMA stated that members had concerns with the proposed 7 and 10 year limits, but did not provide specific information. Allison noted that data collected at the higher mileages may not accurately predict the use of vocational vehicles that are more limited by hours of operation. Allison suggested EPA should "utilize a finer-targeted system" and further differentiate warranties by vehicles classes and vocations. NWRA suggested EPA consider hours-of-service regulations as the basis of our warranty hours. Cummins and CARB supported applying an hours-based warranty period for all engine classes to cover lower-speed applications and the 20-mph conversion factor that we proposed.

Response:

- While MEMA indicated concern for the proposed Option 1 years values, they did not provide specific information to update our proposed years. To account for engines that are less frequently used (e.g., seasonal vehicles such as motorhomes or snowplows), we are continuing to apply year-based warranty periods and the final years values are increased from 5 years to 10 years for all engine classes, which matches the MY 2031 step of proposed Option 1. See preamble IV.B.1.
- We agree with Allison that vocational vehicles have distinct use patterns; however, we did not propose and are not finalizing warranty periods at the vehicle level. See preamble IV.B.1.
- Regarding NWRA's suggestion, it is our understanding that the hours-of-service regulations would not be appropriate for determining hours, because those regulations target drivers operating high speed vehicles that travel many miles per year. High mileage vehicles would likely reach the warranty mileage criteria first and do not represent the vehicles that would be hours-limited. The hours criterion is intended to limit an engine manufacturer's warranty obligation for lower-speed vehicles, such as refuse trucks, that may not accumulate many miles, but operate frequently in modes that can stress the engine.
- We appreciate Cummins and CARB support for hours-based warranty periods. We received no adverse comments on this issue and are adding hours-based warranty periods for all engine classes in the final rule. Consistent with our final hours-based useful life periods, we are calculating the final hours-based warranty periods by scaling the final mileages using a 20-mph conversion factor.

Components covered by emissions warranty

The NPRM included a request for comment on expanding the list of components covered under warranty to include any component that triggers an OBD MIL. CARB recommended EPA adopt the provision to align with their program, referring to proposed 40 CFR 1036.120(c) to suggest that the phrase "covers all components whose failure would increase an engine's emissions of any regulated pollutant" logically connects warranty to the OBD system, since it monitors for emissions increases and would indicate that a failed component has led to an emissions increase. Allision, Cummins, DTNA, and EMA opposed expanding the list of components. DTNA provided examples of components (e.g., fuel level sensors, vehicle speed sensors, real-time clocks) that provide an input to the OBD system and could trigger a MIL. EMA suggested we update the regulatory text describing the components covered by warranty to be consistent with the proposed 1068.30 definition of "critical emission-related component" and paragraph (IV) of 1068, appendix A. Specifically, they requested that warranty to be limited to components whose "primary purpose to reduce emissions or whose failure would commonly increase emissions without significantly degrading engine/equipment performance."

<u>Response</u>:

- While we did not directly propose to use a component's connection to a MIL as an indicator that it should be covered under warranty, EMA and CARB seemingly interpreted our proposed regulatory text in 40 CFR 1036.120(c) as expanding the list of components covered.
- We agree with CARB that OBD is an effective tool to identify components that fail and lead to emissions increases. However, we retain our proposed position and disagree that <u>all</u> components that trigger a MIL should be covered under warranty. Since a failure of some components would not directly increase emissions, we would not consider them a component covered under emissions-related warranty.
- We are revising proposed 40 CFR 1036.120(c) to refer directly to appendix A of 1068 as the list of components covered under warranty. This revision is consistent with the original intent of the list of emission-related components in 1068, appendix A, which states that "This appendix specifies emission-related components that we refer to for describing such things as emission-related warranty or requirements related to rebuilding engines." By removing the proposed phrase "covers all components whose failure would increase an engine's emissions of any regulated pollutant" in 40 CFR 1036.120(c), we clarify that we are not expanding the list of components beyond what is currently covered under emissions-related warranty.
- We note here and in our maintenance discussion in preamble IV.B.2 that we are also replacing the current text of paragraph IV of 40 CFR 1068, appendix A, with a reference to the new part 1068 definition of critical emission-related components. This revision avoids having similar text in the appendix and definition. We expect that these updates, along with the revised 40 CFR 1036.120(c) reference to the 1068 appendix, will address EMA's recommendation since their recommended text is consistent with the new definition of critical emission-related components.

- We note that the warranty provisions for other sectors continue to use the language proposed for 40 CFR 1036.120(c) and we may consider addressing any potential inconsistency in a future rulemaking.

Two manufacturers requested that EPA clarify the regulatory text in proposed 40 CFR 1036.120(b) and 1036.120(c). EMA commented that the phrase “offers with or without charge” in 1036.120(b) is misleading. PACCAR expressed concern that, under the proposed 1036.120(c), OEMs would be liable for third-party components added to their engine.

Response:

- We are revising the proposed 40 CFR 1036.120(b) to remove “with or” in the final provision, which was added in error. The phrase “offers without charge” is consistent with the corresponding provision in other sectors (e.g., 40 CFR 1039.120(b)) and with the current definition of warranty in 40 CFR 86.004-2 that refers to a “basic mechanical warranty” that would be offered without charge.
- We are revising proposed 40 CFR 1036.120(c) to clarify one aspect of the components covered by warranty. Since manufacturers rely on many suppliers to create the emission-related components on the engine they are certifying, we continue to believe it is appropriate for an emission-related warranty to cover any components, regardless of the company that produced them, that are the original components or the same design as components from the certified configuration, We note that we are adding the same clarification to the corresponding vehicle provision in 40 CFR 1037.120(c). We also note that we proposed no changes and are finalizing no changes to the existing 40 CFR 1068.115, which specifies when manufacturers may or may not deny warranty claims. See also section 6.3 of this document for our description of the relationship between warranty and scheduled maintenance under the final rule.

Recommended changes to the structure of the emissions warranty program

In the ANPR and NPRM for this rule, we requested comment on alternative approaches we should consider for emissions-related warranties. Allison and OOIDA expressed support for the graduated warranty approach that included options for pro-rating certain components over time. Similarly, Allison, AVE, and BorgWarner recommended that EPA identify certain components to be covered by the longest warranties.

Response:

- While we recognize that there could potentially be value in these approaches, we did not propose and do not have sufficient data at this time to develop a graduated warranty program or determine appropriate warranty periods for specific components. We may consider those approaches in a future rule.

AVE, BorgWarner, and MEMA noted that many components require routine maintenance and that those components should not be covered under warranty. MEMA suggested that, instead, such parts and components should be defined as standard maintenance or replacement items. BBU Environmental Services requested that DEF systems be covered by manufacturer warranty for the full life of the vehicle.

Response:

- In our updated maintenance provisions (see Section 6 of this document and section IV.B.2 of the preamble), we are retaining the current structure that allows manufacturers to specify maintenance intervals for components that require regular adjustment, cleaning, and/or replacement within the useful life. We are updating the minimum maintenance intervals to reduce the frequency at which manufacturers can require this scheduled maintenance.
- In general, scheduled maintenance specified by the manufacturer is proactive maintenance covered by the owner, which is distinct from a manufacturer's responsibility to cover a failed component under warranty.
- In response to BBU, DEF systems are emissions-related components and will be covered under warranty for a larger portion of the operational life of the vehicle under this final rule. We are not finalizing a unique extended warranty for DEF systems. While we believe manufacturers will be able to design their aftertreatment systems to be durable enough to last the useful life of the engine (see preamble section IV.A), they continue to have the option to schedule replacement of those systems as long as they pay for the catalyst bed, the most expensive part of a DEF system. See our updates to the proposed maintenance provisions and corresponding responses to comments in Section 6 of this document.

Miscellaneous regulatory changes

AVE and BorgWarner requested that owners should have to supply maintenance records and show no sign of abuse or manufacturers should be allowed to deny a warranty claim. BorgWarner expressed concern over current practices in shops that use inadequate or incomplete diagnostic routines to identify failures. BorgWarner also suggested that having a useful life definition for each system component would limit a manufacturer's warranty exposure.

Response:

- Our current regulations under 40 CFR 1068.115(a) specify that a manufacturer can deny a warranty claim for "improper maintenance or use." We are making no changes to that provision in this final rule.
- In section 5 of this document and section IV.B.3 of the preamble, we describe the serviceability improvements we are finalizing. Some of the new serviceability requirements are targeted at improving access to repair and servicing information that may address some of the concerns expressed by BorgWarner.

- In section 6 of this document and section IV.B.2 of the preamble, we describe our update to 40 CFR 1036.125(h)(2) to clarify the information we require that manufacturers include in their owner’s manual if they expect specific maintenance record be kept by owners.
- While BorgWarner suggests a unique useful life for each emission-related component, we note that regulatory useful life applies for the entire certified engine configuration and is distinct from a manufacturer’s requirement to warrant emission-related components. We do not have sufficient information to set warranty periods for individual components at this time.

In response to EPA’s request for comment in the NPRM for this rule, NASTC commented in support of EPA explicitly stating in the warranty regulations that manufacturers may not deny warranty based on use of commonly available DEF.

<u>Response</u>:

- We did not propose and are not finalizing any explicit regulatory text to note the use of commonly available DEF at this time. We may consider this in a future rule where we expect we would propose to apply it broadly to all sectors covered under 1068.

5 Serviceability

5.1 Repair and servicing information in owner’s manual

<u>Comments by Organizations</u>

Organization: *American Truck Dealers (ATD)*

Regarding “serviceability,” ATD specifically objects to any EPA requirement that:

1. Emissions-related service information be published in owners’ manuals given that professional technicians have ready access to such information elsewhere. [EPA-HQ-OAR-2019-0055-1321-A1, p. 7]

2. OEMs prominently “advertise” to CMV owners their right to have emissions-related repairs performed at so-called “independent” repair facilities using third-party components of their choosing. To the contrary, OEMs are and should be free to encourage CMV operators to use original equipment parts and components, and to seek out franchised dealership service departments when in need of emission-related service, thereby helping to protect air quality by

both ensuring the proper service and repair of emissions-critical systems, and avoiding emissions tampering. [EPA-HQ-OAR-2019-0055-1321-A1, p. 7]

Organization: *California Air Resources Board (CARB)*

U.S. EPA has recognized that defective designs and tampering can contribute to increase in-use emissions. Mal-maintenance can also result in increased emissions. Many commenters on U.S. EPA's ANPRM stated that they were frustrated with the emission control system reliability, misdiagnosis with improper repair by professional service facilities and limited access to maintenance information that would facilitate the owner's ability to properly repair their vehicles themselves. To help address these concerns, U.S. EPA has proposed that important maintenance information be available in the owner's manual starting voluntarily before 2027 and be required in 2027 and subsequent model years. U.S. EPA has asked comment about making this proposal mandatory as soon as 2024 MY and what other information should be included in the owner's manual. [EPA-HQ-OAR-2019-0055-1186-A2, p.117]

CARB staff fully supports U.S. EPA making serviceability requirements mandatory as early as 2024 MY. Manufacturers already have this information and provide it to their authorized repair facilities (usually for a fee). Although there will be additional printing costs to include the information requested by U.S. EPA, this cost should be negligible. Furthermore, it can be argued that accurate information on how an owner can properly repair and service an engine available readily in the owner's manual would pay for itself by potential avoided warranty costs by the manufacturer. Therefore, CARB staff believes this requirement should be made mandatory and should not be delayed for another 3 years. Better accessibility to repair information will help owners to address repairs as soon as possible with accurate information and help avoid having their truck taken out of service. [EPA-HQ-OAR-2019-0055-1186-A2, p.118]

CARB staff supports that the manufacturer provide in the owner's manual more detailed information on how to clean their DPF. DPF is a critical emission control component designed to control toxic/carcinogenic diesel particulate matter. Failure to properly remove accumulated ash at regular intervals will result in DPF cracking and/or uncontrolled thermal events that could cause sintering or platinum group metal migration for catalyzed DPFs. CARB staff agrees that it is important to have owner's manual information on how to remove the DPF for cleaning, the criteria for determining if the ash was properly removed, such as using the clean or 'birth' weight of the DPF, DPF inlet and outlet pressures are available with a generic scan tool and any other information on how to properly maintain and prevent damage to the DPF. In addition to these items listed in the NPRM, CARB staff has assembled an internal workgroup to provide more specific criteria what needs to be in the owner's manual for DPF cleaning. This working group is also intended to provide criteria for manufacturer 'swapping' programs where an owner can turn in their DPF at an authorized repair facility for cleaning and get installed a different DPF that has been 'cleaned'. This is to ensure that damaged DPFs are not returned into service and no used DPFs are offered for sale. This more recent effort was based on experiences gained in implementing CARB's diesel retrofit program. When CARB staff have developed a more finalized version of DPF cleaning, we will share that with U.S. EPA staff for possible guidance and/or adoption. [EPA-HQ-OAR-2019-0055-1186-A2, p.118]

Other information that should be included in the owner's manual are inducement warnings, inducement derate schedules, and when a vehicle will go into final inducement. Also, as mentioned above, CARB staff believes it is important to have detailed DPF cleaning information and the criteria for when a filter is deemed 'clean' in the owner's manual. [EPA-HQ-OAR-2019-0055-1186-A2, p.118]

Organization: *Cummins Inc. (Cummins)*

In §1036.125(h)(3)-(11), EPA proposes to require manufacturers to include eight types of information in their engines' owner's manuals: how the owner can use OBD information, how the emission control systems operate, flow path diagrams, exploded-view drawings with part numbers and assembly requirements, basic wiring diagrams for aftertreatment-related components, where to find emission recall and repair information for free from NHTSA, troubleshooting guide for DEF and DPF warning signals, and DPF cleaning instructions including filter weights and inlet/outlet pressures. Much of this information is currently readily available to owners of Cummins engines, accessible online for free after specifying their engine serial number or engine model. For example, see https://quickserve.cummins.com/ and https://parts.cummins.com/. Additionally, some of the same information is already required by regulation and is made available per EPA's and CARB's service information requirements (SIR). [EPA-HQ-OAR-2019-0055-1325-A1, p. 17]

Much of the additional information EPA proposes to require manufacturers to include in the owner's manual resides in numerous sources today, such as operation and maintenance manuals, service manuals, troubleshooting and repair manuals, wiring diagrams, parts databases, temporary repair practices, technical service bulletins, etc. Each source is organized and tailored according to the intended audience and type of information it needs to convey. Requiring manufacturers to add such information to the owner's manual, which is the source intended to describe normal operation of the engine, is redundant and could cause unnecessary confusion. EPA should allow manufacturers to determine the best approach for communicating the information owners need to know and should not prescribe where that information resides or how it is delivered. [EPA-HQ-OAR-2019-0055-1325-A1, p. 17]

EPA should not finalize the proposed additions to owner's manuals in §1036.125(h)(3)-(11), nor the proposed requirement of §1036.135(c)(10) to link to that information from a QR code on the emission control information label. (If EPA does finalize the requirement for a mandatory QR code on the engine label, it should take effect no earlier than MY 2027.) [EPA-HQ-OAR-2019-0055-1325-A1, p. 17.].

Cummins would like to work with EPA to explore alternatives for ensuring owners have the information they need to keep their engines' emission control systems functioning properly.[EPA-HQ-OAR-2019-0055-1325-A1, p. 17]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

The complexity of modern emissions control systems requires expert evaluation to determine the appropriate cause of any given failure, and the correct procedure to replace failed components.

Such determinations and service actions should only be performed by trained professionals operating with detailed information about the particular system at hand. Manufacturers are already required to provide access to their service tools and information at a reasonable price, and professional repair facilities and fleets already make use of this information. [EPA-HQ-OAR-2019-0055-1168-A1, p.76]

EPA proposes to require OEMs to provide additional maintenance information in the owner's manual. This proposal is intended 'as a way to improve factors that may contribute to mal-maintenance, resulting in better service experiences for independent repair technicians, specialized repair technicians, owners who repair their own equipment, and possibly vehicle inspection and maintenance technicians.'120 The proposal is unnecessary, however, as most of the information that EPA would require is already readily available to technicians and fleets, and manufacturers are already required to provide access to detailed service procedures, manuals, etc.121 [EPA-HQ-OAR-2019-0055-1168-A1, p.106]

120 Proposed Rule, 87 Fed. Reg. at 17,516.

121 For example, the public is able to purchase service information for Detroit Diesel engines readily at https://dtnacontent-dtna.prd.freightliner.com/content/public/DDCSN/Literature/chassis-engine-service-informationsubscription.html. Similarly, our service and diagnostic tools are available to the public,

Detailed service information is necessary so that trained technicians can properly maintain the engine and its emissions control systems. Daimler Truck provides detailed information intended to keep the service technician safe and to ensure the continued proper functioning of the system. For example, the Company provides safety-critical information including how to properly remove and service an aftertreatment system (including to clean the DPF), or how to service the fuel system, with safety-critical specifications for torque, identified one-time-use components, and more information necessary to guard against the risk of fire and other safety issues. [EPA-HQ-OAR-2019-0055-1168-A1, pp.106-107]

The operator's manual is not sufficient (in terms of length, scope, or detail) to provide this information. EPA nonetheless proposes to require manufacturers to provide technical information in the owner's manual about how to repair the engine, how to diagnose and troubleshoot problems, exploded-view diagrams with part numbers and basic assembly requirements with 'enough detail to allow a mechanic to replace any of those components.'122 [EPA-HQ-OAR-2019-0055-1168-A1, p.107]

122 Proposed Rule, 87 Fed. Reg. at 17,516.

Daimler Truck is extremely concerned that providing the required information in the owner's manual could lead owners to believe that the detailed service information in the troubleshooting and service manuals is not necessary, and could lead operators and mechanics to attempt to diagnose, troubleshoot, repair, or maintain the system without adequate information. This, in turn, would likely lead to improper maintenance of the emissions control system, but more importantly, could also lead to *significant safety concerns* as untrained, ill-informed technicians may miss critical maintenance and repair operations. [EPA-HQ-OAR-2019-0055-1168-A1, p.107]

123 Id.

It is not feasible, practical, or effective to include all necessary service information in the operator's manual. For comparison, the operator's manual provided with Detroit engines is less than 100 pages; but the service information (which Detroit makes available at a reasonable cost) is an online resource with *thousands of pages* of detailed troubleshooting information, diagrams, troubleshooting procedures, and most importantly, *safety critical procedures* to protect the operator and/or technician. It also includes exploded diagrams and assembly instructions for all components, including the most up-to-date part number information. The troubleshooting, repair, and part number information is all updated constantly with the most recent procedures and parts. [EPA-HQ-OAR-2019-0055-1168-A1, p.107]

Daimler Truck is similarly concerned by EPA's proposal to require manufacturers to provide in the operator's manual a troubleshooting guide to address DEF dosing-and DPF regeneration-related warning signals, including a description of the fault condition, potential causes, including a list of all codes that cause derate or inducement.123 This information is already provided in the existing service information that manufacturers provide at a reasonable price. For instance, the troubleshooting manual for any given Detroit engine is roughly one thousand pages of detailed service information and cannot be reasonably condensed into an operator's manual format. [EPA-HQ-OAR-2019-0055-1168-A1, p.107]

Indeed, several printed pages of information included in an engine operator's manual are not sufficient to enable adequate troubleshooting, diagnosis, repair, or maintenance. Further, given the limitations of the print manual format, any information included in the engine operator's manual will be out of date before it can be used. Including such information in the manual only serves to encourage untrained, ill-informed service work, which is detrimental to emissions performance and will cause a variety of safety risks. [EPA-HQ-OAR-2019-0055-1168-A1, p.107]

While EPA has received comments that many fleets would like this information, the fact remains that this information is already available. Fleets and service facilities can access all of this information, with significantly more detail than could be included in the operator's manual. [EPA-HQ-OAR-2019-0055-1168-A1, p.108]

Modern diesel engines are complicated equipment that must be serviced by a trained and informed professional. The full repair and diagnostic information needed to perform this work competently cannot be included in an operator's manual. Daimler Truck recommends that instead of mandating enhanced service information in an operator's manual, EPA should focus on enforcing current requirements to make service tools and information available to trained technicians—and specifically, that the Agency focus on ensuring that the information provided by manufacturers is sufficient, accurate, and accessible. [EPA-HQ-OAR-2019-0055-1168-A1, p.108]

Daimler Truck acknowledges EPA's goals of trying to increase owner understanding of emission control systems and improve repair experiences. However, in setting what information must be included in the operator's manual for proper service and maintenance, the Agency makes some assumptions about these procedures that are not borne out in reality. The most specific example, and the most problematic, is EPA's proposal to require the inclusion of instructions for servicing the DPF. [EPA-HQ-OAR-2019-0055-1168-A1, p.108]

EPA assumes that manufacturers could provide relatively simple instructions that would enable them to easily clean their own DPFs. For Detroit engines, Daimler Truck does not currently provide an in-shop DPF cleaning procedure in any service literature, including to our branded dealer network, due to the complex, sensitive nature of DPF cleaning. We do not believe an in-shop DPF cleaning procedure would stand up to the performance equivalency requirements demanded today by EPA and CARB. Our validated and EPA-approved DPF cleaning process requires a core exchange, where filters are cleaned in a controlled facility with specialized equipment. Daimler Truck cannot provide simple instructions for how an operator can perform this procedure, since it cannot be performed without special training, equipment, and instructions. [EPA-HQ-OAR-2019-0055-1168-A1, p.108]

Failure to perform DPF cleaning or improperly cleaning a DPF may result in negative outcomes that significantly affect the health of the emissions control system, including: DPF soot leakage; DPF coating degradation; DPF overtemp, which can result in DPF cracking or SCR damage due to PGM migration; and SCR overtemp. [EPA-HQ-OAR-2019-0055-1168-A1, p.108]

EPA proposes to specify, in a new Section 1036.125(h), the information manufacturers must provide to help an operator to determine that DPF maintenance is necessary, or that it has been sufficient. The information required in the Proposed Rule is insufficient, and is in fact inadequate for these purposes. OEMs should have the ability to determine the best way to notify an operator of approaching DPF maintenance requirement. Below are examples of specific pieces of information that EPA proposes to require in Section 1036.125(h) that would in fact be counterproductive to the goal of ensuring optimal DPF service and cleaning: [EPA-HQ-OAR-2019-0055-1168-A1, p.108]

First, system backpressure is not necessarily a primary or reliable metric for determining DPF state. Backpressure is a function of mass flow, temperature, soot, and ash load. Displaying DPF backpressure is not useful or meaningful unless done in a controlled way (i.e., during a specific service routine). The sensitivity of backpressure measurements to external factors may result in false negative/positive for indicating DPF maintenance is required. Backpressure is also influenced by other factors in the system, for example, solidified DEF deposits, DOC face-plugging with hydrocarbons and soot. If an operator uses backpressure as a DPF diagnostic with other influencing variables, they may interpret a false positive or negative for DPF maintenance. Isolating backpressure to the DPF component level requires sensors located at DPF in and DPF out. Manufacturers may not measure pressure directly across the DPF today. [EPA-HQ-OAR-2019-0055-1168-A1, pp.108-109]

Second, clean filter weight & preinstalled filter weight are inappropriate as 'clean filter' criteria. Due to a stack up of production tolerances on the particulate filter, mat, and can weights, a generic clean filter weight band lacks the granularity required to determine weight gain due to ash. Weights by serial number are required. Further, using pre-installed filter weight as a metric requires the filter to be measured before installation into the assembly. This weight must be recorded and tracked from the canning/housing supplier to the truck plant, then manually flashed into the calibration. This tracking is a significant undertaking for a method that has additional error and other issues. [EPA-HQ-OAR-2019-0055-1168-A1, p.109]

Our experience with weighing DPFs has found a number of challenges for capturing an accurate ash weight over lifetime. DPF assembly weights may fluctuate with residual gasket material stuck to the flange, due to dirt road grime improperly cleaned from the can, and even influences of can oxidation/rust. DPFs must be weighed hot both pre-and post-installation to eliminate the effect of condensation due to ambient and exhaust conditions. This requires an oven for weights at the canner and increases cost and complexity of manufacturing. A repair shop must either purchase an oven to check DPF weights, or a technician removes the filter from the vehicle at a controlled, high temperature. In our experience, this violates safety protocols and safe handling DPF removal guidelines for many shops and technicians. A filter weighed at different conditions can have different measured weights. Manufacturers carefully control for this during testing to determine accurate filter weights, which is not feasible or controllable in a service environment. Moisture trapped in the DPF can significantly influence the weight of DPFs, which may obscure any information about the amount of ash or particulate matter in the DPF. [EPA-HQ-OAR-2019-0055-1168-A1, p.109]

Third, pressure drop and weight are also inappropriate as 'clean filter' criteria. EPA's proposed wording of Section 1036.125(h)(11)(ii) implies that 'clean filter criteria' must include pressure drop and weight. For the reasons described above, we do not believe these criteria are appropriate for determining whether a filter has been adequately cleaned or not. [EPA-HQ-OAR-2019-0055-1168-A1, p.109]

Daimler Truck invests significant research and development resources into developing its proprietary filter cleaning process. This process requires specialized equipment for an effective multi-step cleaning process, as well as thorough multi-step quality checks after cleaning. The Company does not use system backpressure or filter weight in this process as a metric to indicate a DPF has been successfully cleaned. The metrics used and validated as part of this cleaning process cannot be measured or reported in the vehicle, and rely on off-board measurement equipment. Furthermore, in order to gain approval for offering this process to the field, the Company has demonstrated equivalency between a new and remanufactured cleaned DPF with EPA and CARB. [EPA-HQ-OAR-2019-0055-1168-A1, p.109]

EPA's proposal to require certain DPF cleaning information in operator manuals will encourage less precise, less complete DPF cleanings, which could lead to premature DPF failures and increased PM emissions. EPA should allow manufacturers significant leeway with regards to such critical maintenance of emissions critical components. DPF cleaning is not a simple operation, and cannot be treated as such. [EPA-HQ-OAR-2019-0055-1168-A1, pp.109-110]

Because of the sensitivity of the emission control system to proper DPF maintenance and the scrutiny that regulatory oversight agencies apply to the OEM cleaning procedures, it is unreasonable for EPA to require an OEM to publish criteria for DPF cleaning. This would amount to a tacit endorsement of third-party cleaning methods that have not been validated for effectiveness or risk to the system. [EPA-HQ-OAR-2019-0055-1168-A1, p.110]

As an alternative approach for ensuring adequate DPF maintenance and cleaning, Daimler Truck recommends that EPA:

- Allow OEMs flexibility in the metrics used to display DPF service life to the operator. For example, an indicator of DPF ash full % or estimated mileage to cleaning can be provided in J1939 or in a dash maintenance menu, rather than a specified parameter (such as pressure drop) which may not be adequately indicative of remaining filter life.
- Allow OEMs sole discretion to determine whether and how to release DPF cleaning methods, given the sensitivity of the component and its direct impacts to emissions, as well as potential risks for long-term compliance and warranty obligations. Further, EPA should not require the publication of in-shop cleaning procedures if the OEM has deemed them insufficient. [EPA-HQ-OAR-2019-0055-1168-A1, p.110]

Organization: *Ford Motor Company (Ford)*

We recommend that EPA remove the requirement to include extensive service information for critical emission-related components in the owner’s manual (e.g., OBD information, flow path for intake air and exhaust gas, engine coolant flow path, emission-related part numbers, etc.) . This type of information is already available in Ford service manuals. Including this type of information in the owner’s manual will require significant quantities of new data to be added to the owner’s manual and will likely provide little benefit to customers. Ford would be willing to support a requirement that instruction on how to access manufacturer service information resources (web site addresses, etc.) be included in the Owner’s Manual. [EPA-HQ-OAR-2019-0055-1300-A1, p. 6]

Organization: *Lubrizol Corporation (Lubrizol)*

2) Lubrizol supports provisions to require lubricant-related maintenance information to be provided to owners and operators in the owner’s manual. Lubrizol supports EPA’s proposal to require important maintenance information to be made available in the owner's manual.3 As EPA knows, the owner's manual relied upon by heavy-duty vehicle owners or operators to describe appropriate engine maintenance, applicable warranties, and any other information related to operating or maintaining the engine or vehicle. By requiring additional maintenance information in the owner's manual, EPA will be taking an important step towards reducing mal-maintenance, better service experiences for independent repair technicians, specialized repair technicians, owners who repair their own equipment, and possibly vehicle inspection and maintenance technicians. Most important, we believe that this step will provide greater assurance of long-term in-use emission reductions by reducing likelihood of occurrences of tampering. [EPA-HQ-OAR-2019-0055-1304-A1, p.3]

3 See Proposal, p. 17515.

The owner's manual and engine label should also include an internet link that would enable owners or operators to obtain this information online. [EPA-HQ-OAR-2019-0055-1304-A1, p.3]

We support making these changes mandatory, starting with MY 2024. Given the importance and complexity of emission control systems and the impact to drivers for failing to maintain such systems, Lubrizol urges EPA to require that OEMs provide this additional information in the owner's manual as soon as possible. [EPA-HQ-OAR-2019-0055-1304-A1, p.3]

Organization: *National Association of Small Trucking Companies (NASTC)*

Nevertheless, NASTC first and foremost appreciates that, with this proposed rule, the agency has carefully considered our sector's input from the 2020 advanced notice of proposed rulemaking, as seen from this NPRM's modernization of inducement and serviceability provisions. Specifically, NASTC applauds separate inducement schedules for high- and low-speed vehicles — making it easier for truckers to make repairs while on the road, using generic scan tools, and providing more, specific information like diagnostic codes — and better warranty coverage of emission system and parts failures so as to keep trucks that remain in service performing emissions reduction while reducing truckers' costs of servicing the systems for the actual life of a vehicle. [EPA-HQ-OAR-2019-0055-1130-A1, p. 2.

Requiring that systems provide more, specific information, including diagnostic codes. Having cab displays that name the condition that triggered the pending or active derate and a countdown timer of the estimated time or distance before the next stage of derating (even if overridden) would give truckers more and better information about inducements as they happen, help them make informed decisions about trip management, repairs, etc., and make the inducement system more tolerable. Coupled with generic scan tools and new capabilities to diagnose and repair emission system problems, this empowers drivers with better information, better tools, and better options. Drivers are more likely to take action when enabled in the ways and by the means proposed. They would know not only the problem, but how to fix it, while better able to manage trip plans and commercial obligations. Moreover, NASTC supports the proposed additional information in owner's manuals, including how to use the OBD system to troubleshoot problems. [EPA-HQ-OAR-2019-0055-1130-A1, p. 3] (these comments are also in 7.4)

In addition to rectifying the overly aggressive inducement and imbalanced serviceability rules that presently affect commercial motor carriers, there are other important reasons to enact the above and most of the other proposed regulatory reforms in these areas. As NASTC members and other transportation industry commenters in the ANPRM made clear, the present rules, including those relating to inducement and serviceability, cause extensive unpredictability, uncontrollability, and unduly burdensome and economically harmful effects, such as unreasonable costs and delays for truckers and supply chain disruptions for businesses and consumers. [EPA-HQ-OAR-2019-0055-1130-A1, p. 3]

The reason for far too many of the consequences suffered under present inducement and serviceability rules is the underlying emissions standards and the highly complex, expensive equipment created in response to the mandates on newer model diesel engines and heavy-duty vehicles. As welcome as regulatory relief from the status quo is regarding these respects, the underlying proposed NOx and GHG emissions reduction standards in this NPRM will certainly result in OEMs introducing even more complex, expensive diesel engines and associated systems. The mandates on OEMs will surely result in unpredicted, adverse spillover effects on commercial vehicle owners—including even more equipment unreliability, unpredictability, additional uncontrollable expenses, delays keeping truckers from productive use of time and resources, lost business, and sweeping adversity and deprivation visited upon businesses and consumers across the nation. [EPA-HQ-OAR-2019-0055-1130-A1, p. 4]

Organization: *Owner-Operator Independent Drivers Association (OOIDA)*

More repair and servicing information in owner's manuals such as descriptions, diagrams, instructions, troubleshooting guides, and QR codes will make self-maintenance more understandable and more commonplace. [EPA-HQ-OAR-2019-0055-1266-A1, p.7]

Organization: *PACCAR, Inc (PACCAR)*

Finally, as proposed, section 1036.125(h)(6) states that manufacturers should 'Include exploded-view drawings to allow the owner to identify the part numbers and basic assembly requirements for turbochargers, aftercoolers, and all components required for proper functioning of EGR and aftertreatment devices. Include enough detail to allow a mechanic to replace any of those components.' (emphasis added). As parts are improved and updated, part numbers will change and be superseded. Therefore, EPA should revise its Proposed Rule to allow industry to identify these parts by name instead of number. [EPA-HQ-OAR-2019-0055-1346-A1, pp.53-54]

Organization: *Truck and Engine Manufacturers Association (EMA)*

As also noted below in our specific comments on the proposed regulations, EMA does not support EPA's proposal to include additional maintenance information in the owners' manual. Many of the proposed service information items go beyond the scope of general information necessary for all users, and could create significant unintended consequences. Most of the service-related information that EPA is proposing to now provide in the owners' manual is already available and provided by manufacturers today, but through specific service databases, guides and other documentation, where different types of information are made available according to specific user skill-sets, warranties, maintenance needs, etc. Further, much of the information at issue is already provided for at a "fair and reasonable cost" (as required by the service information regulations of 40 CFR part 86). Given that this information is already available, we do not understand the need to provide duplicate information in the owners' manual, especially when any such information likely will go beyond the maintenance capabilities of the target audience for vehicle owners' manuals. The proposed inclusion of maintenance and emission controls information along with general vehicle information would give the false impression that more substantive repairs are similar in nature to the general use information otherwise provided in an owners' manual. Further, including service information in the owners' manual would greatly increase the size of the manual – it would result in a manual that is prohibitively large, and would not fit in a typical vehicle glove box or elsewhere in the vehicle without taking up a significant amount of space. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 97 - 98]

In sum, it is unclear why information that is otherwise available, and tailored to the appropriate audiences, should also be included in a general vehicle owners' manual. While we do not support the proposal to provide such information in the owners' manual, we would not be opposed to providing information in the owners' manual regarding where service information can be found. [EPA-HQ-OAR-2019-0055-1203-A1, p. 98]

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §1036.125(h): "(h) Owners manual. Include the following information in the owners manual to clarify maintenance instructions and the owner's responsibilities:" As noted above, we do not support the proposed addition of the items listed in paragraphs (h)(1) through (11) to owners' manuals. These items go beyond the scope of general information provided to all users, and more detailed service-related information is available via other manufacturer-provided manuals and tools. We note that manufacturers are already obliged by the service information regulations of 40 CFR 86.010-38 to make such information available, thus manufacturers are already providing this information publicly. While we do not support the proposal to also provide such information in the owners' manual, we would not be opposed to providing information in the owners' manual regarding where service information can be found. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 103 - 104]

EMA opposes the proposed requirement to describe the emissions control system and OBD trouble codes (§§1036.125(h)(4) through (8)) in such detail as to give owners the sense that they could apply "backyard mechanic" skills to repair complex emissions control systems, despite a complete lack of training, and without the correct tools to make quality repairs to restore emissions control. Just the opposite could happen, where the actions of the owner could lead to other component issues and potentially more severe emissions exceedances. Today's technicians connect to the emissions control system with qualified tools to perform diagnostic routes, and to reset parameters when new sensors are installed. This level of rigor is required to take appropriate corrective action on today's complex emissions control systems. [EPA-HQ-OAR-2019-0055-1203-A1, p. 128]

EPA should abandon the proposal to compel manufacturers to educate owners on repair processes through the owner's manual. The proposed requirements of §§1036.125(h)(3) through (11) should be deleted in the final rule. Current service information requirements offer qualified repair technicians the tools, information and supporting training they need to effect quality repairs. This should be the preferred path owners take when they are alerted to component issues by way of the OBD MIL lamp. [EPA-HQ-OAR-2019-0055-1203-A1, p. 128]

EPA Summary and Response

Summary:

EPA received comments from users indicating the need to adopt the proposed serviceability provisions. NASTC commented that the proposals to improve serviceability are important for two main reasons: 1) to address existing imbalanced serviceability rules that presently affect commercial motor carriers, 2) to prepare and assist with serviceability of more complex, expensive diesel engines and emission systems resulting from the revised emission standards. NASTC also commented that they support EPA's new serviceability requirements in the owner's manual including how to use the OBD system to troubleshoot problems and that these provisions will make it more likely that drivers will take action. OOIDA commented that EPA must finalize all provisions in the proposal regarding serviceability, inducements, and self-diagnostic tools that will help drivers better assess and maintain their emissions equipment. Individual operators reinforced the concern that current systems are very complex and cannot be serviced by individual owners, which increases operating costs and downtime. Lubrizol, a supplier of lubricants to the heavy-duty industry also commented in support of the serviceability provisions in the rule and indicated that the owner's manual is heavily relied upon by owners and operators.

CARB commented that their staff fully supports EPA making serviceability requirements mandatory as early as MY 2024. CARB noted that manufacturers already have this information and provide it to their authorized repair facilities, and although there will be additional printing costs to include the information requested by EPA, this cost should be negligible. Furthermore, CARB stated it can be argued that accurate information on how an owner can properly repair and service an engine available readily in the owner's manual would pay for itself by potential avoided warranty costs by the manufacturer. Therefore, CARB staff stated they believe this requirement should be made mandatory and should not be delayed for another 3 years as better accessibility to repair information will help owners to address repairs as soon as possible with accurate information and help avoid having their truck taken out of service.

EPA received comments from service providers that EPA should not require emission-related service information to be published in owner's manuals, given that professional technicians have ready access to such information elsewhere. EMA and manufacturers such as DTNA, Ford, Cummins and PACCAR commented that this information is available elsewhere. Specifically, Cummins said much of this information is available to their owners online for free after specifying ESN or engine model. Daimler stated that manufacturers already provide troubleshooting information at a reasonable price and that this information is too extensive to be reasonably condensed into an owner's manual. Finally, EMA and manufacturers such as DTNA and PACCAR expressed concerns that providing this information would only serve to encourage untrained, ill-informed service work by owners who may think they can apply "backyard mechanic" skills to perform certain repairs and that modern engines are complicated and must be serviced by trained and informed professionals. Cummins added that the owner's manual is intended to describe normal engine operation, and that adding this information to the owner's manual could cause confusion because they provide the additional service information in other ways. DTNA stated that additional information in the owner's manual could lead operators and mechanics to perform diagnosis and repair without adequate safety information, because they might believe the detailed information in the troubleshooting and service manuals is not necessary.

Response:

See Section IV.B.3 of the preamble for details on the requirements we are finalizing and our supporting rationale. It is clear from the comments EPA received that operators believe there is a lack of information available to perform proper and prompt maintenance and avoid derates. EPA also received comments confirming that in the real-world repairs and maintenance are not always done by professional mechanics. See, for example, the OOIDA comments stating that their members have the resources and means to maintain their trucks, and prefer doing this work themselves.[21] EPA's final rule includes requirements to improve availability of serviceability information to facilitate proper maintenance throughout the life of the vehicle. This information is especially helpful for older vehicles to help operators maintain long-term compliance that will improve real-world environmental outcomes. EPA agrees with commenters that there is a particular need to improve access to serviceability information related to engine derating.

EPA agrees with CARB's comments that any additional printing costs in the owner's manual would be negligible if there are any at all. OEMs today already provide some of this information, for example, DTNA and PACCAR include some assembly drawings of parts in their manuals,[22] Many manufacturers also include some diagrams that can be slightly improved to meet these new requirements (e.g., adding exhaust flow indicators or DEF flow indicators). EPA also disagrees that owner's manuals are intended only to describe normal engine functions, which is why today they contain information on warning lights and emergency procedures (like emergency jump starting, etc.)

EPA appreciates the comments that operators should not see the owner's manual as a substitute for any service or troubleshooting guides and has added a requirement that manufacturers identify a web site for the service information we require under 40 CFR 86.010-38(j).

Manufacturers commented that this information is available elsewhere, and therefore should not be put into the owner's manual. EPA disagrees with this rationale, as this is true for nearly all the information already in an owner's manual. For example, information on how to check belts, fluids, air filter components would also be expected in other technical documents, but is also in the owner's manual because having prompt access to this information is essential for proper maintenance. Regarding DTNA's comments expressing concern that additional information in an owner's manual may lack safety information or sufficient detail, EPA disagrees that the final serviceability requirements present such risk. First, we note that we have modified the final regulations from those proposed to not take final action at this time to require certain additional information, in particular information proposed about assembly like the requirement to include "enough detail to allow a mechanic to replace any of those components." See preamble Section IV.B.3 for further details. Second, we have included a requirement for manufacturers to include information in the owner's manual on where operators can access or purchase more detailed serviceability and safety information, like the service manual DTNA mentioned in their comment.

EPA received comment from CARB and Lubrizol that it is both feasible and beneficial to adopt these provisions early; however, to ensure manufacturers have enough time to implement these changes within the context of this overall final rule, we are finalizing as proposed that the final serviceability requirements apply starting in MY 2027. Manufacturers may optionally meet these requirements before MY 2027.

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[21] Comments from the Owner Operator Independent Driver Association, EPA-HQ-OAR-2019-0055-1266.
[22] https://dtnacontent-dtna.prd.freightliner.com/content/dam/public/dtna-servicelit/ddc/pdfs/OperatorsManual/DDPlatform/DDC-SVC-MAN-0189_2022.pdf#page=140&zoom=100,0,529, https://www.peterbilt.com/download/file/6031

EPA recognizes that part numbers are updated as designs change and as manufacturers address problems. EPA is not requiring that an owner's manual would need to be updated for a given model year to reflect changes in part numbers. We have added language to reflect this expectation. We have also limited the part number requirement to just SCR-related sensors and filters. The critical information path for locating correct replacement parts is to have data to start with and work with parts counter specialists to find updated part numbers. EPA expects that, just like owner's would be able to identify updated replacement parts based on the part numbers of outdated failed parts installed on their vehicle, the same is possible with outdated part numbers on drawings.

EPA understands the concerns of some commenters regarding the potential breadth of requirements as proposed to include a troubleshooting guide for DEF-dosing and DPF-regeneration. EPA did not intend the proposal to result in the equivalent of service manuals being published in the owner's manual. Today, there is little if any information available in owner's manuals regarding vehicles that have been induced to 5 mph. For example, the word "derate" only appears three to five times in some heavy-duty engine owner manuals (out of 100-200 pages total) and only in connection to a trouble light turning on. Derating engines because of SCR-related issues without providing information to understand the cause of the derate is counter-productive to the intended effect of inducing the owner/operator to quickly address the cause of the condition, and such timely response would more likely occur with proper information. For example, if an operator unknowingly puts in contaminated DEF which will result in inducement, there should be information in the available through the owner's manual on how to promptly address this issue and avoid inducement. After consideration of comments,

EPA is finalizing a more specific set of requirements in 40 CFR 1036.125(h)(8) to describe what troubleshooting information needs to be included that will provide operators with proper maintenance information.

EPA received comments on our proposed requirement to include DPF cleaning information in the owner's manual, including information from CARB that CARB has an ongoing effort related to the aim of this proposed requirement. After consideration of comments, EPA is not taking final action at this time on this aspect of the proposal and may consider this in a future rulemaking.

Finally, EPA agrees with CARB that we should also require inclusion of information regarding inducement warnings and derate schedules in the owner's manual and has accordingly updated the requirements from proposal in the final rule.

5.2 QR Code on engine label with link to owner's manual

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

CARB staff supports the standardization of sensor labeling and the QR code on the engine label. These are common sense requirements that give truckers and repair facilities repair information quickly and would better assist in making correct engines repairs. [EPA-HQ-OAR-2019-0055-1186-A2, p.118]

Organization: *Cummins Inc. (Cummins)*

EPA should not finalize the proposed additions to owner's manuals in §1036.125(h)(3)-(11), nor the proposed requirement of §1036.135(c)(10) to link to that information from a QR code on the emission control information label. (If EPA does finalize the requirement for a mandatory QR code on the engine label, it should take effect no earlier than MY 2027.) [EPA-HQ-OAR-2019-0055-1325-A1, p. 17.].

Organization: *Ford Motor Company (Ford)*

We recommend that the engine label requirements be modified to remove the requirement that manufacturers host the IT system that is linked to the QR Code on the engine label. We support making engine information and owner's manuals available electronically, but we believe that it would be appropriate for EPA to host such an IT system; as is the case with fueleconomy.gov. Having EPA host this type of information will ensure that the data linked to the QR Codes is presented in a consistent manner for all engine manufacturers and the data provided will link directly to data submitted to EPA during engine certification. [EPA-HQ-OAR-2019-0055-1300-A1, p. 6]

Organization: *Lubrizol Corporation (Lubrizol)*

3) Lubrizol supports requiring OEMs to provide lubricant and oil information in an engine label. In addition to requiring manufacturers to provide more information in their owner's manuals, Lubrizol urges EPA to require that lubricant information should also be provided on a label that is placed at the appropriate place in the engine compartment. As EPA notes in the Proposal,4 the agency has had similar requirements in the past, such as when EPA required vacuum hose diagrams to be included on the emission labels. The engine label should include an internet link that would enable owners or operators to obtain this information online. [EPA-HQ-OAR-2019-0055-1304-A1, p.4]

4 See Proposal, p. 17516.

4) Lubrizol supports requiring OEMs to include a QR Code to help ensure that the appropriate engine oil or lubricant is used throughout useful life. Lubrizol supports EPA's proposal,5 in 40 CFR 1036.135(c), that manufacturers include a Quick Response Code or 'QR Code' on the emission label that would direct repair technicians, owners, and inspection and maintenance facilities to a website which provides critical emissions systems information at no cost. This information should include engine-specific lubricant requirements, including the recommended lubricant, service intervals, and other relevant information that is necessary to ensure that the correct high-performing lubricant is used throughout the engine's useful life. Providing this information will help ensure that the engine and emissions control systems are adequately protected during all modes of operation throughout their useful lives. [EPA-HQ-OAR-2019-0055-1304-A1,p.4]

5 See Proposal, p. 17516.

Organization: *Truck and Engine Manufacturers Association (EMA)*

EMA has concerns related to the proposed QR code included in the labeling requirements of §1036.135(c)(10). EMA is generally supportive of the concept of electronic labeling, and has been working to develop specific features of electronic labeling for some time. We do, however, have concerns about the QR code requirements EPA proposes. [EPA-HQ-OAR-2019-0055-1203-A1, p. 128]

As an initial matter, EMA views electronic labeling as an alternative to conventional emissions label requirements. EPA's proposal, however, is to add a QR code to the existing emissions label. EPA should make the QR code-based label available as an alternative to the existing physical label mounted on the engine. [EPA-HQ-OAR-2019-0055-1203-A1, p. 129]

If EPA does not finalize the rule with the option to use electronic labeling as an alternative to conventional labeling requirements, EMA recommends that manufacturers be given the option to add a second label featuring the QR code EPA describes, as an alternative to adding the QR code to the existing label. A manufacturer should also be given the option to make a readable QR code accessible by means other than labeling. For instance, the QR code could be readable as a physical impression on a component surface accessible to users. [EPA-HQ-OAR-2019-0055-1203-A1, p. 129]

EMA does not think it is appropriate that owner's manuals be accessible from the QR code required. Manufacturers already have various means to make owner's manuals available to users. To make them available via the QR code is redundant and unnecessary. This requirement should be eliminated in the final rule. [EPA-HQ-OAR-2019-0055-1203-A1, p. 129]

The other information proposed to be accessible through the QR code link requires clarification. For example, it is unclear what EPA means in §1036.135(c)(10)(i) by, "as long as the appropriate information is available for each engine." It is unclear what "appropriate" information is intended to be covered, and how it must be associated with the engine from which the QR code was read. In (ii), it is unclear if EPA is requiring the same list of emissions control systems that manufacturers are required to include on the emissions control label. If that is the case, EMA recommends removing that redundant requirement. In (iii), EMA is uncertain what type of fuel and lubricants requirements EPA is proposing to include. It is also a risk to exclude fuel sulfur level requirements when providing fuel requirements; that element of the provision should be removed in the final rule. EMA stands ready to work with the Agency to finalize §1036.135 in a more reasonable manner. [EPA-HQ-OAR-2019-0055-1203-A1, p. 129]

EMA recommends that EPA make available an option that EPA host the QR-code accessed information proposed under §1036.135(c)(10) on an EPA-supported website. Although individual manufacturers could host this information, it would be preferrable for some users accessing this information for EPA to do so. EPA could design a website, similar to Fueleconomy.gov, which would provide data to the public in a consistent format for all engine manufacturers. [EPA-HQ-OAR-2019-0055-1203-A1, p. 129]

EPA Summary and Response

Summary:

EPA received comment from CARB and Lubrizol supportive of the proposed requirement to add a QR code on the engine label with a link to an electronic version of the owner's manual for the engine. Lubrizol added that they recognize the benefit of greater access to repair information and instructions for proper oil and lubricants. EMA commented that they support efforts to create an electronic label, but they objected to the proposed requirement to add a QR code as redundant and unnecessary because owner's manuals are already available to users. EMA recommended that EPA allow electronic labeling as an alternative to conventional labels, rather than adding electronic labeling requirements as a supplement to the conventional label. EMA recommended that EPA at least allow manufacturers to create a second label with a QR code, and to make QR codes accessible separate from labeling. EMA requested clarification of various information items described in the proposed rule, and they suggested that EPA design an EPA-supported website to provide relevant engine information to the public (like fueleconomy.gov).

Ford recommended that we modify the proposed requirement for QR codes by instead arranging for EPA to maintain the linked information on an EPA-supported website (like fueleconomy.gov). Cummins recommended that EPA not finalize the proposed requirement for QR codes, but also stated that EPA should not require QR codes before model year 2027 in any case.

Response:

We are not taking final action at this time on the proposed requirement to include QR codes on the emission control information label. EPA recognizes the potential for electronic labels with QR codes or similar technology to provide useful information for operators, inspectors, and others. Manufacturers are actively pursuing alternative electronic labeling. After reviewing submitted comments, we think we should engage in further analysis before moving forward with adopting electronic labeling requirements.

We note that consistent with existing regulations, which are not reopened or changed by this rulemaking, manufacturers must continue to meet requirements for applying physical labels to their engines. Manufacturers may also include a QR code or other electronic labeling information that goes beyond what is required under our regulations for physical labels. We note that the prohibition in 40 CFR 1068.101(b)(7)(iii) against applying false information labels also applies for information that is available electronically. We recommend that manufacturers communicate any such plans with EPA's Compliance Division, and note that such information could help inform a potential future rulemaking in this area. Further, we are including a final requirement that manufacturers include information on where to obtain more service information in the owner's manual to ensure that owners are properly informed on how to find such information, which should ensure users have information regarding where to access the same information that was proposed to be available using the QR code.

5.3 Improved serviceability of electric vehicles

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

CARB staff appreciates U.S. EPA's acknowledgement of the work to develop the ZEP Certification procedures for medium and HD vehicles. In response to U.S. EPA's request for comments on maintenance and operational information for improved serviceability of BEVs and FCEVs, CARB staff recommends that the U.S. EPA proposal include, at minimum, all elements in ZEP Certification related to the access to service information and diagnostics. CARB staff agrees that with U.S. EPA's assertion 'that the maintenance and operational information described in the NPRM could help potential BEV and FCEV purchasers to understand the possible operational impacts of these technologies on their businesses, as well as ensure the vehicles are supported during their use in the field.' These provisions would result in vehicles that can be easily serviced and repaired outside of warranty periods and support secondary markets. [EPA-HQ-OAR-2019-0055-1186-A2, p.24]

CARB staff is providing several references50,51,52,53 to similar efforts under the Advanced Clean Cars II rule making development proposals to require robust warranties, service information, and recycling labels for light-duty vehicles. [EPA-HQ-OAR-2019-0055-1186-A2, p. 25]

50 https://ww2.arb.ca.gov/sites/default/files/2021-10/accII_october_2021_workshop_presentation_ac.pdf

51 https://ww2.arb.ca.gov/sites/default/files/2021-12/draft%20zev%20battery%20label%201962.6%20posted.pdf

52 https://ww2.arb.ca.gov/sites/default/files/2021-12/draft%20zev%20warranty%201962.8.pdf

53 https://ww2.arb.ca.gov/sites/default/files/2021-12/draft%20service%20information%201969.pdf

Organization: *Lion Electric Co. USA Inc. (Lion)*

We support the EPA's proposal that battery-electric vehicle (BEV) manufacturers take responsibility towards educating fleets on how to properly maintain their vehicles. Lion provides detailed training for drivers and mechanics through our Customer Success Team as part of vehicle delivery, to ensure that all parties are comfortable with and prepared to utilize their new electric truck or bus. While a battery-electric vehicle comes with fewer parts to maintain, it is important that owners adhere to regularly scheduled maintenance to get the most out of their vehicle. Lion makes that transition as accessible as possible. For maintenance that requires a Lion technician to perform, we have Experience Centers across the United States that are equipped to address any service needs. [EPA-HQ-OAR-2019-0055-1151-A2, p. 3]

We believe that the service and diagnostic monitoring applications as listed under Request for Comments on Maintenance and Operational Information for Improved Serviceability for Electric Vehicles should be included on all BEVs and that OEMs should strive to make electric vehicles that are accessible to their customers. Adopting the California Air Resources Board (CARB) Zero-Emission Powertrain Certification (ZEPCert) program would provide nationwide direction to OEMs and encourage manufacturer accountability. This is the best way to promote widespread ZEV adoption and create an ecosystem of vehicles that supports fleet industries with easy-to-use controls and data points. [EPA-HQ-OAR-2019-0055-1151-A2, p. 3]

We also support BEV manufacturers providing purchaser guidance and powertrain monitoring as part of their vehicle configuration. Lion electric buses and trucks already come standard with onboard touchscreens that provide detailed monitoring data that can be understood by a trained technician (this is part of the training Lion offers upon delivery of our vehicles). LionBeat, our telematics fleet management software, can provide charging power, range, energy use, and even data on the time spent idling versus driving per trip. These metrics can help fleet owners assess the efficiency of their routes and the health of their vehicles, minimizing downtime. In addition, the onboard diagnostics can provide maintenance history and reminders to keep servicing on schedule. These tools give fleet owners more control over their vehicles and operations. They also provide a sense a security, removing uncertainty that might otherwise prevent business growth by generating dependable, accessible data for vehicle servicing and optimal usage. Having this type of flexibility and knowledge will allow fleets to operate confidently, facilitating a smoother transition into zero-emission technology. [EPA-HQ-OAR-2019-0055-1151-A2, p. 3]

Organization: *Retail Industry Leaders Association (RILA)*

- EPA's rulemaking notes the accelerated rate of adoption for HD ZEVs within the market. RILA suggests that this shift presents a significant opportunity for EPA to provide guidance on HD ZEV battery's 'second life', recycling, or disposal. [EPA-HQ-OAR-2019-0055-1189-A2, p.8]

- RILA requests that EPA consider new requirements for original equipment manufacturers (OEMs) to provide standard repair time (SRT) recommendations for HD ZEVs. [EPA-HQ-OAR-2019-0055-1189-A2, p.8]
- RILA supports EPA's proposal to require manufacturers to include a Quick Response Code or 'QR code' on HD ZEV labels linking to a website that would direct repair technicians, owners, or inspection and maintenance facilities to a website with information. There is considerable value in allowing users to connect quickly to safety procedures, first responder guides, and information regarding maintenance intervals. RILA suggests that there are other areas of information that could be included, such towing requirements and clearly identified lift points that are specific to HD ZEVs since such vehicles need to be towed from rear axle or have axle shafts disconnected. [EPA-HQ-OAR-2019-0055-1189-A2, p.8]

Organization: *Tesla, Inc. (Tesla)*

EPA also proposes an update to communication protocols and data access for medium- and heavy duty BEVs that would require a standardized connector that is compatible with automotive scan tools.151 The agency should ensure that any such requirement is future proofed and inclusive of new technologies that can provide service repair information in easier and more cost-effective ways. [EPA-HQ-OAR-2019-0055-1219-A1, p.19]

151 87 Fed. Reg. at 17518.

In BEVs OBD-CAN is archaic and it should not be the only way manufacturers can be compliant. EPA should allow for additional connector options. CARB has taken such an approach in its standards for new heavy-duty zero-emission powertrains.152 CARB's standards allow manufacturers to choose how to best provide relevant diagnostic information to the vehicle operator. This ensures the vehicle purchasers and operators will have the necessary operating information for repairability while maintaining product design flexibility and more optimal customer experience, which is critical to driving product innovation and adoption.153 [EPA-HQ-OAR-2019-0055-1219-A1, p.19]

> 152 California Air Resources Board, California Standards and Test Procedures for New 2021 And Subsequent Model Heavy-Duty Zero-Emission Powertrains (June 27, 2019) at C.3.1. ('A manufacturer must have installed a connector meeting the requirements in subsection (h)(2) of title 13, CCR, section 1971.1, with a vehicle controller area network communications protocol that is capable of connection and communication with scan tools that meet the requirements in subsection (h)(3) of title 13, CCR, section 1971.1 or have a device permanently installed on the vehicle capable of displaying the information required in section 3.2 without the need for additional diagnostic tools.')(emphasis added).
>
> 153 See, Tesla Comments to CARB (Feb 15, 2019). Tesla incorporates by reference these comments.

More specifically, EPA should provide the flexibility to utilized diagnostic over IP (DoIP) capabilities. Allowing for DoIP communication supports future designs and will promote greater access to diagnostic information. To that end, Tesla recommends EPA also allow other devices to be installed in a BEV, including, but not limited to, a RJ45 connector or wireless connection option. Allowing for DoIP supports wireless diagnosis and is a more futureproof solution to communicate onboard diagnostic data, software updates, and vehicle data. Tesla vehicle advances such as software updates need higher data throughput (software updates, drivers assistance, navigation maps, large software games, etc.). Many components within a Tesla vehicle, and increasingly other OEMs, do not necessarily communicate over CAN. Newer technology and autonomous driving features have high data throughput needs (for example, camera images or transferring a 4-dimensional rendering of the environment around the vehicle during the process of troubleshooting) that are not compatible with the CAN system. Allowing for RJ45, wireless, and other manners of connection will allow for proper and fulsome communication of such data. [EPA-HQ-OAR-2019-0055-1219-A1, pp.19-20]

Further, as to the agency asking about which (if any) vehicle signals should be standardized and made available for repair and service technicians,154 Tesla suggest that EPA follow the recommendations that CARB is proposing in the Advance Clean Car II rulemaking and align with them where applicable.155 [EPA-HQ-OAR-2019-0055-1219-A1, p.20]

154 87 Fed. Reg. 17526-17529.

155 See, CARB, Proposed Advanced Clean Cars II (ACC II) Regulations

Organization: *Walmart*

The proposed rule requests input on several system needs that can improve the performance and maintenance of BEVs/FCEVs. As a large fleet, these reflect valuable improvements that can better ensure that a smooth integration of BEV/FCEVs into our operation and better meet the distribution and logistics expectations we hold as a business. In particular: [EPA-HQ-OAR-2019-0055-1191-A2, p. 3]

We agree with the labelling recommendations requiring original equipment manufacturers (OEMs) to install QR codes on alternative fuel vehicles with links to the operators/service manuals, safety procedures, first responder guides as well as maintenance intervals. [EPA-HQ-OAR-2019-0055-1191-A2, p .3]

We believe OEMs should provide standard repair time (SRT) recommendations guidance for BEV/FCEV to fleet owners and operators for expected operational life of vehicle. [EPA-HQ-OAR-2019-0055-1191-A2, p. 3]

We believe BEVs/FCEVs specific towing requirements and lift points need to be clearly displayed on vehicles (for example, EVs need to be towed from rear axle or have axle shafts disconnected). [EPA-HQ-OAR-2019-0055-1191-A2, p. 4]

We request that OEMs be encouraged to consider alignment of BEV/FCEV maintenance intervals and diagnostic equipment/connectors with compression ignition. [EPA-HQ-OAR-2019-0055-1191-A2, p. 4]

We support EPA's effort to provide future guidance on battery second life, recycling, or disposal. [EPA-HQ-OAR-2019-0055-1191-A2, p. 4]

We recommend OEMs include in onboard diagnostics and signals like a distance to empty (DTE) display for alternative energy powered vehicles that are commonly found in both ICE and passenger EVs today. [EPA-HQ-OAR-2019-0055-1191-A2, p. 4]

EPA Summary and Response

Summary:

Several commenters provided perspectives on EPA's request for comment to improve serviceability of electric vehicles. Commenters were generally supportive of the concepts that EPA requested comment on; several commenters also suggested additional ideas to consider (e.g., new requirements for original equipment manufacturers (OEMs) to provide standard repair time (SRT)).

Response:

EPA is not taking final action at this time on this topic EPA requested comment on in the proposal. We may consider the comments provided on improved serviceability of HD electric vehicles in a future rulemaking relevant to HD electric vehicles.

5.4 Improved service information through education and voluntary incentives

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

U.S. EPA is seeking comment on whether educational programs and voluntary incentives could lead to better maintenance and real-world emission benefits. CARB staff fully supports such educational programs and in fact has experience with requiring manufacturers of diesel particulate retrofit filters provide training to end users and installers on how to properly assess an engine prior to retrofit installation, how to properly clean their retrofit DPF, what the warning lights mean, and other important information for the successful operation of their retrofit. The training could be provided either online or in person. This regulatory driven education requirement helped avoid many problems with retrofits that were seen in the early years of implementation. [EPA-HQ-OAR-2019-0055-1186-A2, p.119]

A similar approach can be extended to manufacturers of HDEs. Manufacturers should be required to provide online or in-person training sessions to drivers and repair technicians to better understand the engine's emission control system, dashboard warnings, inducements, maintenance, etc. This will help minimize manufacturer warranty costs, unhappy operators, and avoid unplanned downtime, thus resulting in a more successful HDE program. [EPA-HQ-OAR-2019-0055-1186-A2, p.119]

Organization: *Lubrizol Corporation (Lubrizol)*

5) Lubrizol supports providing increased education and information about the benefits of using the appropriate high-performing lubricant throughout useful life. [EPA-HQ-OAR-2019-0055-1304-A1, p.4]

Lubrizol supports providing increased education and information about the benefits of using the appropriate high-performing lubricants and oils throughout their useful life.6 Lubrizol has worked closely with SmartWay staff and others in the Office of Transportation and Air Quality to ensure that vehicle owners or operators can easily access the most up-to-date information regarding the benefits of using the appropriate engine oils and lubricants throughout useful life. We believe that the SmartWay program can provide a necessary complement to the information that should be distributed in owner's manuals, engine labels, and QR Codes by providing additional information about the cost savings, emissions reductions, maintenance benefits, and other benefits of using the appropriate engine oils and lubricants throughout useful life. Education should be directed to service and maintenance facilities and technicians, as well as owners and operators of the vehicles. [EPA-HQ-OAR-2019-0055-1304-A1, p.5]

6 See Proposal, p. 17519.

In designing its education and outreach programs, Lubrizol encourages EPA to consider strategies to ensure that communications reach service and maintenance facilities and technicians, as well as owners and operators of the vehicles. [EPA-HQ-OAR-2019-0055-1304-A1, p.5]

Organization: *Port of Seattle, Port of Tacoma, and Northwest Seaport Alliance (NWSA)*

Technical assistance to owners/operators on maintenance of their new trucks: Battery electric and hydrogen fuel cell technologies are complex compared to diesel engines. Drivers, fleet operators, and the truck maintenance and repair industry on which they depend should be provided with additional resources to maintain their engines when needed, to ensure proper emission controls and avoid tampering. Technical assistance should be offered in numerous languages to ensure communications are equitable across the fleet. [EPA-HQ-OAR-2019-0055-1312-A1, p.3]

Organization: *Repair Association/Repair.org*

Another important contribution to the future repair of emission control systems will be the education of service personnel and equipment owners about the proper software settings for the control system on any given machine. It is insufficient to have the proper functioning of emission control systems the sole control of the manufacturer or franchise dealerships. [EPA-HQ-OAR-2019-0055-1036-A1, p.6]

EPA Summary and Response

Summary:

Commenters provided perspectives on improved service information through education and voluntary incentives, including the use of educational programs and voluntary incentives to improve maintenance and real-world emissions benefits. Commenters supporting educational programs and voluntary incentives stated that manufacturers should be required to provide online or in-person training sessions to drivers and repair technicians to better understand the engine's emission control system, dashboard warnings, inducements, maintenance, etc. They commented that education programs will help minimize manufacturer warranty costs, unhappy operators, and avoid unplanned downtime, which would result in a more successful HDE program. One commenter stated that technical assistance should be offered in numerous languages to ensure communications are equitable across the fleet, while another encouraged EPA to consider strategies to ensure that communications reach service and maintenance facilities and technicians, as well as owners and operators. Another commenter emphasized the importance of education for service personnel and equipment owners about the proper software settings for the control system on any given machine. Finally, one commenter supported providing increased education and information about the benefits of using the appropriate high-performing lubricants and oils throughout their useful life.

Response:

EPA appreciates feedback from commenters on the potential benefits that education and voluntary incentives can provide to improve maintenance and achieve real-world emissions benefits. EPA is not taking any final action on this topic at this time, but intends to continue to look for future opportunities to improve serviceability of emission control systems.

5.5 Other comments on serviceability

Comments by Organizations

Organization: *Booth, Norman (OOIDA)*

"The biggest problem is when it goes out the replacement cost is unaffordable that what kills the small business." [EPA-HQ-OAR-2019-0055-1266-A2, p.3]

Organization: *Compass Coach Inc.*

The broken sensor I had last month placed my $550,000 vehicle out of service for 5 (FIVE) weeks while we waited for Cummins first to look at it (that took 9 days), then to order the part and waiting for that to arrive and then trying to figure out how we get our bus which is 300 miles away. [EPA-HQ-OAR-2019-0055-2120, pp.1-2]

Organization: *Faircloth, Josh (OOIDA)*

The emissions guides you have done on diesel engines on commercial trucks is a complete financial disaster! The expense on keeping the emissions system operating is way off the charts! This will be my 3rd truck with emissions and 3/4's of my maintenance expense had been directly related to the breakdown of your emissions guide line and not to mention the lost revenue I have .incurred while in the shop for 2 to 5 days at a time! I do not know where you get your ideas for these emissions systems but they are really flawed and way too expensive to maintain! This will most likely be my last truck I will ever buy and hope it will last me 2 1/2 to 3 years, this will be a stretch! In other words, your emissions guide and system "royally sucks"!! [EPA-HQ-OAR-2019-0055-1266-A2, p.3]

Organization: *Flueger, Art (OOIDA)*

Several years ago I leased 3 2015 Kenworth t660. Cummins ISX. Mileage 525,000 to 550,000. I kept them 21 weeks and turned them back. I had to buy a protote wrecker attachment so I could get them home. Fleet maintained and checked by Kenworth dealer. Driver turned 1 off. Went to eat. Came back truck wouldn't start. Turbo locked up so tight it wouldn't run period. Had to hire local wrecker to get it out from trailer so another truck could take load. I towed 1 home every week. Parts were very expensive, especially the VGT turbos. No thanks. [EPA-HQ-OAR-2019-0055-1266-A2, p.4]

Organization: *Kenny Sites*

I am opposed to more restrictive emission regulations for all truck engines and equipment. As a former mechanic and as CDL driver the emission regulations today are causing less milage (MPG) and efficiency of trucks and equipment. The engines have become less durable and reliable due to the emission requirements today and any truck shop you go to has 20 30 trucks sitting waiting on parts. This is causing delays and safety issues on the road for everyone in the hauling and construction industries.

The engines today consume more fuel to overcome the restriction created by the emission systems, and in return causes less usable life from the trucks and equipment. There is a fine line between fuel economy and clean emissions. The systems today produce very clean emissions and do need further regulation from government agencies that do not have a clue about the real issues of supply chain and construction issues. The reality is when a piece of equipment or truck engine shuts down to a glitch in the emissions system it has to fixed by someone with a computer to analyze the problem and involves shutting down the construction for that day or several days until another piece of equipment can be brought out or for trucks it may block the road until it can be towed to a shop and then the delivery of the merchandise may be delayed for days. [EPA-HQ-OAR-2019-0055-1495]

Organization: *Kloke, Stephen (OOIDA)*

Emissions have cost me my business. I could no longer afford to fix my 2013 Peterbilt with a Cummins diesel because it ate turbos and constantly was broke down because of the emissions system. It bankrupted me. [EPA-HQ-OAR-2019-0055-1266-A2, p.4]

Organization: *Kubiak, Gene (OOIDA)*

The emission technology is horrible as a one truck owner it cost me more to repair the down time is longer and we are being beat down with all these regulations that cost a good dollar. [EPA-HQ-OAR-2019-0055-1266-A2, p.5]

Organization*: Midwest Bus & Motorcoach Association*

Our members are concerned with the availability of parts and the ability to service a vehicle while on the road or even when at the home base facility. Due to faulty design flaws and less than acceptable parts, operators experience an overwhelming amount of engine codes resulting from emission standards. Many times, motorcoach operators find themselves scrambling to locate a service shop with the knowledge and technology to repair the issue. Most of the equipment companies run require OEM software to force the regeneration of a motorcoach, which not all shops have access to. To add to this problem, there is a small chance the service locations carry the specific part needed to service the motorcoach. Of note, if a motorcoach is coding for a DPF issue, it will most likely be able to operate normally and perform catalyst as intended. [EPA-HQ-OAR-2019-0055-1158-A1, p.4]

Further issues involve parts accessibility and reliability. It is becoming all too common for our companies to experience difficulties, if not impossibilities, to find replacement parts that will fix the DPF system in a timely manner. Recently, several operators were informed by OEM engine manufacturers that there is a three-month backorder on a common NOx sensor. Aside from parts availability, additional issues arise in respect to parts performance and reliability. In a recent industry survey, it was determined that 80% of DPF system-related issues directly resulted from a wide-range of faulty sensors in addition to the NOx sensors and would lead to a derate or inducement. Unlike other parts that show signs of wear over time, there is no plausible way to determine when a faulty sensor will occur. Our members have experienced failed sensors on a new motorcoach with less than 1,000 miles. Sometimes sensors are put in place to deter operators from using less than standard DEF products and to make sure the operators are not running low or empty on DEF. However, the cost of DEF is minimal, and companies are committed to ensuring the proper use. Unfortunately, the quality and reliability of sensors need be evaluated as a determining factor of derating a motorcoach. [EPA-HQ-OAR-2019-0055-1158-A1, p.4]

Recommendations:

1. Allow Non-OEM and generic scanners to clear SCR codes or Tamper Codes

2. Program ECM and software to perform secondary checks in the system to monitor SCR instead of relying on one sensor.

3. Require engine and part manufacturers to guarantee reliable parts. This can be achieved by mandating a warranty of 5 years or 500,000 miles instead of 50,000 miles. Until OEMs are motivated ore required to produce quality parts our industry will not see any improvements to the less than acceptable products they have been selling. Our members cannot be expected to efficiently and safely operate on low quality replacement parts. [EPA-HQ-OAR-2019-0055-1158-A1, p.4]

Organization: *Motorcoach Companies*

We are further concerned with the readily availability of parts and the ability to service a vehicle while over the road or sometime even in house. Due to faulty design flaws and subpar parts, we experience an overwhelming amount of engine codes resulting from emission standards. Many times, motorcoach operators find themselves scrambling to locate a service shop with the knowledge and technology to repair the issue. Most of the equipment our companies run require

OEM software to force regen a bus, which not all shops have access to. To add to this problem, there is a small chance these service locations even carry the specific part needed to service the bus to get back on the road. It is important to note, although the vehicle is coding for DPF issue, the vehicle will most likely be able to operate normally and still perform catalyst as intended. [EPA-HQ-OAR-2019-0055-1149-A1, p.4]

Further issues involve parts accessibility and reliability. It is becoming all too common that our industries companies are finding it difficult if not impossible to find replacement parts to fix the DPF system in a timely manner. Just recently, several operators were informed by OEM engine manufacturers that there is a 3 month back-order on a common NoX sensor. Aside from part availability, additional issues arise in respect to a parts performance and reliability. In a recent industry survey, it was determined that 80% of DPF system related issues directly resulted from faulty sensors. This includes a wide range of sensors, not just NoX sensors, so any sensor that would lead to derate or inducement. Unlike other parts that wear over time, there is no way to determine when a faulty sensor will occur. We have seen them happen on a new bus with less than 1,000 miles on the vehicle. Some of these sensors are simply put in place to deter operators from using subpar DEF products and to make sure the operators are not running low/empty on DEF. However, the cost of DEF is minimal, and companies are committed to ensuring the proper use. Unfortunately, the quality and reliability of these sensors has been subpar in themselves and must be relooked at as a determining factor to derate a vehicle. [EPA-HQ-OAR-2019-0055-1149-A1, p.4]

Recommendations:

1. Allow Non-OEM and generic scanners to clear SCR codes or Tamper Codes

2. Program ECM and software to perform secondary checks in the system to monitor SCR instead of relying on one sensor.

3. Require engine and part manufacturers to guarantee more reliable parts. This can be achieved by mandating they extend warranty to 5 years or 500,000 miles instead of 50,000 miles. Until OEMS have a motivation to produce quality parts we don’t see any improvements to the subpar products they have been selling to consumers. It seems as though OEMs feel these part sales are revenue generating and would rather keep them subpar to increase sales. We need better more durable/reliable products. [EPA-HQ-OAR-2019-0055-1149-A1, p.4]

Organization: *National Association of Small Trucking Companies (NASTC)*

The older vehicles will remain in operation longer than they would today. To be sure, the handful of very large motor carriers will purchase new vehicles. But with used-truck-buyer behavior being what we expect, based on NASTC’s experience, the turnover rate of older vehicles will be reduced, as discussed above, on account of this rule. [EPA-HQ-OAR-2019-0055-1130-A1, p. 6]

NASTC surveyed its members in 2020 (see attachment 1) about their experience with post-2010 vehicles, which are equipped with complex emissions systems under the present emissions standard. It is a cautionary tale. Our motor carriers identified which emission control system components fail most frequently. The components most often named as failing were sensors, DPF, and DEF doser, hoses, pumps, and filters. Respondents mentioned other failing components: EGR valves, coolers, actuators, SCR catalyst, DOC, turbo, wiring, decomp tube, cracked head, and PDF. Many respondents emphasized how expensive it is to repair these emission systems. [EPA-HQ-OAR-2019-0055-1130-A1, p. 6]

Respondents indicated that emissions system failures occur routinely. Some have problems with a single component monthly or twice a month; others said they have a problem with a component constantly. Others experience problems with multiple components, there seeming to be something faulty all the time. [EPA-HQ-OAR-2019-0055-1130-A1, p. 6]

We would expect similar system and component problems to crop up with new generation and novel systems. Also, the degree to which this emissions reduction proposal is perceived as part of a “Green New Deal”-type government push toward zero-emission vehicles and eradication of diesel and other fossil-fuel-burning vehicles is likely to spark resistance from the hundreds of thousands of small motor carriers for whom the predominant diesel trucks best suit their business models.4 [EPA-HQ-OAR-2019-0055-1130-A1, p. 6]

> 4. NASTC has no objection to consumer-driven, market-based additions of alternative-fuel vehicles entering the market that perhaps someday replace diesel vehicles, as decided by consumers. Ours is an “all of the above” perspective, where electric, natural gas, and other alternative fueled energies vie for market share. We do have a problem with government fiat and manipulation of markets to drive such major shifts.

Of course, slowed turnover of older commercial trucks being retired and newer models replacing them through the used-vehicle market, coupled with what we expect would be markedly higher used truck purchase prices, along with increased retention of used vehicles in service will translate into less reduction of NOx and GHG levels in the atmosphere. [EPA-HQ-OAR-2019-0055-1130-A1, p. 6]

Organization: *Owner-Operator Independent Drivers Association (OOIDA)*

Following the January 2020 Cleaner Trucks Initiative Advance Notice of Proposed Rulemaking (ANPRM), many truckers told EPA about problems they’ve experienced and how the agency could work to address them. OOIDA commends the agency for listening to those comments and including provisions in the proposal regarding serviceability, inducement, and self-diagnostic tools that will help drivers better assess their emissions equipment. [EPA-HQ-OAR-2019-0055-1266-A1, p.6]

Organization: *Small, George (OOIDA)*

I am a very small transportation company and it has been an expensive maintenance issue [EPA-HQ-OAR-2019-0055-1266-A2, p.3]

Organization: *Starnes, Elvin (OOIDA)*

"I own a 2014 Prostar and I have had numerous problems with the EGR coolers and DPF problems at a cost of $3,700 to as much of $9,500 at least once a year. The fuel economy is worse than my older truck that didn't have any emissions on it also I wish that I never got rid of the older truck." [EPA-HQ-OAR-2019-0055-1266-A2, p.1].

Organization: *Virginia Motorcoach Association*

Our members are concerned with the availability of parts and the ability to service a vehicle while on the road or even when at the home base facility. Due to faulty design flaws and less than acceptable parts, operators experience an overwhelming amount of engine codes resulting from emission standards. Many times, motorcoach operators find themselves scrambling to locate a service shop with the knowledge and technology to repair the issue. Most of the equipment that our member companies run requires OEM software to force the regeneration of a motorcoach, which not all shops have access to. To add to this problem, there is only a small chance that the service locations carry the specific part needed to service the motorcoach. Of note, if a motorcoach is coding for a DPF issue, it will most likely be able to operate normally and perform catalyst as intended. [EPA-HQ-OAR-2019-0055-2715-A1, p.3].

Further issues involve parts accessibility and reliability. It is becoming all too common for our member operator companies to experience difficulties, if not impossibilities, to find replacement parts that will fix the DPF system in a timely manner. Recently, several operators were informed by OEM engine manufacturers that there is a three-month backorder on a common NOx sensor. Aside from parts availability, additional issues arise in respect to parts performance and reliability. In a recent industry survey3, it was determined that 80% of DPF system-related issues were direct results of a wide- range of faulty sensors in addition to the NOx sensors and would lead to a derate or inducement. Unlike other parts that show signs of wear over time, there is no plausible way to determine when a faulty sensor will occur. Our members have experienced failed sensors on a new motorcoach with less than 1,000 miles. Sometimes sensors are put in place to deter operators from using less than standard DEF products and to make sure the operators are not running low or empty on DEF. However, the cost of DEF is minimal, and companies are committed to ensuring the proper use. Unfortunately, the quality and reliability of sensors need be evaluated as a determining factor of derating a motorcoach. [EPA-HQ-OAR-2019-0055-2715-A1, p.4].

3. ABA Industry Survey, "Engine Derate," June 2021

Recommendations:

1. Allow Non-OEM and generic scanners to clear SCR codes or Tamper Codes

2. Program ECM and software to perform secondary checks in the system to monitor SCR instead of relying on one sensor.

> 3. Require engine and part manufacturers to guarantee reliable parts. This can be achieved by mandating a warranty of 5 years or 500,000 miles instead of 50,000 miles. Until OEMs are motivated or required to produce quality parts our industry will not see any improvements to the less than acceptable products that have been provided. Our members cannot be expected to operate safely and efficiently using low quality replacement parts. [EPA-HQ-OAR-2019-0055-2715-A1, p.4].

EPA Summary and Response

Summary:

EPA received numerous comments on the cost and downtime associated with maintenance and repairs, and availability of emission-related components. Commenters noted spending thousands of dollars per year on maintenance and extensive time out of service due to these repairs, and some quoted 2-5 days in the shop at a time per repair. One commenter noted that problems with a sensor took a bus out of service for 5 weeks and stranded the vehicle 300 miles away from base. Others reported safety issues, delays, difficulty analyzing service-related problems, and numerous and repeat failures. Motorcoach companies noted that availability of parts and service is not guaranteed, they have difficulty finding replacement parts in a timely manner (including an example of a NOx sensor being on a 3-month backorder), and they are overwhelmed with engine codes. Motorcoach companies stated that it is difficult to find shops that can repair a bus due to specialized parts, tools, and software. Motorcoach companies stated these issues are made worse by repeated failures of many sensors (not just NOx sensors) which lead to derate or inducement, including on buses with less than 1,000 miles on them. They also commented that these concerns include sensors that evaluate whether a vehicle should be in inducement, and that such sensors are not dependable and should not be used to evaluate whether buses should be in inducement. Other commenters reiterated that maintenance expenses, towing expenses, and quick vehicle and engine shutdowns result in businesses like construction and hauling not able to complete tasks as contractually obligated. Some commenters included lists of components that they assert commonly break, including: sensors (DPF and DEF-related), DEF dosers, hoses, pumps, filters, EGR valves, coolers and actuators, SCR catalysts, DOC, turbos, wiring, decomposition tubes, cylinder heads and DPFs. Motorcoach Companies included specific recommendations to improve serviceability, including a requirement to allow a generic scantool to clear inducement codes, to program ECM and software to perform secondary checks in the system to monitor SCR instead of relying on one sensor, and to meet warranty requirements over a longer period. These concerns (frequent component failures, difficulty locating parts, difficult diagnoses, extensive downtime, and the need for improved serviceability) were echoed by other individual operators.[23]

Response:

EPA is aware of the need to improve serviceability of heavy-duty highway engines and is confident the improvements we are finalizing as a part of this rule will improve repair experiences for owners. As an initial matter and as discussed, in RIA Chapter 3, the technologies we expect to be used to meet the final standards build upon the technologies used in today's

[23] For example, see EPA-HQ-OAR-219-0055-2022 and EPA-HQ-OAR-219-0055-2483.

light- and heavy-duty engines, which we expect will help to address concerns related to serviceability of heavy-duty engines. In addition, we are finalizing serviceability provisions that we expect will help to address these concerns (see section IV.B.3. of the preamble for more discussion). Finally, see preamble Section III and section 3 of this document for further information and our responses to other comments related to the final standards, including technical feasibility of the final standards.

6 Maintenance

6.1 Minimum maintenance intervals

Comments by Organizations

Organization: *Cummins Inc. (Cummins)*

In §1036.125(a)(2), EPA proposes more stringent (longer) minimum scheduled maintenance intervals for adjustment/cleaning and replacement of various critical emission-related components. Changes are needed for certain components to reflect the possibility that manufacturers may need more frequent scheduled maintenance in the future due to more stringent emission standards and useful life and warranty requirements: [EPA-HQ-OAR-2019-0055-1325-A1, p. 15]

- In general, EPA's minimum intervals should be no longer than those finalized in CARB's recent HD Warranty and Omnibus rulemakings. EPA should revise any proposed intervals that are longer than CARB's intervals to match those in the CARB regulations. Improved alignment will allow manufacturers to better optimize their products and customers to experience more consistency in maintenance practices. [EPA-HQ-OAR-2019-0055-1325-A1, p. 15]
- NOx sensors are a specific example of misalignment between EPA and CARB maintenance intervals. EPA proposes to eliminate its existing sensor category and proposes that sensor maintenance should follow the requirements of an associated component, presumably a catalyst in the case of a NOx sensor. For catalyst systems (other than catalyst beds), EPA proposes a minimum replacement interval no shorter than today's UL, while CARB retains a separate sensor category with minimum replacement intervals less than today's UL. EPA should align the replacement intervals for sensors with CARB's: 100,000 mi / 3,000 hrs for SI HDE and Light HDE, and 150,000 mi / 4,500 hrs for Medium HDE and Heavy HDE. [EPA-HQ-OAR-2019-0055-1325-A1, p. 16]
- Another example is for Exhaust Gas Recirculation (EGR) system cleaning, where CARB retained previous minimum cleaning intervals of 100,000 mi / 3,000 hrs of use initially and 150,000 mi / 4,500 hr intervals thereafter for Medium HDE and Heavy HDE. EPA should retain the initial shorter period for Medium HDE and Heavy HDE before changing to the longer interval for subsequent maintenance events on adjustment and cleaning of any component with those intervals today. EPA indicates it does not intend to

change today's adjustment and cleaning intervals (87 FR 17523), but Table 2 of §1036.125 does not include the shorter initial maintenance intervals. [EPA-HQ-OAR-2019-0055-1325-A1, p. 16]

- DEF filter replacement may need to become more frequent due to flowing more DEF to meet future emission standards. Cummins recommends a minimum replacement interval of 100,000 mi / 3,000 hrs for DEF filters across Light, Medium, and Heavy HDE. [EPA-HQ-OAR-2019-0055-1325-A1, p. 16]
- For spark plugs, ignition wires, and coils, replacement intervals should remain at today's values due to the increased gap and amperage of the heavy-duty system needed for commercial applications. [EPA-HQ-OAR-2019-0055-1325-A1, p. 16]
- EPA's proposed standards are premised on the use of CDA and dual SCR systems for diesel engines. EPA should be flexible in approving minimum scheduled maintenance intervals for components associated with new technologies not yet in production for heavy-duty vehicles. Whether it is an "additional" component already included in Tables 1 and 2 of §1036.125(a)(2) but not employed today, such as a second DEF doser or added light-off catalyst, or fully "new" technology such as CDA, EPA should be open to shorter minimum intervals than shown in the tables. Cummins requests that EPA confirm it would not expect the same minimum intervals for new components as for components which manufacturers already have significant experience. [EPA-HQ-OAR-2019-0055-1325-A1, p. 16]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

In the Proposed Rule, EPA expresses its intent to 'continue to restrict replacement of catalyst beds and particulate filter elements, requiring that manufacturers pay for the repair […] if needed, within regulatory useful life.'125 EPA proposes to accomplish this through two specific new regulations in Sections1036.125(a)(2) and 1036.125(g). Proposed Section 1036.125(a)(2) would read as follows:

- (2) Minimum scheduled maintenance intervals. You may not schedule replacement of catalyst beds or particulate filters during an engine's useful life. […] [EPA-HQ-OAR-2019-0055-1168-A1, p.111]

As written, this provision suggests that no catalyst or DPF replacements could be scheduled during the engine's useful life. However, proposed Section 1036.125(g) appears to qualify the above statement in 1036.125(a)(2), stating that:

- *(g) Payment for scheduled maintenance*. Owners are responsible for properly maintaining their engines, which generally includes paying for scheduled maintenance. However, you may commit to paying for scheduled maintenance as described in paragraph (a)(1)(iv) of this section to demonstrate that the maintenance will occur. **<u>You may also schedule maintenance not otherwise allowed by paragraph (a)(2) of this section if you pay for it.</u>** You must pay for scheduled maintenance on any component during the useful life if it meets all the following conditions: […] (emphasis added).

Daimler Truck believes that these provisions, taken together, meet EPA's intent as expressed in the Proposed Rule preamble, but are needlessly complicated and could accidentally be misinterpreted in the future—specifically, by reading (a)(2) without realizing it is later modified in (g). [EPA-HQ-OAR-2019-0055-1168-A1, p.111]

We propose that EPA clarify its intent and prevent misinterpretation by changing 1036.125(a)(2) as follows:

(2) Minimum scheduled maintenance intervals. You may not schedule replacement of catalyst beds or particulate filters during an engine's useful life, unless you pay for that replacement during useful life, per 1036.125(g). […] [EPA-HQ-OAR-2019-0055-1168-A1, p.111]

With this change to 1036.125(a)(2), EPA would not need to adjust 1036.125(g), since it applies to more than just catalysts and particulate filters. [EPA-HQ-OAR-2019-0055-1168-A1, p.111]

125 Id. at 17,525.

Organization: *PACCAR, Inc (PACCAR)*

PACCAR recommends that EPA revise the proposed provisions governing 'minimum scheduled maintenance intervals' within 40 C.F.R. 1036.125. As proposed, 1036.125(a)(2) provides that '[y]ou may not schedule replacement of catalyst beds or particulate filters during an engine's useful life.' However, PACCAR respectfully submits that EPA should follow the California Air Resources Board's regulatory approach and allow OEMs to replace and/or repair catalyst beds and particulate filters during an engine's useful life. See California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles (as amended April 18, 2019)1 (incorporated by reference at 13 CCR 1956.8(d)) (incorporating 40 C.F.R. 86.004-25 with changes, including the addition of catalytic converter beds and particulate filters to the list of functions that manufacturers can replace during an engine's useful life) (stating in relevant part that 'manufacturers may schedule replacement or repair of particulate trap elements (or trap oxidizer elements), catalytic converter beds (including NOx adsorber, diesel oxidation catalyst, and selective catalyst reduction beds) . . . provided that the manufacturer demonstrates to the Executive Officer's satisfaction that the repair or replacement will be performed according to the schedule and the manufacturer pays for the repair or replacement.') [EPA-HQ-OAR-2019-0055-1346-A1, p.43]

1 Available at https://ww2.arb.ca.gov/sites/default/files/2020-06/hddtps_warranty_clean%20complete_10_19_accessible.pdf.

If EPA's final rule retains the general proposed catalyst beds or particulate filters prohibition – and even though PACCAR urges EPA to promulgate reasonable, technically-feasible emissions standards, useful life and warranty provisions that will not force the replacement of catalyst beds to remain compliant -- PACCAR respectfully requests that EPA provide an exception under which OEMs may repair or replace catalyst beds and particulate filters if the manufacturer demonstrates to EPA's satisfaction that the repair or replacement will be performed according to the manufacturer-proposed maintenance schedule and the manufacturer pays for the repair or replacement. [EPA-HQ-OAR-2019-0055-1346-A1, p.44]

Such an exception is particularly warranted in light of EPA's substantially extended useful life and warranty proposals beginning in MY 2027. Moreover, revising the prohibition on replacing or repairing catalyst beds or particulate filters would be consistent with EPA's preamble, which provides: 'Current 40 CFR 86.004 25(i) clarifies that these components could be replaced or repaired if manufacturers demonstrate the maintenance will occur and the manufacturer pays for it. We propose to continue to restrict replacement of catalyst beds and particulate filter elements, requiring that manufacturers pay for the repair or replacement of catalyst beds and particulate filter elements, if needed, within the regulatory useful life.' 87 Fed. Reg. at 17525. [EPA-HQ-OAR-2019-0055-1346-A1, p.44]

PACCAR therefore respectfully submits that EPA should modify proposed 1036.125(a)(2) as follows: 'You may not schedule replacement of catalyst beds or particulate filters during an engine's useful life., except as allowed in paragraph (g) [Payment for scheduled maintenance]. However, manufacturers may schedule replacement or repair of particulate trap elements (or trap oxidizer elements), catalytic converter beds (including NOx adsorber, diesel oxidation catalyst, and selective catalyst reduction beds), provided that the manufacturer demonstrates to EPA's satisfaction that the repair or replacement will be performed according to the schedule and the manufacturer pays for the repair or replacement.' [EPA-HQ-OAR-2019-0055-1346-A1, pp.44-45]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EPA proposes to modify the emissions-related maintenance provisions, and to establish new requirements related to making information about service-related maintenance available to the vehicle owner. EPA has also updated the minimum maintenance intervals for various components. The proposed maintenance intervals are not aligned with the intervals CARB has finalized in its Omnibus low- NOx regulations. CARB conducted extensive analysis to understand current industry practices and capabilities, and established the intervals accordingly. EMA recommends that wherever EPA's requirements are more stringent (longer) than CARB's, that they be reduced to align with the CARB requirements. This will ensure that manufacturers have the greatest opportunity to optimize product configurations and maintenance practices based on the latest technical data. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 125 - 126]

Of particular concern is EPA's proposal to prohibit scheduled maintenance on all sensors at intervals less than today's UL (though the NPRM mentions only NOx sensors at 87 FR p. 17523). Most sensors, and especially NOx sensors and most likely NH_3 sensors (where there is little experience), do not have the kind of durability necessary to last throughout the current UL, let alone the new proposed extended UL of the engine. Table 1 of §1036.125 is unclear whether sensors are allowably replaced at current UL (for example, at 435,000 miles for HHDE), as there is no definition of "catalyst systems," and sensors are not always integrated into catalyst systems. Notwithstanding this point, the interval provided is too short for current sensor durability. Manufacturers may be changing their recommended maintenance practices with respect to sensors given the myriad changes in the proposed regulations, including significantly more stringent standards, and longer UL and warranty requirements. EMA recommends that the Agency specify that manufacturers may require scheduled replacement of sensors every 150,000 miles or 4,500 hours for HHDE and MHDE, and every 100,00 miles or 3,000 hours for LHDE and SI engines, just as permitted under the CARB Omnibus regulations. [EPA-HQ-OAR-2019-0055-1203-A1, p. 126]

Another example is for EGR system cleaning, where CARB retained previous minimum cleaning intervals of 100,000 mi/3,000 hours of use initially, and specified 150,000 mi/4,500 hour intervals thereafter (MHDE and HHDE.) EPA should retain the initial shorter period for MHDE and HHDE before changing to the longer interval for subsequent maintenance events. [EPA-HQ-OAR-2019-0055-1203-A1, p. 126]

Similarly, EMA recommends that §1036.125(a)(2) be modified to read, "You may not schedule replacement of catalyst beds or particulate filters during an engine's useful life, except as allowed in paragraph (g)." [EPA-HQ-OAR-2019-0055-1203-A1, p. 127]

Organization: *Volvo Group*

More frequent maintenance or replacement interval flexibility is requested due to the lack of data from applications that comply with the proposed lower emission standards. [EPA-HQ-OAR-2019-0055-1324-A1, p. 7]

EPA Summary and Response

The summary and response for this section includes a summary of the subtopics raised and the responses follow each summary.

EMA and Cummins suggested that some sensors should have their own minimum maintenance intervals; not be tied to a "system". Both organizations recommended EPA match the intervals from CARB's HD Omnibus regulation.

Response:

- We agree that there are sensors that are not integrated into components or systems and that those sensors should have a separate minimum interval. As noted in section IV.B.2 of the preamble, we are finalizing a separate set of minimum maintenance intervals for "sensors, actuators, and related control modules that are not integrated into other systems" that match the intervals specified in 40 CFR 86.004-25(b) and are consistent with commenters' requested minimum interval values.
- We are retaining in the final rule our proposed requirement that the minimum intervals specified for each component or system applies to any actuators, sensors, tubing, valves, and wiring that *are* integrated into that component or system.

Cummins and EMA commented that, while EPA stated it was not changing adjustment and cleaning intervals for EGR systems, the proposed intervals were set at 150,000 miles or 4,500 hours and did not include an initial interval of 100,000 miles or 3,000 hours as currently applies.

Response:

- As noted in preamble section IV.B.2, we are correcting in the final requirements the proposed intervals to include an initial minimum maintenance interval of 100,000 miles or 3,000 hours for adjusting and cleaning catalyst system components, EGR system components (other than filters or coolers), particulate filtration system components, and turbochargers, with intervals of 150,000 miles or 4,500 hours thereafter, consistent with existing 40 CFR 86.004-25(b). As we stated in the NPRM, we did not intend to change these intervals.

Cummins requested EPA allow a DEF filter replacement of 100,000 miles or 3,000 hours for all engine classes, since higher flow volumes to meet the new standards may require more frequent filter replacements.

Response:

- The proposed minimum interval for DEF filter replacement was based on the most frequent replacement interval manufacturers specified in their owner’s manual for recent model year engines to meet current standards. After considering comments, we are finalizing minimum interval of 100,000 miles or 3,000 hours for DEF filter replacement. We note that this final interval is less frequent than the minimum interval of 50,000 miles or 1,500 hours that currently applies for CI engines.

Cummins requested that spark plugs, ignition wires, and ignition coil replacement intervals stay at today’s interval values, suggesting these components may wear under the commercial applications of the heavy-duty engines.

Response:

- We proposed intervals of 100,000 miles or 3,000 hours for ignition wires based on maintenance intervals specified in owner’s manuals for recent model year engines. We are revising in the final rule the proposed intervals for ignition wires to match the current intervals in existing regulations, 50,000 miles or 1,500 hours. We are also including ignition coils, which were inadvertently omitted in the proposal, at the same intervals.

DTNA, PACCAR, and EMA noted that the proposal disallowed scheduled replacement of catalyst beds or particulate filters in 40 CFR 1036.125(a)(2) and suggested EPA add a clarifying reference to 40 CFR 1036.125(g) where we state that such replacement would be allowed if the manufacturer pays for it.

Response:

- We are revising in the final rule the proposed 40 CFR 1036.125(a)(2) by adding a reference to 1036.125(g), to clarify the proposed and finalized exception that applies to scheduled maintenance not otherwise allowed by paragraph (a)(2).
- We note that we are also revising 40 CFR 1036.125(a)(2) by replacing the statement that "You may not schedule replacement of catalyst beds or particulate filters during an engine's useful life" with a new line in Table 1 to Paragraph (a)(2) of § 1036.125 for catalyst substrates and particulate filter substrates. The minimum maintenance intervals for catalyst substrates and particulate filter substrates match the useful life miles and hours of 1036.104(e) for each engine class.

Volvo requested flexibility for more frequent maintenance intervals than EPA proposed. Cummins requested EPA be flexible in approving shorter intervals for new technologies (e.g., CDA) and requested that EPA confirm it would not expect the same minimum intervals for new components as for components which manufacturers already have significant experience

Response:

- We are finalizing maintenance intervals with some revisions from our proposed values as discussed in preamble section IV.B.2.
- We note that our final maintenance provisions include minimum intervals for certain components and manufactures may request approval for critical emission-related maintenance on other components at intervals that they specify (see 40 CFR 1036.125(a)(2)).
- In 40 CFR 1036.125(g), we are finalizing as proposed that manufacturers may schedule maintenance not otherwise allowed by paragraph 40 CFR 1036.125(a)(2) if they pay for it. Manufacturers choosing this option for a component may request approval of scheduled maintenance at a more frequent interval than those specified in paragraph (a)(2).
- As noted in section IV.B.2 of the preamble, we are finalizing as proposed 40 CFR 1036.125(a)(3), which is migrated from 40 CFR 86.094 25(b)(7)(ii) and (iii), specifically for new technology not identified in (a)(2). We cannot confirm and will not commit to accepting more frequent intervals for components on the categorical new technology basis commenters requested; instead, we intend to make such determinations through the process finalized as proposed in 40 CFR 1036.125(a)(3), which includes evaluating the specific facts in the manufacturer's request regarding the data to support the need for the maintenance at the recommended interval and a demonstration that the maintenance is likely to occur at the recommended interval using one of the conditions specified in 40 CFR 1036.125(a)(1).

6.2 Other kinds of scheduled maintenance

Comments by Organizations

Organization: *Cummins Inc. (Cummins)*

Cummins appreciates EPA's proposed addition of a new type of maintenance called "special maintenance" in §1036.125(c) to allow more frequent maintenance in case of special situations, such as atypical engine operation. Cummins requests EPA to provide more specific examples of situations or operation that could be considered special or atypical. [EPA-HQ-OAR-2019-0055-1325-A1, p. 16]

EPA Summary and Response

Summary:

Cummins supports EPA's proposed new special maintenance category in 1036.125(c) and requests specific examples of special maintenance.

Response:

We are updating 40 CFR 1036.125(c) to include an example of biodiesel use.

6.3 Source of parts and repairs

Comments by Organizations

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

EPA proposes a new paragraph 40 C.F.R. 1036.125(f) that would prohibit manufacturers from limiting the source of components or service required for engine maintenance and would clarify that manufacturers may not condition an emission warranty on a requirement that the engine be serviced by a franchised dealer or any other service establishment with which the manufacturer has a commercial relationship (unless the manufacturer provides the component or service without charge or unless it obtains a waiver from EPA).124 These provisions are intended to implement CAA Section 207(c)(3) and mirror the companion prohibitions in 40 C.F.R. 1037.125(f) for heavy duty vehicle manufacturers. [EPA-HQ-OAR-2019-0055-1168-A1, p.110]

124 See Proposed Rule, 87 Fed. Reg. at 17,525.

Daimler Truck has an established track record of honoring the valid emissions and other warranty claims of its customers, recognizing that reliable warranty coverage is an important part of the customer experience. The Company recognizes its obligations under CAA Section 207(c)(3) to not unreasonably condition its emission warranties on the use of brand-affiliated parts or services. Nonetheless, Daimler Truck notes that—even within the proposed 1036.125(f) and existing legal framework under CAA Section 207—manufacturers should not incur warranty liability for faulty or off-spec components from third party suppliers that contribute directly to an emission system failure. In other words, denial of an emission warranty claim would be appropriate where a manufacturer discovers that the emission system performance or durability issue in question was caused by a technical shortcoming in a non-OEM component or system. Similarly, any faulty or off-spec component determined to contribute directly to increased emissions should not create emissions compliance liability for the engine manufacturer during in-use emissions testing or otherwise. Daimler Truck believes that current law accommodates this interpretation but would appreciate clarification that EPA's proposed Section 1036.125(f) is not to the contrary. [EPA-HQ-OAR-2019-0055-1168-A1, pp.110-111]

Organization: *PACCAR, Inc (PACCAR)*

PACCAR agrees with, and incorporates by reference, the following EMA comments: While EPA may permit an engine manufacturer to void an in-use test (or reject a candidate vehicle) if an aftermarket DPF or other third-party components are used, there are no such guarantees available to manufacturers when utilizing some of the alternative compliance demonstration methods. For example, among the DF verification procedures a manufacturer may use is one which involves submitting NOx sensor-based emissions results from a high volume of vehicles (50% of the family volume) in operation. Similarly, the in-use testing provisions at 1036.405(g) permit manufacturers to use on-board NOx sensor data as a surrogate for PEMS-based testing as a means to satisfy an in-use test order (the volume requirements are not specified, but EPA may similarly require a high volume of vehicles to use this provision). In both of those cases, it is impossible for the manufacturer to inspect each vehicle to confirm that there are only manufacturer-approved components, or to review vehicle records to confirm that independent repair facilities have not (mis)performed maintenance or repairs. In fact, there is no obvious way for a manufacturer even to investigate those matters, as the affiliated dealers would not possess such records. In this regard, it is impossible for a manufacturer to adequately screen to exclude such vehicles from consideration. In the final rule, EPA should eliminate the requirement to make the independent repair and third-party component statement as proposed. [EPA-HQ-OAR-2019-0055-1346-A1, pp.31-32]

If EPA chooses not to delete the requirements of 1036.125(f), EPA has allowed the provision to be disregarded only under one of two conditions. The first condition is that the manufacturer commit in the purchase agreement to provide components or services free of charge. While it is not clear whether this is with respect only to any isolated, named components or services, or to all components or services, the requirement is nonetheless unreasonable. The second condition is to demonstrate to the Agency that the 'engine' will work properly with the 'identified' component or service. This would mean that the manufacturer would have to be aware of all possible sources for the service or components, and to have explicit knowledge about all the services or components and their potential impact to emissions, which is impossible, and therefore unworkable. See EMA Comments at 123-25. [EPA-HQ-OAR-2019-0055-1346-A1, p.32]

Proposed section 1036.125(f) also should be revised. The NPRM provides: 'Source of parts and repairs. State clearly on the first page of your written maintenance instructions that a repair shop or person of the owner's choosing may maintain, replace, or repair emission control devices and systems. Your instructions may not require components or service identified by brand, trade, or corporate name. Also, do not directly or indirectly condition your warranty on a requirement that the engine be…..' 87 Fed. Reg. at 17514. [EPA-HQ-OAR-2019-0055-1346-A1, p.53]

This aspect of EPA's Proposed Rule is inconsistent with the goals of EPA's UL to ensure long-term emissions compliance. Allowing stakeholders to use unvalidated, non-branded parts to repair emissions systems that are must meet new Low NOx extended durability and performance requirements does not make sense. First, the proposal does not expressly require that any stakeholder validate that the parts meet the durability and variance requirements needed to maintain the performance of the original equipment manufacturer's emissions system throughout full useful life. The OEM should not be legally responsible for these unbranded parts, let alone have to include the failure in the warranty failure analysis. [EPA-HQ-OAR-2019-0055-1346-A1, p.53]

Organization: *Truck and Engine Manufacturers Association (EMA)*

Other aspects of the Agency's proposed maintenance requirements are problematic as well. As an initial matter, it is unreasonable to require manufacturers to prominently "advertise" to vehicle-owners their right to have emissions-related repairs performed at non-affiliated independent repair facilities using third-party components of the owners choosing. Manufacturers have invested billions of dollars developing products that are compliant with the Agency's ever increasingly stringent emissions standards. Putting the entirety of that effort, at huge customer and societal expense, at risk by prominently highlighting this "right-to-repair" appears to be at odds with ensuring the feasibility and durability of the new low-NOx controls and systems that the Agency is seeking to mandate. On top of that, it is discouraging that EPA is willing to compel this type of advocacy for independent repair facilities, directly in competition with the companies who have made these significant investments, time and time again, in response to the Agency's latest emissions standards and diagnostic requirements. While the CAA does not permit manufacturers to require repairs at their own facilities as a condition to honor emissions warranties, it does not require manufacturers to actively encourage owners to seek repair elsewhere from independent repair facilities, or to use third-party components, putting emissions compliance at risk. [EPA-HQ-OAR-2019-0055-1203-A1, p. 126]

While EPA may permit an engine manufacturer to void an in-use test (or reject a candidate vehicle) if an aftermarket DPF or other third-party components are used, there are no such guarantees available to manufacturers when utilizing some of the alternative compliance demonstration methods. For example, among the DF verification procedures a manufacturer may use is one which involves submitting NOx sensor-based emissions results from a high volume of vehicles (50% of the family volume) in operation. Similarly, the in-use testing provisions at §1036.405(g) permit manufacturers to use on-board NOx sensor data as a surrogate for PEMS-based testing as a means to satisfy an in-use test order (the volume requirements are not specified, but EPA may similarly require a high volume of vehicles to use this provision). In both of those cases, it is impossible for the manufacturer to inspect each vehicle to confirm that there are only manufacturer-approved components, or to review vehicle records to confirm that independent repair facilities have not (mis)performed maintenance or repairs. In fact, there is no obvious way for a manufacturer even to investigate those matters, as the affiliated dealers would not possess such records. In this regard, it is impossible for a manufacturer to adequately screen to exclude such vehicles from consideration. In the final rule, EPA should eliminate the requirement to make the independent repair and third-party component statements as proposed. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 126 - 127]

If EPA chooses not to delete the requirements of §1036.125(f), EPA has allowed the provision to be disregarded only under one of two conditions. The first condition is that the manufacturer commits in the purchase agreement to provide components or services free of charge. While it is not clear whether this is with respect only to any isolated, named components or services, or to all components or services, the requirement is nonetheless unreasonable. The second condition is to demonstrate to the Agency that the "engine" will work properly with the "identified" component or service. This would mean that the manufacturer would have to be aware of all possible sources for the service or components, and to have explicit knowledge about all the services or components and their potential impact to emissions, which is impossible, and therefore unworkable. [EPA-HQ-OAR-2019-0055-1203-A1, p. 127]

EPA's proposal requires that engine manufacturers "state clearly on the first page of your maintenance instructions that a repair shop or person of the owner's choosing may maintain, replace, or repair emissions control devices and systems." (§1036.125(f)) Repairs performed by independent repair facilities that do not have proper training, and that are installing unapproved third-party components to correct issues caused by the use of biodiesel, can create serious problems. For example, an untrained service technician may install a lower efficiency fuel filter to overcome issues with filter clogging due to operation on biodiesel blends at low temperatures. While this action may appear to have resolved the issue, the impact to the high-pressure fuel system may be significant and catastrophic. [EPA-HQ-OAR-2019-0055-1203-A1], p. 142]

As discussed above, EPA's proposed requirement to allow service by independent repair facilities using third-party emissions control components further jeopardizes the integrity of the manufacturer's design of an integrated fuel, engine and aftertreatment management system critical to compliance with the applicable emissions standards throughout the useful life. In addition, the burden of proof for denying a customer claim for misfuelling, mal-maintenance or use of unapproved biodiesel falls upon the manufacturer at the time of repair. The OEM can accurately determine that damage has occurred, but not when, or under what circumstances (e.g., prolonged use of biodiesel) the damage occurred or how fuel deficiencies or deferred maintenance contributed to the failure. Absent the ability to reliably control or know the biodiesel blend level when refueling occurs, it is unrealistic to assume that customers or manufacturers will be able to adequately prescribe an appropriate maintenance schedule that prevents damage from biodiesel use. [EPA-HQ-OAR-2019-0055-1203-A1, p. 142]

EPA Summary and Response

Summary:

DTNA acknowledged the "legal framework under CAA Section 207" that is the basis of source of parts and repairs provision proposed in 40 C.F.R. 1036.125(f), but commented that manufacturers should not be liable for non-OEM components or systems, such as "faulty or off-spec components from third party suppliers" directly linked to an emission system failure. PACCAR commented that allowing owners to use "unvalidated, non-branded parts" would not ensure long-term emissions compliance. EMA commented that it was “unreasonable” for EPA to require manufacturers to state on their first page that owners could use non-affiliated facilities and third-party components for repairs, noting manufacturers’ investments in developing EPA compliant products. EMA commented (and PACCAR commented in agreement with EMA) with a wide range of concerns related to testing vehicles with third-party components. EMA (and PACCAR) also stated concerns with the two proposed options for a manufacturer to disregard the limitations of proposed 40 CFR 1036.125(f). EMA stated that it is unclear if the option to pay for components or services can apply to a specific component or service or if it must apply to all. EMA also stated that it is impossible for a manufacturer to be aware of all possible sources of parts or services, so it is “unworkable” for manufacturers to convince EPA that an engine will only work properly with an OEM part or service.

EMA commented with several maintenance concerns relating to the use of biodiesel fuel, including that it is challenging for manufacturers to specify a maintenance schedule to prevent damage from “unapproved biodiesel”.

Response:

As noted in section 4 of this document, we are revising 40 CFR 1036.120(c) to clarify that warranty covers components that are part of the certified configuration even if they are produced by a company other than the engine manufacturer.. We also note that we proposed no changes and are finalizing no changes to the existing 40 CFR 1068.115, which specifies when manufacturers may or may not deny warranty claims.

See preamble Section IV.B.2 for the final provisions related to proposed 40 CFR 1036.125(f) and supporting rationale, after consideration of comments.

We are updating 40 CFR 1036.125(h)(2) as described in section 6.5, which also includes moving and revising the proposed “source of parts and service” provision from 40 CFR 1036.125(f) to be part of paragraph (h)(2) in the final rule in order to emphasize the connection to proper maintenance.

We are not finalizing at this time the proposed 40 CFR 1036.125(f) requirement regarding specific statements on the first page of written maintenance instructions; after consideration of comments, we agree with commenters that the final regulatory text accomplishes the intent of our proposal without the additional proposed first sentence.

We are finalizing as proposed the two options manufacturers have to disregard the limitations on the source of parts and service. In response to EMA, we clarify in this document that the first option allows manufacturers to isolate the payment to a specific component or service. For example, if a manufacturer chooses to pay for only their DEF filters to be installed, we would not require manufacturers to pay for all emission-related components. For the second option, we agree with the commenter to the extent that they suggest that it is not easy to demonstrate that only a manufacturer’s components or services are appropriate for properly maintaining an engine, as this exception is intended to be narrow.

With respect to EMA's comment on biodiesel, in the section IV.B.2 of the preamble to this rule, we describe the types of maintenance, including special maintenance. Manufacturers can specify more frequent maintenance (e.g., replacing filters) for atypical engine operation, which could include biodiesel use. As noted in section 6.2 of this document, we are adding an example of biodiesel use to the description of special maintenance in 40 CFR 1036.125(c). For additional discussion relating to biodiesel considerations, see section IV.E of the preamble to this rule, chapter 1.3 of the final RIA, and section 11.5 of this document.

6.4 Payment for scheduled maintenance

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

U.S. EPA requested comment on including turbochargers as components that should have limited replacement irrespective of the four 40 CFR 1036.125(g) criteria. CARB staff have significant concerns regarding owner payment for scheduled maintenance of a turbocharger. The repair cost and the emission increase of turbocharger failure were of a similar magnitude as those of diesel oxidation catalysts, DPF, and SCR for which requiring replacement at owner's cost during UL is already prohibited. The proposed 40 CFR 1036.125(g) states that manufacturers would pay for scheduled maintenance, including parts and labor, only if all the following criteria are met:

1. Each affected component was not in general use on similar engines before 1980,
2. The primary function of each affected component is to reduce emissions,
3. The cost of the scheduled maintenance is more than 2 percent of the price of the engine, and
4. Failure to perform the maintenance would not significantly degrade the engine's performance. [EPA-HQ-OAR-2019-0055-1186-A2, pp.115-116]

According to these criteria, manufacturers would not be required to pay for scheduled maintenance of turbochargers because a turbocharger's primary function is not to reduce emissions and because a turbocharger's failure would degrade engine's performance (thereby failing to meet criteria #2 and #4). [EPA-HQ-OAR-2019-0055-1186-A2, p.116]

CARB staff believes the criteria are too restrictive. In California's Step 1 warranty rulemaking, CARB staff analyzed repair cost and emissions increase for HHDD components and showed that the repair cost of a turbocharger is $5,100, and the failure of turbochargers would result in 147 percent increase in NOx emissions.178 Therefore, CARB staff believes the fact that turbocharger repairs are costly and have significant impact on NOx emission is enough to require manufacturers to pay for scheduled maintenance of turbochargers. [EPA-HQ-OAR-2019-0055-1186-A2, p.116]

178 Staff Report: Initial Statement of Reasons for Proposed Rulemaking, 'Public Hearing to Consider Proposed Amendments to California Emission Control System Warranty Regulations and Maintenance Provisions for 2022 and Subsequent Model Year on-Road

Heavy-Duty Diesel Vehicles and Heavy-Duty Engines with Gross Vehicle Weight Ratings Greater Than 14,000 Pounds and Heavy-Duty Diesel Engines in Such Vehicles,' (Step 1 Warranty), May 8, 2018, page III-16, https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/hdwarranty18/isor.pdf?_ga=2.159591101.1089019171.1648488649-859068364.1628622434

Organization: *Truck and Engine Manufacturers Association (EMA)*

The provisions of §1036.125(g) allow manufacturers to pay for emissions-related maintenance under various circumstances. The sentence reads, "You must pay for scheduled maintenance on any component during the useful life if it meets…" That statement, as written, is overly broad. It should read, "You must pay for scheduled maintenance not otherwise allowed by this section on any component during the useful life if it meets…"

EPA Summary and Response

Summary:

CARB responded to EPA's request for comment on restricting the replacement of turbochargers irrespective of the four criteria in 40 CFR 1036.125(g). Instead of relying on the criteria to determine if scheduled maintenance of a turbocharger should be paid by the manufacturer, CARB would like turbocharger replacement to always be the manufacturer's responsibility, citing the cost of repair of the component. EMA stated that proposed 40 CFR 1036.125(g) was "overly broad" and suggested we add the phrase "not otherwise allowed by this section" to narrow the scope of the proposed requirement to pay for scheduled maintenance.

Response:

See section IV.B.2 of the preamble for our response to CARB's comment related to turbochargers and the final provisions. We disagree with EMA that paragraph (g) is overly broad. We believe that it identifies specific provisions that define requirements that are already largely covered by 40 CFR 1036(a)(1). The four qualifying criteria serve a narrow purpose of informing manufacturers under which conditions EPA will require manufacturer payment as the only acceptable demonstration that scheduled maintenance is reasonably likely to occur.

6.5 Emission-Related Components

Comments by Organizations

Organization: *Lubrizol Corporation (Lubrizol)*

1) EPA Should Include Lubricants and Engine Oils on the List of Critical Emissions- Related Components

Compared with prior generations of internal combustion engines (IC engines), today's IC engines operate with extremely high temperatures, high pressure, high shear, and other extremely sensitive operating environments. In order to operate efficiently, durably, and with low emissions, today's IC engines need to use the appropriate engine oil or lubricant at all times throughout its useful life. Using the wrong lubricant can impact the engine's performance and durability, as well as the performance and durability of emissions control systems. Numerous studies have been done in the past that highlighted the relationship between lubricant composition and emission system durability (see Appendix 2 for a summary of pertinent research). It can be expected that lubricant compatibility will become even more important when the next generation of emission control systems is deployed to meet the new standards. To help ensure that vehicle owners or operators use the appropriate engine oil or lubricant, we strongly urge EPA to include lubricants on the list of Critical Emission- Related Components.2 Doing so will enable EPA to require regular service intervals for oil changes, as well as require that engines are consistently using the appropriate higher-performing lubricant oil for each particular engine - at all times throughout its useful life. [EPA-HQ-OAR-2019-0055-1304-A1, p.2]

2 See Proposal, Tables IV-11 and IV-12 and related discussion.

By including lubricants on the list of Critical Emission-Related Components, EPA would be able to require that owners or operators use specified higher-performing lubricants, or oils, throughout an engine's useful life. Such specified lubricants would provide the engine with the appropriate level of performance, engine protection, and protection of emission control technology, according to objective characteristics as determined by the OEMs. These characteristics could be in the form of an OEM performance specification or an industry category defined by an entity like the American Petroleum Institute (API) or the European Automobile Manufacturers' Association (ACEA), along with a maximum viscosity level. (To be clear, Lubrizol does not suggest that EPA should specify particular lubricant brands or servicing locations as a warranty requirement.) [EPA-HQ-OAR-2019-0055-1304-A1, p.3]

OEMs already use these higher performing lubricants in the development and certification of their powertrain systems. They rely on them to demonstrate that their engines will meet EPA's requirements throughout the full useful life of their engines and emissions systems. [EPA-HQ-OAR-2019-0055-1304-A1, p.3]

By adding lubricants to the list of Critical Emission-Related Components, EPA would be taking an important step to ensure that the same category and maximum viscosity level that is used for certification and initial fill is used when the vehicle is serviced to maintain vehicle powertrains, engines, and emission control technologies throughout their useful life. Doing so will help ensure that engines maintain their emissions durability throughout their useful life, thereby helping to ensure that real world emissions remain at the levels EPA seeks to achieve in this Proposal. [EPA-HQ-OAR-2019-0055-1304-A1, p.3]

Lubrizol provides the following additional information to support our request that EPA adds lubricants to the list of Critical Emission-Related Components. [EPA-HQ-OAR-2019-0055-1304-A1, p.11]

There is a significant amount of research that explores the impact of engine lubricants or oils on catalysts and filters, in addition to the core emissions benefits from keeping the engine clean and free from wear over the course of each lubricant's service interval. [EPA-HQ-OAR-2019-0055-1304-A1, p.11]

Below, Lubrizol lists several of the most relevant papers, including some pertinent research conducted by Lubrizol. [EPA-HQ-OAR-2019-0055-1304-A1, p.11]

CATALYST POISONING:

Sulfur and phosphorus are both known to contaminate (or, as more commonly described, poison) catalysts. Sulfur poisoning may be reversible at high temperatures. Damage due to phosphorus poisoning is considered to be much more permanent. [EPA-HQ-OAR-2019-0055-1304-A1, p.11]

Numerous papers have investigated the extent of phosphorus-related catalyst poisoning, dating back to the 1980s. [EPA-HQ-OAR-2019-0055-1304-A1, p.11]

Brett, P. S., et al. 'An Investigation into Lubricant Related Poisoning of Automotive Three- Way Catalysts and Lambda Sensors.' SAE Transactions, vol. 98, 1989, pp. 269–80

- 55 engine tests on 24 oils of varying formulations
- 99% confidence of link between lubricant phosphorous level and catalyst performance.
- High phosphorus oils reduce oxygen sensor performance, especially at low temperatures [EPA-HQ-OAR-2019-0055-1304-A1, p.11]

Dieselnet.com contains additional information on deactivation of diesel catalysts

- See, e.g., https://dieselnet.com/tech/cat_d_deactiv.php
- Lube oil additives, including phosphorus (P), zinc (Zn), calcium (Ca), and sulfur (S) are recognized as poisons [EPA-HQ-OAR-2019-0055-1304-A1, p.11]

Bardasz, E.A., Schiferl, E., Nahumck, W., Kelley, J., Williams, L., Riley, M. and Hubbard, C.P. (2007) 'Low Volatility ZDDP Technology: Part 1 - Engines and Lubricant Performance in Field Applications' SAE Technical Paper 2007011990 (JSAE 20077288), SAE, Warrendale, PA.

- This Lubrizol research was critical to the development of low-volatility ZDDP technology
- Research showed that low volatility ZDDP improved light-off performance and reduced CO and NOx by helping ensure proper catalyst performance [EPA-HQ-OAR-2019-0055-1304-A1, pp.11-12]

Bardasz, E., Schiferl, E., Nahumck, W., Kelley, J. et al., 'Low Volatility ZDDP Technology: Part 2 - Exhaust Catalysts Performance in Field Applications,' SAE Technical Paper 2007- 01-4107, 2007. Accessible at https://doi.org/10.4271/2007-01-4107.

- Lubrizol field testing to confirm emission related advantages of low volatility ZDDP
- Research showed additional benefits in wear protection due to ZDDP retention within oil [EPA-HQ-OAR-2019-0055-1304-A1, p.12]

PARTICULATE FILTER BLOCKING:

Ash effects on particulate filters are very well known, and probably better understood than any other effect. Dieselnet.com provides a good overview of DPF blockage with many references for further review. See https://dieselnet.com/tech/dpf_ash.php [EPA-HQ-OAR-2019-0055-1304-A1, p.12]

In the early 2000s Lubrizol was very active in this area, both formulators and engineers from Engine Control Systems, an aftertreatment company owned by Lubrizol at that time. [EPA-HQ-OAR-2019-0055-1304-A1, p.12]

Bardasz, E., Cowling, S., Panesar, A., Durham, J. et al., 'Effects of Lubricant Derived Chemistries on Performance of the Catalyzed Diesel Particulate Filters,' SAE Technical Paper 2005-01-2168, 2005. Accessible at https://doi.org/10.4271/2005-01-2168.

- Lubrizol research
- Ash collected related to oil consumption
- Research showed that different ash types have different impacts on back pressure [EPA-HQ-OAR-2019-0055-1304-A1, p.12]

Zhang, R., Howard, K., Kirkman, P., Browne, D. et al., 'A Study into the Impact of Engine Oil on Gasoline Particulate Filter Performance through a Real-World Fleet Test,' SAE Technical Paper 2019-01-0299, 2019. Accessible at https://doi.org/10.4271/2019-01-0299.

- Lubrizol field trial research
- 9 car / 3 oil field trial in Shanghai
- Significant difference in back pressure
- Effects on efficiency and power recorded [EPA-HQ-OAR-2019-0055-1304-A1, p.12]

Organization: *Truck and Engine Manufacturers Association (EMA)*

Finally, EPA should include definitions of "particulate filtration system," "particulate filter," "Catalyst system," and "catalyst bed" to clarify the distinctions being made in Table 1 of §1036.125. [EPA-HQ-OAR-2019-0055-1203-A1, p. 127]

EPA Summary and Response

Lubrizol requested that EPA add lubricants as a critical emission-related component, suggesting that doing so would "enable EPA to require regular service intervals for oil changes, as well as require that engines are consistently using the appropriate higher-performing lubricant oil." Lubrizol provided several summaries of research related to lubricants in support of their request.

EMA requested that EPA define the particulate filtration systems, particulate filter, catalyst systems, and catalyst beds.

Response:

We thank Lubrizol for sharing the resources related to lubricants. As noted in preamble section IV.B.2 of this rule, we are not including a specific list of critical emission-related components in 40 CFR 1036.125. Lubrizol's comment suggests that they would like to ensure more frequent oil changes, but EPA's minimum maintenance intervals do not serve that purpose. Rather, we are specifying *minimum* maintenance intervals to prevent the manufacturers from creating unrealistic expectations for maintenance from users beyond what is necessary for maintenance and at intervals that would be less likely to occur in-use. Furthermore, we also note that lubricants are a consumable product and are not considered components.

With respect to EMA's requests for definitions, we are finalizing a new paragraph (a)(4) to clarify which components are included in particulate filtration and catalyst systems. We note that particulate filter and catalyst bed are terms used in current 40 CFR part 86, subpart A. We have replaced those terms with "particulate filter substrate" and "catalyst substrate" in our migration to 40 CFR part 1036.

6.6 Maintenance Instructions

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

U.S. EPA allows manufacturers to deny warranty claims if vehicle owners do not have proper recordkeeping documenting that the engine and emissions control system are properly maintained. U.S. EPA is proposing that manufacturers be required to describe in the owner's manual the documentation they consider appropriate to demonstrate that the engine and emissions control system are properly maintained. CARB staff will continue to not allow manufacturers to deny warranty claims if vehicle owners do not have proper recordkeeping of maintenance records. [EPA-HQ-OAR-2019-0055-1186-A2, pp.116-117]

CARB staff recommends that U.S. EPA consider omitting regulatory language that allows manufacturers to deny warranty claims if vehicle owners do not have proper recordkeeping. Warranty claims should only be denied if it can be proven that improper maintenance was the direct cause for needing the repair or replacement of a part. [EPA-HQ-OAR-2019-0055-1186-A2, p.117]

CARB staff believes that U.S. EPA's warranty program will be improved if CARB's requirements are adopted because of the reasons summarized below:
U.S. EPA's warranty program allows manufacturers to deny warranty claims based on improper recordkeeping of maintenance. This can be problematic as manufacturers may deny warranty coverage even though all maintenance was performed on the vehicle but was improperly documented. Additionally, it may cause vehicle owners to delay repairing their vehicles in a timely manner due to the cost of performing a repair that should have been covered under warranty. This may cause vehicle owners to continue to operate their vehicle with a failed emission control component resulting in their vehicle producing excess emissions. CARB staff allows manufacturers to deny warranty claims if it can be proven that improper maintenance is

the direct cause of the need for a repair or replacement of a part. Manufacturers cannot deny warranty coverage based on a lack of proper recordkeeping of maintenance. [EPA-HQ-OAR-2019-0055-1186-A2, p.117]

CARB will continue to maintain its separate warranty program as it has done so in the past. The program has proven to be effective, and CARB staff is unaware of many instances where warranty has been denied due to improper recordkeeping of maintenance. Therefore, it is anticipated that adopting a warranty program similar to CARB's would not be overly burdensome to the manufacturers. [EPA-HQ-OAR-2019-0055-1186-A2, p.117]

Organization: *PACCAR, Inc (PACCAR)*

PACCAR agrees with, and incorporates by reference, the following EMA comments: EPA's maintenance-related requirements go on to require additional information to be included in the owner's manual. Under 1036.125(h)(2), manufacturers must 'identify steps owners must take to qualify their engines as properly maintained, consistent with the requirements of this section.' The owner's manual must also instruct owners as to what 'documentation you [the manufacturer] consider appropriate for making these demonstrations.' These requirements are not practical. First, there's an implication that owners are 'on notice' as to documentation responsibilities, and are somehow responsible to maintain emissions-related maintenance records. Second, it makes no sense for the manufacturer, speaking through the owner's manual, to advise what should be done to 'qualify' their engines as 'properly maintained.' Not only is it totally foreign to customers to 'qualify' their purchased products in any way, but there would be an underlying sentiment that overlooking other maintenance requirements might nonetheless still provide for a vehicle that is 'properly maintained.' The whole of 1036.125(h)(2) is inappropriate and unreasonable on its face, and should be removed from the final rule. [EPA-HQ-OAR-2019-0055-1346-A1, p.32]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EPA's maintenance-related requirements go on to require additional information to be included in the owner's manual. Under §1036.125(h)(2), manufacturers must "identify steps owners must take to qualify their engines as properly maintained, consistent with the requirements of this section." The owner's manual must also instruct owners as to what "documentation you [the manufacturer] consider appropriate for making these demonstrations." These requirements are not practical. First, there's an implication that owners are "on notice" as to documentation responsibilities, and are somehow responsible to maintain emissions-related maintenance records. Second, it makes no sense for the manufacturer, speaking through the owner's manual, to advise what should be done to "qualify" their engines as "properly maintained." Not only is it totally foreign to customers to "qualify" their purchased products in any way, but there would be an underlying sentiment that overlooking other maintenance requirements might nonetheless still provide for a vehicle that is "properly maintained." The whole of §1036.125(h)(2) is inappropriate and unreasonable on its face, and should be removed from the final rule. [EPA-HQ-OAR-2019-0055-1203-A1, p. 127]

EPA Summary and Response

Summary:

CARB recommended that EPA omit regulatory language allowing manufacturers to deny warranty claims if owners do not keep records. Instead, CARB indicated that it is the manufacturer's responsibility to prove improper maintenance directly caused the need for a repair/replacement. CARB stated that they will maintain their separate warranty program and are "unaware of many instances" of warranty being denied do to improper maintenance records. EMA commented (with PACCAR commenting in agreement with EMA) that a requirement for owners to maintain records was "not practical", "inappropriate", and "unreasonable" and 40 CFR 1036.125(h)(2) should be removed.

Response:

In section IV.B.2 of the preamble to this rule, we clarify that the proposed 40 CFR 1036.125(h)(2) was not intended as a *requirement* for owners to keep maintenance records; instead, it was intended to require manufacturers to communicate what records they expect when owners file a warranty claim. While 40 CFR 1036.120(d) allows manufacturers to deny warranty claims for improper maintenance and use, owners have expressed concern that it is unclear what recordkeeping is needed to document proper maintenance and use, and both the proposed and final 40 CFR 1036.125(h)(2) are intended to ensure manufacturers are communicating their expectations to owners. For example, if there are any maintenance steps that the manufacturer intends to expect or intends to require certain documentation for filing a warranty claim, the owner will be well served to know that from the beginning.

In the final 40 CFR 1036.125(h)(2), to clarify the provision consistent with this intent, we removed the proposed sentences stating that manufacturers would identify steps to "qualify the engine as properly maintained" and identify types of "engine operation that would not qualify their engines as being properly used". The replacement text makes a clearer connection to warranty without the term "qualify": *Identify all maintenance you consider necessary for the engine to be considered properly maintained for purposes of making valid warranty claims.*

6.7 Prognostics as Scheduled Maintenance

Comments by Organizations

Organization: *Cummins Inc. (Cummins)*

Prognostics systems, which use proprietary data and algorithms to predict component failures on in-use engines before they happen and notify the owner of upcoming maintenance needed, are becoming more prevalent. They can be an important technology for eliminating unplanned downtime. Cummins requests EPA to include a provision for manufacturers to request approval of scheduled maintenance for a component that occurs at variable intervals, as determined by the prognostics algorithm. In lieu of the traditional fixed intervals, the interval would be dependent on duty cycle which could vary on an engine-by- engine basis. [EPA-HQ-OAR-2019-0055-1325-A1, pp. 16 - 17]

Organization: *PACCAR, Inc (PACCAR)*

Proposed section 1036.125(a) Critical emission-related maintenance, states: 'Critical emission-related maintenance includes any adjustment, cleaning, repair, or replacement of components listed in paragraph (a)(2) of this section. This may also include other maintenance that you determine is critical, including maintenance on other critical emission-related components as defined in 40 CFR part 1068, if we approve it in advance. You may perform scheduled critical emission-related maintenance during service accumulation on your emission-data engines at the intervals you specify.' PACCAR submits that, in the spirit of lengthening useful life to improve long-term performance durability, EPA should allow manufacturers to implement proactive, predictive maintenance strategies if they proactively monitor and identify potential maintenance issues. Under this type of maintenance regime, the manufacturer can become aware, but would not necessarily know in advance, that a particular component is in need of maintenance. This approach would incentivize preventative maintenance, and even goes further by promoting vehicle service before any malfunction occurs, which would lead to emission reductions. EPA should therefore support and encourage these initiatives, including by allowing targeted maintenance subject to EPA approval. Rather than penalizing maintenance initiatives as failures, EPA should encourage manufacturers to take the initiative to prevent malfunctions in the first place. The following proposed regulatory provision would accomplish this goal: 'Vehicle connectivity and advanced analytics (machine learning, cloud computing, etc.) enable pattern recognition and predictive analytics. The OEM shall be allowed to use advanced predictive measures to proactively remedy potential emissions related part failures, and these actions shall not be counted as a failure for the purpose of the emissions warranty. This strategy recognizes the breadth of customer use conditions and the potential uneven impact on long-term engine performance. The OEM may choose how and when to alert the driver when a proactive measure is required. The cost of these repairs would be covered by the OEMs. EPA must approve the OEM's proposed action before it is initiated.' [EPA-HQ-OAR-2019-0055-1346-A1, pp.33-34]

Examples of Predictive Preventive Maintenance include:

- Component is predicted to fail within a prescribed number of days
- OEM identifies next scheduled maintenance
- OEM includes the component repair with next scheduled maintenance
- Pro-actively repaired vehicles avoid unplanned downtime
- These actions must be excluded from filtered failures for reporting [EPA-HQ-OAR-2019-0055-1346-A1, p.34]

PACCAR encourages EPA to revise the Proposed Rule to allow for more preventative maintenance in the spirit of emissions reduction under the Clean Air Act. [EPA-HQ-OAR-2019-0055-1346-A1, p.35]

PACCAR summarizes below the major issues that EPA should take into account as it moves forward with this rulemaking: In the spirit of lengthening useful life to improve long-term performance durability, EPA should allow manufacturers to implement proactive, predictive maintenance strategies if they proactively monitor and identify potential maintenance issues. [EPA-HQ-OAR-2019-0055-1346-A1, p.60]

EPA Summary and Response

Summary:

Cummins and PACCAR commented to request that EPA consider “prognostic systems” and “proactive, predictive maintenance strategies”, respectively, as allowable maintenance. Cummins specifically requested that EPA allow the prognostic system to determine variable maintenance intervals based on the particular duty cycle of an engine. PACCAR indicated that predictive maintenance can notify a user that a vehicle may need service “before any malfunction occurs”. PACCAR provided examples of scenarios where predictive preventative maintenance may be used and suggested regulatory text revisions.

Response:

We recognize the value that engine prognostics can provide for ensuring emissions systems are functioning as designed and generally support the recommendations from Cummins and PACCAR. We agree there is an environmental benefit to providing a warning for owners to indicate that it is time to adjust, clean, or replace emission-related components as part of general maintenance, allowing them to delay replacement in lieu of requiring them to discard a functional component at a specific interval. We recognize there is also a benefit to notifying owners that an emission-related component is at risk of failing so they can replace the part before its emission control performance deteriorates. However, we are not finalizing provisions that would remove a manufacturer’s liability for warranty, defect reporting, or recall simply for including prognostic systems on their engines. It continues to be the manufacturer’s responsibility to design durable components, determine the components’ deterioration over the useful life, and schedule maintenance as appropriate and consistent with our regulations. For example, if a component fails before its scheduled maintenance interval or the component did not have a maintenance interval specified in the engine configuration’s application for certification, we would continue to treat that failed emission-related component as an emission-related defect subject to the reporting requirements of 40 CFR 1068, subpart F.

We proposed and are finalizing an update to 40 CFR 1065.410(c) to clarify that inspections performed during testing can include electronic monitoring of engine parameters, such as prognostic systems. The provisions of 40 CFR 1065.410 would apply for the service accumulation testing for certification.

We generally support and may further consider aspects of PACCAR’s comment to request allowances for predictive preventative maintenance, but we do not support extending such allowances to malfunctions and failures where a component is defective or otherwise not properly functioning as designed.

We did not propose and are not finalizing specific revisions to 40 CFR 1036.125 related to predictive maintenance or prognostics systems, but we recognize that manufacturers may wish to apply prognostics in their durability testing and demonstration that maintenance will occur in-use. We encourage those manufacturers to work with EPA if they wish to account for prognostics when they request approval of maintenance intervals.

6.8 Other Maintenance-Related Comments

Comments by Organizations

Organization: *American Trucking Associations (ATA)*

The current performance of NOx sensors continues to raise concerns with fleets trying to keep their equipment on the road. In addition, on-going chip shortages nationwide cannot keep pace with fleet repair needs. To help demonstrate this point, ATA conducted an independent survey of its members on costs and frequency involving NOx sensor failures. Fleets have indicated that sensors start going bad in as early as two years. Including parts and labor, replacing one sensor today generally ranges in price from $500 - $700. Tack on downtime and those overall cost estimates increase substantially – in one case up to $1,600 per sensor replacement. One large fleet reported that they typically experience two weeks of downtime per failure (including out-of- service time for the repair and return of the equipment). [EPA-HQ-OAR-2019-0055-1326-A1, p. 8]

Another large fleet broke down their current monthly NOx sensor repairs at $30,000/month in parts, $10,000/month in labor, and $45,000/month in downtime. Over a 12-month period, this fleet's costs average $1.14 million – no small amount for NOx sensors that have now been in use for over 10 years. Since these events do not normally align with routine fleet maintenance schedules, equipment is frequently required to be taken out-of-service to undertake diagnostics and repairs. Fleets with emission control systems under warranty do not typically experience costs for parts and labor – only downtime. However, fleets consistently report that downtime costs far exceed parts and labor costs. These costs are typically neglected when undertaking EPA cost calculations. Given the need for highly sensitive NOx sensors under either proposed Option, fleet maintenance shops have expressed that they are extremely concerned. Memories from the 2010 NOx emission implementation period left a permanent stain that remains to this date. [EPA-HQ-OAR-2019-0055-1326-A1, p. 8]

Organization: *Evergreen Action*

As stronger NOx regulations are promulgated it is critical that state and local air agencies have the capacity to thoroughly enforce compliance with emissions controls. This means ensuring that local authorities have the funding and appropriate staffing levels to provide routine inspections to minimize efforts to tamper with pollution control devices. Regular inspections are also needed to assure that necessary maintenance and repairs are done so that all heavy duty vehicles are in strict compliance with new standards. The millions of Americans living in counties with unsafe levels of air pollution rely on the EPA and local authorities to protect their health, which is why every effort must be made to adequately enforce MHDV standards. [EPA-HQ-OAR-2019-0055-1289-A1, p.2]

Organization: *Great Rivers Environmental Law Center and Dutchtown South Community Corporation (DSCC)*

The undersigned support inclusion of the following requirements in the Final Regulation:

- Mandatory additional maintenance requirements and onboard diagnostics to help combat mal-maintenance and tampering, and to ensure long-term emissions performance. [EPA-HQ-OAR-2019-0055-1323-A1, p.6]

Organization: *Manufacturers of Emission Controls Association (MECA)*

MECA supports the implementation of robust state-led diesel inspection and maintenance programs. [EPA-HQ-OAR-2019-0055-1320-A1, p.33]

To ensure truck engines and aftertreatment systems are properly maintained and operating over their full useful life especially after the warranty has expired will require periodic inspection. This is particularly true for large class 7 and 8 tractor trailer trucks that may be on their second or third owner. MECA supports EPA's activities that encourage states to develop enforceable I/M programs for all vehicles. [EPA-HQ-OAR-2019-0055-1320-A1, p.33]

MECA believes that sensors, already on vehicles, that are an essential part of the OBD system to monitor the NOx emissions from trucks over their operating lives can be used for the purpose of compliance monitoring in the future. MECA members provide their customers with the full spectrum of temperature, NOx, ammonia, PM and numerous other sensors and OBD control units to allow them to comply with CARB and EPA OBD requirements. Real Emissions Assessment Logging (REAL) requirements, which are now in force, require OEMs to store NOx and CO_2 emissions information on the vehicle and report to CARB periodically. MECA members offer telematics capability, that in the future, could be combined with robust sensor monitoring to provide real-time reporting. [EPA-HQ-OAR-2019-0055-1320-A1, p.33]

On-Board Monitoring (OBM) has been adopted by China beginning in 2023 and this will be combined with telematics to report emissions and OBD information in real time to the regulators. Beijing Environmental Protection Bureau has instituted a demonstration program on 50,000 trucks operating in the city to require OBM and telematics to report OBD information to the agency. All OBD functions are monitored in real time including NOx, DPF back-pressure, urea quality along with the normal engine operating parameters collected by the OBD system. A GPS installed on each truck monitors vehicle location and all data is stored for up to a year. Currently the system is being used only for monitoring and demonstration, however the agency will begin using it for enforcement before 2023 when it will be mandated nationally. If an emission or OBD problem is identified, the truck owner will be notified that they must fix the issue. [EPA-HQ-OAR-2019-0055-1320-A1, p.33]

Organization: *Motorcoach Companies*

In a recent industry survey, it was determined that 80% of DPF system related issues directly resulted from faulty sensors. This includes a wide range of sensors, not just NoX sensors, so any sensor that would lead to derate or inducement. Unlike other parts that wear over time, there is no way to determine when a faulty sensor will occur. We have seen them happen on a new bus with less than 1,000 miles on the vehicle. Some of these sensors are simply put in place to deter operators from using subpar DEF products and to make sure the operators are not running low/empty on DEF. However, the cost of DEF is minimal, and companies are committed to ensuring the proper use. Unfortunately, the quality and reliability of these sensors has been subpar in themselves and must be relooked at as a determining factor to derate a vehicle. [EPA-HQ-OAR-2019-0055-1149-A1, p.4]

Organization: *North Central Texas Council of Governments (NCTCOG)*

Also, efforts to identify HD trucks on roadways that are in need of repair and HD trucks that have been tampered with must continue to be supported through state Inspection and Maintenance programs and other initiatives, including roadside inspections. [EPA-HQ-OAR-2019-0055-1254-A2, p.4]

EPA Summary and Response

Summary:

ATA commented that its members have experienced performance issues with sensors and that recent chip shortages are making it challenging to fix the components. ATA described the costs for sensor replacements, including parts, labor, and downtime. ATA also noted its member fleets have shared that sensors “start going bad in as early as two years”. Commenters from Motorcoach Companies also stated that faulty sensors are a problem that can happen with less than 1000 miles on the vehicle.

Evergreen Action, MECA, and NCTCOG commented in support of national inspection and maintenance programs to ensure owners maintain, repair, and do not tamper with emission controls. MECA added that existing sensors and OBD systems can provide real-time reporting of compliance.

Great Rivers Environmental Law Center and DSCC supported additional maintenance requirements to ensure long-term emissions performance.

Response:

With respect to ATA’s comment, as noted in preamble IV.B.1, we are lengthening the warranty periods for heavy-duty engines, which will lengthen the period over which failed or defective emission-related components (which includes any sensors used by emission control systems) would be covered by the manufacturer under warranty.

Manufacturers may schedule maintenance, including replacement, for emission-related components as long as they can demonstrate the maintenance will occur in-use and the specified maintenance interval is not more frequent than the EPA-specified minimum intervals. Manufacturers must demonstrate that the maintenance is needed at their maintenance intervals, and we note that maintenance is most often scheduled in mileage intervals, which may translate to only a few years for some high-mileage vehicle applications. As noted in preamble section IV.B.2, we are generally lengthening minimum maintenance intervals for replacing certain emission-related components to reduce the frequency that manufacturers can specify replacement. If a manufacturer receives approval from EPA to schedule maintenance for sensors, the cost would likely be covered by the owner, unless the manufacturer opts to pay for it as a demonstration that the maintenance will occur in-use. The combination of lengthened warranty and lengthened minimum maintenance intervals in this rule should reduce the frequency of owners paying for components to be replaced.

We regret that sensor replacement has been delayed by the recent chip shortages and that the delay may have contributed to increased downtime. We recognize the importance of keeping heavy-duty engines on the road. We hope that the serviceability provisions we are finalizing in this rule (see section 5 of this document and section IV.B.3 of the preamble) will provide additional information for owners and technicians to efficiently diagnose and repair components to get the engines back on the road.

In terms of inspection and maintenance programs, EPA acknowledges the value that inspection and maintenance programs can play in ensuring the proper function of emission controls in use, but a national inspection and maintenance program is out of scope for this rulemaking. The Clean Air Act mandates that the states operate light-duty vehicle I/M programs in certain areas based on criteria such as air quality attainment status, population, and geographic location. The purpose of these I/M programs is to periodically (either annually or biennially) inspect light-duty vehicles to identify and repair high-emitting vehicles to improve air quality in these identified areas. The Clean Air Act does not require a national I/M program that addresses heavy-duty vehicles, but some states and areas have developed strategies to reduce emissions from heavy-duty vehicles.

We thank Great Rivers Environmental Law Center and DSCC for their support of maintenance requirements.

7 Onboard diagnostics (OBD)

7.1 Adopting CARB’s OBD requirements

Comments by Organizations

Organization: *Allison Transmission, Inc. (Allison)*

EPA has proposed to align federal on-board diagnostic ("OBD") requirements with existing CARB requirements, last updated in 2019.59 At the same time, EPA is proposing additional OBD elements that it believes will be beneficial to federal OBD requirements, even if such requirements are not currently part of the CARB program. As a general matter, Allison supports the harmonization of federal and CARB OBD programs. The benefits of such alignment are obvious: to the extent practicable, aligning federal market for heavy-duty vehicles. [EPA-HQ-OAR-2019-0055-1231-A1, pp.28-29]

59 87 Fed. Reg. at 17,425.

EPA has specifically requested comment how OBD may present a barrier to the adoption of heavy-duty hybrid systems, and any potential opportunities for EPA to address such barriers. As discussed in the preamble of the Phase 2 rule (at XIII.A.(1)) OBD requirements generally apply for hybrid powertrain and components only if the engine manufacturer includes the hybrid system features or parameters as part of the certified configuration for their engines. Allison agrees with this approach and would recommend that it is retained in the final rule. [EPA-HQ-OAR-2019-0055-1231-A1, p.29]

At the same time, Allison recognizes hybrid systems could become included in engine or powertrain certification in order to reach a more aggressive NOx stringency in the future. In that event and for purposes of this rule, Allison would urge EPA to consider that there are various companies involved in the production of hybrid vehicles and not all are similarly situated. Vertically-integrated hybrid manufacturers hold several advantages in terms of regulatory compliance, not only due to their larger size but also in terms of longer-term planning of future vehicle types. In contrast, non-vertically integrated hybrid powertrain suppliers may interact with several OEMs and provide systems for different vehicle types on an intermittent basis. If EPA adopts a more comprehensive approach to OBD requirements for hybrid vehicles, EPA should be aware of these commercial differences and consider provisions similar to those that have been utilized for smaller vehicle manufacturers to allow additional time and flexibility for compliance.[EPA-HQ-OAR-2019-0055-1231-A1, p.29]

Allison also supports EPA flexibilities which have traditionally been part of the OBD program. First, Allison supports retention of the existing deficiency policy in 40 C.F.R. 86.010-18n, as EPA has proposed.60 We believe a deficiency policy is extremely valuable to manufacturers bringing new technologies to market. Allison has utilized CARB's deficiency program for HD hybrid powertrains and has found that this program has allowed Allison to develop new products and higher capability in onboard diagnostics through interactions with regulators during the certification and deficiency resolution process. [EPA-HQ-OAR-2019-0055-1231-A1, p.29]

60 87 Fed. Reg. at 17,528.

Organization: *American Truck Dealers (ATD)*

As EPA knows, when emissions related sensors and on-board diagnostic systems fail to operate properly, false positive or negative readings may result, frustrating the purpose of those sensors and systems (i.e., the proper diagnosis of potential emission failures) and/or aggravating CMV operators and dealership service personnel alike. Therefore, EPA in conjunction with the HDE and CMV OEMs, should carefully revisit existing CMV HDE OBD requirements in the context of appropriately tighter NOx standards to ensure that they will perform properly in-use. ATD also concurs with the OBD and serviceability issues raised by EMA, including harmonization between EPA and CARB OBD mandates. [EPA-HQ-OAR-2019-0055-1321-A1, p. 7]

Organization: *California Air Resources Board (CARB)*

The NPRM requests comment on harmonizing U.S. EPA's HD OBD regulations with future amendments in CARB's HD OBD regulations, specifically CARB's most recent updates proposed in July 2021. CARB staff strongly recommends that U.S. EPA adopt the same amendments once they have been officially adopted. CARB staff believes these amendments are necessary to help ensure the integrity of the HD OBD systems. The NPRM also requests comment on whether and to what extent the U.S. EPA regulations should harmonize with CARB's next expected update to their OBD regulation or whether the proposed language in 1036.110(b) is sufficient to accommodate future divergence in both regulations. CARB staff strongly encourages harmonization of U.S. EPA OBD with CARB OBD requirements and will work toward that direction. [EPA-HQ-OAR-2019-0055-1186-A2, p.66]

The NPRM requests comment to the proposal to keep the numerical values of the NOx and PM OBD thresholds unchanged from the current numerical thresholds to harmonize with CARB's Omnibus rule. [EPA-HQ-OAR-2019-0055-1186-A2, p.67]

First, the threshold in 1036.110(b)(5)(iv) (i.e., 0.60 g/bhp-hr NOx threshold) is not needed, since there are no thresholds of 3.0 times the applicable NOx standard required in 13 CCR section 1971.1 for 2027 and subsequent model engines. [EPA-HQ-OAR-2019-0055-1186-A2, p.67]

Second, while CARB generally agrees that harmonization between the federal and California requirements is appropriate, in this case, CARB staff believes the OBD thresholds can be more stringent than the proposed federal OBD thresholds. While CARB staff did not have enough time to research and propose more stringent thresholds when developing the Omnibus OBD thresholds, staff has since determined that more stringent thresholds are possible for vehicles certified to lower emission standards. [EPA-HQ-OAR-2019-0055-1186-A2, p.67]

Specifically, CARB staff has certified OBD systems (Appendix I) with three or fewer deficiencies for diesel engines that were certified to a NOx FEL of 0.16 grams per brake horsepower-hour (g/bhp-hr), which shows that the engines were able to meet the currently required OBD thresholds (e.g., NOx threshold of 0.32 g/bhp-hr) for all but at most 2 of the emission threshold monitors. [EPA-HQ-OAR-2019-0055-1186-A2, p.67]

Additionally, CARB staff also has certified an OBD system136 without deficiencies for a gasoline engine certified to a NOx FEL of 0.12 g/bhp-hr that was certified to meet all the currently required OBD thresholds for all emission threshold monitors. As such, CARB staff believes that more stringent OBD thresholds than those being proposed by U.S. EPA are feasible, and recommends that U.S. EPA adopt more stringent OBD thresholds based on existing certifications.137 [EPA-HQ-OAR-2019-0055-1186-A2, p.67]

136 https://ww2.arb.ca.gov/sites/default/files/classic/msprog/nvepb/executive_orders/EO%20Files/MDE-HDE/2020/GM/gm_hdoe_a-006-2249-1__date--20200616__year--2020__mfrcarb--gm__ver--orig__uid--7-3860__itr--1__fam--lgmxe06.6001_6d6_0d12-0d01.pdf

137 For these certifications, the HD OBD thresholds can be summarized as follows:
For diesels: 2.0xNMHC FEL, 2.0xNOx FEL or NOx FEL+ 0.2 g/bhp-hr, PM at 0.03 g/bhp-hr or FEL+0.02 g/bhp-hr.
For gasoline: 1.75xNMHC FEL and NOx FEL for catalyst, and 1.5xFEL (NMHC, NOx, PM) for all other monitors

As noted in comment 7.b above, CARB staff recommends that U.S. EPA harmonize the federal HD OBD regulations with future amendments in CARB's HD OBD regulations. However, CARB staff has concerns regarding the exceptions to CARB's 2019 OBD regulations that U.S. EPA is proposing to adopt, specifically the 'testing and reporting requirements in 13 CCR 1971.1(i)(2.3) and (2.4).' First, there is confusion about U.S. EPA's description of this exception. Specifically, U.S. EPA indicated that they have issues with the 'manufacturer self-testing (MST)' requirements in 13 CCR 1971.1(i)(2.3) and (2.4). However, CARB's MST requirements are contained in 13 CCR 1971.1(l)(4) and 13 CCR 1971.5(c), not 1971.1(i)(2.3) and (2.4), which contain the aging requirements for durability demonstration engine (DDE) testing. Based on the description of the requirement at issue, CARB staff believes U.S. EPA is specifically referring to the DDE aging requirements, not the MST requirements. CARB staff recommends U.S. EPA make clear the specific OBD requirements they are addressing. [EPA-HQ-OAR-2019-0055-1186-A2, p.68]

Second, CARB staff is concerned about the language in 1036.11 (b)(6), which states 'the testing and reporting requirements in 13 CCR 1971.1(i)(2.3) and (2.4) do not apply.' Both sections 1971.1(i)(2.3) and (i)(2.4) require manufacturers to use aged engines when performing DDE testing. So, the regulation language U.S. EPA is proposing seems vague and may be interpreted as not requiring aged engines to be used for testing. Further, while section 1971.1(i)(2.3) requires specific data to be collected from high mileage in-use engines to validate the manufacturer's aging process for diesel engines, section 1971.1(i)(2.4) does not contain any specific data collection requirements for gasoline engines. So, CARB staff is confused about why 1971.1(i)(2.4) was included in the exceptions in U.S. EPA's OBD regulation. [EPA-HQ-OAR-2019-0055-1186-A2, p.68]

The NPRM requests comment on whether there are opportunities for further reducing OBD compliance and certification costs of the federal program through increasing the modeling or other calculation-based methods as part of the certification process, which could potentially replace certain testing requirements like those for meeting the test-out criteria or calculating adjustment factors. CARB staff has concerns about such approaches. These systems can be very complex, and the modelling and calculations can be manipulated to generate desired results that may not represent the true performance of the system. If U.S. EPA considers modeling/calculation approaches, CARB staff recommends U.S. EPA adopt regulation language indicating that the manufacturer is still liable for compliance and enforcement if U.S. EPA conducts tests and the test results show non-compliance with the OBD requirements. [EPA-HQ-OAR-2019-0055-1186-A2, p.68-69]

The NPRM requests comment on whether or not OBD may present a barrier to adopted of HD hybrid systems and any potential opportunities for U.S. EPA to address such barriers. From CARB staff's experience certifying HD hybrid OBD systems, CARB staff has been accommodating of the horizontally integrated business structure of the HD industry, and has independently approved the hybrid system OBD systems and engine OBD systems. This dual approval strategy has been working for CARB staff and HD manufacturers for years. Further, CARB staff's experience certifying HD hybrid OBD systems has reinforced the importance of an appropriate evaluation of the engine and hybrid systems together to ensure compliance with all the OBD requirements (e.g., standardization, monitoring frequency) when the engine and hybrid systems are integrated into a vehicle. Hybrid systems inherently change the duty cycles and operating conditions experienced by the engines. Evaluating the systems separately and independently will not necessarily expose the shortcomings that result when the systems are integrated, and the consequence can be poor OBD performance or noncompliance in the field. [EPA-HQ-OAR-2019-0055-1186-A2, p.70]

CARB staff supports the proposal to allow manufacturers to continue to use a CARB OBD approval letter to demonstrate compliance with federal OBD regulations for an equivalent engine family where manufacturers can demonstrate that CARB OBD program has met the intent of the U.S. EPA OBD program, and the process U.S. EPA intends to apply when CARB and U.S. EPA provisions are different (e.g., the additional parameters U.S. EPA is proposing that do not exist in the CARB regulations). However, in the discussion on page 17534, it mentions proposing to migrate the language from 86.010-18(a)(5) to 1036.110(a), but that language from 86.010-18(a)(5) does not appear in the proposed 1036.110(a). Further, while the discussion mentions 1036.110(c)(4), this section does not appear in the proposed language. [EPA-HQ-OAR-2019-0055-1186-A2, p.77]

The NPRM requests comment on U.S. EPA's proposal allowing manufacturers to count two equivalent engine families as one for the purposes of determining the number of engines that are subject to OBD demonstration testing provided the two families are identical in all aspects material to expected emission characteristics, including whether additional restrictions should be included. CARB staff believes it is worth counting both families when determining the number of OBD demonstration engines if the manufacturer has elected to certify separate families despite the equivalency between the families. [EPA-HQ-OAR-2019-0055-1186-A2, p.76]

The NPRM also requests comment on allowing a similar provision for cases where equivalent engine families differ only in terms of inducement strategies. Specifically, the NPRM requests comment on provisions to accommodate equivalent engine families that are identical except for the diagnostic system adjustments needed to meet the different inducement protocols. CARB staff needs to understand why two different engine families would be created by the manufacturer. CARB staff believes a more straightforward approach would be to modify the engine family rules to allow these two engines to be in the same engine family. [EPA-HQ-OAR-2019-0055-1186-A2, p.77]The NPRM requests comment on U.S. EPA retaining the existing deficiency requirements in its entirety. CARB staff has concerns with the U.S. EPA's deficiency provisions. The proposed language in 1036.110(d)(2) states that a deficiency will be approved 'if you show us that full compliance is infeasible or unreasonable considering any relevant factors, such as the technical feasibility of a given monitor, or the lead time and production cycles of vehicle designs and programmed computing upgrade.' CARB staff is unsure if this language allows for typical software bugs or robustness issues to be granted deficiencies. [EPA-HQ-OAR-2019-0055-1186-A2, p.69]

Further, CARB staff has concerns with U.S. EPA's requirement in 1036.110(d)(4) that will not approve deficiencies retroactively. CARB's HD OBD regulation allows manufacturers to certify OBD systems with 'deficiencies' in cases where the manufacturer does not meet a requirement but has demonstrated a good faith effort to fully comply. While manufacturers generally perform some validation work before the start of production to ensure the OBD system is working properly and meeting the requirements of the HD OBD regulation, it is not always possible to find all problems with the OBD systems during this time. Therefore, CARB's HD OBD regulation requires manufacturers to perform thorough validation testing of the OBD system on production engines and vehicles after the start of production (and after OBD system certification). As an incentive, a manufacturer could request that any problem discovered during this testing be evaluated as a deficiency and take effect retroactively to the start of production of the engine. If the other factors necessary to qualify for a deficiency are indeed satisfied, the Executive Officer would amend the certification to retroactively assign the deficiency to the start of production of the affected engines. In contrast, problems discovered later by CARB staff during in-use testing would become noncompliance issues and handled in accordance with OBD-specific enforcement regulations. Additionally, manufacturers have often found problems through means other than this production engine/vehicle evaluation testing that require them to apply running changes and/or field fixes to address the problems. Without the allowance for retroactive deficiencies, CARB staff would most likely have granted a deficiency for this issue on the affected engines in the next model year, which would mean that manufacturers would be given an 'extra' model year to fix the issue given the 2-3 year carryover allowance for deficiencies. Furthermore, if the manufacturer cannot get a retroactive deficiency, then the manufacturer would be subject to the OBD enforcement regulations when the running changes and field fixes are submitted, and CARB staff is notified of the issues. In other cases, if that specific model year was the last model year for the engine, no deficiency would have been applied at all to the engine. CARB staff believes that this would incentivize manufacturers to approach CARB staff later than they should to report problems in the field and applicable running changes/field fixes, which is not appropriate. Therefore, CARB staff recommends U.S. EPA modify the requirements to allow for retroactive deficiencies. [EPA-HQ-OAR-2019-0055-1186-A2, pp. 69-70]

Organization: *Cummins Inc. (Cummins)*

Durability Demonstration Testing (DDE)

For the new aging protocol DDE/demo requirement in the CARB 2019 OBD regs, In §1036.110(b)(2), EPA proposes not to lower NOx and PM thresholds proportionally with the new emissions standards, which Cummins supports. It is not clear whether engine dynamometer-certified engines in vehicles <14k lbs GVWR are subject to OBD requirements in §1036.110(b) or in §1036.110(a)(1), the latter of which references EPA OBD requirements in §86.1806. Since those engines will also be required to meet EPA's new NOx and PM emission standards, EPA should ensure the same OBD threshold relief is applied. If those engines are indeed subject to §1036.110(a)(1), EPA should adopt similar relief provisions which includes freezing the OBD threshold limits and updating all references to the emissions standards contained within §86.1806-05 and §86.1806-17 (13 CCR 1968.2- equivalent). Additionally, where EPA references section 13 CCR 1971.1, EPA should consider also referencing section 1968.2 as appropriate (e.g., see §1036.111(a)(1)). [EPA-HQ-OAR-2019-0055-1325-A1, p. 14]

Cummins proposes EPA to consider adding an option to utilize EPA-approved durability protocol (DF). [EPA-HQ-OAR-2019-0055-1325-A1, p. 27]

For the 3 test-out requirements (2 feedgas and NMHC Catalyst), propose to remove these requirements from CARB 2019 OBD regs entirely as they add no environmental benefit (the requirements add no new diagnostic monitors, just additional unnecessary internal testing done each year to document justification data that doesn't change). [EPA-HQ-OAR-2019-0055-1325-A1, p. 27]

For failed part IRAF, propose to EPA to improve upon existing CARB OBD 2019 language to include good engineering judgement (based on historical data) that could severely reduce the testing costs associated with these requirements. An Improvement here, would allow more carry-over results (for carry-over products), especially for negligible failed-part IRAF numbers/results, which would reduce testing burden. [EPA-HQ-OAR-2019-0055-1325-A1, p. 27]

Production Engine/Vehicle Evaluation Testing (PVE)

For sister families (combined CARB/EPA sister 50-state families), propose to include language that indicates that EPA accepts CARB PVE results for sister EPA engine families. [EPA-HQ-OAR-2019-0055-1325-A1, p. 28]

For PVE1 CARB OBD 2019 requirements, propose modifying the requirements to testing only 3 production vehicles. Experience by engine manufacturers has shown a significantly reduced number of production vehicles (much less than the current requirement of 10) is sufficient to catch any issues. [EPA-HQ-OAR-2019-0055-1325-A1, p. 28]

For PVE2 CARB OBD 2019 requirements, CARB made changes to increase the scope of PVE testing to include testing demo diagnostics for PVE. These new requirements are costly (mainly in relation to acquiring the specific leased HD vehicles), and only proving MIL lamp activation (which is already done during demo with same engine rating). Propose to eliminate these DDE demo PVE2 CARB OBD 2019 updates. [EPA-HQ-OAR-2019-0055-1325-A1, p. 28]

For PVE2 CARB OBD 2019 requirements, propose updating test picks to one PVE2 pick per year. The time it takes to procure vehicles (leasing/purchasing) is a lot more burdensome for engine manufacturers than it is for vehicle manufacturers - we may need to wait for vehicles to be built, or for a built truck to go to a body builder for additional customization work. These are all factors that can impact the timeline and cost associated with this task, despite the fact that diagnostics are usually tuned the same across platforms and persist across multiple model years. [EPA-HQ-OAR-2019-0055-1325-A1, p. 28]

For PVE2 CARB OBD 2019 requirements, propose to include new language that for the PVE2 pick, an allowance to use a different rating within the family if the OBD system is the same. Child ratings are very similar to parent ratings, and if the DDE pick's rating happens to be one of low-volume production, it is burdensome and costly to acquire. [EPA-HQ-OAR-2019-0055-1325-A1, p. 28]

For PVE3 CARB OBD 2019 requirements, Cummins proposes that EPA considers removing the specific new language introduced in Section l (3.2.2) - "The Executive Officer may determine that the manufacturer is required to submit data representative of a subgroup of the monitoring performance group. The Executive Officer shall make this determination based on information indicating that the subgroup of vehicles differs from other vehicles in the monitoring performance group and that a reasonable basis exists to believe that the differences may directly impact the data submitted. " Rationale here is that the manufacturer should be working more upfront with EPA on unique duty cycles, on a specific sub-group in order to define the plan prior to certification. This introduced language has provided a level of uncertainty with how and when CARB has applied compliance upon certain subgroups with manufacturers. [EPA-HQ-OAR-2019-0055-1325-A1, p. 28]

Hybrid OBD

Hybrid vehicle IUMPR increases from 0.1 to 0.3 in MY 24 per CCR 1971.1. We propose that EPA includes IUMPR relief for the hybrid applications and keep IUMPR at 0.1. The higher limit of 0.3 can be a more difficult requirement to meet for hybrid applications and has the potential to push manufacturers to need more investments in new technologies and complex software in order to meet this requirement. That in turn would delay the implementation of hybrid technology and the emissions reduction that would be achieved. [EPA-HQ-OAR-2019-0055-1325-A1, p. 30]

While not mentioned in CARB's 13 CCR 1971.1 and 1971.5 HD OBD regulations, for an engine manufacturer not vertically integrated with the hybrid drivetrain manufacturer, CARB in practice requires a dual Executive Order (EO) OBD certification process, where both the engine manufacturer and the hybrid drive manufacturer independently submit certification documents for OBD approval for a combined dual EO approval. This process proves to be a major hurdle for non-vertically integrated manufacturers from launching into new hybrid solutions. EPA should retain the current conventional engine OBD certification process for obtaining a Certificate of Conformity. [EPA-HQ-OAR-2019-0055-1325-A1, p. 14Deficiency Provision

Cummins is in agreement with EPA on most of their deficiency provision proposal (to retain existing EPA requirements) except with regards to CARB's concept of retroactive deficiency. Retroactive deficiencies are key for issues found during PVE testing. It provides a mechanism for manufacturers that find any issues/concerns during PVE Testing (an event that takes place post-certification) to report to EPA.[EPA-HQ-OAR-2019-0055-1325-A1, p. 29]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

In the Proposed Rule, EPA proposes to update its outdated OBD standards by incorporating by reference CARB's recently amended OBD requirements. EPA also proposes adding flexibility to allow continued technical commonality between engines that are certified to CARB's OBD standards and engines that are not. Daimler Truck supports these proposals. [EPA-HQ-OAR-2019-0055-1168-A1, p.73]

A consistent technical basis for diagnostics and repair across all domestic HDVs is important. Allowing for common approaches reduces development and vehicle costs while providing a consistent repair experience for OEM and third-party repair facilities alike. Daimler Truck supports EPA's proposal to adopt the versions of 13 CCR 1968.2, 1968.5, 1971.1 and 1971.5 that CARB adopted on October 3, 2019. Such an approach ensures that EPA's OBD regulations reflect the most important changes to state-of-the-art diagnostics since the federal regulations were last updated in 2009. [EPA-HQ-OAR-2019-0055-1168-A1, p.73]

Daimler Truck also supports EPA's proposed Section 1036.110(b), whereby the Agency may certify an 'OBD system meeting alternative specifications if you demonstrate that it meets the intent of this section.'99 Such an approach is critical to maintaining long-term technical compatibility between EPA- and CARB-certified OBD systems. Without the flexibility provided by these provisions, the EPA regulation could limit technical advances of diagnostics systems beyond that envisioned by the current regulatory language. EPA rightly identifies communications standards as an example where this has happened in the past; CARB regulations have evolved with technical advances in diagnostics and communications technology, whereas the EPA rules have stayed static. Without the flexibility to certify an OBD system that meets the intent of the regulations, such a divergence in standards could threaten the technical compatibility and consistent repair experience across EPA- and CARB-certified vehicles. [EPA-HQ-OAR-2019-0055-1168-A1, p.74]

99 Id. at 17,665

EPA also requests comments on whether the Agency should adopt anticipated updates to CARB OBD regulations that were proposed in July 2021.100 Daimler Truck does not believe that this is necessary. Rulemaking efforts for the CARB's OBD regulations are nearly continuous in nature. For example, the program was updated in the Omnibus rulemaking package in December 2021 and is currently being updated as part of the passenger car OBD biennial review. It is likely that the HD OBD biennial review process will start soon, and further modify the relevant CARB regulations. Selecting a 'most appropriate' version of the CARB program for EPA to adopt is not necessary, and the version adopted by CARB on October 3, 2019 is sufficient for these purposes. Further, EPA's proposal in Section 1036.110(b)—where the Agency may certify an 'OBD system meeting alternative specifications if you demonstrate that it meets the intent of this section'— obviates any need to expressly incorporate expected future amendments to the CARB program. If CARB adopts newer diagnostic regulations, EPA has the flexibility to certify systems compliant with those newer regulations, as necessary and appropriate. Such flexibility can be leveraged to enable J1979-2, for example. [EPA-HQ-OAR-2019-0055-1168-A1, p.74]

> 100 See id. at 17,526

EPA also proposes a new Section 1036.110(b)(5) to set specific OBD emissions thresholds for monitoring, which are equivalent to their current absolute values under the existing CARB regulations. Daimler Truck supports this approach but does not believe that tighter OBD monitoring thresholds are technically feasible, as there are no predicted improvements in sensor technology that would enable thresholds tighter than the current requirements. [EPA-HQ-OAR-2019-0055-1168-A1, p.74]

EPA appears to have made an error in the proposed new Section 1036.110(b)(6). [EPA-HQ-OAR-2019-0055-1168-A1, p.74]

In the Proposed Rule, EPA expresses an intent to exempt manufacturers from the expensive in-use OBD system testing requirements under CARB's Manufacturer Self-Testing program based upon the Agency's continued concern 'that the cost of this testing may be significant and is not warranted for the federal program.'101 Daimler Truck agrees with this assessment and supports the intended exemption. [EPA-HQ-OAR-2019-0055-1168-A1, p.74]

> 101 See id. at 17,527.

However, EPA appears to have made an error in codifying this exemption in Section 1036.110(b)(6). EPA's proposed regulatory language states that 'the testing and reporting requirements in 13 CCR 1971.1(i)(2.3) and (2.4) do not apply,' whereas we believe the intended references are to 13 CCR 1971.1<u>(l)(3) and (l)(4)</u>. [EPA-HQ-OAR-2019-0055-1168-A1, pp.74-75]

> 13 CCR 1971.1 subsection (i) contains CARB's regulations on certification demonstration, and subsections (i)(2.3) and (2.4) specifically describe the 'aging and data collection of diesel test engines' and 'aging of gasoline engines' for use during the initial certification testing. [EPA-HQ-OAR-2019-0055-1168-A1, p.75]
>
> 13 CCR 1971.1 subsections <u>(l)(3) and (l)(4)</u> describe the in-use data collection programs in the CARB regulation, which more closely aligns with the requirements outlined in the preamble section. [EPA-HQ-OAR-2019-0055-1168-A1, p.75] Daimler Truck believes EPA should exempt manufacturers from the testing 13 CCR 1971.1(l) (3) and (4)—and additionally evaluate whether the aging provisions of (i)(2.3) and (2.4) are necessary and add sufficient value to justify their expense. [EPA-HQ-OAR-2019-0055-1168-A1, p.75]

Daimler Truck supports EPA’s proposed new Section 1036.110(d) and believes it is appropriate for EPA to review and approve deficiencies separately from CARB. However, EPA adds additional stringencies that unnecessarily deviate from CARB’s rules and add significant challenges for manufacturers. [EPA-HQ-OAR-2019-0055-1168-A1, p.75]

Specifically, Section 1036.110(d)(3) is unnecessarily limited. EPA proposes only to approve deficiencies for a maximum of two years, unless a manufacturer demonstrates the need for additional lead time to make substantial changes to engine hardware.102 This stands in contrast to CARB’s rules, which recognize that complex OBD function definition, software and calibration development, validation, and release can take more than two years to implement. Specifically, 13 CCR 1971.1(k)(4) allows deficiencies to be carried over for a maximum of two years – for a total of three years including the initial year of the deficiency. Accordingly, Daimler Truck requests that EPA change Section 1036.110(d)(3) to read ‘We will approve a deficiency for more than three years only if you further demonstrate that you need the additional lead time to make substantial changes to engine hardware.’ Daimler Truck believes that EPA rightly recognizes that substantial changes to engine hardware could take more time to remediate, and otherwise supports the rest of this paragraph. [EPA-HQ-OAR-2019-0055-1168-A1, p.75]

102 See id. at 17,666.

EPA’s proposed new Section 1036.110(d)(4), which would prohibit retroactive approval of deficiencies, is also too restrictive.103 Due to the wide variety of applications and duty cycles in the heavy-duty sector, it is impossible for manufacturers to be certain that all diagnostics will work without fail in all vehicles. A manufacturer may not discover until wide production exposure that a monitor has issues with certain duty cycles, and does not work as expected. For example, it is common for manufacturers to detect issues with In-Use Monitoring Performance Ratio after production. These issues may arise due to unforeseen production variability, unique vehicle applications (over which the engine manufacturer may have little control), or from unique duty cycles. It is important for EPA to leave manufacturers with a path to correct these unforeseen issues, including in circumstances where a retroactive deficiency might be necessary. Otherwise, EPA could force a situation where operators are confronted by false indications of failure, leading to increased expenses in unneeded repairs, unnecessary downtime, and frustration. Similarly, such false failures could undermine operator’s faith in the diagnostic system, leading to actual failures going unrepaired. [EPA-HQ-OAR-2019-0055-1168-A1, pp.75-76]

103 See id.

Organization: *General Motors LLC (GM)*

EPA proposes to incorporate by reference regulations and test procedures in many cases that are unclear, duplicative, or are not yet final. [EPA-HQ-OAR-2019-0055-1246-A1, p.5]

In "§ 1036.110 Diagnostic controls", EPA proposes that an "Engine must comply with the 2019 heavy-duty OBD requirements adopted for California…", but CARB considered many OBD requirements in 2019 and did not finalize a proposal until 2021. EPA's proposed regulatory language is unclear. In this specific example, GM asks EPA to make clear what regulation the Agency incorporates by reference. [EPA-HQ-OAR-2019-0055-1246-A1, p.6]

Incorporating standards by reference that are not finalized, unclear, or duplicative adds uncertainty to what is expected in a finalized regulation, and often increases the burden to industry to comply with standards. GM encourages EPA to not incorporate by reference regulations and test procedures that are unclear, potentially duplicative, or not finalized. [EPA-HQ-OAR-2019-0055-1246-A1, p.6]

Organization: *International Council on Clean Transportation (ICCT)*

The ICCT fully understands the importance of OBD systems as one of the most cost-effective ways to maintain in-use emissions within certification and OBD threshold levels. Ensuring that HDV operators and regulators have access to harmonized data would reduce the cost of maintaining and ensuring low emission levels. [EPA-HQ-OAR-2019-0055-1211-A1, p. 24]

The ICCT supports EPA's decision to harmonize with CARB's OBD provisions for MY 2022 to 2024 and with the intention to expand those signals as listed in the NPRM (FR page 17532). [EPA-HQ-OAR-2019-0055-1211-A1, p. 24]

Organization: *National Association of Clean Air Agencies (NACAA)*

EPA's existing onboard diagnostics (OBD) requirements, adopted in 2009, allow manufacturers to demonstrate how the OBD system they designed to comply with California's OBD requirements also complies with the intent of EPA's OBD requirements. (EPA maintains separate OBD regulations but manufacturers currently seek approval from California for OBD systems in engine families applying for 50-state certification and then use that approval to demonstrate compliance with EPA's requirements.) In this rulemaking, EPA proposes to update its OBD regulations by incorporating by reference the California Air Resources Board's (CARB) 2019 OBD regulations "as the starting point for our updated OBD regulations" and then "exclude or revise certain CARB provisions that we believe are not appropriate for a federal program" and "include additional elements to improve the usefulness of OBD systems for users." [EPA-HQ-OAR-2019-0055-1232-A1, pp. 15 - 16]

EPA should update its OBD requirements but should incorporate by reference CARB's current program without omission so there is alignment between the federal and California programs. [EPA-HQ-OAR-2019-0055-1232-A1, p. 16]

Organization: *Northeast States for Coordinated Air Use Management (NESCAUM)*

Should EPA instead promulgate Option 1, we urge the Agency to make the following changes to the proposed standards: EPA's existing onboard diagnostics (OBD) requirements, adopted in 2009, allow manufacturers to demonstrate how the OBD system they designed to comply with California's OBD requirements also complies with the intent of EPA's OBD requirements. (EPA maintains separate OBD regulations but manufacturers currently seek approval from California for OBD systems in engine families applying for 50-state certification and then use that approval to demonstrate compliance with EPA's requirements.) In this rulemaking, EPA proposes to update its OBD regulations by incorporating by reference the California Air Resources Board's (CARB) 2019 OBD regulations "as the starting point for our updated OBD regulations" and then "exclude or revise certain CARB provisions that we believe are not appropriate for a federal program" and "include additional elements to improve the usefulness of OBD systems for users." NESCAUM urges EPA to update its OBD requirements and incorporate by reference CARB's current program without omission so there is alignment between the federal and California programs. [EPA-HQ-OAR-2019-0055-1249-A1, p. 15]

Organization: *Roush CleanTech (Roush)*

EPA mentioned manufacturers concerns relating to manufacturer self-testing in 13 CCR 1971.1(i)(2.3) and 1971.1(i)(2.4) (p. 381 and others), and these sections are listed as excluded in the proposed 1036.110(b)(6). We believe this is an error, as 1971.1(i)(2.3) and (2.4) do not relate to manufacturer self-testing; those sections refer to the requirements of demonstration engines which we don't believe EPA intended to exclude. We believe the intended exclusion is to exclude 13 CCR 1971.5(c). Roush fully supports exclusion of the MST requirements in 1971.5(c) due to the high costs and logistical difficulties, especially given that any EPA-only OBD families would likely be specialty or low-volume applications. [EPA-HQ-OAR-2019-0055-1276-A1, p.6]

OEMs (including Roush) often utilize CARB's deficiency policy to avoid the profound financial implication of disruptions to the vehicle production plan, and to implement new emissions control technologies which may require some regulatory flexibility. This has been vital in implementation of new technologies; Roush has specifically used deficiencies as part of the implementation of new monitoring requirements associated with LPG and CNG, and for heavy-duty gasoline ORVR system. As required by ARB, these issues were all fully reviewed and resolved in a timely fashion. [EPA-HQ-OAR-2019-0055-1276-A1, p.6]

- We would fully expect manufacturers to continue to require the flexibility of OBD deficiencies in order to implement the technologies proposed in this NPRM; eliminating or restricting this existing flexibility would almost certainly jeopardize the feasibility assessments included here.
- Roush believes that the current EPA regulations for pre-production deficiencies are sufficient to provide OEM flexibility as is consistent with 13 CCR 1971.1(k). However, Roush is concerned that without the provisions of a retroactive deficiency as declared in 40 CFR 86.010 18(n)(3), manufacturers could endure excessive costs relating to a mandatory recall, or significant technological investments to generate remedies outside of the normal product development cycle plan. Roush believes that the EPA could incorporate the CARB provision for retroactive deficiencies up to six months after entry to commerce and thereby provide much greater OEM flexibility with no concern that this would degrade the emissions benefit of the program (since retroactive deficiencies are fully incorporated in the ARB rule under which nearly all engines/vehicles will be certified). [EPA-HQ-OAR-2019-0055-1276-A1, p.6]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EMA supports EPA's proposal to harmonize (as much as possible) to CARB's 2019 OBD regulations, and further supports the overall framework to modernize the OBD requirements in EPA's regulations. Harmonization is key to the success of OBD overall, as it provides the certainty and clarity that manufacturers need to develop and implement more robust vehicle OBD systems. [EPA-HQ-OAR-2019-0055-1203-A1, p. 95]

That said, EMA agrees that there are some CARB provisions that are not well-suited to a federal OBD program. Accordingly, we support EPA's proposals for MST testing and deficiencies, with some exceptions. More specifically, while we support the majority of EPA's proposed deficiency provisions, we believe that EPA should more closely align with CARB with respect to certain of those provisions. In that regard, EPA's deficiency timeline is shorter than that provided under the CARB regulations, and would not allow for retroactive deficiencies. Retroactive deficiencies are key for resolving issues found during Production Vehicle Evaluation (PVE) testing, which may not be immediately apparent. Deficiency fines under CARB's OBD program are sufficiently punitive to facilitate compliance, yet the allowance for retroactive deficiencies provides additional necessary flexibility. [EPA-HQ-OAR-2019-0055-1203-A1, p. 95]

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §1036.110(d)(3) and (d)(4): EMA requests that EPA provide clarity on the allowance for deficiency carryover and retroactive deficiencies (namely for small errors, as manufacturers do utilize retroactive deficiencies routinely and frequently). As noted above, we strongly recommend that EPA harmonize these specific deficiency provisions with those of CARB. [EPA-HQ-OAR-2019-0055-1203-A1, p. 102]

Additionally, EMA has concerns with the proposed incorporation by reference provisions of 40 CFR 1036.810(d), as discussed further below. There are multiple versions of CARB's 2019 OBD regulations. Thus, we request that EPA provide additional clarity as to which specific version is being referenced. EMA also is concerned with the proposal that manufacturers provide additional information that is not required in the California 13 CCR 1971.1 regulations, as this will lead to a lack of both harmonization and standardization across the two regulatory regimes. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 95 - 96]

As noted above, EMA supports EPA's proposal to harmonize with CARB's determination not to lower the OBD NOx and PM threshold levels at this time. We agree that more time is needed, as CARB has noted, to fully evaluate the capability of HD OBD monitors to accommodate lower NOx and PM thresholds, and to ensure adequate time for the development and prove-out of robust systems for both EPA and CARB's OBD programs. [EPA-HQ-OAR-2019-0055-1203-A1, p. 96]

Consistent with CARB's regulatory updates to 13 CCR 1968.2 with respect to the Low- NOx Omnibus rulemaking regarding engines under 14,000 lbs., EMA recommends that EPA carry forward the standard-relief provisions (e.g., freezing the OBD threshold limits, updating all references to the emissions standard contained within 40 CFR 86.1806-05 and 86.1806-17 (13 CCR 1968.2-equivalent), etc.). [EPA-HQ-OAR-2019-0055-1203-A1, p. 96]

We support the proposal to allow manufacturers to continue to use a CARB OBD approval letter to demonstrate compliance with federal OBD regulations. [EPA-HQ-OAR-2019-0055-1203-A1, p. 97]

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. Additionally, we request that EPA expressly state which 13 CCR 1971.1 provisions are being referenced in EPA's regulatory provisions. As noted below, there are incorrect references to CARB provisions, which makes it difficult in some instances to review the proposed regulations, since it is unclear which CARB provisions are actually being referenced. That lack of clarity will pose challenges for regulated entities during any implementation of the proposed program. [EPA-HQ-OAR-2019-0055-1203-A1, p. 99]

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §86.010–18(a): "(a)… Note that 40 CFR 1036.150(u) allows for an alternative communication protocol before model year 2027…" This paragraph appears to have an incorrect reference; in the proposed regulatory text, the OBD communication protocol-related interim provisions are specified in paragraph (v). [EPA-HQ-OAR-2019-0055-1203-A1, p. 99]

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §1036.110(b)(6): "(6) The testing and reporting requirements in 13 CCR 1971.1(i)(2.3) and (2.4) do not apply." Subsections (i)(2.3) and (2.4) cover aging requirements for diesel and gasoline engines; we believe EPA intended this to be a reference to "the Production Engine/Vehicle Evaluation testing and reporting requirements of 13 CCR 1971.1(l)(2.3) and (2.4)…". [EPA-HQ-OAR-2019-0055-1203-A1, p. 99]

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §1036.110(b)(9) and (b)(10): "(9) Design compression-ignition engines to make the following additional parameters available for reading with a generic scan tool, if so equipped:"; "(10) Design spark-ignition engines to make the following additional parameters available for reading with a generic scan tool, if applicable:" EMA presumes that "if so equipped" and "if applicable" in the aforementioned paragraphs do not compel manufacturers to add the components implied by the listed parameters as requirements. Not all of the terms listed in proposed paragraphs (b)(9) and (b)(10) can be precisely matched to existing content in SAE J1939DA. For example, the broad statement in paragraph (b)(9)(vi) "any additional parameters" cannot be assessed independently, and the proposed air/fuel enrichment parameters requested in paragraph (b)(10)(i) do not appear to be defined in SAE J1939DA. Further, some of the proposed provisions, such as the requirements of paragraph (b)(9)(i), may not reside in the OBD boundary for engine manufacturers. We request that EPA consult with the SAE Truck and Bus Control and Communication Network Committee and the Vehicle E/E System Diagnostic Standards Committee to ensure that each of the requested items listed in the proposed regulations has been defined. [EPA-HQ-OAR-2019-0055-1203-A1, p. 100]

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §1036.110(b)(11)(i): EPA is proposing that manufacturers provide additional information that is not required in 13 CCR 1971.1, thus leading to a lack of harmonization and standardization. [EPA-HQ-OAR-2019-0055-1203-A1, p. 100]

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §1036.110(b)(11)(ii): This paragraph lacks clarity and seems to contain incorrect references to the California regulations: 13 CCR 1971.1(i)(2.3) and (2.4): Manufacturers can send the information at the time of certification; however, it is unclear if EPA intended to reference the OBD Durability Demonstration Engine testing results. This is unclear because 13 CCR 1971.1(i)(2.3) and (2.4) cover vehicle selection, and specifically aging. We recommend that EPA consider instead referencing "the Monitoring System Demonstration Requirements for Certification provisions of 13 CCR 1971.1 (i)". [EPA-HQ-OAR-2019-0055-1203-A1, p. 100]

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §1036.110(b)(11)(ii): This paragraph lacks clarity and seems to contain incorrect references to the California regulations: 13 CCR 1971.1(l): This provision covers post-production engine evaluation testing, which cannot be provided at the time of certification. Such information, however, can be provided per the deadlines set out in 13 CCR 1971.1. [EPA-HQ-OAR-2019-0055-1203-A1, p. 100]

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §1036.110(b)(11)(ii): This paragraph lacks clarity and seems to contain incorrect references to the California regulations: 13 CCR 1971.5(b): This provision is specifically for "Testing Procedures for ARBConducted Testing" – did EPA intend to reference 13 CCR 1971.5(c)? If so, we recommend that EPA specifically state "the Manufacturer Self-Test provisions of 13 CCR 1971.5(c)" for clarity. [EPA-HQ-OAR-2019-0055-1203-A1, p. 100]

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. 1036.810(d)(1)-(2): As noted, the proposed provisions to incorporate CARB's "2019" regulations by reference are confusing, as they lack clarity of which specific version is being incorporated. We recommend that EPA instead specific the regulations by their specific date of finalization, to ensure that there is not confusion about which version of the regulations EPA is incorporating. [EPA-HQ-OAR-2019-0055-1203-A1, p. 104]

EMA recommends that EPA retain its current conventional engine OBD certification process for procuring Certificates of Conformity. While not specified in the 13 CCR 1971.1 regulation, for engine manufacturers that are not vertically integrated with the hybrid drivetrain, CARB allows for a dual Executive Order OBD certification process, where both the engine manufacturer and the hybrid drive manufacturer independently submit certification documents for OBD approval for a combined dual E.O. approval. However, this process can be a significant burden for non-vertically integrated manufacturers launching new hybrid solutions. We also recommend that EPA include in-use monitor performance ratio (IUMPR) relief for hybrid applications to keep the IUMPR at 0.1, instead of the higher 0.3 limit. [EPA-HQ-OAR-2019-0055-1203-A1, p. 98]

EPA Summary and Response

General Comments

EPA received comments from Allison, ATA, EMA, DTNA, ICCT, and CARB supportive of the proposal for EPA to harmonize with CARB's most recent OBD requirements. DTNA also supported EPA's proposal to adopt language similar to that currently in 40 CFR 86.018-10 into 40 CFR 1036.110 allowing manufacturers to demonstrate they meet the intent of our requirements by meeting what could be a slightly different set of requirements from CARB. NACAA commented that EPA should adopt CARB's requirements without omission to ensure complete harmonization. EMA and GM noted that EPA must be clear in how they incorporate by reference these CARB regulations in 1036.810(d), as there are multiple versions of CARB's 2019 regs. EMA commented that they are not supportive of proposed requirements to provide additional information that differs from CARB. CARB also commented that EPA should adopt the future update to their OBD requirements to ensure we include important changes. DTNA commented that including more recent CARB regulations than the 2019 regulations was not necessary because CARB's OBD program is updated continuously and the 2019 version combined with EPA's "intent" language is enough to accommodate future divergences.

- EPA agrees that updating our OBD requirements is important, see preamble Section IV for further details on the final provisions and the rationale to support those requirements. EPA does not agree with NACAA that all of CARB's requirements are appropriate for a Federal program, as further explained in preamble Section IV. We have made adjustments from proposal in our final regulations and worked with CARB to ensure we are incorporating the appropriate version of CARB's 2019 regulations in the final 40 CFR 1036.810(d). EPA agrees with DTNA that our OBD regulations are not updated as frequently as the CARB regulations and we believe that it is important to include the final regulatory language to allow manufacturers to be able to demonstrate compliance with the intent of our OBD requirements, even though they may be meeting different CARB requirements (e.g., that may be more stringent), to ensure we can accommodate such changes in CARB OBD requirements as appropriate without delay. CARB's pending OBD update was not finalized in time for us to harmonize with it in this rule. We intend to monitor their rulemaking and may consider if we should take further action to harmonize in a future rulemaking.

  EPA recognizes EMA's comments that our information requirements are different than CARB's in certain cases. It is important to note, however, that this is because EPA is allowing manufacturers flexibility to use good engineering judgement to show that they meet the intent of our requirements by meeting a potentially different set of requirements from CARB. It would not be appropriate for manufacturers to use this flexibility without describing how their OBD system is compliant with the intent of our requirements.

Deficiencies

EPA received comments from Allison, EMA, Cummins, DTNA, Roush, supportive of our retention of existing deficiency requirements, but not supportive of omitting an allowance for retroactive deficiencies. DTNA commented they need retroactive deficiencies due to the wide variety of engine applications and duty cycles in the heavy-duty industry that makes it impossible to be certain that all diagnostics will work without fail in all vehicles. EMA commented retroactive deficiencies are important for resolving issues that cannot be discovered until testing that can only occur after the start of production. CARB expressed concern with EPA's lack of a retroactive deficiency policy stating it provides time for manufacturers to continue validation work after start of production ("SOP"), allows CARB to amend the certification documents to assign a deficiency as if it occurred prior to SOP, and without retroactive deficiencies, CARB would most likely have to wait until the next model year to apply deficiency.

EMA and DTNA commented that EPA's deficiency timeline is shorter than CARB's where EPA proposed a deficiency for a maximum of 2 years unless a manufacturer demonstrates the need for additional lead time to make substantial changes to engine hardware. They noted this is not consistent with CARB's requirements in 1971.1(k)(4) which allows deficiencies to be carried over for a maximum of 2 years for a total of 3 years.

CARB expressed concerned that EPA's proposed language in 1036.110(d)(2) will not allow for typical software bugs or robustness issues that may be granted deficiencies.

CARB also commented that if EPA modifies test out requirements, that we should finalize language saying OEMs are still liable for compliance and enforcement if allowed.

- EPA agrees that the adoption of our existing deficiency program is important. See preamble Section IV.C.1.i for discussion on the final provisions we are finalizing for deficiencies and our response to many of these comments.

  As discussed in preamble Section IV, EPA reviewed our proposed language regarding the proposed deficiency timeframe and agrees that it is not consistent with CARB's and we have adjusted the language from proposal in final 40 CFR 1036.110(d)(3) to reflect the allowance of three years to make substantial engine hardware changes. Further, in response to CARB's concern with the language used to describe acceptable deficiencies, EPA reviewed, but did not make any adjustments to our proposed language in 40 CFR 1036.110(c)(2) which states "We will approve a deficiency only if you show us that full compliance is infeasible or unreasonable considering any relevant factors, such as the technical feasibility of a given monitor, or the lead time and production cycles of vehicle designs and programmed computing upgrades." We believe this language will accommodate minor issues like software problems that may be infeasible or unreasonable to address.

  See preamble Section IV regarding test-out requirements. Existing approaches to compliance and enforcement continue to apply for these provisions.

Thresholds

ATA expressed concerns about OBD and the final lower standards which could result in false readings and OBD faults if OBD thresholds are too quickly and aggressively changed. ATA noted this would frustrate operators and repair facilities. CARB commented that since they finalized their Omnibus rule they have seen manufacturers meet lower thresholds, two CI engines with deficiencies and one SI engine with no deficiencies. Therefore, CARB commented that this indicated the thresholds can be lowered. DTNA supports EPA's proposal to not change thresholds because they do not believe tighter OBD monitoring thresholds are technologically feasible as there is no predicted improvement in sensor technology that can enable lower thresholds. EMA supported EPA's threshold proposal and commented that sufficient time is needed for development and prove-out of robust systems. Cummins and EMA commented that engines certified on an engine dynamometer installed in vehicles less than 14,000 lbs GVWR will be required to meet new lower NOx and PM standards and need the same threshold relief, and that it is not clear if EPA's proposal applies also to these vehicles.

- EPA appreciates the different perspectives on potential threshold changes. See preamble Section IV.C.1.ii for further discussion on the threshold requirements EPA finalized and our response to these comments.

Hybrid OBD

Allison commented that current OBD requirements generally apply for hybrid powertrains and components only if the engine manufacturer includes the hybrid system features or parameters as part of certified configuration. Allison agrees with this approach and wants it retained. CARB commented that their path to certifying hybrid OBD systems is appropriate. Cummins commented that CARB's program is not appropriate for engine manufacturers that are not vertically integrated with a hybrid drivetrain manufacturer and can be a major hurdle for non-vertically integrated OEMs launching new hybrids. Cummins said that EPA should retain the current conventional engine OBD cert process for obtaining a certificate of conformity. Further, Cummins commented EPA should increase the in-use monitoring performance ratio for hybrids from 0.1 to 0.3 in MY2024 to avoid a delay in hybrid production.

- EPA appreciates the comments on changes we can consider to improve outcomes of OBD certification for hybrid vehicles. We requested comment on this topic but are not taking any final action at this time regarding OBD certification changes specific to hybrid vehicles. We may continue to evaluate whether to consider changes in a future rulemaking.

Manufacturer Self Test

EPA received a number of comments on the regulations we cited in our proposal to exclude manufacturer self test requirements from our OBD program. CARB, DTNA, Roush, and EMA all commented on the need for EPA to clarify the cite in the proposed regulatory text for the CARB requirements for manufacturer self test requirements, stating that the cite in the proposal was incorrect.

EMA commented on the need for greater clarification on several aspects of the proposed regulation, including defining requirements in 1036.110(b)(9) and (10) and ensuring that all requirements in those section reside in the OBD boundary, and clearly stating which version of CARBs 2019 OBD requirements we are IBRing. EMA also pointed out an incorrect cite for the interim OBD communication protocol.

CARB commented that EPA did not need to include the 0.60 g/bhp-hr threshold in 1036.110(b)(5)(iv) since there are no threshold requirements of 3.0 times the applicable NOx standard in 13 CCR 1971.1 for 2027 and subsequent model engines.

Cummins provided multiple proposals in their comments including adding an option to use EPA-approved durability protocol for deterioration factor testing, remove the 3 test-out requirements (2 feedgas one NMHC catalyst), and to include language to use good engineering judgement based on historical data to reduce test burden for failed IRAF parts. Cummins also proposed

changes for PVE testing including using CARB PVE results for sister EPA engine families, reduce testing for PVE1 to 3 production vehicles as data has shown that fewer than 10 vehicles is sufficient to catch any issues, reduce test picks for PVE2 tesing to one vehicle per year, to allow PVE2 testing on an engine with a different rating within the same engine family if the OBD system is the same, and to remove the language "The Executive Officer may determine that the manufacturer is required to submit data representative of a subgroup of the monitoring performance group. The Executive Officer shall make this determination based on information indicating that the subgroup of vehicles differs from other vehicles in the monitoring performance group and that a reasonable basis exists to believe that the differences may directly impact the data submitted" from the PVE3 requirements.
CARB commented that EPA should count two equivalent OBD families separately to determine the number of engines for demonstration testing.
CARB commented that EPA should modify their engine family rules so that two engine families that are identical in all respects except for OBD adjustments required to accommodate differing inducement strategies to be considered one engine family.
CARB commented that EPA did not include language from 40 CFR 86.010-18(a)(5) in 40 CFR 1036.110(a) as was proposed and that 40 CFR 1036.110(c)(4) did not appear in the proposed language.

- We appreciate the comments correcting our cite of CARB's manufacturer self-testing and have updated to the correct cite in the final rule, see Preamble IV.C.1 for additional details. We have updated the requirements for additional OBD parameters to be more specific and ensured that they are appropriate, as detailed in preamble Section IV.

  We have included additional details about the version of CARB's 2019 OBD requirements, see Preamble IV.C.1, to more clearly specify the version of 2019 CARB OBD requirements that we are incorporating by reference.
  See preamble Section IV for further details on the final thresholds and EPA's response to those comments.

  We did not propose and are not finalizing any of Cummins' proposals for DF tesing, the 3 test-out requirement, IRAF parts, or PVE testing. As explained in preamble Section IV, our final provisions aim to maintain as much commonality with CARBs regulations as is appropriate for the Federal program. We note that we believe that the majority of engines applying for EPA OBD certification will have already received a CARB certification and adopting Cummins' proposals would likely not significantly reduce testing burden.

  See preamble Section IV.C.1.v for details on the final provisions regarding counting engine families for OBD demonstration requirements and our response to those comments.

  As explained in preamble Section IV, we are finalizing the migration of language from 40 CFR 86.010-18(a)(5) to 40 CFR 1036.110(b), as we proposed for the final rule. We also removed the proposed reference to 40 CFR 1036.110(c)(4), as the regulations have been updated from those proposed for the final rule and this reference is no longer valid in the final provisions.

7.2 Health monitors

<u>Comments by Organizations</u>

Organization: *California Air Resources Board (CARB)*

The NPRM requests comment on U.S. EPA's proposed health monitors for the SCR, DPF, and EGR systems for CI engines, including the benefits of the specific methods being proposed to inform a vehicle operator of the general health of these systems. Further, the NPRM requests comments on the U.S. EPA's proposal for a broad requirement that leaves identification and implementation of the specific methods up to each manufacturer, the alternative approach which would require a specific method to be used by all manufacturers, and any other approach that may be more beneficial or less costly but still provide benefits to the owner and result in environmental benefits from better performing emission control systems. CARB staff generally supports U.S. EPA's concept for proposed health monitors. Concepts to provide system health information could be taken from existing diagnostics and test results and made into more general output for a larger audience. Further discussion with manufacturers is needed to decide on the best approach to support health results and whether the output should be standardized. [EPA-HQ-OAR-2019-0055-1186-A2, p.71]

CARB staff has concerns about how the health monitors may affect the warranty program. CARB staff understands the benefits of having such a requirement and CARB staff has met with one manufacturer to discuss a similar concept using on-board and off-board analytics with driver notification to trigger maintenance or repair. However, in the context of in-use compliance and warranty reporting, CARB staff is still unclear how the manufacturer would identify a systematic component defect that would need corrective action. Also, how would these replaced components be reported on defect or emission warranty information reporting (EWIR)? CARB staff recommends that all components replaced due to the health monitors be reported on defect and EWIR reports, and the manufacturer do the same root cause analysis on failed parts. This way, systemic defects will be promptly addressed through corrective action. [EPA-HQ-OAR-2019-0055-1186-A2, p.71]

Additionally, the NPRM requests comments on whether additional monitors could be developed using existing OBD requirements which can further help prevent downtime, such as additional upstream health indicators (e.g., preventing excessive internal oil leaks) to proactively prevent damage to expensive aftertreatment components. Manufacturers today use diagnostic and sensor input data for purposes of engine protection. These are designed largely at the discretion of the manufacturer and not a CARB requirement, though they are required to disclose such strategies and get them approved by CARB staff. If such strategies were to be made mandatory, CARB staff would need clear regulation citations to support such a proposed rule. [EPA-HQ-OAR-2019-0055-1186-A2, p.71]

CARB staff has concerns regarding the proposed language in 1036.110(c)(3)(v). The language states that the proposed data for the DPF and SCR health monitors are required to be provided 'based on a default method of updating or resetting collected data.' For example, the current data may include information from the Active 100-Hour Array or Stored 100-Hour Array. The system must allow the operator to perform a manual reset to start collecting new data on demand.' CARB staff believes the language 'based on a default method of updating or resetting collected data' is not clear enough about what qualifies as an acceptable default method. CARB staff recommends that the language be modified to clarify this or to provide examples of acceptable default methods of updating and resetting collected data (e.g., 'based on a default method of updating (e.g., automatically replacing an older set of data with a newer one every 100 engine hours) or resetting collected data (e.g., setting collected data values back to zero via a code clear command).'). [EPA-HQ-OAR-2019-0055-1186-A2, pp.71-72]

The NPRM requests comment on the use of CARB's lifetime counter of DPF regens to meet the DPF health monitor proposal. CARB staff believes the DPF PID data could be an indicator of DPF health. [EPA-HQ-OAR-2019-0055-1186-A2, p.72]

The NPRM also requests comment on if the proposed regen frequency indicator is important enough to require it to be communicated when the frequency of regens reaches a particular level that may indicate the need for inspection and possibly repair, what this level would be, and what such warning system should look like. Considering the cost of aftertreatment, CARB staff supports providing an indication of regeneration frequency that could be used alert operators of potential problems and initiate inspection, maintenance and repairs as needed. However, CARB staff does not support a second light and warning notification system at this time, since this would require OBD resource evaluation and program planning to make sure the proper team is in place to lead such work. [EPA-HQ-OAR-2019-0055-1186-A2, p.72]

Further, the NPRM requests comment on whether the DPF health monitor should provide information like passive regens that occur during certain vehicle operation (e.g., OBD REAL Bin 14) on demand and if it should notify users of potential concerns. It is assumed the passive regens would add to deterioration of the DPF, but CARB staff's understanding is that it is the active regens that are primarily responsible for DPF and aftertreatment aging. Therefore, CARB staff does not see a specific need to track passive regen activity. [EPA-HQ-OAR-2019-0055-1186-A2, p.72]

Lastly, CARB staff supports the point in the NPRM that 'providing operators with notification of when active regens have been disabled by the system (even temporarily) as well as the reason it was disabled would provide benefits to operators and repair technicians. Manufacturers generally implement severe derates when DPF system faults occur that prevent active regens from occurring. Providing owners with information on the cause of a DPF-related derate would reduce frustration and may reduce downtime by allowing repairs to be made more quickly, increasing in-use emission system performance. [EPA-HQ-OAR-2019-0055-1186-A2, pp.72-73]

The NPRM requests comment on if the SCR health monitor should provide information about the DEF dosing being disabled and the reason (if accompanied by a derate) on demand and if it should also notify users of potential concerns. While CARB staff expects the malfunction indicator light (MIL) to be illuminated and an OBD fault code stored in such cases, CARB staff supports providing information to the operator about the disablement and the reason. [EPA-HQ-OAR-2019-0055-1186-A2, p.73]

The NPRM also requests comment on alternative methods to develop a health monitor for the SCR system, such as one that would use DEF dosing trim values (i.e., DEF dosing rates at particular operating points like within NTE operating zones or REAL bins) and compare the dosing rate occurring in real-time to what the dosing rate was when the vehicle was new. If U.S. EPA is trying to get an overall indication of system health, CARB staff believes a more direct comparison would be to compare SCR conversion efficiency rather than DEF dosing rate. [EPA-HQ-OAR-2019-0055-1186-A2, p.73]

The NPRM requests comment on other strategies that can help inform operators of the functionality of the EGR system to help prevent breakdowns due to EGR system failures, including whether or how to monitor for EGR cooler leaks or plugging, such as through the use of pressure or temperature sensors, and whether today's engines are equipped with sensors in the EGR system that could be used for this purpose. Regarding the monitoring of EGR cooler leaks or plugging, EGR plugging is required to be monitored today under CARB's OBD regulations, while EGR cooler leaks are indirectly monitored through the EGR cooler efficiency diagnostic requirements in CARB's OBD regulations. For monitoring of major emission control components (e.g., fuel system, boost control system, EGR system), the CARB OBD requirements generally require malfunction detection when the component degradation or malfunction causes significant emission impacts and emission thresholds are exceeded. However, CARB staff understands that lesser degradation than the OBD threshold for an upstream component may cause degradation/irreversible damage to downstream components (e.g., an EGR cooler leak causing after treatment fouling; fuel system, EGR, or boost system issues causing high engine out PM and filter overloading) without causing significant immediate tailpipe impacts. CARB staff supports measures to identify, maintain and repair such upstream components before consequent damage occurs to downstream components. [EPA-HQ-OAR-2019-0055-1186-A2, pp.73-74]

The NPRM also requests comment on whether fault codes related to the incidents of engine derate due to EGR-related failures should be displayed in the cab as part of the health monitor, similar to what is being proposed for SCR and DPF-related derate issues. CARB staff believes this may be proposed as a larger, more general question regarding a requirement to make OBD and/or health-related information available on the instrument cluster or driver display. [EPA-HQ-OAR-2019-0055-1186-A2, p.74]

CARB staff has concerns about the regulation language in 1036.110 (c)(iii) and (iv). Specifically, these sections require manufacturers to provide 'an indication of EGR valve health, such as by comparing commanded and actual EGR position' and 'an indicator of EGR cooler performance, such as by displaying parameters described in 13 CCR 1971.1(e)(3.2.5).' CARB staff believes the language is vague and does not provide clear direction of what indicators/indication are acceptable. While U.S. EPA provides one example each of the type of indicator/indication that would meet the requirements, there is no direction about what other examples would be considered acceptable. CARB staff recommends that U.S. EPA provide more details about the criteria that must be met to meet these requirements. [EPA-HQ-OAR-2019-0055-1186-A2, p.74]

Organization: *Cummins Inc. (Cummins)*

System Health Monitors (While Cummins is not in support of the System Health Monitors proposal, if EPA does finalize those provisions, changes are suggested here.)

40 CFR 1036.110(c)(3)(i)(C)

Propose to replace the DPF proposal stated here - “The estimated mileage until the particulate filter needs cleaning to remove accumulated ash" language with CARB's DPF language instead - Lifetime counter of PM filter regeneration events (1971.1, Section 5.8.2). [EPA-HQ-OAR-2019-0055-1325-A1, p. 30]

40 CFR 1036.110(c)(3)(i, ii, iii, iv)

Where appropriate (for example, EGR commanded vs. actual parameters), propose for EPA to include the reaction time expectation of data provided on the dashboard (i.e., state whether they expect the instantaneous or filtered versions of these parameters) as different manufacturers may do things differently. [EPA-HQ-OAR-2019-0055-1325-A1, p. 30]

40 CFR 1036.110(c)(3)(i, ii)

Where appropriate, propose that EPA adds more details/clarity on defining the boundaries between current and historical data that is being asked for. [EPA-HQ-OAR-2019-0055-1325-A1, p. 30]

In response to request for comment on including an advance notice/warning to the operator in the event of a plugged DEF line or doser, as opposed to actual tampering, Cummins proposes that EPA consider not including this concept as it is challenging to effectively differentiate blocked DEF line/doser due to direct tampering vs. actual urea crystallization/line plugging. [EPA-HQ-OAR-2019-0055-1325-A1, p. 31]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

Another area of concern with of the proposed off-cycle test procedures is the mismatch between the applicable NOx emissions and the detection capabilities of state-of-the-art OBD systems. Current generation OBD systems are designed and calibrated to detect degradation of emission control systems before such degradation results in tailpipe NOx emission of 0.4 g/hp-hr as measured on the cold/hot FTP, and RMC cycles. This limit was intentionally set higher than the existing applicable emission standards to recognize the limits of detection capability. [EPA-HQ-OAR-2019-0055-1168-A1, p.47]

EPA does not propose any modification to the diagnostics emission limit, and in fact enshrines the current emissions thresholds in its new OBD proposal. EPA is tacitly acknowledging that current technology does not allow for the design of OBD systems with a higher detection sensitivity. [EPA-HQ-OAR-2019-0055-1168-A1, pp.47-48]

Today, manufacturers are protected from in-use liability for failed emissions control components by their OBD systems. With the current emissions thresholds and OBD emissions limits, it is ve1y likely that the OBD system will detect a failure before the system's emissions are significantly increased. These vehicles will be identified and repaired- and would not be tested for compliance while an emissions failure is present. [EPA-HQ-OAR-2019-0055-1168-A1, p.48]

This protection against possible high emitters due to malfunctioning emission control systems is lost with EPA's proposed standards. With the proposed extremely low in-use limits for NOx emissions, manufacturers will be liable for the in-use emissions of vehicles with failed emissions control systems which the EPA acknowledges cannot be detected by OBD systems. [EPA-HQ-OAR-2019-0055-1168-A1, p.48]

EPA's proposal for emissions system health monitoring is likely to cause increased uncertainty, unnecessary repairs, and further operator frustration, rather than resolving these concerns. The Agency appears to believe that its proposal will provide vehicle owners information on the overall health of important emissions systems at a given point in time. However, the information that EPA proposes to make available to operators is neither necessary nor sufficient to make service decisions appropriately, and is not an adequate indicator of the overall health of the system. [EPA-HQ-OAR-2019-0055-1168-A1, pp.76-77]

EPA states in the Proposed Rule that existing OBD monitors and data parameters could be used to communicate to an operator 'how close a system is to exceeding an OBD threshold,' and enable operators to perform predictive maintenance.104 This misunderstands how diagnostics function, and risks the costly replacement of components which have not, and may never, fail. [EPA-HQ-OAR-2019-0055-1168-A1, p.77]

104 Id. at 17,529.

It is important to understand that diagnostic monitors do not report failure degradation in a linear manner, and there is a significant amount of statistical uncertainty that the manufacturer must account for before identifying a part as failed. In Figure 31 below, Daimler Truck shows a typical distribution of test results for an OBD monitor for a 'good part' which is not at risk of failure, and a part which has already failed and should be replaced. Daimler Truck uses here as an example an industry accepted margin of four sigma from the mean result for a good part, and two sigma mean for the failed part, to the fault threshold. This is a standard and accepted practice for evaluating the relative quality of an OBD monitor, and the provided example shows a typical 'target' level of robustness. [EPA-HQ-OAR-2019-0055-1168-A1, p.77]

Under the Proposed Rule, the operator would be presented with a diagnostic result value. EPA expects that if operators saw a value close to exceeding the threshold, they may desire to perform predictive maintenance. However, EPA's proposal would not communicate to the operator what the appropriate threshold for replacement would be—and this example illustrates that functioning systems could report results that are 'close to exceeding the threshold.' Extrapolating, a 'partially degraded' system, which is not failed and not in need of replacement, would be even more likely to report a result 'close to exceeding the threshold.' [EPA-HQ-OAR-2019-0055-1168-A1, p.77]

Manufacturers typically employ a variety of statistical methods to better identify whether parts are failed or not, including debouncing a fault over time, averaging a number of test results, employing exponentially-weighted moving averages, and evaluating the system over multiple key cycles. Similarly, the appropriate threshold at which a part should be replaced might be different at different times, depending on operating and ambient conditions. Additionally, while some components fail in a linear fashion, the vast majority of failures are catastrophic and cannot be predicted by linear degradation of a test result. Operators do not, however, have access to any of that additional information or context. Any decision made to perform predictive maintenance risks replacing components which are not failed and do not need replacement, increasing costs and further undermining public confidence in the diagnostics system, which threatens to further encourage tampering. [EPA-HQ-OAR-2019-0055-1168-A1, p.78]

EPA gives the deviation of actual EGR position from commanded EGR position as an example of information that might be used to evaluate the health of system or to inform a decision to perform predictive maintenance. In modern engines, with smart actuators and digital position control feedback, it is expected that deviation between a desired and actual EGR position should be very near zero. Any deviation at all likely indicates a system that has already failed, and is at risk of significantly damaging the system. Accordingly, it is expected that manufacturers would have already chosen to illuminate the MIL. Our engines, for example, do not expect or tolerate any significant amount of EGR valve position deviation before illuminating the MIL. Additionally, many EGR system failures are not related to EGR valve position deviation but are caused by fouling of the EGR cooler transfer tubes, leaks in the system, or catastrophic failures of other components in the system, which cannot be measured and provided to the operator accordingly. In that matter, EPA's proposal provides no actionable information to the operator, and only serves to add confusion.[EPA-HQ-OAR-2019-0055-1168-A1, p.78]

EPA also proposes that the frequency of passive and active regeneration be provided to the operator, further expecting this could be used to determine system health. Regeneration frequency is heavily dependent on duty cycle and control mechanisms and is not an indication of health of the system or remaining life. During a recent investigation into aging phenomenon, Daimler Truck conducted a survey of more than two thousand heavy-duty engines' electronic data records. All engines were of the same vintage and regeneration control mechanism, and were similar displacements. Daimler Truck found that the average frequency of regeneration varied significantly—with a median frequency of 5,249 miles per regeneration, and a standard deviation of more than 3000 miles per regeneration. With such a wide spread of healthy-system regeneration frequencies, it would be impossible to determine a 'healthy' or 'unhealthy' regeneration frequency—and to do so would risk contributing even further uncertainty to fleet operations. Similarly, one engine manufacturer might choose to perform more-frequent, shorter-duration regenerations than another manufacturer, which would lead to higher 'regeneration frequency' as envisioned under this proposal. [EPA-HQ-OAR-2019-0055-1168-A1, p.78]

Similarly, EPA proposes that manufacturers report on the frequency of passive regeneration events. Passive regeneration is not a discrete event with a target duration or end conditions, and it would be impossible to determine the 'number' of passive regenerations. Passive regeneration is a phenomenon that can occur in some circumstances that the engine enters naturally. Manufacturers can track when the system is in these conditions, and accordingly delay the need for an 'active regeneration'—but these conditions do not require any interaction with system controls and do not contribute to system aging. It would be inappropriate to use the frequency of passive regeneration to make any determinations about the health of the system. [EPA-HQ-OAR-2019-0055-1168-A1, pp.78-79]

Each of EPA's proposed emission system health monitors present similar concerns. While Daimler Truck does not oppose providing the information necessary to diagnose and service our vehicles, EPA must recognize that a one-size-fits-all approach to that information is counterproductive and confusing. For some components, prognostics like the EPA envisions may be possible, but manufacturers must be able to define their own thresholds to indicate such service is appropriate. In many cases, like for many emissions system health monitors, a prognostic is not feasible, and a pass-fail diagnostic is the best available technology. [EPA-HQ-OAR-2019-0055-1168-A1, p.79]

If EPA mandates that this information is available to the operator, the Agency must also recognize in the regulation that parts replaced using this information must not be considered as failed for the purposes of the emissions control system warranty, or for potential defect reporting or, ultimately, recall. Such a cursory evaluation of the system is not appropriate to determine the presence of a warrantable or recallable failure, and EPA should acknowledge this in the final regulations. Manufacturers cannot be held responsible for misinterpretation of generic information that may not indicate a failure. [EPA-HQ-OAR-2019-0055-1168-A1, p.79]

EPA's OBD proposals related to service are unworkable, unnecessary, or incomplete. [EPA-HQ-OAR-2019-0055-1168-A1, p.76]

EPA proposes a variety of new requirements intended to increase the usability of the diagnostics system for the purposes of repair and maintenance of vehicle emissions control systems. Daimler Truck understands the diagnostics-related concerns faced by our customers and the various stakeholders. However, we believe that EPA's proposals are unlikely to streamline or simplify repairs and could lead to increased confusion, uncertainty, and unpredictability concerning repairs, as well as increase cost by driving unnecessary replacement of components that have not failed. [EPA-HQ-OAR-2019-0055-1168-A1, p.76]

The OBD system is intended to detect failures of emissions controls systems at a 'system' level, rather than diagnosing the root cause and/or pointing towards a specific service action. For example, manufacturers are required to diagnose, at a system level, that EGR flow rates do not meet the specified flow expected, or that SCR conversion efficiency has degraded and emissions are increased. These diagnostics do not necessarily identify the root cause of the failure, which could result from a variety of different failure modes. Manufacturer-published troubleshooting procedures are used to identify the specific component that needs repair. [EPA-HQ-OAR-2019-0055-1168-A1, p.76]

Daimler Truck is also concerned with the requirement to present emission system health monitor information in the cab to the operator. Such a proposal ties the certification of the OBD system, and by extension, the engine, to display functions and components (instrument clusters, screens, etc.), which are typically controlled by the vehicle manufacturer. While it is relatively simple to ensure that a vehicle manufacturer will appropriately illuminates a MIL, it is more difficult to ensure the correct transmission of a wide variety of messages. Similarly, this will add expense to traditionally price-sensitive vehicles, which will be required to add digital instrument clusters capable of displaying this information. [EPA-HQ-OAR-2019-0055-1168-A1, p.79]

Organization: *Ford Motor Company (Ford)*

We appreciate that this element of the proposed regulation is intended to provide information to customers about when critical emissions components are expected to fail and to provide forewarning of vehicle inducements. However, we believe that the health warnings as proposed are likely to cause significant confusion for customers and service providers. For example, a customer may incorrectly infer from a health warning that a vehicle component has failed. Such a scenario could result in unnecessary component replacements and elevated levels of warranty claims. [EPA-HQ-OAR-2019-0055-1300-A1, p. 5]

Ford recommends that EPA eliminate the requirement for health monitors on critical emission control systems. We also recommend that EPA shift their focus to existing emission-related service information regulatory requirements found in § 86.010-38(j) as well as the Heavy Duty OBD and Production Vehicle Evaluation testing requirements found in 13 CCR 1971 (l)(1) to ensure that truck operators and qualified technicians have access to comprehensive diagnostic and repair information and that required diagnostic data is properly communicated to generic scan tools. [EPA-HQ-OAR-2019-0055-1300-A1, p. 5]

In addition to ensuring compliance with existing emissions related service information requirements, we believe that truck owners and operators would also benefit from changes to existing EPA guidance on "derate" inducements for component malfunctions that disable EGR. Ford recommends that EPA issue formal guidance recommending that a "countdown" operator notification strategy be implemented for such faults providing operators sufficient time to safely seek proper service before experiencing compromised engine operation. [EPA-HQ-OAR-2019-0055-1300-A1, pp. 5-6]

Organization: *General Motors LLC (GM)*

On-board diagnostic (OBD) systems monitor the performance of an emissions system. If a malfunction is detected, a malfunction indicator light (MIL) or check engine light will illuminate on the dashboard. In some cases where a fault is detected, the operating authority of the powertrain may be restricted to protect system components and occupants, or to lower the likelihood of increased emissions until the vehicle is serviced and the fault is no longer detected. [EPA-HQ-OAR-2019-0055-1246-A1, p.5]

Vehicle operators, through the Owner-Operator Independent Drivers Association (OOIDA), have provided feedback to EPA that faults associated with emissions equipment can disrupt operations.9 [EPA-HQ-OAR-2019-0055-1246-A1, p.5]

> 9 Testimony of Lewie Pugh, Owner-Operator Independent Drivers Association, EPA Virtual Public Hearing (April 12, 2022), transcribed at EPA-HQ-2019-0055, p. 165-168. Available online at https://www.epa.gov/system/files/documents/2022-04/hd-2027-stds-public-hearing-transcript-2022-04-12-day1.pdf

EPA proposes to address this concern by requiring manufacturers to estimate when components will fail, based on OBD information, and to display that information to the operator. This proposed solution is not practicable. [EPA-HQ-OAR-2019-0055-1246-A1, p.5]

Detecting if a fault has occurred is a different task than projecting when a fault will or may occur. Such a requirement would have significant implications to on board communications protocols, data streams, and onboard processors. The volume and esoteric nature of information that would need to be displayed to a driver could be overwhelming, confusing, and distracting. Further complicating this matter, EPA has proposed changes in stringency and useful life over the course of the program, which could require algorithms to be significantly redesigned after just a few years to comply with steps in stringency in some proposals. [EPA-HQ-OAR-2019-0055-1246-A1, p.5]

GM suggests a multi-party workshop, including both EPA and the California Air Resources Board (CARB), on practical ideas to address operator concerns related to fault detection. Many cross-functional problems would need to be solved to successfully address the underlying operator concerns as EPA proposes, including human machine interaction, repair procedures and replacement part specifications, operator training, service training, updates to service and owner's manuals, and the feasibility of prognostics on systems subject to regulations, just to name a few. GM stands ready to work with regulators to address operator concerns related to the MIL, to protect air quality, and to create a great customer and operator experience with equipment in the field. Proposed requirements for prognostics are premature. Prognostics and state-of-health monitors of emissions systems should be a standalone rulemaking given the multitude of cross-functional issues. [EPA-HQ-OAR-2019-0055-1246-A1, p.5]

Organization: *International Council on Clean Transportation (ICCT)*

Having access to SCR, DPF and DEF operational parameters would facilitate preventive maintenance and reduce cost to operators to ensure real world emission reductions over the lifetime of the vehicle. For regulators, access to these parameters would ensure that the data captured during in-use HDV emission testing with Portable Emission Measurement Systems can be correlated with these parameters. This is critical to better understand the emissions profile of each engine family tested as well as to identify potential deviations that may indicate the use of defeat devices. [EPA-HQ-OAR-2019-0055-1211-A1, p. 24]

Organization: *PACCAR, Inc (PACCAR)*

PACCAR is committed to ensuring OBD systems ‘generally detect malfunctions in the emission control system, store trouble codes corresponding to detected malfunctions, and alert operators appropriately.’ 40 C.F.R. 1036.110 Diagnostic controls (proposed). However, PACCAR has identified two primary issues with the proposed system health monitoring provisions that EPA should amend. [EPA-HQ-OAR-2019-0055-1346-A1, p.41]

First, for particulate filter information, EPA proposed to require an ‘[i]ndicator of historical and current active and passive regeneration frequency’ as section 1036.110(c)(3)(B) of the regulations. 87 Fed. Reg. 17414, 17666 (March 28, 2022) (emphasis added). But it is technically infeasible to control or track passive regeneration frequency due to, among other things, temperature and oxygen exhaust concentration variability. This variability would inevitably lead to inaccurate monitoring because the indicator would not be able to record correctly each passive regeneration event. PACCAR therefore urges EPA to remove the proposed passive regeneration frequency indicator requirement. [EPA-HQ-OAR-2019-0055-1346-A1, p.41]

Second, for SCR-related information, EPA proposed to require '[i]nformation describing any detected flow obstruction in DEF lines or dosing valve in anticipation of triggering an inducement.' Id. These proposed requirements are also technologically infeasible and should be withdrawn. The plethora of variables, e.g., ambient temperature at which the DEF freezes, whether there are thawing heaters, etc., makes it impossible to design a function that would accurately assess obstruction information. [EPA-HQ-OAR-2019-0055-1346-A1, pp.41-42]

In addition, PACCAR notes that the cross-referenced CARB citation in proposed 1036.110(b)(6) needs to be corrected. The proposed provision purports to cite to 'testing and reporting requirements' but instead incorrectly cites to engine aging requirements. Id. at 17665 (incorrectly citing to 13 CCR 1971.1(i)(2.3-2.4). EPA should revise the final rule to include the proper citation. [EPA-HQ-OAR-2019-0055-1346-A1, p.42]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EPA's proposal to include health system monitors raises significant concerns. OBD is a diagnostic, not prognostic, tool. Proposing to change the function of OBD without robust consideration and prove-out utilizing input from the entire affected stakeholder community, especially in the timeframe being considered, is not reasonable. Accordingly, we request that EPA defer the finalization of health system monitors, and instead implement a pilot program to provide time to fully evaluate the proposed provisions, including an evaluation of the perceived benefits, along with an assessment of the necessary standardization, demonstration, etc. That would be especially helpful since the proposed requirements could result in the potential for false prognostics being broadcast to operators, leading to more confusion for drivers and service technicians. [EPA-HQ-OAR-2019-0055-1203-A1, p. 96]

We also have concerns with the Agency's proposal to include such health monitors in the cab – presumably on the dashboard. Adding another display to the dash, again without adequate prove-out (or standardization), also could contribute to operator distraction and confusion. (See Exhibit "I") We recommend that EPA focus on existing emission-related service information regulatory requirements found in §86.010–38(j), as well as the Heavy Duty OBD and Production Vehicle Evaluation testing requirements found in 13 CCR 1971.1(l)(1), to ensure that truck operators and qualified technicians have access to comprehensive diagnostic and repair information, and that required diagnostic data is properly communicated to generic scan tools. [EPA-HQ-OAR-2019-0055-1203-A1, p. 96]

To date, OBD requirements have led industry to provide standardized OBD data, and key operator displays. The ISO 2575 F.01 symbol and fault code standards are now ubiquitous across products approved by the Agency and offered for sale to the public. In the NPRM, EPA proposes to require manufacturers to provide health monitors that have no standardization model in SAE

J1939 or J1979 et. al. to support their orderly development and deployment. The implementation timeframe defined in the proposed rule would require engine manufacturers to invent disparate, proprietary communication methods for instrument clusters and dash displays. In many HD vehicles, instrument clusters and dash displays are controlled by the vehicle manufacturers, who would be required to develop new instrument clusters and dash displays to present the new health monitors to vehicle operators. An implementation requirement without supporting communication standards as a guide will lead to multiple inconsistent efforts across the industry, and increased costs and burdens, all while providing little if any appreciable air quality benefit. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 96 - 97]

Accordingly, EMA does not support health monitors as a general matter. Moreover, we strongly disagree with the incorporation of such monitors in the absence of communication standards that would provide the methods that can be used by all manufacturers. Without uniform supporting communication standards, manufacturers would face unacceptable risks due to their differing interpretations and methods for implementing the proposed requirements. We recommend that EPA consult with industry, the SAE Truck and Bus Control and Communication Network Committee, and the Vehicle Electrical/Electronic (E/E) System Diagnostic Standards Committee, prior to finalizing new requirements that would require new communications from the engine to new instrument clusters and dash displays. [EPA-HQ-OAR-2019-0055-1203-A1, p. 97]

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §1036.110(c)(3)(i) through (c)(3)(iii): Many of the terms used throughout these paragraphs do not appear in the current SAE J1939DA protocol. Again, it is requested that EPA consult with the SAE Truck and Bus Control and Communication Network Committee and the Vehicle E/E System Diagnostic Standards Committee to insure each of the items that EPA proposes to request are defined. Specifically: Health monitoring specific metrics are not currently defined in SAE J1939DA. Proposed paragraphs (c)(3)(i)(B) and (c)(3)(ii)(A) refer to "current and historical"; however, the commonly used terms in SAE J1939DA and J1979DA are "lifetime", "trip", and "operating cycle." Furter, the timeframe for the proposed term "current" is not clear for the data items cited (e.g., is a resettable "trip" context intended, or a "start-to-start" operating cycle context intended?). We recommend that any items that are not currently required in 13 CCR 1971.1(h)(4.2) should not be utilized in EPA's regulations. [EPA-HQ-OAR-2019-0055-1203-A1, p. 101]

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §1036.110(c)(3)(i)(B): "(B) Indicator of historical and current active and passive regeneration frequency." Passive regeneration events are not known, and thus should not be required by the regulations. EMA recommends deletion of "and passive" from paragraph (B). [EPA-HQ-OAR-2019-0055-1203-A1, p. 101]

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §1036.110(c)(3)(ii)(C): "(C) Information describing any detected flow obstruction in DEF lines or dosing valve in anticipation of triggering an inducement under §1036.111(b)(2)." This paragraph would require tracking of DEF blockages and actual valve output to determine degradation; however, the DEF hardware may not be able to provide such degradation information. EMA recommends deletion of paragraph (C). [EPA-HQ-OAR-2019-0055-1203-A1, p. 101]

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §1036.110(c)(3)(v): "(v) Provide current data under paragraphs (c)(3)(i) and (ii) of this section based on a default method of updating or resetting collected data. For example, the current data may include information from the Active 100-Hour Array or Stored 100-Hour Array. The system must allow the operator to perform a manual reset to start collecting new data on demand." 100-hour active resets on operator demand are not recommended, as they imply increases in non-volatile memory demand for array resets that cannot be confidently estimated. Writes to non-volatile memory are limited by the technology employed, and multiple non-volatile memory locations are employed to prevent memory locations from overuse. Further, on-demand resets need not include any 100-hour stored values. 13 CCR 1971.1 (h)(5.3.5) and (h)(5.7.3-4) require 100-hour active arrays to reset with a code clear command, and prohibit resets for stored 100-hour and lifetime array values. Inclusion of an operator-initiated 'clear fault' command is also not recommended, as previously noted in these comments. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 101 - 102]

Organization: *Walmart*

We recommend OEMs include in onboard diagnostics and signals like a distance to empty (DTE) display for alternative energy powered vehicles that are commonly found in both ICE and passenger EVs today] [EPA-HQ-OAR-2019-0055-1191-A2, p. 4]

EPA Summary and Response

EPA received adverse comment from Cummins and DTNA on the concept of health monitors with DTNA citing an increase in uncertainty of the status of the emissions system as well as an increase in repairs due to the uncertainty.

CARB expressed general support on this concept, but CARB also stated the need to work with manufacturers on developing this concept further. CARB was concerned about the effects of repairs due to health monitor reporting on warranty claims and suggested that all repairs made from health monitor results should be reported on defect and EWIR reports. CARB also suggested that some of the current OBD monitors could be used as part of the health monitor concept for the DPF and EGR system. CARB supported indicating to the operator when DPF regen was disabled and the reason why as a benefit to operators and repair technicians. They also noted that severe derates generally accompany faults that prevent the DPF system from regenerating. CARB also noted that SCR dosing disabled is a MIL on condition and a fault code would be stored.

Several commenters provided perspectives on EPA's request for comments to improve serviceability of electric vehicles. Commenters were generally supportive of the concepts that EPA requested comment on; several commenters also suggested additional ideas to consider (e.g., new requirements for original equipment manufacturers (OEMs) to provide standard repair time (SRT)).

- See Section IV.C.1.iii of the preamble for the final provisions related to health monitors and our response to these comments.
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  EPA appreciates the comments on serviceability of electric vehicles. EPA requested comment on this topic but is not finalizing at this time serviceability provisions specific to electric vehicles. We may consider this topic in a future rulemaking.

7.3 OBD communication protocol

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

The NPRM requests comment on whether U.S. EPA should finalize provisions to allow the SAE J1979-2 protocol if CARB staff does not finalize their update before U.S. EPA completes the final rule, and on potential challenges with this change. The NPRM also requests comment on the interim provision in 1036.150(v) that would allow the use of J1979-2 for model years before 2027 and the provision in 1036.110(b) that would allow J1979-2 for 2027 and subsequent model years, including whether any additional changes need to be made to the existing or proposed OBD requirements to accommodate the use of J1979-2. CARB staff is supportive of the U.S. EPA proposal to allow the SAE J1979-2 protocol if CARB staff does not finalize its update prior to the U.S. EPA rule. [EPA-HQ-OAR-2019-0055-1186-A2, p.77]

The NPRM requests comment on whether the use of J1979-2 could have negative impacts on the existing U.S. EPA OBD program, and on the potential impacts on the U.S. EPA service information requirements. CARB staff is supportive of the use of SAE J1979-2 and does not anticipate negative impacts on the existing U.S. EPA program, CARB OBD program, or U.S. EPA service information requirements. [EPA-HQ-OAR-2019-0055-1186-A2, pp.77-78]

The NPRM requests comment on how tool vendors would be affected by this J1979-2 proposal, whether they would be able to support the new services and data, and if there are any concerns tool manufacturers have regarding access to vehicle data at a fair and reasonable cost. CARB staff anticipates tool vendors will be able to fully support the SAE J1979-2 protocol at a fair and reasonable price for the vehicle repair industry and consumers. [EPA-HQ-OAR-2019-0055-1186-A2, p.78]

Organization: *Cummins Inc. (Cummins)*

Cummins supports EPA providing an allowance for the J1979-2 protocol but proposes to not include the corresponding 2022 Biennial CARB OBD rulemaking that mandates manufacturers using this protocol to provide support for new and additional requirements like Supplementary Monitor Activity Data (SMAD) requirements, new DataStream/freeze frame requirements, new readiness requirements, new trackers etc. [EPA-HQ-OAR-2019-0055-1325-A1, p.27]

Organization: *International Council on Clean Transportation (ICCT)*

We support efforts that would communicate in natural language and not computer codes the fault conditions that may trigger inducements. Lowering these communication barriers would reduce the impacts of trigger inducements on vehicle down-time. [EPA-HQ-OAR-2019-0055-1211-A1, p. 24]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EMA supports the proposal at 40 CFR 1036.150(v) allowing the option to use J1979–2 for manufacturers seeking EPA OBD approval prior to MY 2027. We further support the interpretation that proposed §1036.110(b) would provide a path for the use of J1979–2 when the proposed program becomes effective. Additionally, EMA recommends that EPA also allow for the use of the SAE J1939 protocol beyond MY 2027. [EPA-HQ-OAR-2019-0055-1203-A1, p. 97]

<u>EPA Summary and Response</u>

EPA received comments from CARB, EMA, ICCT, and Cummins that all supported the provisions allowing the use of SAE J1979-2 communication protocol as early as MY 2022 and to allow the use of SAE J1979-2 after MY 2027. Cummins also commented that EPA should not adopt the 2022 Biennial CARB OBD which mandates new and additional requirements like Supplementary Monitor Activity Data, data stream and freeze frame parameters, readiness requirements, and new trackers.

CARB commented that they do not expect any negative impacts from allowing SAE J1979-2 protocol on tool vendors, and that the tool vendors will be able to accommodate SAE J1979-2 requirements at a fair and reasonable price.

- See our response to these comments and the final provisions in preamble Section IV.C.1.vi.

7.4 Other requirements

<u>Comments by Organizations</u>

Organization: *Allison Transmission, Inc. (Allison)*

EPA has also requested comment with respect to provisions designed to improve diagnosis and repair, specifically whether additional data parameters should be included in the freeze frame data to identify the source of the malfunction more effectively.61 Allison's preference is to ensure that a primary controller such as the engine control module (ECM) stores its own freeze frame and parameter data and other secondary controllers on the vehicle are not required to store data from the primary (i.e., ECM) controller. EPA has set precedent that transmission controllers are comprehensive component controllers that do not need to store other system data, and Allison recommends continuing this approach because it keeps OBD systems simpler and more streamlined. [EPA-HQ-OAR-2019-0055-1231-A1, p.29]

61 Id. at 17,529.

Organization: *American Bus Association (ABA) (1070 and 1308)*

In addition, one of the major issues that many of the motorcoach fleet operators face is the lack of available diagnostic equipment. For each of the engine manufacturers, different diagnostic licensed software is required, in addition to specialized training. Very few motorcoach fleet operators are going to have many of the computers equipped with the requisite software readily available, particularly with those software licenses retailing in excess of $20,000 each. With many motorcoach fleets averaging 5-7 operational units, only the largest operators or the manufacturers will even have equipment capable of diagnosing an emissions control system issue, much less potentially resolving one. As a result, many motorcoach operators have to send their vehicles to the motorcoach manufacturers or to the engine manufacturers. If the generic scan tool is going to be as scarcely available or as costly as the currently diagnostic software, those costs will need to be factored into this rulemaking as well as the cost of increased down time. And any cost savings anticipated by offering the generic scan tool option to delay the derate inducement should be reduced by a factor of the availability of that tool. [EPA-HQ-OAR-2019-0055-1308-A1,p.8]

iv. Self-Heal and Generic Scan Tools – ABA appreciates EPA's consideration but needs more time to review this proposal with motorcoach operators. On face value, the proposal appears meritorious, but it also raises a number of questions. Such as who is to provide the generic scan tools and at what cost? Who is expected to use the tools? Motorcoach drivers have an enormous responsibility in operating their vehicle safely and addressing passenger needs. They are not expected to be vehicle technicians. In addition to a driver shortage, as well as a lack of availability or access to the diagnostic software due to cost, there is also a severe technician shortage in the motorcoach industry. Again, this is a distinction of motorcoach operations versus property-carrying operations. [EPA-HQ-OAR-2019-0055-1308-A1, p.10]

Organization: *California Air Resources Board (CARB)*

CARB staff supports U.S. EPA's proposed additional parameters for CI engines. The NPRM requests comment on whether any additional signals should be included in this list and whether any other signals should be included such as any signals related to maintenance derates (outside of inducements). CARB staff believes it is worth considering expanding parameters where needed to support maintenance and repair of derates outside of inducements. CARB staff also notes that regulatory requirements for additional parameters require engagement with the SAE J1979 and J1939 committees. The regulation must allow sufficient time for the parameters to be developed and adopted into the standards before the requirement can take effect. [EPA-HQ-OAR-2019-0055-1186-A2, p.74]

CARB staff supports U.S. EPA's proposed additional parameters for SI engines. The NPRM requests comment on whether any additional signals should be included in this list and whether any other signals should be included such as any signals related to maintenance derates (outside of inducements). CARB staff believes it is worth evaluating expanding parameters where not currently required by the OBD regulations to support maintenance and repair of derates outside of inducements. CARB staff believes it is also worth evaluating adopting an OBD REAL requirement for NOx emissions based on on-board NOx sensors for spark ignited engines, including those derived from diesel engines. CARB staff also note that regulatory requirements for additional parameters require engagement with the SAE J1979 and J1939 committees. The regulation must allow sufficient time for the parameters to be developed and adopted into the standards before the requirement can take effect. [EPA-HQ-OAR-2019-0055-1186-A2, p.75]

CARB staff has concerns regarding U.S. EPA's statement about the difficulty of accessing many of the signals CARB requires to be made public with a generic scan tool. C ARB regulations require standardization tests (SAE J1699 and SAE J1939-84) on production vehicles to verify the OBD communications are working properly. So, any issues should be detected during these tests and reported to CARB as part of the reporting requirements. CARB staff would like to understand which signals are at issue and if issues were not properly identified through the OBD production vehicle testing and reporting requirements. [EPA-HQ-OAR-2019-0055-1186-A2, p.75]

The NPRM requests comment on U.S. EPA's proposal to require the parameters in CARB's regulation sections 13 CCR 1971.1(h)(4.2.1)(D), (h)(4.2.2)(H), (h)(4.2.3)(F), (h)(4.2.3)(G), and (h)(4.2.2)(I) to be included in freeze frame, and whether additional parameters should be included to more effectively identify the source of malfunction and increase the usefulness of freeze frame data, especially for conditions that result in inducement. CARB staff generally supports additional data where there is an identified benefit to owners, inspectors, or repair technicians. [EPA-HQ-OAR-2019-0055-1186-A2, pp.75-76]

U.S. EPA is proposing to require the DEF dosing test be made available for use with either a generic scan tool or an alternative method (e.g., an option commanded through a vehicle system menu). The NPRM requests comment on whether U.S. EPA should make SCR performance tests available via generic scan tool or other on-vehicle methods, and the need to make other self-tests accessible with generic scan tools to improve in-use emission systems maintenance and performance (e.g., being able to command the evaporative system on spark-ignited engines be sealed to allow for leak testing, ability to perform manual regens for DPF systems). Regarding the DEF dosing test, service shops already have DEF injector tests available using dealer tools or enhanced tools. While it can be difficult to standardize the test commands to support such testing in a generic scan tool, CARB staff supports the idea where standardized tests would be beneficial. Regarding the SCR performance test, however, the SCR system is designed to control emissions over a broad range of speeds, loads, temperatures and NOx concentrations. The shop service procedure for SCR performance may not be as useful as the REAL NOx tracking data primarily due to the limited conditions in the shop environment, since the high load, high speed, and high NOx operating points would not be experienced in the shop. An evaluation conducted under low load, low NOx, and low temperature conditions may lead to an erroneous health assessment or be of limited value. [EPA-HQ-OAR-2019-0055-1186-A2, p.76]

Organization: *Cummins Inc. (Cummins)*

Infrastructure/Scantool

Propose to remove the Over-the-Air (OTA) software reflash requirement from the CARB OBD 2019 requirements since EPA is not planning an updated EPA HD I/M program at the moment. Without an I/M program, the requirement introduces challenges like requiring an increase in ECM storage space as well potential burdensome administrative tasks during subsequent software changes. [EPA-HQ-OAR-2019-0055-1325-A1, p.27]

In Section H (4.2.3) (G) of the 2019 CARB 1971.1 regs, propose to remove specific new scantool reporting requirements (DataStream additions) w.r.t modelled/estimated NH3 storage level on SCR and target NH3 storage level on SCR. There is no benefit to service environment and not required to troubleshoot a vehicle. [EPA-HQ-OAR-2019-0055-1325-A1, p.27]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

To ease operator concerns, EPA includes a variety of new proposals, including emission system health monitors, increasing the number of publicly available data parameters, increasing the freeze frame data, and enabling certain self-testing capabilities for owners. [EPA-HQ-OAR-2019-0055-1168-A1, p.76]

Daimler Truck supports providing increased information in data stream and freeze frame, but only if such parameters are specified by the relevant SAE and ISO standards, and the requirement is updated to reference such standards specifically. This approach has been used for several decades to successfully implement data stream and freeze frame parameters, and EPA should continue to use this approach to specify any expansions in their expectations. Otherwise, EPA risks inconsistent implementation—both in terms of how the information is calculated, and how it is made available to a generic scan tool—which undermines EPA's stated goals for making this information available. [EPA-HQ-OAR-2019-0055-1168-A1, p.76]

Lastly, Daimler Truck is concerned about allowing generic control of service functions, such as the DEF dosing quantity check. Daimler Truck is concerned about allowing external, unverified control of any emissions control components, which might ultimately provide a path for malicious actors to tamper with emissions controls by allowing new paths to command software controls of emissions systems. Additionally, EPA's proposal prevents two-way verification of control—and many service routines have built-in safety and emissions checks before they can be executed. Forcing the system to respond to generic requests from unknown third party tools removes the ability of the manufacturer to verify proper system operation from 'both directions,' so to speak. EPA should also reconsider this aspect of its proposal in light of various functional safety standards, such as ISO 26262, and cybersecurity standards. EPA's proposals create a path of attack that could risk the safety and security of the systems. Manufacturers are already required to provide access to their service tools and directions at a reasonable cost; there is thus no reason to create an alternate diagnostic and control path. [EPA-HQ-OAR-2019-0055-1168-A1, p.79]

In summary, manufacturers are already providing state-of-the-art diagnostics systems, and EPA's proposal creates a secondary, less-effective, and more-problematic method of diagnosing failures that could ultimately lead to more expensive service, greater confusion and frustration, and increased interest in tampering. Manufacturers already have significant motivation to reduce downtime and improve the service experience as much as possible. EPA's proposals do not serve to improve that experience, and will have significant unintended consequences. Daimler Truck recommends that EPA adopt the CARB OBD regulations as proposed, without the added provisions for prognostics and service functions. [EPA-HQ-OAR-2019-0055-1168-A1, pp.79-80]

Organization: *Delaware Department of Natural Resources and Environmental Control (DNREC)*

EPA should not ease measures designed to prevent the avoidance of maintenance or repair costs. Delaware recommends that EPA maintain a robust onboard diagnostics (OBD) program that will ensure OBD continues to accurately detect system failures and vehicle problems can be promptly, proficiently and cost-effectively repaired. [EPA-HQ-OAR-2019-0055-1200-A1, p.3]

Organization: *Great Rivers Environmental Law Center and Dutchtown South Community Corporation (DSCC)*

The undersigned support inclusion of the following requirements in the Final Regulation:

- Mandatory additional maintenance requirements and onboard diagnostics to help combat mal-maintenance and tampering, and to ensure long-term emissions performance. [EPA-HQ-OAR-2019-0055-1323-A1, p.6]

Organization: *International Council on Clean Transportation (ICCT)*

The ICCT supports EPA's decision to harmonize with CARB's OBD provisions for MY 2022 to 2024 and with the intention to expand those signals as listed in the NPRM (FR page 17532). [EPA-HQ-OAR-2019-0055-1211-A1, p. 24]

Organization: *National Association of Small Trucking Companies (NASTC)*

Making it easier for truckers to make repairs themselves using generic scan tools while on the road and truckers or carriers to repair vehicles in-house. Having all inducement-related diagnostic data parameters accessible with generic scan tools, as well as scan tools being capable of removing an inducement condition after repair, would enable truckers to repair emissions systems themselves while on the road, respond to inducements more quickly, perform normal operation with less disruption, and reduce repair costs and wasted time. [EPA-HQ-OAR-2019-0055-1130-A1, p. 3]

Requiring that systems provide more, specific information, including diagnostic codes. Having cab displays that name the condition that triggered the pending or active derate and a countdown timer of the estimated time or distance before the next stage of derating (even if overridden) would give truckers more and better information about inducements as they happen, help them make informed decisions about trip management, repairs, etc., and make the inducement system more tolerable. Coupled with generic scan tools and new capabilities to diagnose and repair emission system problems, this empowers drivers with better information, better tools, and better options. Drivers are more likely to take action when enabled in the ways and by the means proposed. They would know not only the problem, but how to fix it, while better able to manage trip plans and commercial obligations. Moreover, NASTC supports the proposed additional information in owner's manuals, including how to use the OBD system to troubleshoot problems. [EPA-HQ-OAR-2019-0055-1130-A1, p. 3]

Organization: *Owner-Operator Independent Drivers Association (OOIDA)*

Many OOIDA members have the resources and means to maintain their trucks, and prefer doing this work themselves. According to the 2018 Land Line Reader Survey, 73% of owner-operators indicated that they complete minor repairs and maintenance to their truck, engine, and trailer themselves. Most owner-operators have their trucks on a regular maintenance schedule because they recognize the necessity of ensuring their truck is safe to operate on the roadways. The ability to diagnose and fix equipment problems without having to a visit a dealership saves small-business truckers both time and significant money. Unfortunately, many modern heavy-duty vehicles have taken self-maintenance options away from drivers. Newer trucks that incorporate more complex technology and components typically can only be serviced at dealerships, where charges can be hundreds of dollars per hour simply to inspect the engine or perform other routine work. [EPA-HQ-OAR-2019-0055-1266-A1, pp.6-7]

EPA must ensure that the provisions outlined in Section IV, B (Ensuring Long-Term In-Use Emissions Performance) and C (Onboard Diagnostics) are maintained. These provisions would assist drivers who perform their own maintenance and repairs. [EPA-HQ-OAR-2019-0055-1266-A1, p.7]

Following the January 2020 Cleaner Trucks Initiative Advance Notice of Proposed Rulemaking (ANPRM), many truckers told EPA about problems they've experienced and how the agency could work to address them. OOIDA commends the agency for listening to those comments and including provisions in the proposal regarding serviceability, inducement, and self-diagnostic tools that will help drivers better assess their emissions equipment. [EPA-HQ-OAR-2019-0055-1266-A1, p.6]

Further, on-board diagnostic tools and generic self-scan options will help drivers better analyze possible problems without having to make those costly visits to repair shops. [EPA-HQ-OAR-2019-0055-1266-A1, p.7]

Organization: *PACCAR, Inc (PACCAR)*

PACCAR supports having trained technicians perform DEF dosing diagnostic testing under proper conditions. But proposed section 1036.110(c)(2) would require that '[d]iagnostic testing to measure the effectiveness of DEF dosing . . . be made available for use with either a generic scan tool or an equivalent alternative method (such as an option commanded through a vehicle system menu). (emphasis added). This proposed provision is problematic for a number of reasons. [EPA-HQ-OAR-2019-0055-1346-A1, p.42]

Currently, trained technicians ensure proper conditions before conducting DEF dose diagnostic testing. Requiring generic scan tool or equivalent testing would lead to testing that is conducted under improper conditions, e.g., the catalyst must be at the appropriate temperature to ensure proper dosing, and misuse. Both scenarios likely will cause engine, catalyst or other systematic damage, which would have an adverse impact on emissions. PACCAR therefore submits that the risks associated with the DEF dosing diagnostic testing proposal significantly outweigh any purported benefits. EPA should revise its proposal to remove the DEF dosing diagnostic testing requirement and leave such testing to trained technicians. [EPA-HQ-OAR-2019-0055-1346-A1, p.42]

Organization: *Roush CleanTech (Roush)*

We believe that the added data stream items in 1036.110(b)(10) would more appropriately developed in conjunction with ARB and SAE for incorporation in 13 CCR 1971.1 and SAE J1979 and J1939, which would then be incorporated in EPA regulation by reference. We do not believe there is any benefit in including these requirements in this NPRM, or in EPA having unique federal-only data stream requirements. If EPA does wish to pursue unique federal-only data stream requirements, we would suggest at minimum adopting the framing language included in ARB 1971.1(h)(5), ensuring parameters are defined and implemented consistent with J1979 or J1939 standards, and including definition on when parameters should be tracked, when they may or should be reset, whether they should be paused during failure conditions, etc. [EPA-HQ-OAR-2019-0055-1276-A1, p.6]

Roush believes the discussion of making inducement-related information available to the vehicle operator for the purpose of potentially resolving inducements as they occur is valuable. We have no strong opinion on this issue as we are not principally involved in systems using inducements. However, we do have concerns relating the continuing language regarding potentially requiring other manufacturer-specific diagnostic functions to be available on generic scan tools or by on-vehicle request. We believe there is already a very robust industry dialog with EPA, ARB, and SAE, including both auto manufacturers as well as service tool providers, on defining requirements for generic scan tools. If EPA wishes to explore adding functions to GST, there is no need to burden the current proposed rule; simply raise the issue for discussion in the existing forums where practical implementation requirements and timeline could be developed. Regarding on-vehicle requests, we caution that typical off-board intrusive tests are designed under the assumption they are only performed by qualified personnel in controlled environments as part of a documented service procedure while physically connected to a service tool; making these tests available to untrained users outside of the service environment would likely require significant redesign to ensure they are performed safely, and do not potentially constitute adjustable parameters or defeat devices which would be in violation of other areas of the regulation. We would suggest limiting such requirements to those items which disable vehicle function and for which the operator has a reasonable ability to perform roadside repair without special tools or parts; otherwise it seems unclear what benefit is offered. [EPA-HQ-OAR-2019-0055-1276-A1, p.7]

Organization: *Truck and Engine Manufacturers Association (EMA)*

There is a similar concern regarding the diagnosis of multi-bed catalyst systems. SwRI has suggested that partial-volume OBD monitoring strategies might be deployed for configurations similar to the Stage 3 prototype system. However, OBD-certification staff have refused to approve partial monitoring strategies when proposed previously by some OEMs. EPA will need to clarify whether there has been a change of policy to account for the advent of systems such as those used on the Stage 3 engine. [EPA-HQ-OAR-2019-0055-1203-A1, p. 95]

EMA does not support the proposal to use a generic scan tool to measure the effectiveness of DEF dosing. Without either an established industry protocol (e.g., SAE), or a requirement that generic scan tools meet such a common protocol, this proposal sets the stage for varied testing among the various manufacturers, and potentially, safety concerns from using an unregulated generic scan tool with a system that is, necessarily, sealed. Further, regarding the request for comment on whether EPA should make SCR performance tests available via generic scan tools (or another on-vehicle method), EMA does not support this proposal. Making SCR performance tests available via either of those methods is not workable, as it would be extremely challenging for the Agency to develop a robust, standardized public SCR performance test that would fit multiple manufacturers' aftertreatment configurations. [EPA-HQ-OAR-2019-0055-1203-A1, p. 97]

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §1036.110(c)(2): "(2) Diagnostic testing to measure the effectiveness of DEF dosing must be made available for use with either a generic scan tool or an equivalent alternative method (such as an option commanded through a vehicle system menu)." The proposed provision would require an on-demand test triggered by either a generic scan tool or a vehicle input to perform a DEF dosing test. We recommend deletion of this provision, as such a test could potentially damage the catalysts and may take an especially long time to run until the conditions necessary to actuate the DEF are correct. Further, making this control function available for anyone with a generic scan tool is not recommended due to safety concerns, negative impacts to air quality (e.g., NOx emissions, DEF spill, ammonia slip, etc.), and the potential for errors in conducting service procedures (and associated additional service actions and increases in repair costs). (See Exhibit "G.") [EPA-HQ-OAR-2019-0055-1203-A1, p. 101]

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §1036.110(b)(8)(i): "(i) Data parameters specified in 13 CCR 1971.1(h)(4.2) and (4.3)." We note that 13 CCR 1971.1(h)(4.3) provides the complete description of freeze frame contents; the reference to subsection (h)(4.2) is not needed and should therefore be deleted. Moreover, expanding the freeze frame to include all of the data defined in (h)(4.2) will significantly increase the non-volatile ECU memory needed to store freeze frames. The SAE J1979-2 specification expands the required number of freeze frames from one to ten per ECU. For ECUs that are at or near their maximum capacity of non-volatile memory, this would drive new ECU hardware (a costly and long-lead time change.) We believe the parameters defined in (h)(4.3) are adequate and appropriate for servicing vehicles. If EPA believes additional parameters are required, those specific parameters should be identified in order to minimize the impact to limited non-volatile memory. We estimate an increase of around 500 bytes of data for this additional data, or a total of five kilobytes per ECU to account for the ‘ten freeze frames per ECU’ requirement for J1979-2. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 99 - 100]

EPA Summary and Response

Summary:

EPA received general support for requiring additional OBD data parameters from Great Rivers Environmental Law Center, DSCC, DNREC, OOIDA, and NASTC, stating the proposed requirements would reduce mal-maintenance, tampering, and ensure long-term emissions performance due to an increase in information available to repair technicians, vehicle operators, and fleets.

CARB also supported the proposed additional data parameters that aid diagnosing and repair of errors that cause derates but are not also inducements, where this information is useful for repair service. CARB suggested to adopt the OBD REAL requirements for NOx emissions based on on-board NOx sensors for SI engines.

Cummins proposed to remove the requirement in 2019 CARB 1971.1 of modeled and actual NH3 storage on the SCR, stating that there is no benefit in a service environment and this information is not required for troubleshooting vehicle problems. Cummins also proposed to remove Over-the-Air software reflash requirement from the 2019 OBD requirements stating that EPA is not planning an updated EPA HD I/M program and stating that this requirement introduces challenges such as an increase in ECM storage space and burdensome administrative tasks during subsequent software changes. CARB commented that requirements in the preamble of this rule that proposed spark ignition (SI) component temperatures that engage thermal protection modes are made available publicly, but this requirement was not reflected in the proposed regulations. CARB commented that they would like to work with the EPA to understand the problems found where publicly available data parameters were not available on a GST.

Roush, Allison, and DTNA all commented that additional data parameters are not required. Allison specifically requested that each control module store its own freeze frame and parameter data and there be no cross storage of system data. Roush and DTNA commented that if additional data parameters are adopted in the final rule, the framing language in 1971.1(h)(5) should be adopted and that the parameters should be defined and consistent with J1979 or J1939 definitions. DTNA further commented that repairs should be performed by professional technicians.

Cummins commented that SI requirements in 1036.111(b)(10)(i) need to be clearly defined, either more generically to allow other modes specified in this regulation to cover the requirement or more specifically in the context of the three modes (throttle, engine protection, or catalyst protection).

EPA received comment from ABA on the lack of availability of generic scan tools (GST) due to cost and lack of choice. They commented that the lack of availability of GSTs creates a dependence on the manufacturer developed diagnostic tools for which licensing can cost up to

$20,000 and this is cost prohibitive, especially for fleet operators that maintain vehicles from multiple manufacturers. ABA also commented that the cost of diagnostic tools and repair time should be included in the rule.

EPA received comment from EMA and CARB on additional parameters for freeze frame data. EMA commented that expanding freeze frame parameters in 1971(h)(4.3) to include 1971.1(h)(4.2) should be deleted since expanding the freeze frame parameter requirements to include all of 1971.1(h)(4.2) would increase nonvolatile ECU memory needed and that 1971.1(h)(4.3) is adequate for service requirements. CARB supported additional freeze frame parameters, but only where there is an identified benefit to owners, inspectors, or repair technicians.

EMA commented on the need for clarification on if a change in policy has been made to allow certification of OBD partial monitoring strategies for multi-bed catalyst systems as they have not been approved to date.

EPA received negative comments from DTNA, PACCAR, Roush, and EMA for the requirement of a DEF dosing and SCR test due to complexities in the manufacturing and operation of these systems. OOIDA and NASTC commented and both supported the requirements for a DEF dosing and SCR test, stating that it would aid operators and fleets in diagnosing errors in aftertreatment systems.

CARB commented that the DEF dosing and SCR tests are available with some manufacturer developed diagnostic tools and supported the requirement for these tests to be available on GSTs if these tests would be beneficial to operators and fleets.

CARB commented on an incorrect reference in the proposed 40 CFR 1036.110(c)(4) that should have referenced 40 CFR 1036.110(b)(10).

Response:

As explained in preamble Section IV, EPA is finalizing the additional parameters consistent with the existing CARB requirements for generic scan tools according to 13 CCR 1971.1(h)(4.2). The focus is on aftertreatment repair and derated engines; it is not clear what Allison's specific concern or request is.

EPA did not propose adopting OBD REAL requirements for NOx emissions based on on-board NOx sensors for SI engines and is not finalizing this requirement. We look forward to working with CARB, potentially in a future rulemaking, on this topic.

EPA appreciates the comments from DNREC, DSCC, ICCT, OOIDA and NASTC in support of adopting robust OBD requirements that help combat mal-maintenance to ensure long-term emissions performance. EPA is confident our requirements meet these goals.

EPA did not propose and is not finalizing changes to the Over-the-Air (OTA) software reflash requirement or other changes requested in Cummins' comment. EPA may consider changes to reduce OBD burdens as appropriate in a future rule.

EPA appreciates CARB's, Roush's, and DTNA's concerns that sufficient time is needed to adopt parameters through SAE and has finalized these requirements for MY 2027, as further explained in preamble Section IV. Many, if not all, of these parameters are from J1939 today. We appreciate CARB's support of additional data parameters and freeze frame data to improve serviceability experiences. We have finalized a reduced set of data parameter and freeze frame requirements from those proposed after further consideration, see section IV.C.1.iii of preamble for further discussion. Further, we appreciate Roush's concerns about adopting the framing language included in ARB 1971.1(h)(5), ensuring parameters are defined and implemented consistent with J1979 or J1939 standards. That was EPA's intent and we have clarified this in 40 CFR 1036.

EPA does not control GST availability or design. These requirements are designed to ensure that manufacturers make a sufficient number of critical emission parameters available for GST manufacturers to read and incorporate into their design if they choose to. Generic scantools for heavy-duty products are available today in a variety of combinations and with varying levels of capability. EPA has finalized these requirements to improve the availability of such data to GST manufacturers, which will likely provide operators with more information to help diagnose critical emission system failures, especially those resulting in derates. GSTs are not a substitute for OEM tools, rather, they are a lower cost alternative and will not have the full capability of OEM developed tools developed for specific applications. EPA has appropriately not included the cost of these tools in the cost analysis for the final program. These tool purchases are optional and assist an owner or operator to troubleshoot issues in the case an owner or operator chooses to investigate issues themselves.

EPA appreciates the comments from CARB, EMA, PACCAR, Roush, DTNA, OOIDA, and NASTC on DEF dosing and SCR tests. After consideration of comments and consideration of the complexity of robust implementation, we are not taking final action on these requirements at this time.

EPA appreciates EMA's comments on freeze frame data and we have revised our final requirements from those proposed to reflect a more limited set of parameters more in-line with our intent, see preamble Section IV.C.1.iii. for further information on these revisions.

Regarding EMA's comment on clarifying the policy of EPA on certifying partial OBD monitoring strategies for multi-bed catalyst systems, at this time EPA is not making any policy changes on certifying partial OBD monitoring strategies for multi-bed catalyst systems. However, we intend to continue assessing this issue as technology advances and these systems become more prevalent.

7.5 Other comments on OBD

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

The NPRM requests comment on whether to allow manufacturers to use onboard emission sensors to help reduce testing burden associated with OBD certification, specifically on ways to reduce test cell time associated with component threshold testing (e.g., ways to use NOx sensor data instead of test cycle NOx measurements). While CARB staff does not have a proposal, CARB staff is supportive of evaluating additional ways to use tailpipe emission sensors to reduce engineering and testing burden associated with OBD certification and other certification requirements while maintaining effective programs. [EPA-HQ-OAR-2019-0055-1186-A2, p.78]

Organization: *Cummins Inc. (Cummins)*

Durability Demonstration Testing (DDE)

Instead of the use of tailpipe emissions sensors to reduce cert burden, propose that EPA introduces flexible, less prescriptive testing methodologies in the current test cell environment and allow manufacturers to exercise engineering judgement during demo testing. This would include running a subset of demo diagnostics using representative hardware (less aged systems) meeting the intent of regulators, through unofficial/manufacturer-directed test procedures and simulation analysis where appropriate, to come up with the demo results for certification. [EPA-HQ-OAR-2019-0055-1325-A1, p. 29]

Organization: *Oshkosh Corporation*

EPA notes comments received on its Advanced Notice of Proposed Rulemaking (ANPRM) regarding opportunities to utilize on-board NOx sensors in lieu of pre-certification test data for OBD compliance in certain circumstances, and the Agency requests further comment on whether and how such sensors could be used to help reduce test burden associated with OBD certification. See Proposed Rule, 87 Fed. Reg. at 17,528, 17,535. As noted above, Oshkosh supports the use of on-board sensors for demonstrating OBD compliance. We welcome the opportunity to work further with EPA to evaluate appropriate reporting options for this scenario, including options to gather certain data from the trucks while in operation to provide assurance that monitors and emission control systems are adequate for the vehicle application.[EPA-HQ-OAR-2019-0055-1226-A1, p. 4]

Organization: *Roush CleanTech (Roush)*

Roush believes the use of tailpipe emissions sensors or other robust technologies in order to determine failure based on actual rather than inferred emissions could be promising, and could eventually lead to reduced costs (after the initial increase in costs associated with ensuring the change does not result in backsliding). However, we believe this is well outside the scope of what could realistically be implemented in the required timeframe of this proposed rule and believe EPA should not consider this change as part of this regulation. [EPA-HQ-OAR-2019-0055-1276-A1, p.7]Organization: Truck and Engine Manufacturers Association (EMA)

EPA requests comment on whether and how to allow manufacturers to use onboard emission sensors to reduce test burden associated with OBD certification, and specifically with regard to a reduction of the test cell time associated with component threshold testing. The Agency suggested use of NOx sensor data instead of test cycle NOx measurements. [EPA-HQ-OAR-2019-0055-1203-A1, p. 98]

Tailpipe NOx sensors are not a replacement for test cycle measurements. EMA would instead recommend that EPA provide flexible, less prescriptive testing methodologies in the current test cell environment, and allow manufacturers to exercise good engineering judgement during demonstration testing. [EPA-HQ-OAR-2019-0055-1203-A1, p. 98]

EPA has requested comment on opportunities to reduce the OBD compliance and certification costs of the federal program through the use of modeling or calculation-based methods to replace testing requirements. That request also references test-out provisions. However, it is unclear if EPA is seeking comment on potentially eliminating test-out provisions. More clarity is needed regarding this request, and regarding the potential provisions to reduce compliance and certification burdens. [EPA-HQ-OAR-2019-0055-1203-A1, p. 99]

Organization: *Volvo Group*

The Volvo Group appreciates the following EPA Onboard Diagnostic flexibility comments. "... whether and how to allow manufacturers to use onboard emission sensors to help reduce test burden associated with OBD certification" (87 FR at p. 17535) "…alternative methods to use onboard emission sensors that could be used to generate and provide real-world data that may enable improved diagnostics, assess the function of emissions critical components and assess the implementation of dynamic AECD inputs." (87 FR at p. 17535) [EPA-HQ-OAR-2019-0055-1324-A1, pp. 5 - 6]

Future optional concepts could simplify diagnostics, deterioration factor testing, and in-use testing based on future NOx and PM sensor performance and durability. [EPA-HQ-OAR-2019-0055-1324-A1, p. 6]

EPA Summary and Response

EPA received comments from CARB, Oshkosh, Volvo that gave general support to reducing test burden by utilizing onboard sensors and diagnostics to provide real-world emissions data of high enough quality to reduce the amount of prescriptive testing.

Roush commented that they support the idea of reducing test burden by utilizing on-board sensors and diagnostics, but they also proposed to not finalize these requirements as the implementation timeline is not feasible for this rulemaking.

EMA and Cummins both proposed an alternate method of reducing test burden without using on-board sensor or diagnostics. They proposed to use less prescriptive test methods, including the use of systems that are less aged but meet the intent of the regulations, and unofficial/manufacturer determined test procedures.

- While we requested comment on this topic, we are not finalizing the provisions to reduce test burden suggested in these comments at this time. EPA appreciates the comments on this section and looks forward to further discussions with stakeholders on such topics.

8 Inducement

8.1 Concept of speed derates for named fault conditions

Comments by Organizations

Organization: *American Bus Association (ABA) (1070 and 1308)*

Further, ABA does not believe EPA properly accounted for the costs associated with its flawed inducement policy and design strategy, even with the Proposals provisions to address this issue which in many ways seem aspirational. [EPA-HQ-OAR-2019-0055-1308-A1, p.8]

Unfortunately, when ABA has raised these issues with EPA, the Agency has admitted it has not collected sufficient data on the issue of fleet related reliability issues or equipment availability. Still, EPA has proposed codifying several inducement provisions in the Proposal, in an effort to address concerns raised, while still intending to “appropriately motivate or restrict certain types of human behavior.” ABA believes, in general, several of EPA’s proposed principles make sense, IF they are actually put into practice and work and are not simply aspirational. For example, establishing a consistent inducement policy among all engine manufacturers, fundamentally makes sense. Below, ABA provides additional feedback on specific proposed principles/provisions:

Finally, in addition to feasibility and costs, a major concern of the motorcoach industry is engine reliability and EPA’s inducement policy. The ABA does not believe EPA sufficiently understands the scope of the problem or adequately addresses the issue in the Proposal, particularly when the proposed new standards and testing cycles have the potential to exacerbate the derate issue. [EPA-HQ-OAR-2019-0055-1308-A1, p.8]

First and foremost, EPA needs to clearly recognize that their SCR inducement policy is a problem, and not describe it as a “mix of incentives and behaviors.” (Notice, Section IV.D.) It is a serious and costly problem for the motorcoach industry. The EPA inducement policy creates undue safety risks for drivers, passengers and other roadway users. The comments referenced in the Notice repeatedly note that EPA’s inducement policy leads to vehicles, and thus people, stranded or parked along a roadway. This is particularly a hardship and safety hazard for the motorcoach industry. In addition to carrying the precious cargo of human lives, unlike the property carrying industry, the motorcoach industry does not have the same flexibility or accessibility to equipment to easily replace a stranded vehicle or find a service repair station. Further, the timeframes for reacting to and/or resolving a derate situation are unreasonable. Also, in terms of timing, as there is currently a driver shortage in the motorcoach industry, limits on the hours a driver is able to drive coupled with time to address a derate issue, further challenges motorcoach operations in the face of the inducement strategy. [EPA-HQ-OAR-2019-0055-1308-A1, p.9]

It is also not a problem solely related to the amount or quality of diesel engine fluid or DEF. Engine inducements or derates deriving from DEF-related triggers are problematic; however, as the comments highlight, DEF-related issues are not the only triggers for derates. Derates can occur from software glitches, loose wiring, faulty sensors, cold temperatures and so forth. Also, troubling, is the lack of consistency in inducement design among engine manufacturers. Regardless of whether it be a DEF-related inducement or other trigger outside of the operators' control, derates are a prevalent and costly occurrence in the motorcoach industry, that raises serious safety and economic concerns. EPA's inducement policy, ABA believes, again highlights EPA's lack of understanding of the motorcoach industry, a key stakeholder subject to its emissions control program. Inducements or derates lead to increased safety risks and often unnecessary operating costs, and loss of business credibility and good will. ABA and other motorcoach stakeholders provided survey results to the EPA, featuring the responses of a variety of fleet operators (Dated Oct. 15, 2021) to their experiences with SCR systems and derate conditions. A couple of highlights to note from that survey:

* 94.66% have had some kind of emissions-related repair issue.

* 92.2% have had an emissions-related issue occur mid-trip.

* 94% experienced a forced regeneration. Required with special software not available at most shops.

* 72.6% had to tow a bus to a facility as a result of an emissions-related breakdown.

* The cost of a tow and related repairs is estimated to average around $7500-8000 per instance.

* 75.8% said that their emissions related breakdown was a result of a faulty sensor. [EPA-HQ-OAR-2019-0055-1308-A1, p.9]

Overall, ABA would prefer to work with EPA further to ensure an adequate body of data is made available to inform development of proposals concerning derates, and believes the Proposal is too rushed. We do see potential value in terms of relief from derate burdens if they work as intended. Yet would like to work with EPA to explore additional relief options such as the voluntary application of auxiliary emission control device's (AECD) on previous model year engine's dating back to 2008 to help mitigate existing issues with faulty derate inducements. As to the specific questions EPA seeks comment on under the inducement strategy section, Section IV. D., ABA will consider providing additional input through supplemental comments. [EPA-HQ-OAR-2019-0055-1308-A1, pp.10-11]

Organization: *American Lung Association et al.*

Ensure pollution benefits are not reduced by credits or tampering. US EPA should work with California to develop a national approach to ensuring meaningful operator inducements to correct emission control failures in a timely manner and to protect against tampering with emission control systems. [EPA-HQ-OAR-2019-0055-1271-A1, p.3]

Organization: *American Trucking Association (ATA)*

While ATA cannot address every aspect of HD2027, we are supportive of the underlying environmental objectives and several of the elements being proposed. ATA's areas of support include: Modifications to the derate schedule are justified to improve access to repair facilities and avoid unsafe operating speeds. [EPA-HQ-OAR-2019-0055-1326-A1, p. 3]

The industry wholly understands EPA's rationale behind low-speed derates. To be perfectly clear, neither fleets nor drivers wish to experience derate episodes which have the potential to create both safety and delivery concerns. Yet, following more than a decade of experience, derates are still occurring at unexpected rates. In surveying fleets, the reasons behind derates do not involve inadequate DEF levels or quality, but rather include a variety of reasons such as:

• Sensor, parts, and wiring harness failures

• DEF quality, heaters, headers, dosers, coolers, and pump /level issues

• Bad pin connectors

• EGR coolers

• Aftertreatment Control Modules [EPA-HQ-OAR-2019-0055-1326-A1, pp. 17 - 18]

ATA supports EPA's efforts to modify the current derate schedule. ATA member companies, in response to the survey included as Appendix A, have indicated this modification should ensure adequate time for drivers to reach repair facilities while avoiding operating at unsafe speeds and/or the need to have the vehicle towed, which can add thousands of dollars to the cost of repair. Other considerations include providing adequate time for vehicles operating in remote areas to reach repair facilities as well as allowing drivers to finish their deliveries should the in-cab display appear during a shift. The proposed modification will also provide fleets with added time to access preferred repair facilities as opposed to the limited choices they may have under the existing 5-mph derate schedule. [EPA-HQ-OAR-2019-0055-1326-A1, p. 18]

Organization: *American Truck Dealers (ATD)*

ATD does not oppose the codification of existing guidance that SCR-equipped HDEs require power derating when SCR is not being properly used. Power derating has proven generally to be a reasonable and effective means to ensure that operators perform critical emissions related scheduled maintenance on the SCR system and that HDEs be operated using quality DEF.15 At the same time, ATD is concerned that improperly functioning SCR derate inducements can lead safety issues or to operator tampering. [EPA-HQ-OAR-2019-0055-1321-A1, p. 7]

15. Id at 17539.

EPA is proposing to require inducements to ensure that SCR systems are designed to be tamper-resistant, thereby reducing the likelihood that they will be circumvented. In addition, EPA is proposing to require monitoring of certain emissions-related components, and the triggering of an inducement if tampering is identified. NADA generally agrees with EPA that a standard list of tampering inducement triggers would aid owners, operators, and fleets in the repair of their vehicles by reducing the cost and time required to diagnose the reason for inducement. At the same time, ATD echoes the concern raised by EMA with respect to revisions to SCR inducement strategies and to allowed minimum maintenance intervals. [EPA-HQ-OAR-2019-0055-1321-A1, p. 7]

Organization: *California Air Resources Board (CARB)*

The NPRM requested comments on the proposed SCR derate schedule. CARB staff has serious concerns regarding the proposed inducement strategy for the SCR aftertreatment system and believes significant changes are needed to prevent unacceptable weakening of the SCR inducement requirements and the corresponding erosion of emissions benefits. The NPRM rightly states that 'operating an SCR-equipped engine without DEF would cause NOx emissions to increase to levels comparable to having no NOx controls at all.' A 2013 report by CARB staff showed vehicle NOx emissions increasing egregiously when DEF is depleted, contaminated, or tampered with, such that NOx emissions were six to ten times higher than baseline emissions.150 Thus, the proper function of the SCR aftertreatment system depends on an adequate supply of high-quality DEF and is critical to the control of NOx emissions from late model HD diesel trucks. [EPA-HQ-OAR-2019-0055-1186-A2, pp.88-89]

> 150 California Air Resources Board, Field Evaluation of Heavy-duty Diesel NOx Control Strategies, January 2013. https://ww2.arb.ca.gov/sites/default/files/2020-05/ADA__scr-field-eval_report-final.pdf

Over the last twelve years, the manufacturer’s guidance document, CISD-09-04R,151 and the joint U.S. EPA and CARB July 2010 workshop152 provided the structure and guidance for SCR inducement strategies to maintain an adequate supply of high-quality DEF to the SCR aftertreatment system and discourage tampering. As with the past joint effort on SCR inducement strategies, we request that U.S. EPA staff work together with CARB staff prior to the Final Rule to develop a unified national approach to inducements for indicated SCR system component malfunctions that would ensure that the SCR aftertreatment systems are functioning properly and are not tampered with, while also addressing truck fleets’ concerns regarding misdiagnosed malfunctions that lead to improper inducement. [EPA-HQ-OAR-2019-0055-1186-A2, p.89]

> 151 United States Environmental Protection Agency, Revised Guidance for Certification of Heavy-Duty Diesel Engines Using Selective Catalyst Reduction (SCR) Technologies, December 30, 2009. https://dis.epa.gov/otaqpub/display_file.jsp?docid=20532&flag=1
>
> 152 California Air Resources Board, Selective Catalytic Reduction Workshop, July 20, 2010. https://ww2.arb.ca.gov/sites/default/files/2020-05/ADA__workshop--2010-07-20--scr--presentation.pdf

The current strategies for SCR inducement are based on CISD-09-04R and a joint U.S. EPA and CARB July 2010 public workshop that explained the guidance with detailed examples of inducement strategies that could be used. Since the details of this joint July 2010 workshop are absent from the NPRM discussion, the following summarizes the examples given at the workshop to guide manufacturers in their design of current SCR inducement strategies. [EPA-HQ-OAR-2019-0055-1186-A2, p.89]

For DEF level problems, the workshop example given to manufacturers was to warn the operator (either via audible or visible indicators, or both) of low-DEF levels before inducement so the operator has time to refill the DEF tank prior to activating inducement. If the operator does not proceed to address the DEF fill level, the first step of the inducement is initiated. CISD-09-04R provides guidance for 'progressing to further degradation that could include operation of the engine being disabled or severely restricted, implemented in a manner designed to prevent operation without DEF'. When DEF is almost depleted, the operator is warned again before a final inducement of 5 miles per hour maximum vehicle speed or no power to the vehicle or idle only is initiated. This final inducement would only occur at a safe harbor condition so as not to cause any safety concerns.[24] [EPA-HQ-OAR-2019-0055-1186-A2, pp.89-90]

For DEF quality and tampering problems, the workshop provided guidance that manufacturers needed to detect the problem within one hour and to notify the operator immediately. If after four hours the issue is not resolved, the operator would be warned again before initiating final inducement down to 5 miles per hour maximum vehicle speed or no power to the vehicle or idle only, which would only occur under safe harbor condition. Again, at each step of the inducement, the driver should be warned both audibly and visibly of the consequence of not taking action to correct the problem. Once the problem is corrected, the workshop guidance allowed for exiting the triggered inducement (self-healing) so that the vehicle can return to normal function. [EPA-HQ-OAR-2019-0055-1186-A2, p.90]

To give the operator warning of the inducement, CISD-09-04R and the workshop provided guidance to the engine manufacturer to give multiple driver warnings, either via visible or audible indicators, or both, before the initial inducement step and at each step of inducement. [EPA-HQ-OAR-2019-0055-1186-A2, p.90]

Two reports prepared by CARB staff subsequent to the workshop, in 2011,153 and 2013,154 contain detailed descriptions of the actual driver warning protocol used by several engine manufacturers. These reports showed that the vehicle operators received various visible warnings through the electronic driver information display, flashing or illuminated dash lights, and/or check engine light. The electronic display provided details of each step of the inducement, including a countdown to the remaining miles for final inducement, and was often accompanied by single and periodic audible chimes. Based on the guidance and 2010 workshop and description of actual driver warning protocols used by manufacturers, it is clear that inducement due to SCR is not required to and should not happen suddenly and without warning. On the contrary, multiple visible and/or audible warnings were required and implemented to provide

[24] CARB refers to "safe harbor" as a condition a vehicle is in prior to an inducement being applied, such that the application of an inducement would not cause a safety concern. Examples include at the time of refueling, when a vehicle is parked or at idle, or prior to a vehicle being restarted.

adequate warning before inducement and hence to alleviate potential safety concerns for the operator. [EPA-HQ-OAR-2019-0055-1186-A2, p.90]

153 California Air Resources Board, Heavy-duty Vehicle Selective Catalytic Reduction Technology Field Evaluation, May 2011. https://ww2.arb.ca.gov/sites/default/files/2020-05/ADA__scr-field-eval_report.pdf

154 California Air Resources Board, Field Evaluation of Heavy-duty Diesel NOx Control Strategies, January 2013. https://ww2.arb.ca.gov/sites/default/files/2020-05/ADA__scr-field-eval_report-final.pdf

Over the last twelve years, as the inducement guidance has been implemented by engine manufacturers, U.S. EPA and CARB staff have monitored the impacts of these inducement strategies and gained experience with what worked and what did not work. We must remember the overall goals of SCR inducement strategies: i.e., to ensure compliance with NOx emission standards by inducing operators to use high-quality DEF and fix faulty DEF related components, and by discouraging any tampering of the system. In achieving these goals, consideration should be given to owners and operators, whose livelihoods depend on functional vehicles and to their desires to reduce false inducements, reduce costly repairs, and avoid inducements causing safety concerns. Nonetheless, we must ensure that any changes do not significantly reduce the effectiveness of today's inducement requirements. Any changes to today's inducement requirements must still require timely repair to SCR systems that are not functioning properly, and prevent excess NOx emissions. Thus, U.S. EPA and CARB staff should work together to make changes that would reduce inducement impacts on vehicle owners and drivers while still maintaining the effectiveness of inducement strategies to minimize air quality impacts. CARB staff believes U.S. EPA's NPRM proposal does not strike the correct balance between protecting air quality and being sensitive to the needs and desires of vehicle owners and operators. On the contrary, in an effort to respond to vehicle owner and operator concerns, U.S. EPA's NPRM proposal goes too far in impermissibly weakening and dismantling today's effective inducement requirements. [EPA-HQ-OAR-2019-0055-1186-A2, pp.90-91]

The NPRM notes that the majority of ANPRM comments expressed concern that in-use vehicles are experiencing inducements for reasons outside of the operator's control despite the use of high-quality DEF and in the absence of any tampering. The ANPRM comments stated that many inducements (not related to tampering) were occurring due to defective SCR system components. Such inducements, called false inducements, can be difficult to diagnose and require repeated visits to the repair shop. Part of the false inducement issue is related to the quality and durability of components used by engine manufacturers. [EPA-HQ-OAR-2019-0055-1186-A2, p.91]

Table 9-1 and Figure 9-1 below show the number of California heavy-duty diesel engine families that have emissions related component warranty claims greater than 4 percent or 50 claims in the last 5 years. Of the 308 engine families with 4 percent or 50 emissions related component warranty claims, 299 (or 97 percent) had components that were replaced under warranty that could result in SCR inducement. If these parts had been designed to work correctly through the engine useful life, the total potential inducement events could have been reduced significantly. [EPA-HQ-OAR-2019-0055-1186-A2, p.91]

Manufacturers need to ensure that they utilize components that are robustly designed and manufactured to minimize false inducement incidences. While CARB has required recalls for SCR inducements that did not work as approved, CARB has not initiated any recalls specifically to address false inducement. CARB's changes to the EWIR program as part of the Omnibus adoption should improve the effectiveness of identifying and repairing malfunctioning parts, and U.S. EPA should also consider adopting similar requirements in the CTP. EWIR changes include requiring corrective action once the warranty threshold is met. U.S. EPA's proposed NPRM changes to lengthen warranty will also help reduce false SCR inducements because manufacturers will be required to make repairs for much longer periods over the vehicles' useful life, driving manufacturers to reduce their cost liability and improve the design of components. [EPA-HQ-OAR-2019-0055-1186-A2, p.93]

Rather than simply proposing to significantly weaken inducement schedules to address false inducements, U.S. EPA should put in place more effective requirements to ensure manufacturers are addressing poor component quality and durability issues. In fact, CARB staff believes that U.S. EPA's proposed Option 1 changes to extend manufacturer warranty requirements will provide an effective incentive for manufacturers to make improvements to monitored SCR system components to reduce their future cost liability. [EPA-HQ-OAR-2019-0055-1186-A2, pp.93-94]

CARB staff has concerns with the proposed Selective Catalytic Reduction (SCR) anti-tamper inducement changes in 40 CFR 1036.111. CARB recommends that U.S. EPA direct staff to work with CARB to develop a nationally aligned SCR inducement requirement that both addresses fleet concerns and ensures SCR emission control systems are functional, effective and tamper resistant. [EPA-HQ-OAR-2019-0055-1186-A1, p.2]

CARB's Omnibus regulation that became effective in December 2021 requires more rigorous durability testing during the certification process and longer warranty and UL requirements for 2024 and subsequent model year engines. It is anticipated that these improvements will result in better quality and durability of emission control components. Additionally, the Omnibus regulations also improved California's EWIR program which requires manufacturers to conduct corrective actions such as providing extended warranties and/or recalling faulty components if component failure rates meet or exceed established thresholds levels. Lastly, the Omnibus regulations also established rigorous in-use compliance and recall provisions. The NPRM proposes many of these same Omnibus regulatory provisions, and CARB staff urges U.S. EPA to adopt provisions equivalent to those Omnibus provisions that will provide further assurance that SCR systems will become more durable and reliable. [EPA-HQ-OAR-2019-0055-1186-A2, p.94]

In response to the comments submitted during ANPRM, CARB staff initiated a limited survey of 33 randomly selected California fleets to better understand their experience with inducements (Appendix III) [Appendix III can be found at EPA-HQ-OAR-2019-0055-1186-A2, pp. 146-164]. Through our normal warranty and in-use testing processes, CARB staff had not been aware of the inducement-related concerns described in the ANPRM. The survey was conducted from October 2021 to February 2022, either in person or by phone. The survey requested information on fleet vehicle data, the frequency of derates, what problems caused the derate, safety concerns, and other issues. The fleet owner or operator was informed that derates may occur due to engine protection or due to SCR inducement as a result of system malfunctioning or tampering, and the survey requested their assessment of the knowledge of the two different types. Almost 80 percent of owners had good knowledge differentiating between derates for engine protection versus aftertreatment system performance. However, only 19 percent of the operators had a good knowledge to differentiate the 2 types of derates. Thus, it is highly possible that the vast majority of operators may not have adequate knowledge to take appropriate action on SCR derate conditions and to avoid entering into severe inducement, which makes the vehicle virtually inoperable. [EPA-HQ-OAR-2019-0055-1186-A2, p.94]

The survey information showed that on average, fleet owners and operators reported that 21 percent of the vehicles experienced engine protection or SCR related derates on an annual basis, with incidents of derates occurring more often with 2013 to 2018 MY vehicles that have more than 160,000 miles. Out of 33 fleets, 3 fleets reported no derates and gave the reason that they maintained their vehicles regularly, including sensor replacements, and/or had vehicles that were less than one year old. [EPA-HQ-OAR-2019-0055-1186-A2, p.94]

In the survey, fleets that experienced derates were asked for the cause, and 37 percent were for failed NOx or DEF quality sensors. This was by far the highest incident of experiencing a derate condition. The next highest was failure of the DEF doser at 17 percent of incidences, while low-DEF level was the cause of 9 percent of incidences. None of the fleets reported derates due to poor quality DEF, which would be the result of poor DEF quality sold in the marketplace or DEF fluid dilution that would be tampering. This is consistent with industry efforts to assure the high-quality DEF supply chain155 and CARB staff's earlier surveys of DEF availability and driver usage156. Other causes of derates were plugged DPF (8 percent), and other aftertreatment-related problems such as those resulting in poor NOx conversion, bad DEF pumps, DEF heater problems, wiring harness issues, and calibration problems (19 percent.) Other non-aftertreatment related problems, such as turbochargers, carbon buildup in the EGR system, and engine temperature problems, accounted for the remaining 9 percent. [EPA-HQ-OAR-2019-0055-1186-A2, p.95]

155 https://www.api.org/products-and-services/diesel-exhaust-fluid/

156 https://ww2.arb.ca.gov/sites/default/files/2020-05/ADA__scr-field-eval_report.pdf

To address the problem and override the derates, 84 percent of the fleet owners and operators responded that derates were able to be addressed without major disruption. However, often it took two or more visits to the repair facility to properly diagnose and address the problem. On average, 33 percent of the vehicles needed work done more than once in a year due to derates. Of the vehicles brought in more than once in a year due to derates, 29 percent were a result of a recuring problem that was not properly addressed in the first repair visit. Significantly, this multiple trip repair impacted almost 10 percent of the total number of vehicles experiencing derates covered by the survey. [EPA-HQ-OAR-2019-0055-1186-A2, p.95]

CARB staff's fleet survey also included fleets have safety related concerns regarding inducements. A large portion, 42 percent, of the owners and operators expressed that they would have safety concerns if they were to experience a derate. A significant minority of owners and operators, 18 percent, had actually experienced some safety concerns due to a derate, such as sudden power loss when operating at highway speeds, power loss coming down a step road grades or power loss during uphill grades and during heavy vehicle traffic conditions. The remaining 82 percent of owners and operators never encountered a dangerous situation with derates or had no comments on the safety concerns. [EPA-HQ-OAR-2019-0055-1186-A2, p.95]

In conclusion, CARB staff's fleet survey shows that current inducement requirements are effective in getting repairs done promptly, with 84 percent of the fleet owners' and operators' responses indicating that derates were easy to address. On average, about one-fifth of these fleet vehicles had experienced derates on an annual basis. Failed sensors, failed DEF doser, and low-DEF levels accounted for over 60 percent of the derate causes (37 percent, 17 percent, and 9 percent, respectively), and thus, the inducements were successful in correcting the problem. While a significant percentage of fleet owners and operators expressed some safety concerns concerning inducements, a much smaller percentage had actually experienced a derate condition that resulted in significant safety concerns. Within this group, it is uncertain whether the derate where the operator experienced significant safety concern was due to an engine protection derate, which may occur immediately to prevent damage to the engine, or whether it was an SCR inducement, which should have provided audible and visible warnings, per the current guidance, to the operator before a derate condition was implemented. Regardless, safety concerns are important to address, and improving and aligning these warnings protocols amongst all manufacturers through regulation may improve these safety concerns. NPRM's proposal to codify in-cab display requirements should provide adequate warning to the operator, as discussed later. [EPA-HQ-OAR-2019-0055-1186-A2, pp.95-96]

CARB staff also recommends removing the NOx sensor as a fault condition in the proposed 40 CFR 1036.111(b) since the NOx override factor, based on the NOx sensors, can be used to override the NOx sensor fault condition. [EPA-HQ-OAR-2019-0055-1186-A2, pp.103-104]

The NPRM requests comments on whether it was proper to use DEF fill level, quality, and tampering to determine fault conditions that may result in SCR inducement. The current inducement guidance defines these three parameters as critical to proper SCR function, and CARB staff continues to agree that these parameters must be monitored. [EPA-HQ-OAR-2019-0055-1186-A2, p.105]

In particular, the NPRM requests whether DEF quality continues to be an issue to monitor since operators have an established practice of using DEF and engines may now have built-in features to prevent diluting DEF or filling a DEF tank with water. Monitoring the use of high-quality DEF continues to be a critical parameter to achieve low NOx emissions from the SCR-equipped HD vehicles. Two HD vehicles tested by CARB staff in 2011/2012 showed that when the DEF was diluted with water, NOx emissions increased eight to ten times the baseline emissions where high-quality DEF was used.169 Without proper monitoring, DEF quality is too easily tampered with, which could lead to excessively high NOx emissions and multiple inducements. The current success and established practice of the use of high-quality DEF, along with engines that have built-in features to compensate for DEF quality, demonstrate the success of current guidance practices that are effective in assuring high quality DEF is used. Staff disagrees with the NPRM statement on page 17541 that 'the cost of DEF at the pump is not that different from the cost of distilled water.' As an example of recent DEF prices, the website price of DEF at Pilot and Flying J truck stops averages $3.89 per gallon across stations in the United States170 while the cost of distilled water is a mere $1.08 per gallon.171 Thus, since DEF costs more than three times the cost of distilled water, a substantial financial motivation still exists for operators to refill the DEF tank with fluids other than the manufacturer's recommended DEF or to tamper with DEF by diluting the tank with water. This will become even more important as the new more stringent CTP NOx standards will require an increased amount of DEF, increasing the desire to tamper with DEF quality to reduce cost. Any relaxation of current monitoring requirements may result in the increased use of poor DEF quality, causing significant increase in excess NOx emissions from tampered HD vehicles. [EPA-HQ-OAR-2019-0055-1186-A2, pp.105-106]

169California Air Resources Board, Field Evaluation of Heavy-duty Diesel NOx Control Strategies, January 2013. https://ww2.arb.ca.gov/sites/default/files/2020-05/ADA__scr-field-eval_report-final.pdf

170https://www.pilotflyingj.com/fuel-prices# , accessed April 13, 2022.

171 https://www.walmart.com/ip/Great-Value-Distilled-Water-1-Gallon/10315382

The NPRM requests comment on the proposed circuit fault condition. CARB staff recommends that the word 'open' be eliminated from the 'open-circuit faults' in 40 CFR 1036.111(b)(4). This would allow a more general specification of circuit faults to include other types of faults that may occur with tampering such as short circuit faults and rationality faults, and thus provide a more comprehensive coverage of tampering and electrical functionality. Additionally, staff recommends adding a more general descriptor of DEF components at the end of the circuit fault list to include components other than those listed, such as 'and any other components that affect the performance of listed DEF components, as determined by the engine manufacturer.' [EPA-HQ-OAR-2019-0055-1186-A2, p.106]

CARB staff agrees that starting the fault condition of the low-DEF level at three hours is appropriate rather than when DEF is depleted. In fact, it is recommended that a dash warning of low-DEF level before three hours be given to the operator to provide additional opportunity to take action prior to inducement. CARB staff believes warning the operator before the point of DEF depletion is absolutely necessary from an emission abeyance perspective and to alert the operator prior to the initial torque and speed inducement. In CARB staff's fleet survey, nine percent of inducements were due to low-DEF levels, and thus notifying the operator of low DEF levels well ahead of inducement allows more opportunity for correcting this condition before inducement is initiated. This is one of the most easily correctable conditions, and advance notification to the operator to refill the DEF tank would reduce air quality impacts as well as help avoid vehicle downtime and costs due to severe inducement. [EPA-HQ-OAR-2019-0055-1186-A2, p.106]

CARB staff believes that current DEF freeze protection guidelines are important because DEF may freeze under certain circumstances and will not be available to flow to the SCR system, causing excess emissions. Thus, staff supports the current DEF freeze protection guidance and believes that it should be codified and described by the manufacturer to U.S. EPA through Auxiliary emission control device (AECD) disclosure requirements. Also, fault conditions due to tampering of freeze protection components should be included in 40 CFR 1036.111 (b). [EPA-HQ-OAR-2019-0055-1186-A2, p.106]

Organization: *Carreras Tours, LLC (2032)*

We had an experience where our bus got a check engine light going on interstate 5 in central California. We had students on board and the bus derate to 5 MPH. The good thing is that we happened to be less than a mile from an exit. We feared that a truck might rear end us and injure the passengers. It took several hours to get a rescue bus to pick up the group. All this could have been avoided if time for us to diagnose the problem in a shop, and in a safe place where the bus and the passengers were safe. If a sensor fails, the bus derate the bus immediately and gives us no chance to get to a safe place. In this instance, it was a $20 sensor that failed. [EPA-HQ-OAR-2019-0055-2032, p.1]

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

EPA should improve the stringency of its proposed modifications to its inducement program to better ensure that operators properly maintain emissions control equipment. As EPA notes, SCR systems depend upon ‘an adequate supply of diesel exhaust fluid (DEF).’ 87 Fed. Reg. 17,536–38. ‘Inducement’ systems—creating engine derates that reduce a vehicle’s maximum speed when the SCR lacks adequate DEF or the system has been tampered with—ensure that operators sustain that supply and properly maintain their aftertreatment systems. Id. at 17,537. In response to complaints that ‘vehicles are experiencing inducements for reasons outside of the operator’s control,’ which may be ‘difficult to diagnose,’ EPA has proposed ‘progressively increasing inducement derate schedules,’ which restrict the maximum speed of vehicles with tampered SCRs or which have failed to maintain adequate DEF supply. Id. at 17,538, 17,543. [EPA-HQ-OAR-2019-0055-1302-A1, p.62]

As EPA acknowledges, lack of adequate DEF can cause NO X emissions to increase to levels comparable to having no NOx controls at all.’ Id. at 17,536. That is likely to be especially harmful in urban areas where HDV operations are concentrated, and where vehicles are consistently operating at speeds well below EPA’s proposed derates. [EPA-HQ-OAR-2019-0055-1302-A1, p.63]

Organization: *Champion Auto Carriers*

Having been in the transportation industry for over 35 years I have witnessed what the DEF regulations has cost my business and drivers since 2012. Down time for DEF issues account for 90% of my overall downtime and driver expense. Maybe the EPA should be looking at better technology or systems to reduce NOx but allow for better performance and uptime. We can't afford any extra truck costs or maintenance costs and still deliver the goods and services trucking provides. [EPA-HQ-OAR-2019-0055-2733, p.1]

Organization: *Coach USA, Inc. (Coach USA)*

However, any derate program for buses is likely unable to ensure the level of safety needed to protect passengers. Coach USA thus supports the ABA proposal that motorcoaches be excluded from any derate requirements that would apply to most trucks and instead be allowed the flexibility of being treated the same as vehicles that respond to emergencies. This can be done by allowing engine manufacturers the flexibility to use approved Auxiliary Emission Control Devices with motorcoach engines. This would avoid the safety risks associated with applying a truck-centered derate system to passenger-carrying vehicles as well as the costs that our industry cannot tolerate. Coach USA thus encourages EPA to study such alternatives to the need for any derate inducement system for the motorcoach sector. [EPA-HQ-OAR-2019-0055-1307-A1, pp. 3-4]

With the above general caveats, if any Proposed Rule is adopted that would apply to motorcoaches, Coach USA believes that the proposed derate schedule would effectively lead bus owners/operators to address certain detected fault conditions within the duration of the schedule specified under the Proposed Rule. [EPA-HQ-OAR-2019-0055-1307-A1, p. 4]

Coach USA supports the latter proposal – that the engine be designed to warn an operator when the DEF supply is running low and the inducement start when the DEF supply is depleted. Coach USA closely monitors and maintains is buses, including ensuring adequate DEF supply at the start of each trip. Refilling of DEF supply, depending on bus routes, may occur within 3 hours of depletion. However, Coach USA believes that it, or its drivers, should not be penalized with the inducement starting at that time, before the DEF supply has been depleted. Coach USA also recommends that EPA require manufactures to provide more precise information to drivers to alert them about DEF levels and how long remaining DEF volumes will last; this will allow drivers to plan accordingly to address a fault condition, while taking into account route schedules and stops. [EPA-HQ-OAR-2019-0055-1307-A1, p. 5]

Coach USA believes that no less than 6 hours of non-idle operation is reasonable for the first stage of inducement to address low DEF, but is not a sufficient amount of time for more major fault conditions that may require repair. Interstate bus routes extend throughout the country, oftentimes far away from Coach USA facilities or other third-party bus repair facilities. Bus repair is also very specialized, with limited repair locations. It is also not a certainty that bus repair facilities will possess the required equipment/software to diagnose and repair a fault condition. Parts, as evidenced throughout the pandemic, may also not be readily available. [EPA-HQ-OAR-2019-0055-1307-A1, p. 5]

Accordingly, buses will not always have the ability to reach a bus repair facility within a 6-hour period when a fault condition prompts repair or replacement of components. Coach USA believes that a minimum 10-hour period for the first stage of inducement, and preferably longer, is appropriate for all default conditions due to other than low DEF levels. This longer period will ensure that passengers are kept safe and not potentially stranded along interstate bus routes. On this point, EPA should aware of the difficulty/inability of bus operators to locate alternative buses to pick-up passengers along interstate routes. Our industry is currently struggling with a serious shortage of drivers, which has reduced operational flexibility. The industry has also experienced a major reduction in the number of bus operators due to COVID, as noted above. Accordingly, Coach USA supports an approach that ensures the ability of its drivers to address a fault condition upon completion of a route. [EPA-HQ-OAR-2019-0055-1307-A1, p. 5]

The relatively short comment period allowed for the EPA's massive (475-page) and technically-complex proposed rules was grossly insufficient to allow Coach USA to adequately analyze all of the implications of the proposed rules on its business and its customers. [EPA-HQ-OAR-2019-0055-1307-A1, p. 2]

Organization: *Cummins Inc. (Cummins)*

EPA has appropriately defined key principles for updating SCR inducements to ensure that emission control function and emissions reductions occur in-use while reducing potential impacts to operators. Cummins is supportive of less severe SCR inducements such as those in EPA's proposed vehicle speed derate schedule in §1036.111(d). However, we recommend that EPA consult with NHTSA on the safety related aspects of the proposal before finalizing it. [EPA-HQ-OAR-2019-0055-1325-A1, p. 14]

In response to request for comment on including an advance notice/warning to the operator in the event of a plugged DEF line or doser, as opposed to actual tampering, Cummins proposes that EPA consider not including this concept as it is challenging to effectively differentiate blocked DEF line/doser due to direct tampering vs. actual urea crystallization/line plugging. [EPA-HQ-OAR-2019-0055-1325-A1, p. 31]

Organization: *District of Columbia Department of Energy and the Environment (DOEE)*

DOEE does not support EPA's proposed changes to the in-use strategies designed to ensure that operators maintain their NOx emission control equipment. [EPA-HQ-OAR-2019-0055-1299-A1, p. 5]

EPA proposes changes that would significantly weaken "inducements" for maintaining Selective Catalytic Reduction (SCR). Since SCR is the most effective means of reducing NOx emissions from diesel engines, when these devices are malfunctioning, NOx emissions soar. Such unacceptable NOx increases can occur from a combination of vehicle neglect, part failures, and malicious tampering with diesel exhaust fluid (DEF), hardware, and software. While the longer warranties proposed and discussed below should provide motivation to resolve design defects and inferior parts, the issues of neglect or tampering require an intentional and diligent approach in the inducement program to ensure adverse emission impacts are minimized. [EPA-HQ-OAR-2019-0055-1299-A1, p. 6]

EPA states in the NPRM that it has received many complaints about inducements, and specifically about the use of DEF, the majority of which express concerns "that despite the use of high-quality DEF and in the absence of tampering, in-use vehicles are experiencing inducements for reasons outside of the operator's control". It is unclear how many of the experiences leading to these complaints are specifically related derating due to SCR inducements verses general engine protection derating that operators can also experience. Among the cited reasons outside the operator's control are faulty sensors and software "glitches". Both would be warrantable issues that should receive increased manufacturer attention under the significantly longer warranty periods advocated here. Simply ignoring these design issues would be deeply problematic and fundamentally undermine the effectiveness of the NOx program. [EPA-HQ-OAR-2019-0055-1299-A1, p. 6]

Finally, rather than just relaxing inducements and potentially allowing a truck with improperly maintained SCR to continue operating with nominal constraint, EPA should put in place measures that will hold manufacturers accountable for addressing the durability and sensor issues about which the agency, dealerships, and manufacturers have received complaints. [EPA-HQ-OAR-2019-0055-1299-A1, pp. 6 - 7]

Organization: *FitzGerald Brothers Bus Co.*

Recently I had a group of 50 people in a bus at 2:00am 500 miles away and the bus decides to de-rate and then shut down because of some sensor is not reading emissions correctly. Lost $10k on that job, lost the customer, driver quit. Why- All due to a small little NOx sensor that needs to read emission input Vs. Output on the SCR. Could the software had allowed us another 8 hours, all this could have been avoided. Why such a quick setting for a shut down? [EPA-HQ-OAR-2019-0055-1149-A1, p.1]

Organization: *International Council on Clean Transportation (ICCT)*

ICCT agrees with EPA that an update of current inducement policies is appropriate. A decade of experience has confirmed inducements are successful in encouraging timely emission-related repairs. Based on operator comments, updates that reduce the downtime of trucks resulting from the inducements also need to be considered. We also agree it is time to replace nebulous guidance documents with clear regulatory requirements that govern certification approval of engine manufacturer inducement strategies and software. [EPA-HQ-OAR-2019-0055-1211-A1, p. 20]

EPA's proposal to modify SCR-related inducements includes several new approaches ICCT supports. These include derates based on speed, a separate derate schedule for trucks that operate mainly at lower speeds, and the use of NOx sensor data to provide an estimate of the importance of initiating inducements. However, ICCT believes the specific provisions of EPA's proposed changes will reduce the incentive for many truck operators to achieve emission-related repairs, and result in higher in-use emissions that are unnecessary. This contradicts EPA's stated belief that the proposed inducement modifications will provide a "net benefit…to the environment". [EPA-HQ-OAR-2019-0055-1211-A1, p. 20]

EPA proposes changes to SCR inducement provisions that we expect will increase real-world NOx emissions, undermining the important improvements the proposal makes in other areas to address this gap. [EPA-HQ-OAR-2019-0055-1211-A1, p. 3]

If the problems with false readings or failure of DEF quality sensors are addressed by engine producers developing and using more reliable sensors, it would reduce the adverse impact on operators. The much longer emission warranty proposed by EPA will increase the incentive for engine manufacturers to use more reliable sensors since they will have to cover the cost of repair for the majority of the truck's life. In addition, improved NOx sensors may also provide an alternative means of determining DEF quality without use of a physical quality sensor, as this approach was used by some OEMs when the inducement requirements were first imposed. [EPA-HQ-OAR-2019-0055-1211-A1, p. 23]

We recommend adoption of EPA's proposal to add additional monitoring of disconnection of devices. This will help prevent tampering. The EPA proposed extended warranty will provide an incentive to engine manufacturers to address operator claims of frequent defective electrical connections of SCR-related devices. [EPA-HQ-OAR-2019-0055-1211-A1, pp. 23 - 24]

We support efforts that would communicate in natural language and not computer codes the fault conditions that may trigger inducements. Lowering these communication barriers would reduce the impacts of trigger inducements on vehicle down-time. [EPA-HQ-OAR-2019-0055-1211-A1, p. 24]

Organization: *Maine Department of Environmental Protection (Department)*

Using the CARB Heavy-Duty Omnibus Regulation as a bellwether, the Department requests the following revisions to the federal proposal: [EPA-HQ-OAR-2019-0055-1288-A1, p.6]

- EPA should not ease measures designed to prevent the avoidance of maintenance or repair costs. Rather than relaxing inducements and potentially allowing a truck with improperly maintained SCR to continue operating with nominal constraints, manufacturers should be held accountable for addressing durability and sensor issues. [EPA-HQ-OAR-2019-0055-1288-A1,p.7]

Organization: *Midwest Bus & Motorcoach Association*

Our primary concern involves the proposed "derate" or "inducement" schedule, which will result in a vehicle experiencing a significant loss of power and torque. This change in power has placed an undue burden on operators since 2008, when it was first implemented. There are numerous repercussions directly related to derates. Motorcoaches often travel to remote areas across the country unlike local transit or school buses that commonly transport intrastate and are home daily. Motorcoaches will drive far distances all times of the day or night making the ability to service a vehicle in a timely manner very difficult. Motorcoaches could be thousands of miles from home or even from an equipped service facility that could assist with a breakdown. This challenge for companies is far greater than what may be realized. [EPA-HQ-OAR-2019-0055-1158-A1, p.1]

When the equipment experiences an inducement, there are fewer options than other types of vehicles fitted with SCR. Since most of the vehicles have manufacturer-specific components, drivers are at most times limited to finding the right parts to fix a vehicle that is over the road. Additional costs involved include towing, outside repair service, reimbursing customers for missed events, refunding customers for long delays, contracting with other companies to move the passengers, and damaging the overall reputation of the company. [EPA-HQ-OAR-2019-0055-1158-A1, p.2]

Aside from the large expenses motorcoach operators must absorb, a more important point is the safety risk a derate presents our passengers. It is our opinion that a regulation crippling or limiting the speed of any vehicle is unacceptable, dangerous, and jeopardizes lives. **This industry is very unique as it transports the most valuable cargo on the road, human lives.** A large number of operators provide a significant amount of travel for school groups and young athletes. Having a motorcoach filled with children is quite different than transporting a truckload of consumer goods or raw materials. There is no room for error when it comes to safety practices and maintaining a proper speed to avoid a fatal rear-end collision on a highway. It will only be a matter of time before a distracted driver drives into the rear of a derated or stranded motorcoach full of passengers. [Emphasis in original; EPA-HQ-OAR-2019-0055-1158-A1, p.2]

Organization: *Motorcoach Companies*

Our primary concern involves the proposed “derate” or “inducement” schedule, which will result in a vehicle experiencing a significant loss of power and torque. This has put an undue burden on operators since 2008 when this first was implemented. The challenges these companies face are far greater than what you may realize or be aware of. There are numerous repercussions directly related to derates. Often times we are traveling in remote areas across the country and areas. Unlike local transit or school buses that are often Intra-State and home the same day, our coaches travel far distances, and at all times of the day or night. Therefore our ability to service a vehicle in a timely manner is significantly different given that our equipment could be thousands of miles from home or even from a equipped service facility that can help with break downs. [EPA-HQ-OAR-2019-0055-1149-A1, p.2]

When our equipment experiences an inducement, we have fewer options than other types of vehicles fitted with SCR. Since most of our vehicles have manufacturer specific components, we are at most times limited at finding the right parts to fix a vehicle that is over the road. There are several other expenses involved as well; including: towing costs, outside repair service costs, reimbursing customers for missed events, refunding customers for long delays, contracting other companies to move the group of passengers, and damaging the overall reputation of the company. [EPA-HQ-OAR-2019-0055-1149-A1, p.2]

Aside from the large expenses motorcoach operators must absorb, a more important point is the safety risk a derate presents our passengers. It is our opinion that the EPA crippling or limiting the speed of any vehicle is unacceptable. This is a blatant overreach that is jeopardizing lives. As we stated earlier, our industry is very much unique in that we are transporting the most valuable cargo on the road, human lives. A large number of operators do a significant amount of business with school groups and young athletes. Having a bus load of children is quite a bit different than transporting freight such as toilet paper, sneakers, or other material goods. We have no room for error when it comes to safety practices, and maintaining proper speed is of utmost importance to avoid a fatal rear end collision on the interstate. It will only be a matter of time before this takes place due to a distracted driver running into the rear of a derated or stranded passenger vehicle. **We want this to be on record that we have made our concerns**

widely known and that when an accident does occur, the blame will be on the EPA for any lives lost or hurt. [Emphasis in original; EPA-HQ-OAR-2019-0055-1149-A1, pp.2-3]

[Additional comment by several companies that joined this mail campaign:] **With this fair warning EPA will be held fully liable and any lawsuits resulting from such accident will be brought against EPA."** [Emphasis in original; EPA-HQ-OAR-2019-0055-1241 and 1267]

Organization: *National Association of Chemical Distributors (NACD)*

In this proposed rule, the EPA makes several adjustments to selective catalytic reduction (SCR) requirements. SCR systems are induced if a truck meets one of the prescribed triggers related to the vehicle's emissions. In this proposed rulemaking, the EPA adds provisions that would reduce the number of false inducements and implements a much more workable derate schedule. While the current derate schedule forces trucks to slow to 5 miles per hour (mph) in just 4 hours, the new regulations in this proposed rule would instead be implemented over 60 hours and reach final inducement speeds of 50 or 35 mph, depending on the typical speed of the vehicle. [EPA-HQ-OAR-2019-0055-1279-A1, p. 5]

NACD supports these important changes to SCR regulations. The current derate system is extremely difficult for drivers to operate under and creates hazardous roadway conditions where heavy-duty vehicles are forced to go a speed significantly under the speed limit. Moreover, it is important for fleet owners to have the ability to get their heavy-duty trucks to a mechanic who knows their vehicles. These adjustments make the roadways safer and improve a fleet-owners ability to get their trucks fixed. [EPA-HQ-OAR-2019-0055-1279-A1, p. 5]

Organization: *National Association of Clean Air Agencies (NACAA)*

NACAA does not support EPA's proposed changes to the in-use strategies designed to ensure that operators maintain their NOx emission control equipment. [EPA-HQ-OAR-2019-0055-1232-A1, p. 11]

EPA proposes changes that would significantly weaken "inducements" for maintaining Selective Catalytic Reduction (SCR). Since SCR is the most effective means of reducing NOx emissions from diesel engines, when these devices are malfunctioning NOx emissions soar. Such unacceptable NOx increases can occur from a combination of vehicle neglect, part failures and malicious tampering with diesel exhaust fluid (DEF), hardware and software. While the longer warranties proposed and discussed below should provide motivation to resolve design defects and inferior parts, the issues of passive neglect or active tampering require an intentional and diligent approach in the inducement program to ensure adverse emissions impacts are minimized. [EPA-HQ-OAR-2019-0055-1232-A1, p. 12]

EPA states in the NPRM that it has received many complaints about inducements related to SCR and the use of DEF, the majority of which express concerns "that despite the use of high-quality DEF and in the absence of tampering, in-use vehicles are experiencing inducements for reasons outside of the operator's control." It is unclear how many of the experiences leading to these complaints are specifically related to SCR inducements verses general engine protection derating that operators can also experience. Among the cited reasons outside the operator's control are faulty sensors and software "glitches." Both of these would be warrantable issues that should receive increased manufacturer attention under the significantly longer warranty periods advocated here. Simply ignoring these design issues would be deeply problematic and fundamentally undermine the effectiveness of the NOx program. [EPA-HQ-OAR-2019-0055-1232-A1, p. 13]

Finally, rather than just relaxing inducements and potentially allowing a truck with improperly maintained SCR to continue operating with nominal constraint, EPA should put in place measures that will hold manufacturers accountable for addressing the durability and sensor issues about which the agency, dealerships and manufacturers have received complaints. [EPA-HQ-OAR-2019-0055-1232-A1, p. 12]

Organization: *National Association of Small Trucking Companies (NASTC)*

Nevertheless, NASTC first and foremost appreciates that, with this proposed rule, the agency has carefully considered our sector's input from the 2020 advanced notice of proposed rulemaking, as seen from this NPRM's modernization of inducement and serviceability provisions. These updates would help address major problems motor carriers and truckers suffer under the existing inducements regime. The proposals rightly reform current policies in light of 12 years' worth of real-world data and real-life circumstances that regularly bedevil truckers. These proposals would mitigate extremely costly, dangerous, counterproductive problems the current rules create. [EPA-HQ-OAR-2019-0055-1130-A1, pp. 1 - 2.]

The proposal makes derating far more reasonable and evidence-based, as well as gives professional drivers greater predictability and appropriate flexibility. A truck traveling at the new derate speeds would no longer pose a serious threat to the safety of other drivers and vehicles, commercial or personal, on high-speed roads. Enhanced by a uniform derate schedule and speeds across manufacturers, professional drivers would be able to deal with the situation in which inducement occurs in an appropriate, safe manner, while the driving public is protected from an inducement-caused road hazard. Also, circumstances that may spur road rage by passing drivers are avoided. [EPA-HQ-OAR-2019-0055-1130-A1, p. 3]

Further, older commercial equipment may pose safety and performance issues. For instance, a DEF sensor that suddenly derates a truck moving at highway speed to 5 miles per hour puts truckers and motorists at grave risk, whether the sensor reads an actual emissions issue or gives a false positive reading.5 [EPA-HQ-OAR-2019-0055-1130-A1, p. 6]

5. The DEF sensor shortage and forcible derating also cost shippers, consumers, and stores, the truckers who lose money with every mile they aren't driving, and the motor carriers that are forced to sideline power units of their fleets. Jobs hang in the balance at every level, threatening debilitating costs and losses.

Aside from DEF sensors requiring microchips amid a shortage, these sensors "derate" trucks, forcing them to slow to 5 mph. Whether derated by malfunction or actual noncompliant DEF levels, affected trucks cannot be used to haul freight. Also, as mentioned, the derating of an over-the-road commercial vehicle while under load creates an extremely unsafe situation for the driver, the driving public that shares the road with trucks, the shipper and/or receiver, and the Insurance provider responsible for the load. Without readily available parts, commercial motor carriers that fill a vital role in our economy face bankruptcy in short order. A derated power unit awaiting a new DEF sensor or other part has a tightening noose on a motor carrier's neck. A truck that can't move freight is a truck failing to generate income, which can put the entire motor carrier operation at risk of financial failure. [EPA-HQ-OAR-2019-0055-1130-A1, p. 7]

Organization: *NW Navigator*

Please exempt passenger carriers from any and all Inducements and Derate's of the vehicles from 2008 to current Why? [EPA-HQ-OAR-2019-0055-2789, p.1]

1) Causes large groups of people to be stranded often in remote areas and often without cellular service [EPA-HQ-OAR-2019-0055-2789, p.1]

2) The lives and safety of human beings, we transport People not toilet paper and paper towels and when were stranded we need water food and heat and Air conditioning we can't just jump in the next car that comes by to go find help!! [EPA-HQ-OAR-2019-0055-2789, p.1]

3) If you have a story about being down because of one of these issues please us it but don't put in too much detail [EPA-HQ-OAR-2019-0055-2789, p.1]

4) Our main passengers are the young and the elderly both are very susceptible to extremes so again it is unsafe to disable these vehicles [EPA-HQ-OAR-2019-0055-2789, p.1]

5) We are often first on scene for a disaster getting people out of the way of a hurricane or removing them when Flood waters hit or evacuating them out of a fires path and so on [EPA-HQ-OAR-2019-0055-2789, p.1]

6) We transport the military for maneuvers, deployment and anywhere there is trouble and they are need we move them there! [EPA-HQ-OAR-2019-0055-2789, p.1]

Organization: *NW Navigator Luxury Coaches*

At first everything was great but just over a year after purchasing a brand new $500,000 MCI motorcoach equipped with a DPF Filter things started to become unsafe. [EPA-HQ-OAR-2019-0055-1098-A1, p. 1]

That vehicle stranded a group of kids at a closed ski resort after everyone had left because it needed a regen after sitting and trying to heat the coach up for the passengers. [EPA-HQ-OAR-2019-0055-1098-A1, p. 1]

What if your kids were on board? How would you feel about them being stranded and unsafe and in the end finding out that it was a $38 sensor that failed, which told the vehicle to shut down-because it might let some exhaust into the air? Nothing was actually wrong the system was working perfectly other than that $38 sensor. [EPA-HQ-OAR-2019-0055-1098-A1, p. 1]

Not even 3 months later this same $500,000 vehicle stranded a group in high heat out in the Columbia River Gorge after first derating the speed and the driver was forced to get off the highway to find somewhere where he could travel at such low speeds and not be rear ended by some inattentive driver on the highway, leaving the group stranded just off the highway with no services or help in any direction for 50 miles or more and no cell service. We had over 50 passengers on board with an average age of 72. [EPA-HQ-OAR-2019-0055-1098-A1, p. 2]

What if your Mother or Father were on that motorcoach and suffered Heat Stroke again because a computer told it there was an issue? Again, in the end it was a failure of the system not a real issue but a failed sensor not the Motorcoach. [EPA-HQ-OAR-2019-0055-1098-A1, p. 2]

These systems were absolutely not ready to be forced on the transportation industry and the newer systems are still not ready but were forced out on us by someone putting an X on a calendar. [EPA-HQ-OAR-2019-0055-1098-A1, p. 2]

When systems fail at the enormously high rate we all are experiencing- and I know and have heard it from other operators in trucking and bussing that they are having the same issues, it is not fair or safe to shut down or even derate a vehicle especially with passengers on board when it is almost always due to the fact that these systems are defective and not ready for market due to a Policy that was pushed out too fast, untested and without regard to the consequences of passengers. [EPA-HQ-OAR-2019-0055-1098-A1, p. 2]

The motorcoach industry is and always has been a very Green mode of transportation and is currently the GREENEST mode on the planet, even cleaning the air in areas where pollution is a major issue, however, we cannot put children, adults, the elderly our Military and people we are evacuating during a disaster at risk for the ‘checking of some box’ in a policy that was rolled out inefficiently and hastily without proper testing. [EPA-HQ-OAR-2019-0055-1098-A1, p. 2]

Please consider and approve the request to separate out our industry into its own category and don’t derate us or shut us down on the side of the road possibly with your children or grandparents on board. [EPA-HQ-OAR-2019-0055-1098-A1, p. 2]

We also request this take effect immediately and cover all vehicles and coaches from 2008 to Current. [EPA-HQ-OAR-2019-0055-1098-A1, p. 2]

Below is what we are countering with and feel would be a more acceptable time frame:

Default maximum speed (mi/hr)	**Commercial Passenger Vehicles Counter**	**Commercial Passenger Vehicles Counter**
65	derate exempt	24 hours
60	derate exempt	48 hours
55	derate exempt	72 hours
40	derate exempt	96 hours

[EPA-HQ-OAR-2019-0055-1098-A1, p. 2]

Organization: *Owner-Operator Independent Drivers Association (OOIDA)*

OOIDA supports the proposed inducement schedules and various derate principles included in Section IV, D. These provisions focus on conditions that are within a driver's control, implement a multi-step derate schedule, and a backup check to override false inducements. [EPA-HQ-OAR-2019-0055-1266-A1, p.5]

OOIDA members have experienced emission technology failures that caused their engines to quickly derate, placing truckers and other motorists in unsafe situations. Clearly, the loss of power resulting from a technology failure is a serious safety concern that absolutely must be avoided in future regulations. OOIDA supports the proposed inducement schedules and various derate principles included in Section IV, D. These provisions focus on conditions that are within a driver's control, implement a multi-step derate schedule, and a backup check to override false inducements. [EPA-HQ-OAR-2019-0055-1266-A1, p.5]

Following the January 2020 Cleaner Trucks Initiative Advance Notice of Proposed Rulemaking (ANPRM), many truckers told EPA about problems they've experienced and how the agency could work to address them. OOIDA commends the agency for listening to those comments and including provisions in the proposal regarding serviceability, inducement, and self-diagnostic tools that will help drivers better assess their emissions equipment. [EPA-HQ-OAR-2019-0055-1266-A1, p.6]

Organization: *State Trucker Associations (1)*

We file these comments in support of the revised inducement provisions under EPA's proposed low-NOx rule. The trucking industry understands EPA's rationale behind low-speed de-rates after: (1) there are three hours of Diesel Emission Fluid (DEF) remaining in the tank; (2) DEF quality fails to meet manufacturers' concentration specifications; or (3) when certain SCR system tampering events have occurred. Current speed derating to five miles per hour within four hours of detecting certain NOx fault conditions pose on-going concerns over driver safety and presents potential hazards for all vehicles operating on roadways due to the stark speed differentials being created. [EPA-HQ-OAR-2019-0055-1075-A1, p.1][25]

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[25] One commenter who joined this mail campaign added the following information: "A situation in which a truck was traveling on the highway at 5 miles per hour or less has been attributed to the cause of the death of a state trooper in Connecticut within the past few years. The trooper's vehicle rear-ended a slow moving tractor trailer truck, and the trooper passed away. The incident occurred on March 29, 2018 on Interstate 84 in Tolland, CT. A Hartford Courant article about the investigation published on March 6, 2019, stated this about the investigation into the incident: "The report said the truck in the right-hand lane of I-84 at a speed of less than 5 mph "created an emergency situation that had a high probability of causing a serious collision." https://www.courant.com/breaking-news/hc-br-trooper-kevin-miller-crash-report-20190306-jgkphof4f5h5vboa3f6zaccgju-story.html" [EPA-HQ-OAR-2019-0055-1088, p.1]

Fleets nor drivers wish to experience derate episodes which have the potential to create both safety and delivery concerns.[26] Yet, following more than a decade of experience, derates are still occurring at unexpected rates and do not involve inadequate DEF levels or quality, but rather a variety of other reasons particularly faulty sensors. [Additional comment by one of the 23 organizations that joined this mail campaign] One thing that is not in the rulemaking scenario is that any sensor that creates a de-rate situation should by law be produced domestically and be available in adequate quantities. Just last year one of our members had a truck de-rate in North Carolina. Peterbilt, Kenworth, Freightliner and Cummins all showed the part on national backorder. The carrier happened onto the part at NAPA via a search on the part number. When their driver arrived at NAPA he had less than 20 min left before the truck went into full derate. Trucking companies that cannot deliver goods in a timely manner lose hauling contracts and suffer financially – the last thing a fleet manager wants. This is why fleets routinely check DEF fluid levels and purchase DEF from reputable sources. [EPA-HQ-OAR-2019-0055-1075-A1, p.1; EPA-HQ-OAR-2019-0055-1095, p1.]

The overriding assumption should be that fleets routinely check all fluid levels and avoid derates at all costs. To do otherwise makes no business sense. [EPA-HQ-OAR-2019-0055-1075-A1, p.1]

Organization: *States of California, et al. (The States)*

In a similar way, EPA should ensure that its inducements provisions secure in practice the emission reductions projected under Option 1. If operators are not properly incentivized to maintain an adequate supply of high-quality diesel exhaust fluid (DEF) in their aftertreatment systems, the real-world operation of these vehicles will severely undermine the emission reductions secured "on paper" by Option 1. The inducements schedule—i.e., the progressive derating of engine performance when DEF supply becomes too low—thus remains an important component of effective NOx standards for heavy-duty vehicles. EPA is rightly attentive to the concerns raised by operators around inducements, especially the challenges of false inducements, and the States largely agree with the seven broad principles that EPA proposes for its inducements approach.80 However, the proposed derate schedules81 are too lenient to ensure that operators properly maintain their vehicles' aftertreatment systems for both low-speed and high-speed vehicles.82 [EPA-HQ-OAR-2019-0055-1255-A1, p. 19]

80. 87 Fed. Reg. at 17,540.

81. Id. at 17,544.

82. See id. at 17,541.

Organization: *Stephen Jackson"*

As a farmer and employee at a John Deere dealership, I have seen the increased complexity and cost associated with emissions components on equipment. If there are new changes made to

[26] Note: Several of the 23 letters represented do not include the phrase "which have the potential to create both safety and delivery concerns."

trucks and off-road equipment for emissions, please make sure the OEMs and repair facilities are up to the task to diagnose and repair these systems with a good supply of replacement parts. It is important to have a long-term warranty to keep these systems functioning correctly. It is important to have some sort of "limp home" mode to be able to move the vehicle some distance when there is a failure of the emissions system. We recently had to have our delivery semi towed when it experienced an emissions related failure on the road. This was complicated by the fact we were hauling over width machinery on the trailer which makes it difficult to find a tow company that can pull a disabled truck and trailer that is over width. Please be aware this will come with increased costs to whoever owns and operates the vehicles and this will get passed on to the end user as higher prices for consumer goods. I believe trucks and off-road equipment have really become much cleaner in recent years with tier 3 and tier 4 regulations. If new requirements push the cost of new equipment higher, I believe we will see a renewed effort by owner operators to continue keeping older "pre-emissions" equipment in service. I see this now with farm tractors, older pre-emission equipment sells for a premium price due to its simplicity and the huge gap in price between used and new equipment. [EPA-HQ-OAR-2019-0055-1481]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §1036.111(b): We offer the following additional comments on the specific proposed provisions of this paragraph: (b)(4): “(4) Open circuit faults related to the following: DEF tank level sensor, DEF pump, DEF quality sensor, SCR wiring harness, NOx sensors, DEF dosing valve, DEF tank heater and aftertreatment control module.” NOx sensors should be removed from the proposed open circuit faults of paragraph (b)(4), as the NOx override factor is part of the derate engagement (specified at proposed paragraph (c)). [EPA-HQ-OAR-2019-0055-1203-A1, p. 102]

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §1036.111(b): We offer the following additional comments on the specific proposed provisions of this paragraph: (b)(5): “(5) Monitor for a missing catalyst.” Regarding the proposed provision that monitoring for a missing catalyst be a trigger for inducement, EMA recommends that EPA consider adding specific language for dual-SCR technology (specifically, for a singular failure versus both failing). However, at the very least, we request clarity on how dual-SCR technologies would be treated. [EPA-HQ-OAR-2019-0055-1203-A1, p. 102]

EPA proposes to codify the SCR inducement strategies (proposed §1036.111) that heretofore have been covered by guidance documents since HDOH SCR technology was first introduced in 2010. EMA supports this proposal, including the proposed new speed-based derate schedule, but suggests EPA consult with NHTSA on the corollary safety aspects. [EPA-HQ-OAR-2019-0055-1203-A1, p. 124]

There needs to be better harmonization between EPA’s and CARB’s SCR inducement requirements for medium-duty and light-duty vehicles. If there is not better harmonization in inducement strategies, customers may be even more confused by inducement, since there could be a proliferation of differing strategies within a single manufacturer (e.g., Class 3 chassis-cert trucks vs. Class 4 dyno-cert trucks). Lack of harmonization also increases the burden on manufacturers, as they will have to integrate multiple inducement strategies when it is much more cost-effective to keep a common control strategy across products. [EPA-HQ-OAR-2019-0055-1203-A1, p. 99]

Organization: *United Motorcoach Association (UMA)*

Fortunately, EPA acknowledges these shortfalls and proposes corrective measures. UMA applauds the Agency for the time they have invested in understanding the scope of the problem. [EPA-HQ-OAR-2019-0055-1311-A1,p.3]

Some UMA Members have raised safety concerns regarding the prospects of a derating (5 mph) bus or motorcoach while in traffic. Similar concerns have been raised regarding disabled buses and motorcoaches roadside. [EPA-HQ-OAR-2019-0055-1311-A1, p.3]

Currently, buses and motorcoaches equipped with emissions reduction technology lacks the level of dependability consumers of bus and motorcoach services seek. The current inducement renders a bus or motorcoach basically inoperative after few hours. Imagine a college athletic team traveling overnight to a tournament and compelled to forfeit the came by not arriving. Imagine your first school field trip to Disney World thwarted by a motorcoach derated by an unknown code. Imagine missing a relative’s wedding or graduation due to an errant code on a scheduled service motorcoach. [EPA-HQ-OAR-2019-0055-1311-A1, p.2]

Bus and motorcoach companies seek to provide dependable economical passenger transportation to the consumer. Failure to do so will eventually lead to a cessation of business through a poor reputation and the related financial difficulties that follows. [EPA-HQ-OAR-2019-0055-1311-A1, p.2]

If individuals and groups cannot depend on modern, low-emissions, commercial buses for motorcoaches they will find alternative transportation less environmentally friendly, yet again defeating the goals EPA sought. [EPA-HQ-OAR-2019-0055-1311-A1, p.3]

The Agency outlines EPA’s goals regarding inducement as follows:

1. A description of how the emission control systems operate.
2. Diagrams of the engine and emission-related components and expected key operating parameters.
3. A description of how to use the OBD system to troubleshoot problems and access emission-related diagnostic information.
4. A wiring diagram to troubleshoot aftertreatment-related components.
5. Provide instructions on where to find emission recall and technical repair information that is available without charge.
6. QR code on engine label that links to engine information and owner’s manual.
7. QR code on engine label that links to engine information and owner’s manual with enlarged-view drawings with part numbers and basic assembly requirements
8. DPF-specific information:
a. Criteria for cleaning the DPF (e.g., pressures and filter weight).

b. Access to DPF inlet and outlet pressures with a generic scan tool
c. Access to DPF inlet and outlet pressures with a generic scan tool,
d. Instructions on how to remove DPF for cleaning.
9. Troubleshooting guide to address DEF dosing- and DPF regeneration-related warning signals
10. Codes associated with inducements and DPF engine derates would be displayed in the cab or with a generic scan tool. [EPA-HQ-OAR-2019-0055-1311-A1, pp.3-4]

EPA proposes SCR inducements would only be required based on detecting the following fault conditions:
1. Low-DEF fill level
2. Blocked DEF lines or dosing valves
3. Poor DEF quality
4. Open circuit faults as an indication of tampering (e.g., disconnection of DEF pump or quality sensor)
5. Missing catalyst [EPA-HQ-OAR-2019-0055-1311-A1, p.4]

EPA proposes additional SCR Inducement Proposed Provisions
1. A NOx Override to prevent false inducements.
2. A derate schedule in four stages implemented over 60 hours
3. Separate derate schedule for low-speed vehicles (defined as vehicles with 30 hours of non-idle engine operation at <20 mph)
4. Final inducement speeds of 50 mph, or 35 mph for low-speed vehicles
5. Any OBD signals involved in inducement-related conditions must be readable with generic scan tools. [EPA-HQ-OAR-2019-0055-1311-A1, p.4]

***Organization**: Virginia Motorcoach Association*

Our primary concern involves the proposed "derate" or "inducement" schedule, which will result in a vehicle experiencing a significant loss of power and torque. This change in power has placed an undue burden on operators since 2008, when it was first implemented. There are numerous repercussions directly related to derates. Motorcoaches often travel to remote areas across the country unlike local transit or school buses that commonly transport intrastate and are home daily. Motorcoaches will drive far distances all times of the day or night making the ability to service a vehicle in a timely manner very difficult. Motorcoaches could be thousands of miles from home or even from an equipped service facility that could assist with a breakdown. This challenge for companies is far greater than what may be realized. [EPA-HQ-OAR-2019-0055-2715-A1, p.2].

When the equipment experiences an inducement, there are fewer options than other types of vehicles fitted with SCR. Since most of the vehicles have manufacturer-specific components, drivers are at most times limited to finding the right parts to fix a vehicle that is over the road. Additional costs involved include towing, outside repair service, reimbursing customers for missed events, refunding customers for long delays, contracting with other companies to move the passengers, and damaging the overall reputation of the company. [EPA-HQ-OAR-2019-0055-2715-A1, p.3].

Aside from the large expenses motorcoach operators must absorb, an even more important point is the safety risk a derate presents our passengers. It is our opinion that a regulation which cripples or limits the speed of any vehicle is unacceptable, dangerous, and jeopardizes lives. **The motorcoach industry has the unique and considerable responsibility of safely transporting the most valuable type of cargo on the road – human lives.** Many operators provide a significant amount of travel for school groups and young athletes, a cargo which is substantially different and more vital than that of a truckload of consumer goods or raw materials. There is no room for error when it comes to safety practices and maintaining a proper speed to avoid a fatal rear-end collision on a highway. This condition increases the likelihood of the extreme danger of a distracted driver driving into the rear of a derated or stranded motorcoach full of passengers. [Emphasis in original; EPA-HQ-OAR-2019-0055-2715-A1, p.3].

Organization: *Volvo Group*

[Inducement] issues affect today the adoption of newer technology trucks in the marketplace. [EPA-HQ-OAR-2019-0055-1324-A1, p. 5]

Organization: *Wisconsin Department of Natural Resources (WDNR)*

EPA's heavy-duty NOx proposal includes multiple program elements, such as extended useful life and warranty periods, that are expected to reduce the incentive for operators to bypass, or delay maintenance on, emission control devices. However, it also proposes to significantly relax some current anti-tampering inducements in the hopes that making compliance easier will result in less tampering. [EPA-HQ-OAR-2019-0055-1162-A1, p. 3]

Instead of finalizing the relaxed inducement schedules as proposed, EPA should take steps to ensure the emission control systems required by this rule are resistant to operator tampering. [EPA-HQ-OAR-2019-0055-1162-A1, p. 3]

As this rule applies only to vehicles MY 2027 and beyond, EPA should continue to prioritize enforcement of vehicle tampering in the current heavy-duty fleet. While EPA has taken a number of steps in recent years to address vehicle tampering including issuing an enforcement alert to the regulated community and resolving multiple enforcement cases concerning aftermarket defeat devices, reports continue to indicate that the use of heavy-duty vehicle defeat devices may be widespread. Additionally, EPA should consider evaluating the impact of a national-level inspection and maintenance program for heavy-duty vehicles to identify tampered vehicles. [EPA-HQ-OAR-2019-0055-1162-A1, p. 3]

EPA Summary and Response

For the purpose of this section, each subtopic is summarized and responded to separately.

Inducements and Emission System Reliability

ABA, Northwest Navigator Coaches, OOIDA, and NASTC commented with concerns that 2010-era type of reliability problems will accompany new NOx standards which will once again exacerbate inducement problems in-use. Northwest commented that the systems already fail at too high of a rate and it is not fair to shut down an engine due to a defective system. UMA commented that operators continue to struggle with technology lacking the level of dependability that bus passengers and operators need. Coach USA commented that the bus industry is experiencing a shortage of drivers, noting the recent pandemic, and they support an approach to allow drivers to complete their route before addressing a fault condition. Volvo noted that inducement issues currently affect the adoption of newer technology trucks in the marketplace.

Response:

As described in preamble Section IV, this rule focuses on developing a comprehensive inducement scheme in regulation to replace the current inducement guidance developed over a decade ago.

The inducement requirements adopted in this final rule include several features that are intended to mitigate many of the issues operators identified as experiencing under the existing guidance.

First, EPA is adopting longer useful life requirements that should lead manufacturers to improve component durability. Second, new serviceability requirements are intended to give operators and independent mechanics better information to allow for timely diagnosis and repair. Third, initial derate speeds are set to allow an initial stage of continued operation at or near prevailing speeds. Fourth, separate derate schedules apply based on each vehicle's average operating speed, rather than applying a universally effective speed restriction to all vehicles. Fifth, the inducement applies gradually increasing restrictions over a schedule that is intended to accommodate drivers returning home or completing other essential activities before the restrictions take full effect.

We are not aware of any way for engine software to discern the difference between faults caused by operator activity (or inactivity) and faults caused by corrosion, component wear, or any kind of defect. The final derate schedules reflects consideration of the concern that operators may not be able to make simple adjustments to resolve issues caused by defective components.

With regard to Volvo's comment, as explained in preamble Section IV, EPA believes the regulations included in this final rule will address many of the inducement issues identified by commenters and thus will not discourage the adoption of new technology trucks.

EPA's Inducement Principles

ABA, CARB et al and OOIDA: Generally agree with seven principles EPA proposed.

Response:

EPA is encouraged that a broad group of stakeholders recognize the importance of balancing the needs and impacts of the many elements of the heavy-duty in-use fleet. EPA continues to want to encourage proper maintenance and functioning of emissions control equipment and discourage tampering. A minimally restrictive approach, which is not what EPA is finalizing, might result in increased emissions because of extended operation without maintenance and circumvention of the limit on the adjustable range (i.e., without use of sufficient high-quality DEF). In contrast, an overly restrictive approach might impose unnecessary costs and pose a threat to operators' businesses, as well as leading to potentially increased tampering with engines or reduced fleet turnover rates that would lead to increased emissions. Commenters have described similar concerns with the 5 MPH final inducement speed that exists in many manufacturers' current inducement designs under the existing guidance. EPA developed the inducement principles to balance these competing concerns.

Concerns with Cost of Inducements

ABA, Coach USA, FitzGerald Brothers Bus Co., NASTC, UMA: ABA, Coach USA, NASTC, OOIDA, 23 State Trucking Associations commented that inducements raise serious economic concerns, are too costly for operators, add unnecessary operating costs (e.g., bus operators must refund tickets for missed travel or events) and can result in loss of customers, business credibility, and reputation. FitzGerald Buses noted that they lost $10,000 on one job alone, and lost the customer, and their driver quit because at 2AM their bus experienced a problem with a NOx sensor 500 miles away from their destination. Coach USA highlighted that there are many unintended consequences of inducements occurring because their mode of transport takes them to remote areas, far distances, traveling day and night, finding parts and they have difficulty finding repair facilities that can work on buses when they are thousands of miles from home base. Coach USA added that in addition to towing costs and outside repair costs, they must reimburse customers for missed events, refund customers for long delays, and hire other companies to move stranded passengers. UMA noted that rendering buses inoperative after a few hours has created consequences like athletic teams having to forfeit games, school field trips being disrupted, and missed family events. UMA commented that failure to provide reliable, dependable, and economical transportation leads to eventual loss of business, poor reputation and financial difficulties. Further, UMA noted that one of the unintended consequence of inducements on the motorcoach industry is to discourage passengers from utilizing this type of travel, which can erode the environmental benefits if passengers instead choose a less efficient mode of transportation. NASTC commented that the costs of repairing away from home base due to the emergency created by the current inducement schedule escalate due to a lack of relationship between repair facility and owner, potential difficulty in getting parts, and the need for extended driver lodging during the duration of the delay – all while the truck is unable to earn money while stranded. NASTC added that contracts and customers are also at risk during these events which makes for a much costlier experience than the current inducement strategy considers. NASTC noted that these cost impacts can be debilitating and cause layoffs. CARB's survey noted it often took more than one visit to properly diagnose and make repairs related to inducements and that 33% of vehicles needed work done more than one time a year due to derates and 29% of those had to return to the shop to have the repair properly diagnosed and repaired. State trucking organizations pointed out that the overriding assumption should be that fleets always check all fluids and avoid derates at all costs, and that to do otherwise makes no business sense.

Response:

EPA received numerous comments on the cost of experiencing inducements as included in today's engine software. This includes, for example, the cost of towing and renting replacement trucks. EPA is aware that the inducement requirements in this final rule will substantially reduce costs borne by operators, but EPA has not attempted to estimate these reduced costs to the fleet. EPA notes that such costs are not costs of compliance for the manufacturer.

Several commenters described their difficult experiences with existing inducements. EPA continues to believe that designing SCR-equipped engines with power derating is an effective and reasonable measure to ensure that operators perform critical emission-related scheduled maintenance on the SCR system. Inducements also demonstrate that engine manufacturers can reasonably expect operators to regularly supply engines with quality DEF, consistent with requirements for adjustable parameters. We have taken stakeholder feedback and concerns into account and are finalizing inducement requirements whose objective is to ensure that emission controls function in-use while reducing potential adverse impacts to operators through consideration of seven key principles.

One of EPA's principles in developing the inducement is to ensure that scheduled maintenance has a reasonable likelihood of being performed and allow manufacturers to demonstrate that they meet adjustable parameter requirements at the time of certification, while addressing operator frustration with false inducements and severe inducement speed restrictions that may potentially lead to in-use tampering of the SCR system. We are concerned that engine designs under the existing SCR guidance may have resulted in high levels of false inducement and overly restrictive speed limitations. The resulting frustration may have increased in-use tampering. We have received several comments following the ANPR and NPRM that real-world inducements are not limited to taking effect in a manner that would "not create undue safety concerns," such as only after a key-off event or at idle. We are also aware that manufacturers do not take consistent approaches to implementing inducements. The final rule addresses both issues by requiring manufacturers to take a consistent approach to gradually reduce vehicle speeds. Further, existing inducements are based on a 'one size fits all' approach – whereas the final inducement requirements set a more appropriate inducement schedule that correlates with the extent of high-speed or low-speed driving for each vehicle. The final inducement program we are adopting allows for more time and higher speeds between inducement steps to allow operators to return home and to diagnose and repair systems. These changes will reduce the need for operators to choose between making repairs at the side of the road and towing vehicles to the nearest available repair facility. These changes will also increase the likelihood that operators will respond appropriately to the inducement to arrange for properly maintaining their engines.

Concerns with Safety and Inducements

ABA, ATA, NASTC, OOIDA, 23 State trucking Organizations, UMA, Stephen Jackson, Volvo, David Pedersen: Inducements raise serious safety concerns. Coach USA noted that for transporting people or school groups, maintaining proper speed is of the utmost importance to avoid fatal rear-end collisions. Many state trucking organizations noted that current inducements pose on-going concerns with driver safety and present potential hazards for all vehicles on roadways due to stark speed differentials. The Motor Transport Association of Connecticut highlighted this concern noting that a situation in which a truck was traveling on the highway at a derated speed of 5 miles per hour and caused of the death of a state trooper who had a high-speed rear-end collision with the truck. NW Navigator Coaches noted that too often inducements strand them in remote areas with no access to cell service, and when they are stranded passengers need access to food and water as well as environmental controls. NW Navigator also noted that their main types of passengers are elderly and the young – both of which are susceptible to environmental extremes (e.g., very cold or hot weather) and they have experienced being stranded in extreme heat with elderly passengers and no cell service or nearby help due to a failed NOx sensor.

CARB's survey showed that 42% of owners had safety concerns with inducements and 18% had experienced a safety concern due to a derate such as sudden power loss when operating at highway speeds, power loss when coming down a steep grade, power loss when attempting to travel uphill, or power loss during heavy traffic. CARB notes that based on existing guidance, SCR-related inducements should not happen suddenly and without warning. Carreras Tours, however, commented that while on Interstate 5 in California with a bus full of students, the bus derated immediately to 5mph after a check engine light came on raising safety concerns that they would be rear-ended. Carreras added that it took several hours to get a rescue bus to pick up the stranded group and noted their frustration that they are not provided adequate time to get to a safe place where the bus and passengers would be safe.

Motorcoach Companies stated that they have no room for error in their safety practices and that maintaining proper speed is of utmost importance to avoid a fatal rear-end collision on the interstate. NASTC commented that the proposed schedule provides a safer atmosphere for professional drivers to deal with the situation in which inducement occurs in an appropriate, safe manner, while the driving public is protected from an inducement-caused road hazard while also reducing incidents of road rage by passing drivers. David Pedersen described the proposed rule as a flawed approach because de-rating vehicle speed creates a hazard for the operator and others nearby. Stephen Jackson noted that inducements can create safety concerns especially in operations that carry unique loads, such as over-width loads that require special permits and generally must keep routes and schedules preapproved by state police.

EMA and Cummins recommended that EPA consult with NHTSA on aspects of the proposed rule related to safety.

<u>Response:</u>

EPA designed the proposed and final derate schedules with the clear expectation that derating at higher initial vehicle speeds would likely address many of the experiences that commenters have described with current vehicles. The initial derate speeds are intended to be slightly lower than the vehicles' typical peak speeds to prevent abrupt speed changes that could pose a traffic risk. As described in Section 8.3, we are revising the final rule from proposal to further protect against abrupt speed changes by specifying that engines need to gradually impose derates at a rate of 1 mph for every five minutes. In addition, the final rule allows manufacturers to design engines with a revised derate schedule that is intended to address the issues that apply uniquely to motorcoaches, as described in Section 8.3.

The process for preparing the proposed and final rule includes interagency review within the federal government. At the same time, we are not aware of any specific issues in the rulemaking that would relate to NHTSA's role for addressing safety for heavy-duty highway vehicles.

Concerns Proposal was Rushed

ABA, Coach USA: Commenters expressed a concern that the inducement proposal might not work as intended and existing problems won't be solved because the proposal was too rushed and they did not have significant time to respond.

<u>Response</u>:

EPA received extensive, detailed comments from these and other stakeholders to describe a full range of concerns, along with suggested alternative approaches. EPA considered these concerns and fully responded to them in the final rule, as detailed in this section of this document and preamble Section IV. See also our response in section 17 of this document regarding sufficiency of the comment period for the rule.

General Support or Opposition to the Proposal

ABA, ATA, Cummins, EMA, NACD, NASTC, OOIDA, State Trucking Organizations, and Volvo broadly support the proposal, though as noted below some of these commenters also suggested some modifications. NASTC commented that this more reasonable and evidence-based modernization of inducement provisions would mitigate extremely costly, dangerous, counterproductive problems the current rules create and provide more predictability for drivers. NASTC stated that the proposals rightly reform current policies in light of 12 years' worth of real-world data and real-life circumstances that regularly bedevil truckers.

CARB, CATF, NACAA: Does not support proposal, believes significant changes are needed to prevent erosion of emission benefits and provide proper incentive for operators to maintain DEF. ALA and CARB commented that EPA should work on a national approach to inducements. ICCT agrees that an update of the current inducement policies is appropriate. ICCT supports several aspects of the proposal including: more time to remedy an indicated fault than is allowed today, separate derate speeds for low-speed vehicles and a NOx override.

ICCT commented that they agree that EPA should replace nebulous guidance documents for inducement provisions with clear regulatory requirements and stated that current guidance successfully encourages timely emission-related repairs, but updated provisions should consider reducing downtime to address operator concerns. ICCT supports several new approaches for inducements in the proposed rule but believes the specific proposed changes will reduce the incentive for many truck operators to achieve emission-related repairs, and result in unnecessarily increased in-use emissions, rather than the net benefit that EPA claims. ICCT comments endorsed EPA's proposed provisions to identify disconnection of emission control devices as an inducement fault condition, which would help to prevent tampering.

Response

As further explained in preamble Section IV, after consideration of comments, the final inducement requirements include some modifications from the proposal. As further explained in preamble Section IV and in this section, the final provisions ensure that scheduled maintenance has a reasonable likelihood of being performed and allow manufacturers to demonstrate that they meet adjustable parameter requirements at the time of certification, while minimizing operator frustration with false inducements and severe inducement speed restrictions that may potentially lead to in-use tampering of the SCR system and likely resulting in fewer costs for operators from inducements. . The most common form of tampering is removal of the emission control systems (e.g., "delete kits") which dramatically increases the emissions from in-use vehicles. Tampering with even a small number of vehicles can substantially increase fleet-wide emissions. While exact tampering rates are not known, tampering does indeed impact emissions in real life. Operators tamper for reasons such as improving fuel economy, avoiding the cost to maintain emission control systems, or avoiding operating restrictions such as inducements. Tampering is not always easy to detect. In determining the final inducement provisions, EPA considered that if inducements are set too stringent (in terms of time, speed, and number of deterred fault conditions), the resulting derate conditions could lead to more tampering, such as to avoid the financial consequences of downtime.

The final rule additionally includes several provisions designed to make appropriate maintenance easier and potentially less costly, which is critical for maintenance to occur in-use long-term (see, e.g., 40 CFR 1036.125(h)). The final rule also includes provisions intended to further protect against tampering (see, e.g., Section XI of the preamble for more information on the final adjustable parameter requirements).

We appreciate ICCT's affirmation of the initiative to adopt updated inducement provisions in the regulation. We note that our concern with the current guidance is not that it is unclear; rather, as described in the preamble, applying the principles to achieve an effective program while also considering the potential impacts of an overly burdensome program leads us to a different set of conclusions. While the current guidance is intended to ensure that operators will never choose to run out of DEF and will make timely emission-related repairs, our assessment is that the 5 mph final derate included in most current inducement designs is much more severe than it needs to be to accomplish that purpose. Experience has also shown that defective components lead to many inducements. Thus, one of the unintended consequences of current derates is that they can increase the motivation for tampering as operators bear the burden of repeated component malfunctions leading to inducement. Based on our assessment of the various considerations at issue, we have determined that a 5 mph final derate is overly restrictive for an effective national inducement strategy and includes additional burden on operators and could potentially lead to increased tampering with engines or reduced fleet turnover rates, which may result in increased emissions.

We developed the proposed and final inducement provisions by asking an additional question—What is the least restrictive means that will still ensure that operators fill DEF tanks and make timely repairs? Consideration of several detailed comments have led us to make several adjustments to the proposed derate schedules, as further discussed in preamble Section IV.

Inducements and Warranty

CARB, DOEE, ICCT, Maine DEP, NACAA, Wisconsin DNR suggested EPA's lengthened warranty periods should incentivize manufacturers to improve their processes and reduce defective parts. CARB suggested the lengthened useful life periods would also incentivize manufacturers to improve the durability of their component designs. Further, CARB stated that EPA should adopt a program similar to CARB's EWIR program which could help identify false inducements that occur under warranty. DOEE and NACAA stated that EPA should put in place measures that "will hold manufacturers accountable for addressing the durability and sensor issues about which the agency, dealerships, and manufacturers have received complaints." The States of California et al. commented that although they understand the frustration with false inducements, these concerns should be solved by manufacturers and do not justify relaxing the inducement schedule.

Response:

EPA agrees that longer useful life and warranty provisions are expected to lead to improved durability and decreased repair costs of emission-related components. CARB's EWIR program may also have some benefits in improving component durability. EPA did not propose to adopt a program similar to EWIR and is not including such a program in the final rule. We note, however, that these provisions would not fully prevent components from failing in the field (e.g., warranty provisions do not address the period after the warranty period ends). As a result, both the improved durability provisions and the final inducement provisions are part of the solution to addressing the false inducements issues raised by commenters. See preamble Section IV for additional discussion of how the final rule includes derate schedules that are consistent with the principles expressed in the proposed rule and includes consideration of comments.

Inducement Triggers

ABA, ATA, Coach USA, NASTC, and OOIDA noted that inducements occur too frequently for reasons outside of the operator's control. ABA commented that existing inducement triggers are problematic and occur for many reasons unrelated to using high-quality DEF and tampering. Examples of such failures include: software glitches, loose wiring, faulty sensors, and cold temperatures. ATA commented that after nearly a decade of experience, derates are still occurring at unexpected rates for reasons unrelated to using high-quality DEF and tampering. Examples of such failures include: sensor, parts, and wiring harness failures, bad pin connectors or faulty modules. CARB commented that they did studies in 2011-2013 showing that inducement warnings were sufficient and that based on these reports and existing guidance it is clear that inducements should not happen suddenly and without warning; however, OOIDA noted that members have experienced emission technology failures that caused trucks to quickly derate, placing trucks and motorists in unsafe conditions.

ABA said there is a lack of consistency among manufacturer's inducement strategies. ATA said that they agree with EPA that a standard list of fault conditions to trigger a tampering inducement would aid owners, operators, and fleets in repairing vehicles by reducing the cost and time required for diagnosis. CARB commented that EPA should remove the word "open" before "open circuit" faults to apply inducements for tampering-related inducements and that EPA should expand the list of tampering triggers to any component that OEMs determine should be added. ICCT also recommended that EPA include additional monitoring for disconnected devices to prevent tampering. Finally, CARB added that freeze protection guidance should be codified and freeze protection components should be added to the list of tampering trigger components. ATD noted that improperly functioning inducements can lead to tampering. EMA commented that it is critically important that sufficient notification be allowed before applying an inducement.

CARB commented that DEF fill level, quality, and tampering must all continue to be monitored for potential inducement. CARB agreed with EPA's proposal that low-DEF level trigger should start 3 hours before DEF is depleted. Coach USA stated that inducements should not begin until DEF is depleted – that they monitor and maintain buses including topping off DEF prior to each trip and usable volume of the tank should not be subject to inducement. ABA believes bus operators would never risk running out of DEF. Champion Auto Carriers stated that DEF issues have resulted in significant truck downtime and extra expense for their business. CSM commented that trucks running on DEF are unreliable and costly. OOIDA commented that DEF issues are costly and cause significant downtime.

CARB commented specifically that EPA should not remove the DEF quality as a fault condition for inducements because of the financial motivation to dilute DEF with water or to refill the DEF tank with something other than DEF. CARB highlighted the financial motivation by pointing out that DEF costs more than three times as much as distilled water and the financial motivation for DEF substitution will increase with new standards that require greater quantities of DEF.

Some commenters noted that the lack of adequate DEF can cause NOx emissions to increase to levels comparable to having no NOx controls at all, which is likely to be especially harmful in urban areas where HDV operations are concentrated, and where vehicles are consistently operating at speeds well below EPA's proposed derates.

EMA recommended that EPA clarify how to treat the failure of an SCR catalyst in a dual-SCR configuration, ideally with specific language to describe how the regulation applies for one or two failing catalysts.

Response:

EPA received comments from many operators who reported experiencing false inducements from faulty hardware that were not a result of tampering. For example, one manufacturer noted that it is difficult to effectively differentiate a blocked DEF line or doser due to direct tampering from a maintenance issue. In considering the comments, EPA reviewed current engine designs regarding fault conditions triggering a tampering inducement. We are concerned that these existing designs may be applying inducements to circumstances outside the intended scope of inducements for SCR systems, and believe that it may be difficult for manufacturers to design inducement strategies to be able to distinguish between tampering and faulty hardware. EPA reviewed various manufacturer's inducement strategies in their certification documents and compared those to our existing guidance. Some manufacturers have certified engines with nearly 200 different fault conditions causing a derate condition, including nearly 50 fault conditions for an SCR-related inducement. Many of those fault conditions are for engine protection; we are not adopting any regulatory provisions that would affect how manufacturers include engine protection in their AECD designs. As detailed in preamble Section IV, we are adopting a specific list of SCR system fault conditions to trigger inducement for meeting critical emission-related maintenance and adjustable parameter requirements. These final provisions focus on specific emission control components and conditions that owners can control, such as disconnecting a DEF pump or other SCR-related emission control hardware. The finalized list includes the tamper-resistance inducement triggers included in CISD-09-04R as well as additional components. Regarding the example of blocked DEF lines, as further explained in preamble Section IV, after further consideration EPA has decided not to finalize this as one of the requirements required to trigger inducements.

EPA agrees with ATD that improperly functioning inducements can lead to tampering and believes that standardizing a regulatory list of tampering inducement triggers will aid owners, operators, and fleets in repairing vehicles by reducing the cost and time required for diagnosis. EPA does not agree with CARB that this tampering list should include other fault conditions. CARB’s reports from 2011-2013 were largely focused on use of DEF in the field, DEF availability, and the effectiveness of the inducement strategies used by manufacturers based on CARB and EPA guidance. For example, in one test program, CARB found that 50 mph with some torque derate was adequate to render a vehicle unacceptable for typical driving (see, e.g., 76 FR 32886, 32889-32890 June 7, 2011). The recent survey data CARB submitted with their comments did not include supporting information to justify treating the additional fault conditions as tampering, or to clarify how manufacturers could reasonably differentiate between tampering and manufacturing defects for these additional fault conditions. EPA has identified the critical components in the list that should be monitored for disconnection. Defining a list of required triggering fault conditions will support a standardized approach for manufacturers to provide servicing information to operators.

EPA agrees with CARB that tampering with freeze protection components should trigger a tampering inducement. EPA proposed to include the DEF tank heater on the list of tampering items in §1036.111; after additional consideration, the final rule includes an update to the proposed list to also include the DEF tank temperature sensor in the final list of elements to be monitored for tampering.

EPA agrees with CARB that the low-DEF level trigger should start 3 hours prior to the DEF tank being depleted. As reflected in the final inducement schedules, EPA believes it is important to start the inducement for low-DEF level at this point in order to provide operators with advance notice that the DEF tank is approaching empty with enough time for them to find a place to refill the tank. As explained further in preamble Section IV, the inducement program adopted in this final rule initiates the inducement with an initial vehicle speed derate that is meaningful—not high enough for the vehicle to continue being used for its commercial purpose, but high enough to not completely disable it such that it would require a tow. We are including DEF quality as a fault condition in the final rule.

With respect to commenters noting emission levels in urban areas where vehicle speeds are slower, as further explained in preamble Section IV, the final inducement provisions include some changes from those proposed regarding derate schedules and final derate speeds. We believe that the final provisions will address many of the concerns raised by commenters. To the extent that the comments presume vehicle operators will not perform maintenance to remedy a detected fault condition until vehicles reach the final derate speed, the commenter did not provide data to support this assertion and EPA disagrees that operators uniformly do not remedy fault conditions until the final derate speed is reached. The proposed rule describes principles and analysis of in-use operating characteristics to support our expectation that operators will typically respond to the proposed derate schedule by performing needed maintenance once they are able to return home, if not sooner. Commenters on the proposed rule representing operators consistently affirmed this expectation. The expectation for performing timely maintenance applies especially for maintenance as simple as adding DEF to an empty DEF tank.

Regarding the commenter stated that vehicles consistently operate well below EPA's proposed derated speeds, we note that while it may be true, EPA disagrees that the existence of some operation below a given speed is a proper measure to evaluate the effectiveness of inducements. For example, refuse haulers, street sweepers, and utility trucks might operate for extended periods at very low speeds, but they need to get to and from the areas of low-speed operation, often on roads where prevailing speeds are well above the derated speed. If those low-speed vehicles can't accomplish those high-speed trip segments, they will be substantially restricted by the speed derate. The commenters offered no information to suggest why operators would be so motivated to continue operating with a fault condition that they would prefer to continue operating at restricted speeds rather than performing needed maintenance. All the information available to us show that all low-speed, medium-speed, and high-speed vehicles would be substantially impaired by the final speed derates. All the information available to us shows that all low-speed, medium-speed, and high-speed vehicles would be substantially impaired by the final speed derates.

With respect to EMA's request for clarification, we have revised from proposal the final regulation to state that any failing catalyst would be a fault condition to trigger inducement. If a second catalyst fails, that would be a separate fault to process.

Parts Shortages

Coach USA commented that parts may not be readily available, as seen during the pandemic, which further supports allowing more time to address fault conditions. A commenter from the State Trucker Associations (1) recommended that EPA deal with the parts shortage by requiring that all inducement-related sensors be produced in the United States and be available in adequate quantities.

Response:

We expect that the final derate schedules should address Coach USA's concern while also ensuring use of high-quality DEF in SCR systems.

Mandating where inducement-related sensors need to be produced or in what quantities is not within the scope of this rulemaking.

Inspection and Maintenance

Wisconsin DNR suggested that EPA continue to prioritize enforcement of vehicle tampering in the current heavy-duty fleet since reports continue to indicate that the use of heavy-duty vehicle defeat devices may be widespread. Wisconsin DNR also suggested that EPA consider evaluating the impact of a national inspection and maintenance (I/M) program for heavy-duty vehicles to identify tampered vehicles.

Response:

EPA indeed intends to prioritize enforcement of vehicle tampering for heavy-duty vehicles. The Clean Air Act mandates that the states operate light-duty vehicle I/M programs in certain areas based on criteria such as air quality attainment status, population, and geographic location. The purpose of these I/M programs is to periodically (either annually or biennially) inspect light-duty vehicles to identify and repair high-emitting vehicles to improve air quality in these identified areas. The Clean Air Act does not require a national I/M program that addresses heavy-duty vehicles, but some states and areas have developed strategies to reduce emissions from heavy-duty vehicles. As explained further in preamble section IV, the inducement program finalized in this rulemaking is designed to immediately detect mal-maintained or tampered SCR systems on heavy-duty vehicles sold and operated nationally and should result in timely action that will better achieve expected emission reductions, and we anticipate that the final provisions should decrease incentives to tamper that may be present under existing inducement strategies.

Light-Duty Inducements

EMA advocated for better harmonization between EPA's and CARB's SCR inducement requirements for medium-duty and light-duty vehicles to avoid user confusion, especially for similar vehicles. EMA also stated that lack of harmonization increases the burden on manufacturers, as they will have to integrate multiple inducement strategies when it is much more cost-effective to keep a common control strategy across products.

Response:

EPA is adopting inducement requirements in this rule for engines certified under 40 CFR part 1036. We expect these new requirements will give us important insights and may be helpful in considering whether, when, and how to codify updated inducement requirements for light-duty and medium-duty vehicles certified under 40 CFR part 86, subpart S. Inducement provisions for those vehicles are outside the scope of this rule.

8.2 Onboard Diagnostics and Overriding Inducements based on measured NOx conversion

Comments by Organizations

Organization: *American Bus Association (ABA) (1070 and 1308)*

ii. Faulty Inducements – Similar to establishing consistent inducement policy among manufacturers, ABA believes stopping inducements from occurring when a fault code is flagged by the system, but the SCR system is still controlling NOx emissions, is a good idea. However, motorcoach operators often experience reliability issues with NOx sensors, which would diminish the value of this proposal. Also, if an engine manufacturer does not have control over third party suppliers for SCR components, such as NOx sensors, ABA questions if this issue can/will be addressed. As well, ABA needs additional time to review the NOx override feature with motorcoach industry members. [EPA-HQ-OAR-2019-0055-1308-A1, p.10]

Organization: *California Air Resources Board (CARB)*

The NPRM requests comment on whether improvements could be made to OBD to monitor inducement for false inducements conditions, and whether OBD systems should monitor the inducement process and detect system malfunctions prior to a failure (e.g., for deterioration of the diesel exhaust fluid (DEF) delivery system). CARB staff believes the OBD system requirements are not the place to address these issues to the extent they exist. Rather, instead of relying on the OBD system, manufacturers should be implementing robust inducement systems that avoid false inducements and provide adequate warning prior to final inducement. CARB staff believes that the longer warranty periods proposed by U.S. EPA will encourage manufacturers to develop more robust inducement systems. [EPA-HQ-OAR-2019-0055-1186-A2, p.70]

CARB staff is also concerned that the NPRM proposed inducement could be avoided completely by tampering with the NOx sensor signal. This single point of contact tampering could allow all the SCR system components to be removed, disabled, and ignored. Operators could avoid the need to refill the DEF tank and obtain a meaningful cost savings. U.S. EPA is certainly aware of the prevalence of tampering with motor vehicle emission control devices and the excess emissions associated with such tampering.163 [EPA-HQ-OAR-2019-0055-1186-A2, p.100]

CARB staff believes that the proposal would only increase the likelihood that tampering of SCR systems would increase with U.S. EPA proposal compared to under today's inducement requirements. Truck owners and operators would be tempted to tamper to avoid SCR repair costs and downtime, as well as to eliminate the cost of purchasing DEF when refueling the vehicle. Savings from avoided repairs, downtime and DEF could be substantial, and so the economics and the reduced complexity needed to tamper with the SCR inducement would drive more tampering. Under the current SCR inducement protocol, tampering would be more difficult because it would require a multifaceted approach and any one inducement condition that gets triggered would introduce severe inducement.

A trade press publication within the last year ran six articles advocating precisely this means of tampering with the SCR system sensor signals using widely available off the shelf components to defeat sensors including pictures, linking how-tos, and describing active strategies to defeat engine control unit detection of the signal tampering.164 The ease with which heavy duty pickup owners have obtained engine control software modifications and other electronic tampering devices as outlined in U.S. EPA’s own summary of enforcement actions illustrates just how little effort is required for a bad actor to perform such tampering on their vehicle.165 These types of tampering strategies are well known166 and commercialized with a market even described as 'flourishing'.167 In a report by the Danish government, the police inspected nine heavy duty vehicles in a pilot remote sensing program and found two HD vehicles that used tampering devices and three HD vehicles with malfunctioning SCR catalysts (e.g., lack of DEF or a defective sensor.)168 We urge U.S. EPA to carefully consider the programmatic and emissions control hazards from such widely available tampering means and intentionally construct inducement strategies that do not reward such illegal actions. [EPA-HQ-OAR-2019-0055-1186-A2, pp.100-101]

164 https://www.rvtravel.com/def-head-problem-ruin-trip/;
https://www.rvtravel.com/def-head-stranded-developments-workaround/;
https://www.rvtravel.com/bad-def-sensors-facts-human-toll/;
https://www.rvtravel.com/good-news-def-head-alternatives-coming/;
https://www.rvtravel.com/epa-speaks-failed-def-heads-promises-reliefbut/;
https://www.rvtravel.com/cummins-def-sensor-software-patch-rvt-1019b/

165 https://www.epa.gov/sites/default/files/2021-01/documents/epaaedletterreportontampereddieselpickups.pdf

166 https://www.project-ucare.eu/wp-content/uploads/2020/01/D1.3-Tampering-.pdf

167 https://www.vert-dpf.eu/j3/images/pdf/VERT_FORUM_2017/Hensel---Emission-Control-Manipulation---VERT-forum-2017.pdf

168 https://www2.mst.dk/Udgiv/publications/2018/06/978-87-93710-42-9.pdf

14 In light of this information, U.S. EPA’s failure to consider the aforementioned factors that will likely incentivize tampering of the SCR systems, including the likelihood that the proposal to implement a NOx sensor override may incentivize greater rates of tampering and consequently result in increased emissions, constitutes a failure to consider an important aspect of this rulemaking. State Farm, 463 U.S. at 43. See also Genuine Parts Co. v. EPA, 890 F.3d 304, 312 (D.C. Cir. 2018) (arbitrary and capricious for an agency to ignore evidence contradicting its

position). Indeed, the arbitrary and capricious nature of U.S. EPA's proposal is especially apparent given that the proposed NOx override provision would only increase the risk of tampering, the very harm U.S. EPA is seeking to address in the proposal, thereby failing to demonstrate a 'rational connection between the facts found and the choice made' State Farm, 463 U.S. at 42. [EPA-HQ-OAR-2019-0055-1186-A2, p.101]

The NPRM proposes to allow the NOx override described in 40 CFR 1036.111(c) to override fault conditions that would initiate SCR inducement, because the SCR system is still controlling NOx emissions and the override may be helpful to reduce false inducements. CARB staff agrees that allowing leniency for fault conditions where NOx emissions are controlled is appropriate and would address many of the ANPRM commenter concerns. However, CARB staff believes that the use of the NOx override should only be used in a limited circumstance to determine which of the 2 derate schedules should be used, as discussed in the previous section and shown in Tables 9-1 and 9-2. [EPA-HQ-OAR-2019-0055-1186-A2, p.104]

The NPRM states that ANPRM commentors 'reported that some of these cases were traceable to incidents where the system detected a problem that did not exist and did not create emission concerns, for example a vehicle with a full DEF tank experienced an inducement due to a faulty DEF level sensor which reported an empty tank.' In this example, while the fix of the faulty sensor under some circumstances may not need to occur immediately to maintain immediate emissions control, but as the DEF is used up in the tank the faulty sensor would not be able to inform the operator when the DEF tank is getting low or empty. While this type of fault does not impact emissions immediately, fixing the faulty sensor in a timely manner is important before it could impact emissions. The operator, in good faith, may continue filling the DEF tank despite the faulty sensor; however, a functional diagnostic system is critical to ensure that DEF is properly filled. The proposed NOx override would not result in operators fixing faulty components if SCR NOx conversion efficiency is within 10 percent of lifetime. [EPA-HQ-OAR-2019-0055-1186-A2, p.99]

Since the NOx override criterion plays an important role in determining derate schedules in CARB staff's proposal, the margin of error threshold to determine NOx efficiency is critical to ensure that NOx emissions are controlled and thus the vehicle not subject to a severe derate schedule. CARB staff agrees with the NPRM margin of error of 10 percent of NOx efficiency as a reasonable threshold to detect NOx emissions at the low NOx engine levels. Any margin of error greater than 10 percent is not acceptable for the allowance to use CARB staff's more lenient derate schedule. As NOx sensor technology improves, the margin of error threshold should be adjusted to a lower level in a future rulemaking. [EPA-HQ-OAR-2019-0055-1186-A2, p.104]

The NPRM requests comment on whether OBD Active 100 Hour Array and the specified OBD REAL Bins 13 and 14 are appropriate for determining the NOx override. CARB staff recommends that OBD Active 100 Hour Array not be reset at the detection of a fault condition, but rather a new temporary active array for Bins 13 and 14 be created and used for the remaining time until the Active 100 Hour Array is completed, stored in the Stored 100 Hour Array, and reset. Currently, OBD regulation restricts the Active 100 Hour Array from being reset until 100 hours of active data is completed and stored, and this Array is used to determine the functionality and performance of many other parameters besides SCR inducement. Such disruption of the Active 100 Hour Array is not necessary if a temporary array is established. [EPA-HQ-OAR-2019-0055-1186-A2, p.104]

In addition to the NOx override feature, CARB staff also recommends including OBD SCR conversion capability monitoring in 13 CCR section 1971.1 (e)(6)(D.2.1)(D)(i) to determine which derate schedule of CARB staff's proposal that the vehicle would be induced. This regulatory subsection specifies that OBD system will detect a catalyst malfunction when the catalyst conversion capability decreases to the point that would cause an engine's emissions to exceed the applicable NOx standard by more than 0.2 g/bhp-hr. If OBD detects this SCR catalyst malfunction, regardless of the value of NOx override the more severe derate schedule would be triggered. The inclusion of this OBD SCR criterion would provide additional protection that the SCR continues to effectively reduce NOx emissions, resolve any concerns about the appropriateness of using OBD REAL Bins 13 and 14, and prevent attempts to tamper with the NOx sensors to override inducements. [EPA-HQ-OAR-2019-0055-1186-A2, pp.104-105]

CARB staff also recommends removing the NOx sensor as a fault condition in the proposed 40 CFR 1036.111(b) since the NOx override factor, based on the NOx sensors, can be used to override the NOx sensor fault condition. Rather, staff suggests adding detected NOx sensor functional problems as a separate subsection, not subject to the NOx override condition, and requiring NOx sensor problem to be subjected to the derate schedule in Table 9-1, which is a less severe derate schedule, to induce its repair. If a fault condition is also detected with the failed NOx sensor, then a more severe derate schedule as shown in Table 9-2 would be necessary to induce an immediate repair of the fault conditions. [EPA-HQ-OAR-2019-0055-1186-A2, pp.103-104]

Organization: *Cummins Inc. (Cummins)*

While supportive of EPA's efforts to improve the accuracy of triggering SCR inducements and reduce instances of false inducements, Cummins has concerns with the use of OBD REAL for this purpose. OBD REAL was originally developed with a different purpose in mind than EPA's proposal to calculate NOx conversion efficiency for use in activating and deactivating inducement. Data collected and OBD REAL binned by WVU, as part of the collaborative work between EMA, EPA, and CARB investigating B-MAW techniques, concluded that the OBD REAL bins typically contain averages that have large Coefficients of Variance (COV). The large COV values indicate that within-bin OBD REAL data is uncorrelated with respect to NOx conversion efficiency, and that suggests that it would not be appropriate to apply NOx thresholds to OBD REAL binned data for any purpose. Without considerations for NOx sensor data collection (e.g., collecting data when SCR dosing is active, avoiding extreme ambient conditions or AECD events, raw vs. filtered data, etc.), the NOx override factor may lead to situations that drive false positive or false negative inducements. Cummins requests that EPA work with CARB, industry, and SAE to revise, harmonize and standardize OBD REAL with its use in EPA's proposed inducement re-design in mind. [EPA-HQ-OAR-2019-0055-1325-A1, pp. 14 - 15]

OBD REAL

In response to this request for comment (and the regulatory language not explicitly specifying the bins associated with low- or high-speed vehicle), Cummins proposes that EPA considers specifying a range of Bins for both low-speed and high-speed vehicles (for example, Bins 7, 8, 9, 11, 12, 13 could be used for low-speed vehicles, and Bins 10 and 14 for high-speed vehicles), in order to give both operating conditions a chance to properly fill the bins over 100 hrs. This proposal needs to also go along with a significant increase in the override factor threshold of 10% in order to prove more robust. [EPA-HQ-OAR-2019-0055-1325-A1, p. 31]

Organization: *International Council on Clean Transportation (ICCT)*

In an effort to mitigate the possibility of false failure indications, the EPA has overcorrected by allowing an inducement override if NOx sensor data indicate SCR efficiency is reduced by less than 10 percent. Not all vehicles with SCR efficiency degraded by less than 10 percent are false failures. Many may have faults that are causing excess emissions that would be corrected due to the proper inducement. Because the SCR efficiency required to meet the proposed NOx standards approaches 99 percent, an in-use truck with SCR efficiency degraded to 90 percent will emit NOx emissions in excess of the current 0.2 gram/hp-hr. standard, an order of magnitude emission increase. With EPA's proposal, many trucks with this high level of excess NOx emissions will have no inducement applied, and there will be no incentive for the operator to seek repair. [EPA-HQ-OAR-2019-0055-1211-A1, p. 21]

ICCT suggests the availability of NOx sensor emission data be used in a different way that provides more balance between achieving emission reductions while reducing inconvenience for operators once an inducement is initiated. Instead of using the NOx sensor-based SCR efficiency loss factor to override inducements, it could be used to determine which of two derate schedules should be required – a more gradual one where emission increases due to a fault are smaller, or a more aggressive one where emission increases are expected to be higher.

We recommend that the EPA proposal to completely override inducements be abandoned. Instead, an indication of SCR efficiency loss of 10 percent or less would be a prerequisite for the more gradual EPA proposed speed derate schedule, but with a lower speed fourth step. [EPA-HQ-OAR-2019-0055-1211-A1, p. 21]

• If indicated SCR efficiency loss is 10% or less, we recommend using the EPA proposed derate schedule with the fourth step speed derate lowered;

• If indicated SCR efficiency loss is more than 10%, we recommend using an accelerated derate schedule with the fourth step occurring at 12 hours, and addition of a final derate to 5 mph at the first stop or refueling after 16 hours of operation from fault detection. [EPA-HQ-OAR-2019-0055-1211-A1, p. 21]

EPA's concept of using the NOx sensors to distinguish between SCR-related failures that are causing very high emissions from those with less impact on emissions or false failures, has some merit. However, EPA's specific proposal to allow no inducements under certain conditions when SCR efficiency has dropped by 10 percent or less will result in many emission-related failures never repaired. [EPA-HQ-OAR-2019-0055-1211-A1, p. 21]

The implication of this inducement override is that an indicated loss of less than 10 percent SCR efficiency is not important enough to require repairs simply because it might be caused by a NOx sensor inaccuracy. This logic is faulty for two reasons. First, not every NOx sensor reads low. For those sensors that are not reading low due to inaccuracy, an indicated loss of SCR efficiency of less than 10 percent is likely a valid indication of excess NOx emissions that deserves attention. Second, a true 10 percent loss of SCR efficiency would result in NOx emissions higher than the current 0.20 gram NOx standard, completely negating the emission reduction benefit of any of the proposed new NOx standards for that truck. For these reasons, we recommend against implementing the use of NOx sensor readings to override all disincentives. [EPA-HQ-OAR-2019-0055-1211-A1, p. 21] We recommend EPA use the NOx sensor-based calculation of SCR efficiency loss to determine the appropriate derate schedule. [EPA-HQ-OAR-2019-0055-1211-A1, p. 21]

For these reasons, we are recommending EPA reconsider and modify its inducement strategy, as indicated below, to assure more vehicles with high emissions are incentivized to seek repair, while reducing unintended inconvenience to truck and bus operators. [EPA-HQ-OAR-2019-0055-1211-A1, p. 21]

Organization: *National Association of Small Trucking Companies (NASTC)*

A derate override feature, triggered when a faulty DEF sensor starts the inducement cycle while an emission level sensor shows the system continuing to reduce NOx emissions.

We endorse the proposed override feature that would operate when a faulty DEF sensor otherwise would prompt inducements, despite sufficient levels of and adequate quality DEF being present and the system continues to reduce emissions. [EPA-HQ-OAR-2019-0055-1130-A1, p. 3]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §1036.111(c): EMA does not support the proposed "within 10 percent" NOx override factor of paragraph (c) and the use of only Bins 13 and 14 to calculate the override factor. EMA recommends that a better approach is for the NOx override factor to start from +/-15% which is the standard test-out requirement, and then include the accuracy of commercially available NOx sensors. Emissions lab data indicates that 15% is a reasonable value for normal testing variation. Considering commercially available NOx sensors accuracy is +/-10% to +/-15%, +/-25% is a reasonable value for the override factor; +/-15% accounts for normal testing variation, and +/-10% accounts for NOx sensor accuracy and impact to binned NOx values. [EPA-HQ-OAR-2019-0055-1203-A1, p. 102]

As an initial matter, the new SCR inducement proposal depends on data recorded using the REAL binning functions required by CARB's OBD regulations. (EPA has proposed to incorporate the obligation to track REAL NOx emissions in §1036.110.) There are several concerns with how the SCR inducement strategies are tied to the REAL data. First, the SCR inducement is only triggered if a fault is confirmed by the "NOx override" function described in

§1036.111(c). Under that provision, the inducement derate should be overridden if the NOx conversion efficiency in the 100-Hour Array is within 10% of the NOx conversion efficiency of the Lifetime Array for REAL Bins 13 and 14. Conversion efficiencies, both lifetime and 100 hour, are going to be calculated based on on-board NOx sensors. Those sensors, however, are known to have significant inaccuracy, as much as +/- 10 ppm according to manufacturers' specifications in the range of data expected to be recorded in Bins 13 and 14 (the highest engine power level bins). Aged sensors have been known to be significantly less accurate. It is imperative that EPA evaluate the sensitivity of these SCR inducement controls for this purpose. Operation on a very cold day may lead to incorrect inducement determinations based on the NOx override function. EPA should consider alternative confirmation methods, at least for some fault types, such as loss of DEF pressure at the DEF pump in the case of an empty-DEF tank fault. [EPA-HQ-OAR-2019-0055-1203-A1, p. 124]

EMA is willing to work with EPA to determine other similar opportunities. For most of the conditions being evaluated, such as empty DEF tank, blocked DEF lines, or missing catalyst, the NOx conversion efficiency should be 0%. A threshold much closer to this value should be applied when inducing for those reasons, in order to account for potential errors. [EPA-HQ-OAR-2019-0055-1203-A1, p. 124 - 125]

A second issue of concern is that for certain applications, there may actually be no data in Bins 13 and 14, making the assessment impossible. [EPA-HQ-OAR-2019-0055-1203-A1, p. 125]

EPA Summary and Response

Summary:

EPA received several comments supporting the concept of a NOx override. Other commenters supported the concept, but suggested improvements. ABA expressed concerns with NOx sensor reliability causing problems. CARB and ICCT suggested that speed derates similar to what EPA proposed should apply for cases where the engine detected a fault condition even though NOx measurements showed good emission reductions over the catalyst.

Some commenters agreed that the proposed threshold for the NOx override was appropriate, while other commenters suggested recognizing a lower level of NOx control as being sufficient for the NOx override. CARB and ICCT suggested tying the threshold for the NOx override to the OBD threshold related to catalyst conversion efficiency.

EMA, Cummins, and CARB suggested that the NOx override algorithm should not depend on the proposed approach of tracking operation in REAL bins. EMA also commented that some failure modes may call for alternative confirmation methods.

CARB expressed a concern that the proposed NOx override could introduce a risk of creating a single point of contact for tampering. CARB suggested addressing that concern by setting speed derates based on catalyst conversion separate from any NOx override. CARB also suggested that the NOx override should not apply if the engine detects NOx sensors as being faulty.

Response:

We continue to believe that the NOx override has the potential to provide important diagnostic information to allow manufacturers to avoid applying speed derates when the catalyst system is working properly to reduce NOx emissions. However, we recognize from the comments that we need to further develop the measurement techniques, calculation algorithms, and thresholds for designing an effective NOx override. Given the timing of this final rule, we are not taking final action at this time on the NOx override feature. We are adopting the final rule with inducements in 40 CFR 1036.111 without the NOx override feature. We intend to continue to consider these issues regarding NOx override and may propose revised inducement provisions to include a NOx override in a future rule.

There are at least two advantages of deferring action on the NOx override in this final rule. First, the NOx override substantially increases the complexity of the algorithms for applying speed derates. Increased complexity corresponds with an increased risk of computational errors that could create unintended outcomes. Additional time to explore alternative methodologies will help to ensure that the engine is able to provide a robust indication of catalyst activity for the full range of possible fault conditions. Second, as noted in Section 8.1, the final rule includes provisions to improve component durability. We may learn that manufacturers are able to comply with new inducement requirements in a way that greatly reduces the experience of engines going into inducement even though the catalyst is functioning normally. We may also learn that less severe initial derates in the final inducement provisions address issues with existing inducements raised by commenters such that the NOx override does not have the same value that it would for engines on the road today.

8.3 Derate schedule

Comments by Organizations

Organization: *American Bus Association (ABA) (1070 and 1308)*

In addition to the rushed nature and time constraints for this complex rulemaking, the ABA identified feasibility, cost and reliability concerns the motorcoach industry has with the Proposal. In the interest of facilitating EPA's rulemaking effort, ABA also offers a proposal to alleviate some of the cost and derate concerns identified, while accounting for the environmental benefits provided by the motorcoach industry and promoting motorcoach travel. Akin to emergency vehicles that rely on heavy-duty engines, manufacturers providing heavy-duty engines to the motorcoach industry should be afforded similar regulatory flexibility with regard to inducement strategy. In line with EPA's 2012 relief measures, EPA could expand the application of the AECD as part of the certification process for engines to be used in motorcoach vehicles. [EPA-HQ-OAR-2019-0055-1308-A1, p.11]

Providing engine manufacturers producing engines for use in motorcoach vehicles with the same flexibility afforded to engines used in emergency situations, would address a number of concerns. First, and foremost, EPA's inducement policy creates a serious risk to life within motorcoach operations. By eliminating the threat of reduced engine performance or derating, particularly for motorcoach drivers who are focused on driving safely and the comfort and care of their passengers, EPA address one of the motorcoach industry's greatest concerns not only with the Proposal but also current emission control requirements. This action would significantly reduce the risk of stranding vehicles and passengers on the road and the stranded vehicle becoming a roadside safety obstacle for other vehicles. Motorcoach operations are heavily dependent on passenger designed and driven schedules. Unlike property, transport of passengers requires providing certain necessities to meet human needs. Along with those motorcoach vehicles serving in an emergency response capacity who are performing work directly related to reducing risk to human life from natural disasters or other emergency situations, motorcoaches should not be subject to artificial inducements that prevent the vehicles from performing as necessary. [EPA-HQ-OAR-2019-0055-1308-A1, p.11]

Additionally, by providing engine manufacturers with flexibility to apply the approved AECD to motorcoach engines, it would eliminate a substantial amount of cost for motorcoach operators. Motorcoach operators would avoid repair costs associated with faulty triggers or components that result in unnecessary derates. Further, it could also reduce the costs under the Proposal associated with extending the useful life of the engine and warranty, and the durability requirements for components. Indirectly, such action would also eliminate the indirect costs outlined in the comments to the ANPRM, related to towing, reimbursements owed due to not meeting schedules, and cost to reputation. The flexibility would also reduce the number of dashboard distractions for drivers, allowing them to remain focused on safely driving the heavy-duty vehicle. By reducing costs and improving safety, by this proposed action, EPA would clearly make a statement on the importance of transport by motorcoach and recognize the benefits motorcoach travel brings by taking cars off the road. [EPA-HQ-OAR-2019-0055-1308-A1,pp.11-12]

The loss of a key transportation option for underserved and price-sensitive communities is also a key concern. The EPA devotes significant attention in the Notice to environmental justice concerns and the need to ensure all communities benefit from air quality improvements. However, the EPA makes no mention of the key role motorcoach services play in meeting the transportation needs of all communities, in particular economically disadvantaged and rural communities. As mentioned, for many of these constituencies, the motorcoach industry is the primary and sometimes the only mode of transportation available. Motorcoach services connect these communities to jobs, education, necessary medical services, and other intermodal transportation services across the country. In FY 2021, the Department of Defense made extensive use of the motorcoach industry, contracting for the motorcoach movements of nearly 28,000,000 military personnel through their military bus program (https://www.defensetravel.dod.mil/site/bus.cfm). According to key emergency transportation coordinator Transportation Management Services, they organized over 500 bus movements as part of emergency transportation and evacuation movements during the 2020 hurricane season getting thousands of people out of harm's way. [EPA-HQ-OAR-2019-0055-1308-A1, p.5]

Different Inducement Schedules and Speeds – ABA believes there is merit in this approach, but has questions as to determining the appropriate category and how it would work in application for motorcoach operations. For example, where would a motorcoach fall, in terms of high-speed and low-speed vehicles? If the vehicle profile changes or fluctuates, does the inducement schedule assessment change for the vehicle? ABA also believes adjusting the derate schedule into a 4-steps along with setting more appropriate maximum and final inducement speeds over the inducement interval has merit; however, ABA has not had sufficient time to review this proposal with motorcoach operators for specific feedback. ABA plans to hold further discussions with motorcoach operators on both the step interval approach and maximum speeds. [EPA-HQ-OAR-2019-0055-1308-A1, pp.9-10]

Conversely, the risk of motorcoach operators not maintaining necessary quantities or quality DEF in their tanks to ensure the RSC is properly working, is low. Motorcoach equipment is expensive to purchase and maintain; motorcoach operators do not want to risk damage to their engine or loss of warranty coverages by not properly maintaining their equipment. Because operators are solely dependent on the availability of their equipment to operate and generate revenue, there is little incentive for operators to circumvent the engine emissions control system. [EPA-HQ-OAR-2019-0055-1308-A1,p .12]

However, returning to the inducement schedule, there needs to sufficient time for the motorcoach to reach a safe location. It is not unusual for motorcoach routes to traverse remote stretches of the country. Also, there are not as many service locations available to a motorcoach, as opposed to a truck. [EPA-HQ-OAR-2019-0055-1308-A1, p.10]

Organization: *American Trucking Associations (ATA)*

EPA’s proposed high speed inducement speed settings will impact typically operations while avoiding operating vehicles at a speed that impedes the normal and reasonable movement of traffic. According to 2020 data collected by ATRI, among reported trucks with speed limiters, 76 percent of them had a speed setting between 65 to 68 mph.16 Thus, while the initial six hours of derate should have minimal operational impacts and allow time for the vehicle to access a repair facility, the second six hours and beyond, where speeds range from 60 to 50 mph, should present an adequate deterrent to prompt a repair response in the event the initial notification and speed restriction did not. [EPA-HQ-OAR-2019-0055-1326-A1, p. 18]

> 16. Williams, Nathan and Murray, Dan. An Analysis of the Operational Costs of Trucking: 2020 Update, American Transportation Research Institute (November 2020).

Organization: *California Air Resources Board (CARB)*

As discussed in the previous section, the NOx emission reductions associated with reduced emission standards will only be achieved with a properly functioning SCR aftertreatment system, by ensuring adequate dosing of high-quality DEF, by timely repair of faulty DEF related components, and by effective diagnosis of SCR system tampering. This becomes even more important as the proposed CTP NOx emission standard is reduced further by up to 90 percent. Every one of these elements for proper SCR function must be accounted for when establishing SCR inducement. The derate schedule proposed in the NPRM does not achieve this objective for the reasons presented below. [EPA-HQ-OAR-2019-0055-1186-A2, p.96]

Because SCR systems that are operated without DEF will not achieve any reductions of NOx,159 as discussed in Section IV.D of the NPRM, U.S. EPA has promulgated proposed policy guidance that is designed to ensure that vehicle owners supply sufficient quantities of high-quality DEF needed to ensure SCR equipped vehicles will in fact comply with applicable NOx emission standards as such vehicles are operated on highways. That guidance includes, in pertinent part, an 'inducement mechanism' that reduces an engine's output and consequently reduces the maximum speed of the vehicle to a degree that is unacceptable for typical driving.160 U.S. EPA is also aware that affected vehicle owners may attempt to override the adverse driving effects by tampering or disabling the inducement mechanism, and is therefore also proposing provisions intended to deter such tampering.161 However, the proposed provisions present legal and technical concerns. [EPA-HQ-OAR-2019-0055-1186-A2, pp.96-97]

159 NPRM at p. 17536.

160 NPRM at p. 17536.

161 NPRM at 17540-17544.

As explained below, U.S. EPA failed to consider important aspects of the inducement proposal that are directly relevant to the effectiveness of the proposed inducement speeds to compel corrective actions by vehicle owners, and the corresponding emissions impacts. The failure to consider those factors constitutes arbitrary and capricious agency action, and contravenes U.S. EPA's statutory duty to ensure heavy-duty engines and vehicles comply with applicable emissions standards over their useful lives. [EPA-HQ-OAR-2019-0055-1186-A2, p.97]

First, the proposed initial inducement speed of 65 mph for high-speed vehicles and 50 mph for low-speed vehicles is insufficiently stringent to compel a vehicle operator to seek timely repairs of SCR systems. The vehicle speed distribution from two real-world driving datasets consisting of 109 trucks with over 20,000 hours of driving shows that these proposed initial maximum speeds would have very limited, if any, impact to induce an operator to fix the inducible fault (see Appendix IV [Appendix IV can be found at EPA-HQ-OAR-2019-0055-1186-A2, pp.165-174] for further analysis of real world on-road heavy-duty activity data analyzed with respect to U.S. EPA's proposed SCR inducements). [EPA-HQ-OAR-2019-0055-1186-A2, p.97]

Furthermore, for high-speed vehicles, the maximum speed limit for line-haul trucks in many states is 65 mph; in fact in California, it is only 55 mph. Eleven other states have 55 mph speed limits for urban freeways.162 Setting the initial inducement at the maximum highway speed limit in many states (and in California and eleven other states, 10 miles above the maximum speed limit) would not compel the operator to make timely repair of SCR components when there is a significant NOx emission impact. While the NPRM noted that the U.S. EPA 'data show that combination long-haul vehicles spend nearly almost 40 percent of their driving time over 65 mph,' this high-speed operation is not evenly distributed nationally, particularly for states with a maximum speed limit of 65 mph or less where this initial inducement speed will not effectively induce the operator to act promptly. [EPA-HQ-OAR-2019-0055-1186-A2, pp.97-98]

162 https://www.iihs.org/topics/speed/speed-limit-laws

In addition, it does not make sense for California to set an initial inducement speed that is 10 mph higher than California's highway maximum speed limit for most trucks. Likewise for low-speed vehicles, whose average speed is at or below 20 mph, these regional or urban vehicles spend most of their time on city streets and are likely able to choose delivery routes that would not be restricted by a 50 mph inducement. Thus, the proposed initial inducement schedule for many trucks would allow long-term delays of needed repairs because of the limited disruption that could be easily dealt with by the operator. [EPA-HQ-OAR-2019-0055-1186-A2, p.98]

U.S. EPA's failure to consider the maximum speed limits in each of the states, the distribution of high speed operations of heavy-duty vehicles throughout the nation, and the possibility that regional or urban vehicles would likely travel on delivery routes not restricted by the proposed 50 mph initial inducement speed constitutes a failure to consider an important aspect of the problem, State Farm, 463 U.S. at 43, because those omissions affect U.S. EPA's analysis and conclusions regarding the effectiveness of the proposed inducements to trigger corrective action. U.S. EPA also failed to propose a 'rational connection between the facts found and the choice made,' State Farm, 463 U.S. at 43, because the proposed initial inducement speeds are unlikely to compel corrective vehicle owners to take corrective actions. [EPA-HQ-OAR-2019-0055-1186-A2, p.98]

Second, the final inducement step of 50 mph for high-speed vehicles and 35 mph for low-speed vehicles is still not severe enough to induce an operator to immediately make repairs (see Appendix IV) [Appendix IV can be found at EPA-HQ-OAR-2019-0055-1186-A2, pp.165-174], especially if this problem has been ignored for the first 60 hours of inducement using operator work-around strategies. This proposed final derate step would be significantly less effective to the operator than the current inducement guidance of driving vehicle speed down to 5 mph at safe harbor conditions. As shown in CARB staff's recent field survey, a severe final inducement is effective at getting timely repairs and minimizing air quality impacts. The NPRM's final inducement step does not cause 'degradation that includes operation of the engine being disabled or severely restricted' as noted in CISD-09-04R, and hence departs significantly from the current effective guidance. This major proposed relaxation of the current guidance would be ineffective to induce the operator to make expeditious repair of the SCR system because the proposed final inducement speeds would allow a vehicle to be driven for *unlimited miles at lower speeds without ever fixing the fault condition.* [EPA-HQ-OAR-2019-0055-1186-A2, p.98]

U.S. EPA's failure to consider the effectiveness of the proposed final inducement speeds to compel corrective actions, and the potential excess emissions resulting if final inducement speeds do not ultimately result in corrective repairs constitutes a failure to consider an important aspect of the problem, State Farm, 463 U.S. at 43, and a failure to propose a 'rational connection between the facts found and the choice made,' State Farm, 463 U.S. at 43, because the proposed final inducement speeds are unlikely to compel corrective vehicle owners to take corrective actions and will therefore increase the risk that defective and/or tampered SCR systems will result in excessive emissions. The extent of such excess emissions may be substantial, in light of the facts that heavy-duty vehicles with defective or tampered SCR systems exhibited NOx emissions that were 6 to 10 times higher than baseline NOx emissions levels, and given CARB staff's concern that the proposed final inducement speeds would allow heavy-duty vehicles with defective or tampered SCR system to operate indefinitely. [EPA-HQ-OAR-2019-0055-1186-A2, pp.98-99]

Moreover, U.S. EPA has not, and cannot demonstrate that the proposed inducement strategy 'is permissible under the statute, that there are good reasons for it, and that the agency believes it to be better...'FCC v. Fox Television Stations, Inc., 556 U.S. 502, 515 (2009). [EPA-HQ-OAR-2019-0055-1186-A2, p.99]

The emissions standards prescribed under the CAA section 202(a)(1) and 202(a)(3) apply to motor vehicles and motor vehicles throughout their useful lives, i.e., as such vehicles and engines are actually operated on highways, for prescribed periods of time. As discussed in Section 5, the overriding directive of the CAA section 202(a) is the protection of the public's health and welfare, and the nation's air quality. U.S. EPA's proposed inducement strategy, unlike the preexisting inducement strategy, is inconsistent with those statutory mandates because it would, as demonstrated by CARB staff's comments, allow vehicles to operate for potentially unlimited periods of time, even if those vehicles are emitting pollutants well in excess of applicable emissions standards, in direct conflict with those unambiguous statutory provisions. Chevron, 467 U.S. at 842-843. CARB staff's comments also make it clear that U.S. EPA has not established that the proposed inducement strategy is more effective than the preexisting inducement strategy in achieving its stated goal of ensuring the reduction of excess emissions from defective SCR systems and of deterring tampering of SCR systems to override inducement systems, and it is accordingly clear that the proposal is arbitrary and capricious. [EPA-HQ-OAR-2019-0055-1186-A2, p.99]

163 See footnotes 504 and 505, NPRM at p. 17512.

Table 1 of 40 CFR 1037.510 - Weighting Factors for Duty Cycles provides the weighing factors for three different emission test cycles (transient, 55 mph cruise, and 65 mph cruise) for tractors and for urban, multi-purpose, and regional vocational vehicles in determining GHG emission compliance. While the weighing factor for tractors is over two-thirds for the 65 mph cycle, the weighing factors for multi-purpose vehicles are only less than one-quarter for the 65 mph cycle and about one-quarter for the 55 mph cycle, with the remaining half for the lower-speed transient cycle. [EPA-HQ-OAR-2019-0055-1186-A2, p.107]

Furthermore, the vehicle speed distribution from two real-world driving datasets consisting of 109 trucks with over 20,000 hours of driving shows that the low 20 mph low-speed vehicle threshold would prevent many urban vehicles that rarely drive at highway speeds from being classified as low-speed vehicles. The 20 mph low-speed threshold would instead make these vehicles subject to the ineffective proposed initial and high inducement maximum speeds of 65 mph and 50 mph, respectively (see Appendix IV) [Appendix IV can be found at EPA-HQ-OAR-2019-0055-1186-A2, pp.165-174]

The NPRM requests comments on the definition of low-speed vehicles. The low-speed vehicle definition having an average speed of 20 mph or less over the preceding 30 hours of operation may only capture urban vehicles, and multi-purpose vehicles that have a mix of city and highway driving may be considered high-speed vehicles. Because NPRM's high-speed vehicle inducement schedule is based on line-haul vehicle operation, the derate speeds for high-speed vehicles would not be as meaningful to multi-purpose vehicles. As stated above, the initial NPRM inducement step is at 65 mph and last inducement step is at 50 mph. [EPA-HQ-OAR-2019-0055-1186-A2, p.107]

CARB staff recommends that NPRM's average speed threshold for low-speed vehicles be increased to 30 mph to capture vehicle operation for multi-purpose and urban vehicles so that these vehicles are subjected to the low-speed vehicle derate schedule. [EPA-HQ-OAR-2019-0055-1186-A2, p.107]

To address fleet owners' concerns about inducements while still adequately protecting air quality, CARB staff proposes two different derate schedules. The first would be a less severe derate schedule when a fault condition is detected, and the SCR NOx override factor as calculated in the proposed 40 CFR 1036.111(c) is at or less than 0.10. In this situation, NOx emissions would not yet be impacted despite the fault condition, and immediate action would not be necessary to avert excess NOx emissions. Thus, a less severe inducement schedule would be preferable, similar to what the NPRM proposes in 40 CFR 1036.111(d). This schedule would allow the operator to continue to drive the vehicle to complete its present task and return to home base or a repair shop to get repairs done that is less disruptive to fleets and operators. The inducement schedule would provide reduced engine performance that encourages the operator to make plans for repairs but still allow the operator to complete the task at hand when inducement is triggered. This change to allow the operator more time to get faulty SCR components repaired, along with new lengthened warranty requirements that will drive improved component designs by manufacturers, should almost completely eliminate unnecessary severe inducements that could affect operators and interrupt fleet operations. CARB staff proposes the following inducement schedule in Table 9-1 for this type of scenario, assuming that NOx sensors are working properly, there is no tampering of components, and it is expected that the SCR system is functioning properly:

- 0 non-idle hours of engine operation
    - Maximum torque derate/max. speed for high-speed vehicles
        - 25% max torque derate
    - Maximum torque derate/max. speed for low-speed vehicles
        - 25% max torque derate
- 24 non-idle hours of engine operation
    - Maximum torque derate/max. speed for high-speed vehicles
        - 25% and 55 mph (from governed top speed lower speed 1 mph every 5 min until 55 mph is achieved)
    - Maximum torque derate/max. speed for low-speed vehicles
        - 25% and 40 mph (from governed top speed lower speed 1 mph every 5 min until 40 mph is achieved)
- 48 non-idle hours of engine operation
    - Maximum torque derate/max. speed for high-speed vehicles
        - 25% and 45 mph (from 45 lower speed 1 mph every 5 min until 45 mph is achieved)
    - Maximum torque derate/max. speed for low-speed vehicles

        - 25% and 30 mph (from 30 lower speed 1 mph every 5 min until 30 mph is achieved)
- 72 non-idle hours of engine operation
    - Maximum torque derate/max. speed for high-speed vehicles
        - 40% and 35 mph (from 45 lower speed 1 mph every 5 min until 35 mph is achieved)
    - Maximum torque derate/max. speed for low-speed vehicles
        - 40% and 20 mph (from 20 and lowered speed 1 mph every 5 min until 20 mph is achieved) [EPA-HQ-OAR-2019-0055-1186-A2, pp.101-102]

As noted earlier, the NPRM's proposed initial inducement speed is higher than twelve (including California) states' maximum urban highway speed limits. Instead of NPRM's initial inducement of 65 mph, CARB staff recommends a derate of the maximum torque of 25 percent be applied for both high-speed and low-speed vehicles with no vehicle speed inducements. After 24 hours, if the operator does not repair the fault condition, a vehicle speed derate to 55 mph would occur in addition to the 25 percent maximum torque derate (or 40 mph for a low-speed vehicle). After another 24 hours, for a total of 48 hours after fault detection, the speed derate would decrease to 45 miles per hour (or 30 mph for low-speed vehicles.) Finally, if after a total of 72 hours the fault condition is still not fixed, then the final inducement step reduces the maximum torque by 40 percent and the maximum vehicle speed to 35 mph (or 20 mph for a low-speed vehicle). CARB staff is also proposing a more gradual speed inducement within each step of 1 mile per hour reduction for every 5 minutes until the step inducement speed is reached. This change would alleviate operator safety concerns during speed derates at highway speeds by inducing speed reductions of 1 mph at a time until the speed inducement is met. [EPA-HQ-OAR-2019-0055-1186-A2, pp.102-103]

For fault conditions when NOx emission control efficiency falls by more than 10 percent, a more severe inducement schedule is warranted and should be maintained, similar to what is currently required. In this situation, the SCR is not functioning at a sufficient NOx conversion efficiency, resulting in significant excess NOx emissions. Repair of the vehicle in a very short and timely manner is extremely important. Thus, CARB staff proposes the following derate schedule in Table 9-2 for this scenario.

- 0 non-idle hours of engine operation
    - Maximum torque derate/max. speed for high-speed vehicles
        - 30% max torque derate
    - Maximum torque derate/max. speed for low-speed vehicles
        - 30% max torque derate
- 3 non-idle hours of engine operation
    - Maximum torque derate/max. speed for high-speed vehicles
        - 30% and 55 mph (from governed top speed lower speed 1 mph every 5 min until 55 mph is achieved)
    - Maximum torque derate/max. speed for low-speed vehicles
        - 30% and 35 mph (from governed top speed lowered speed 1 mph every 5 min until 35 mph is achieved)
- 8 non-idle hours of engine operation

    - Maximum torque derate/max. speed for high-speed vehicles
        - 30% and 45 mph (from 55 lower speed 1 mph every 5 min until 45 mph is achieved)
    - Maximum torque derate/max. speed for low-speed vehicles
        - 30% and 25 mph (from 35 lowered speed 1 mph every 5 min until 25 mph is achieved)
- 10 non-idle hours of engine operation
    - Maximum torque derate/max. speed for high-speed vehicles
        - 40% and 35 mph (from 45 lower speed 1 mph every 5 min until 35 mph is achieved) and 5 mph at safe harbor
    - Maximum torque derate/max. speed for low-speed vehicles
        - 40% and 20 mph (from 20 and lowered speed 1 mph every 5 min until 20 mph is achieved) and 5 mph at safe harbor [EPA-HQ-OAR-2019-0055-1186-A2, p.103]

In this schedule, the time for each step of inducement is significantly shortened compared to the previous schedule in Table 9-1, with the final inducement occurring at 10 hours of non-idle operation. If the vehicle was operating at the top speed of each inducement step, this could still equate to hundreds of miles of vehicle operation before the final inducement takes effect, which still would allow vehicle operation at a maximum speed of 35 mph for high-speed vehicles and 20 mph for low-speed vehicles. Once the vehicle is at safe harbor, the final inducement would reduce the vehicle's maximum speed to 5 mph. This derate schedule still would provide opportunity for the operator to make needed repairs and reduce safety concerns and significantly reduce the frequency of towing vehicle to a repair shop when operators are proactively attempting to address the inducement. As mentioned above, this inducement schedule also incorporates gradual speed derates to significantly reduce safety concerns at highway speeds. [EPA-HQ-OAR-2019-0055-1186-A2, p.103]

Organization: *Carreras Tours, LLC (2032)*

I think this issue of having a bus derate when an issue arises with the engine needs to be extended to a longer period in order to be able fix the issue when the vehicle gets to a safe place. We had an experience where our bus got a check engine light going on interstate 5 in central California. We had students on board and the bus derate to 5 MPH. The good thing is that we happened to be less than a mile from an exit. We feared that a truck might rear end us and injure the passengers. It took several hours to get a rescue bus to pick up the group. All this could have been avoided if time for us to diagnose the problem in a shop, and in a safe place where the bus and the passengers were safe. If a sensor fails, the bus derate the bus immediately and gives us no chance to get to a safe place. In this instance, it was a $20 sensor that failed. We would like to request to have the time extended or miles extended before defraying the bus. Our goal is to keep all of our passengers safe. Please consider this request. [EPA-HQ-OAR-2019-0055-2032, p.1]

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

EPA's proposed inducement schedule offers insufficient incentives to ensure maintenance of SCRs. The Proposal indicates an initial derate that would allow most vehicles to continue to operate at up to 65 mph—close to the speed limit—decreasing after 60 hours of use to 50 mph. Vehicles with a recent history of low-speed operation—an average below 20 mph, for the previous 30 hours of engine operation—are initially restricted to 50 mph, decreasing to 35 mph after 60 hours of operation (the 'LSI' limit). Id. at 17,543–44. The former limits—to numbers at or near the speed limit—are unlikely to induce prompt corrective action.243 The LSI limit provides virtually no assurance of prompt corrective action. A vehicle that routinely operates at an average speed of 20 mph cannot be expected to respond to a derate that restricts its speed to 50 mph. In many cases (such as drayage and similar uses) such vehicles are unlikely to promptly respond even to the final derate, limiting speeds to 35 mph.244 [EPA-HQ-OAR-2019-0055-1302-A1, pp.62-63]

> 243 See FHWA, Freight Management and Operations, Freight Facts and Figures 2010 (2010), https://ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/docs/10factsfigures/table3_8.htm (reporting maximum interstate average speeds below 60 mph).
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> 244 See Andrew Papson & Michael Ippoliti, Key Performance Parameters for Drayage Trucks Operating at the Ports of Los Angeles and Long Beach 6, CALSTART (Nov. 15, 2013), https://calstart.org/wp-content/uploads/2018/10/I-710-Project_Key-Performance-Parameters-for-Drayage-Trucks.pdf (noting maximum speeds for near-dock operations of only 40 mph, and average speeds under 7 mph).

And even for those vehicles whose owners might respond to the derates—which EPA suggests are limited to those that must travel substantial distances to reach a job site, 87 Fed. Reg. at 17,543—the Proposal's 60 hours of non-compliant use would still produce massive quantities of excess pollution. As EPA acknowledges, lack of adequate DEF can 'cause NOx emissions to increase to levels comparable to having no NOx controls at all.' Id. at 17,536. Commenters urge EPA to adopt a more stringent inducement regime than proposed, such as a dual schedule providing less severe derates when the detected fault is unlikely to lead to excess NOx emissions, but imposing more severe derates where NOx emissions are substantially affected so as to demand prompt repair. See Comments of CARB, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022. [EPA-HQ-OAR-2019-0055-1302-A1, p.63]

Organization: *Coach USA, Inc. (Coach USA)*

Coach USA is generally concerned that the selective catalytic reduction ("SCR") inducement proposal made applicable to motorcoaches does not adequately take the unique concerns of passenger transportation safety into account. Under no circumstances, can buses full of passengers be left stranded on the side of a roadway or a bus be unable to travel at a safe highway speed that does not present a potential obstacle to safety. Thus, any derate inducement schedule that might be applied to high speed motorcoach vehicles needs to be fashioned in coordination with highway safety foremost in mind. Unless and until that happens, motorcoaches should be excluded from any derate requirements under the EPA emissions rules. [EPA-HQ-OAR-2019-0055-1307-A1, p. 3]

Coach USA supports the proposed 65 MPH limitation at section 1036.111(d) for the initial speed restriction at least 10 hours after a fault condition is identified, although Coach USA would also support a longer inducement period. Coach USA believes that its drivers will be induced by the vehicle's emissions warning lights to take corrective action relative to the fault condition such that a lower speed restriction (such as 55 MPH) is not necessary. Nor would a lower speed restriction be as safe as a 65 mph limit given that the buses frequently operate on high speed highways where a restriction of less than 65 mph can present a safety problem where the bus would be unable to keep up with the flow of traffic. To the extent that substantial repairs are required to address a fault condition, the subsequent inducements – amounting to up to 60 hours – provide the minimum adequate time. Coach USA trains its drivers to pay close attention to fault condition alerts and requires them to take appropriate action at the next available opportunity, all the while taking into consideration passenger safety. In this regard, EPA should bear in mind the safety considerations that are unique to passenger transportation versus truck transportation, as well as the fact that passengers are often depending on bus transportation to meet connecting buses, flights, trains, job responsibilities and other schedule-dependent requirements. [EPA-HQ-OAR-2019-0055-1307-A1, p. 4]

Interstate bus operations conducted by Coach USA are designed to maintain reliable schedules for its passengers. A speed of 50 MPH, which is generally below interstate/highway speeds and potentially a safety risk, will prompt drivers to take action to address a fault condition, although even such a restriction is not generally going to be required given the sufficiency of the inducement created by the driver's attention to warning lights. Any lower restriction would compromise passenger and driver safety on congested roadways without better ensuring inducement. [EPA-HQ-OAR-2019-0055-1307-A1, pp. 4 - 5]

Accordingly, buses will not always have the ability to reach a bus repair facility within a 6-hour period when a fault condition prompts repair or replacement of components. Coach USA believes that a minimum 10-hour period for the first stage of inducement, and preferably longer, is appropriate for all default conditions due to other than low DEF levels. This longer period will ensure that passengers are kept safe and not potentially stranded along interstate bus routes. On this point, EPA should aware of the difficulty/inability of bus operators to locate alternative buses to pick-up passengers along interstate routes. Our industry is currently struggling with a serious shortage of drivers, which has reduced operational flexibility. The industry has also experienced a major reduction in the number of bus operators due to COVID, as noted above. Accordingly, Coach USA supports an approach that ensures the ability of its drivers to address a fault condition upon completion of a route. [EPA-HQ-OAR-2019-0055-1307-A1, p. 5]

In light of the comment above, Coach USA supports a longer schedule involving more time between stages. This will ensure the ability of drivers to reach repair facilities to address fault conditions, while also ensuring that passengers are safely transported to their destinations without interim stops or delays. Drivers are typically on a 10-hour route schedule. Fault conditions will be addressed, absent repair or part replacement issues, at the end of the period, preventing long-term operation of the bus with a fault condition. A shorter period is not necessary to address a fault condition and will not help to better ensure inducement on the part of the bus industry. [EPA-HQ-OAR-2019-0055-1307-A1, p. 6]

Should any derate inducement rules be adopted for motorcoahes, Coach USA supports the proposed 80 hours of operation. [EPA-HQ-OAR-2019-0055-1307-A1, p. 6]

Coach USA believes that the proposed schedule is both reasonable and effective to induce drivers to correct a fault condition if any rules are adopted. Shortening the proposed schedule would adversely affect interstate bus operations and also comprise passenger/driver safety. The 65 and 50 MPH inducement stages applicable to interstate buses will ensure that SCR systems will be maintained appropriately, although as noted Coach is concerned with any derate schedule applicable to motorcoaches and with a derate speed of less than 65 mph. [EPA-HQ-OAR-2019-0055-1307-A1, p. 6]

Coach USA does not believe that a high-speed vehicle should ever be treated like a low speed vehicle for purposes of inducement. While no inducement schedule should be applied to motorcoaches for the above reasons, a restriction of 50 MPH will induce interstate bus drivers to take corrective action to address a fault condition. An interstate bus cannot be maintained at a speed of less than 50 MPH while ensuring passenger safety and that schedules are maintained. [EPA-HQ-OAR-2019-0055-1307-A1, p. 7]

Organization: *Compass Coach Inc.*

I want to comment on EPA-HQ-OAR-2019-0055. As an owner of a PASSENGER carrier for the past 23 years I 100% believe these EPA regulations are hurting our industry and placing passengers at risk. The Government is so keen to passing rules and regulations that make travel safer. How can this be safe when we are given 4 hours or less once a Regen light comes on to find a safe place to park with our passengers. Attempt to get another vehicle to pickup our current passengers. It's not possible. [EPA-HQ-OAR-2019-0055-2120, p.1]

Don't even go down the road that says 4 hours is enough time to find a place to get it checked out. I literally just had a 2019 Temsa 45' coach sitting in a Cummins yard 300 miles away because we were waiting for a SENSOR. A SENSOR. The system are running fine. It's the sensors that normally go bad. [EPA-HQ-OAR-2019-0055-2120, p.1]

If the Government is dead set on getting more emmissions into these vehicles (which I am all for cleaning the air....100% support this idea), they need to separate passenger vehiles from OTR trucks. There needs to be more time to allow passenger vehicles to get back to their own shop to get looked at. Give us a 72 hour countdown. With 72 hours, any operator should be able to get another bus out to replace the broken one and also get our bus back to our garage so our local dealership can look at the unit. [EPA-HQ-OAR-2019-0055-2120, p.1]

Organization: *Cummins Inc. (Cummins)*

EPA should also allow for transitions between the vehicle speed levels rather than step changes. [EPA-HQ-OAR-2019-0055-1325-A1, p. 14]

EPA has appropriately defined key principles for updating SCR inducements to ensure that emission control function and emissions reductions occur in-use while reducing potential impacts to operators. Derate Schedule

In response to request for comment on dynamically switching the derate restriction of a high-speed vehicle during inducement to a low-speed vehicle derate restriction, Cummins proposes that EPA consider not to utilize this method. This is not only due to the software complexity for the manufacturer in handling such derate switching behaviors when applying the correct derate restrictions/schedule, but also due to the potential of further confusing the end-user during an active inducement. [EPA-HQ-OAR-2019-0055-1325-A1, p. 31]

Organization: David Pedersen

Regarding the proposed de-rating requirements, I believe that the Agency's approach is flawed. In-use de-rating poses a clear danger to the vehicle/machinery operator as well as others nearby, particularly for on-road vehicles, and should be abandoned. Instead, the Agency should require a "soft" mechanism similar to the one employed for light-duty vehicles, which is that the engine will refuse to start if compliance-imperiling faults are detected in any of the emissions controls and/or their components. This would also increase compliance as it would *require* operators to redress the faults prior to being able to operate the vehicle again. [EPA-HQ-OAR-2019-0055-1059]

Organization: *District of Columbia Department of Energy and the Environment (DOEE)*

EPA suggests that relaxing SCR inducements would more effectively result in truck operators properly maintaining SCR devices and proposes that for high-speed vehicles the initial inducement would be 65 miles per hour (mph) and the final inducement no lower than 50 mph (up from the current final inducement of 5 mph). For low-speed vehicles, the proposed initial inducement is 50 mph and the final inducement no lower than 35 mph. Such SCR inducements are too lax to encourage a truck operator to act in a timely fashion to fix a problem. Furthermore, the proposed derate schedules would allow up to 60 hours of operation before the final inducement takes effect. Because modern engines rely almost exclusively on SCR to control NOx, that would mean 60 hours of driving, without emission controls, possibly through vulnerable communities, past schools and recreational areas, and near homes and small-business and community hubs. EPA has proposed alternatives to the inducement schedules in the Notice which drop the initial inducements to the following:

- Low speed vehicles have an initial derated speed of 40 mph and a final derated speed of 25 mph;
- High speed vehicles have an initial derated speed of 55 mph and a final derated speed of 40 mph; and

• The time for all vehicles from when inducement begins to the final derated speed would drop to 40 hours. [EPA-HQ-OAR-2019-0055-1299-A1, p. 6]

DOEE is concerned that the proposed derating schedule does not do enough to sufficiently compel operators to properly maintain their equipment, and will cause excess pollution in areas that are already the most overburdened. [EPA-HQ-OAR-2019-0055-1299-A1, p. 6]

If EPA believes changes to the inducement strategies are technologically necessary, DOEE offers the following recommendations. First, EPA's proposed inducements, which would dramatically increase maximum speeds allowed under the derate schedules, should be revised considerably downward, at least to the alternative speeds that EPA has already proposed. Second, EPA should amend the definition of a low-speed vehicle from a 20-mph threshold to a 30-mph threshold so that these vehicles would be subject to a more appropriate low-speed vehicle derate schedules. Third, EPA should finalize derate schedules with less time between stages to reduce the total allowed hours of operation before the final inducement occurs.[EPA-HQ-OAR-2019-0055-1299-A1, pp. 6 - 7]

Organization: *International Council on Clean Transportation (ICCT)*

RECOMMENDATION: We recommend EPA strengthen proposed SCR inducement provisions to include a final speed derate inducement of 20 mph or less for low-speed trucks, 35 mph or less for other trucks with a possible exception for line-haul trucks, abandon proposed override disincentives, continue to monitor diesel exhaust fluid quality, and adopt the proposal to add additional monitoring of disconnection devices. [EPA-HQ-OAR-2019-0055-1211-A1, p. 3]

We recommend that EPA continue to require monitoring of DEF quality with more time allowed to remedy an indicated fault. If there is indication that the SCR is functioning with less than 10 percent loss of efficiency, a final derate would not occur for up to 60 hours, providing adequate time to obtain a repair. If SCR efficiency loss is greater than 10 percent, indicating very high NOx emissions, the operator would have a shorter period of time, up to 16 hours of operation to obtain repairs before a 5 mph derate is imposed. The extension of time to seek repair should help address operator concerns that the current 4-hour period before a 5 mph derate occurs is too short and can cause the vehicle to be stranded. [EPA-HQ-OAR-2019-0055-1211-A1, p. 23]

We recommend the EPA proposed speed derate schedules, with the fourth step derate speed lowered as discussed above, be followed only if the NOx sensors also indicate a SCR efficiency loss of 10 percent or less due to the indicated fault. This revised provision provides a more gradual set of speed derate over 60 hours (about 4 or more days) of operation, with no disabling 5 mph final derate, based on the probability that the NOx impact of the faulty component or failure to properly maintain the DEF system is relatively low. The greater time before the final speed derate occurs will give the operator more opportunity to resolve the indicated fault with less inconvenience. More vehicles with faults that increase emissions will be repaired. [EPA-HQ-OAR-2019-0055-1211-A1, p. 22]

For vehicles with indicated SCR efficiency loss of greater than 10 percent, we recommend adopting a new schedule of speed derates with a shorter period between steps. In addition, a fifth step would be added warning that after 4 more hours of operation speed will be limited to 5 mph after the next refueling or engine stop. [EPA-HQ-OAR-2019-0055-1211-A1, p. 23]

If the sensor indicates more than a 10 percent loss in SCR efficiency, the threat of extremely high emissions grows dramatically, with a hundred-fold increase in NOx possible in the event of a complete SCR failure. In this case, we recommend the vehicle be subject to a new, much quicker speed derate schedule so that repairs are made sooner. ICCT suggests the fourth step of speed derate occur within 12 hours of fault indication, rather than at 60 hours as EPA has proposed. In the event this final inducement does not cause the operator to seek repairs, we recommend the operator be warned that after another 4 hours of operation speed will be limited to 5 mph following the next refueling or engine shutdown. This extra step is needed to assure the highest emitting trucks do not continue to operate for long periods without repair. Note this final 5 mph speed derate is not new and has been part of the HD emission control program for a decade. Limiting the 5 mph derate to the highest emitting trucks with an indicated SCR efficiency decline of more than 10 percent as indicated by the NOx sensors will preserve important emission reductions. Providing a total of 16 hours from the initial fault notification before the 5 mph derate occurs will help address concerns of operators that the short period of time in the current guidance before the speed derate of 5 mph occurs (as little as 4 hours from fault indication) can create significant cost and inconvenience to operators and, in the case of non-transit buses, their passengers. [EPA-HQ-OAR-2019-0055-1211-A1, p. 23]

We recommend a final speed derate inducement of 20 mph or less for low-speed trucks. This will provide a meaningful incentive to seek repairs, thereby reducing excess emission operation. [EPA-HQ-OAR-2019-0055-1211-A1, p. 21]

EPA proposes a final derate speed of 35 mph for low-speed vehicles. These urban trucks could avoid repairs even with the final EPA proposed speed derate by operating only on local streets and arterials and avoiding urban freeways that require higher speed. This is possible for many small businesses such as lawn care and home repair that do not travel long distances between jobsites. The ability to continue operating without repair in urban areas could have a disproportionate impact on disadvantaged communities, an unacceptable outcome. [EPA-HQ-OAR-2019-0055-1211-A1, pp. 21 - 22]

We recommend a final speed derate inducement of 35 mph or less for trucks other than low-speed trucks, with the possible exception of line haul trucks. The unlikelihood of being able to operate on urban and regional highways at this maximum speed will provide a meaningful incentive to seek repair of indicated faults. [EPA-HQ-OAR-2019-0055-1211-A1, p. 22]

EPA’s proposed final speed inducement of 50 mph will be meaningless for many urban-based trucks capable of freeway speeds. The objective of speed derates is to keep trucks with failed components and high emissions from operating at highway speeds, thus providing an incentive for repair. While a 50 mph final speed derate may be a strong enough disincentive for line haul trucks, it will not provide a strong incentive to obtain repairs for many regional and urban-based trucks. [EPA-HQ-OAR-2019-0055-1211-A1, p. 22]

The truck speed limit in many urban areas is 55 mph, so a 50 mph derate limit will not prevent trucks from operating on the highways. For example, a 50 mile trip at 50 mph takes only 6 minutes longer than if the truck travelled at 55 mph, a relatively minor inconvenience compared to taking the truck out of service for repair. Many urban areas have considerable urban congestion during which speeds are less than the speed limit. The 50 mph final speed derate would have little or no impact on trucks during these frequent congested conditions. Another consideration is many regional and urban-based trucks regularly travel though or near residential neighborhoods surrounded by warehouses, ports and industrial sites, where air pollution is already higher than other urban areas. High truck emissions due to repair avoidance will disproportionately impact residents of these areas, who are often low-income persons of color, and who would benefit from more, rather than less protection from truck emissions. [EPA-HQ-OAR-2019-0055-1211-A1, p. 22]

If EPA believes a lesser speed derate is appropriate for line haul trucks, ICCT suggests allowing a higher final speed derate if the truck exceeds an average speed based on typical line haul operation. A 50 mph speed derate would provide an incentive for line haul trucks to seek repair since speed limits on interstate highways are often higher than 55 mph and it is common practice for trucks to operate at higher speeds. When these trucks age and become urban-based, such as moving shipping containers, their average speed may decline below the interstate speed average and the final 35 mph derate would be applied. [EPA-HQ-OAR-2019-0055-1211-A1, p. 22]

Organization: *Maine Department of Environmental Protection (Department)*

Using the CARB Heavy-Duty Omnibus Regulation as a bellwether, the Department requests the following revisions to the federal proposal: [EPA-HQ-OAR-2019-0055-1288-A1, p.6]

- EPA’s proposed speed derates (Table IV-13 of the NPRM) do not provide sufficient inducement for many low-speed vehicles to repair (or replace DEF) in a timely manner since locally operated vehicles could operate at the lowest speed of 35 miles per hour without a significant performance penalty in a congested traffic area.17 Even when engine derating is an incentive for operators to perform required maintenance, the new schedule allows for up to 60 hours of operation before the final inducement goes into effect. This could amount to 60 hours of driving on local streets, near schools, small businesses, and residences without emissions control. The Department strongly urges EPA to reconsider the low-speed vehicle inducement schedule and make the derated vehicle speeds significantly lower. [EPA-HQ-OAR-2019-0055-1288-A1, p.7]

17 Many roads in urban areas already have speed limits of 25 mph or lower

Using the CARB Heavy-Duty Omnibus Regulation as a bellwether, the Department requests the following revisions to the federal proposal: [EPA-HQ-OAR-2019-0055-1288-A1, p.6]

- SCR inducements. The limitations imposed on vehicle operation that occur when a vehicle runs out of diesel exhaust fluid (DEF), has poor quality DEF, or when tampering occurs to the SCR should be revised for low-speed vehicles. [EPA-HQ-OAR-2019-0055-1288-A1,p.7]

Organization: *Midwest Bus & Motorcoach Association*

Motorcoaches play an important role when a natural disaster occurs and people need to be evacuated. Each year this industry is asked to transport citizens out of an area that has experienced an environmental hazard such as a hurricane or wildfire. The industry is actively engaged in moving our nation's military in time-sensitive situations, such as national guard deployments. It is important to note that there is a current exemption of inducements applied to emergency vehicles. Because of safety concerns and risk to supporting human health, in 2012, EPA issued a DFR for all emergency vehicles such as ambulances and firetrucks, preventing them from losing speed or power. This ruling provided OEMs the ability to offer new engine software calibrations that eliminated the chance of inducements that would cause delays to life saving measures. With the multi-use purposes motorcoaches provide, including life saving measures, it would fall in line to include this industry in the derating exemption. [EPA-HQ-OAR-2019-0055-1158-A1, p.3]

This proposed rule change is not safe or sensible for our industry's vehicles. Rather than further restricting the industry and causing additional undue burdens, we need flexibility and reasonable timeframes that allow operators to transport their passengers back to the point of origin to receive proper maintenance. The motorcoach industry transports people and should be separated from the freight transporters. [EPA-HQ-OAR-2019-0055-1158-A1, p.3]

Organization: *Motorcoach Companies*

It is also important for us to mention the role we play in natural disaster and other evacuations. Every year our industry is called upon to offer relief when there are environmental hazards such as hurricane or wildfires to transport citizens out of harm's way. Our industry is also actively engaged in moving our nation's Military across country in time sensitive situations, such as the national guard being deployed. We would also like to point to the current exemption that emergency vehicles have for inducements. Because of safety concerns and risk to supporting human health, in 2012 the EPA issued a DFR for all emergency vehicles such as ambulances and firetrucks, preventing them from losing speed or power. This ruling then granted OEMs to offer new engine software calibrations that eliminated the chance of inducements causing delays to life saving measures. It makes perfect sense for the EPA to offer this flexibility and exemption to any vehicle that would be subject to derating in a life-saving situation. We feel that our industry should fall under this category of emergency vehicles. This alone should be reason enough to grant our industry an exemption as we are helping save lives in these emergency situations. [EPA-HQ-OAR-2019-0055-1149-A1, p.3]

What the EPA has proposed is not suitable for our industries vehicles. We are in need of increased flexibility and a more reasonable time frame to allow operators to transport their passengers back to the point of origin, allowing a vehicle to return to the operator's facility to receive proper maintenance. [EPA-HQ-OAR-2019-0055-1149-A1, p.3]

Given the nature of our business and the fact we are transporting large groups of people not freight, we feel our industry should be separated into its own category. If the EPA is not willing to grant us a derate exemption as they had all other emergency vehicles; we present the below counter option for your consideration and feel our counter offer would be a more acceptable time frame. [EPA-HQ-OAR-2019-0055-1149-A1, p.3]

Default maximum speed (mi/hr)	**Commercial Passenger Vehicles Counter 1**	**Commercial Passenger Vehicles Counter 2**
65	derate exempt	24 hours
60	derate exempt	48 hours
55	derate exempt	72 hours
40	derate exempt	96 hours

[Additional comment by several companies that joined this mail campaign:] *Four companies that joined this mail campaign recommend 50 mi/hr instead of 40 mi/hr; see* EPA-HQ-OAR-2019-0055-1198, 1199, 1241, 1267]

[Additional comment by several companies that joined this mail campaign:] There may be some opinions that this schedule offers too much flexibility and operators would be content to run at these speeds. We can assure you that would not be the case for our industry. With any speed limitations our ability to complete a trip without having a second relief driver would be much less likely. Our drivers have a 10-hour drive time for hours of service. Reducing them 5 mph over a course of 10 hours would take roughly 50 miles for each driver. This in turn would complicate our operations and prevent us from completing trips. With the national driver shortage, we are already having issues and stretch drivers to the maximum distance of 600 miles. In order to complete a 600-mile trip we would then need to add a second driver, decreasing the overall trips we could cover, ultimately reducing our full utilization and revenue. This alone would be reason enough for us to not be complacent and continue to operate a slowed vehicle. [EPA-HQ-OAR-2019-0055-1241 and 1267]

Aside from this point, is the customer dissatisfaction that would arise from a slower running vehicle. Most of our customers are on a strict time frame and plan far in advance of arrival times based on calculated ETA from mapping and routing software. If a group is traveling at a reduced speed there will be a lot of complaints and frustrated passengers contacting us. There could be missed flights, sporting events, shows, etc. .. all of these loses are a concern for operators because we pay for reimbursements and will lose a customer's trust. We cannot afford to keep a derated vehicle on the road and would do whatever is necessary to repair that vehicle so that it is capable of operating at posted speed. [EPA-HQ-OAR-2019-0055-1241 and 1267]

Again, there is the safety aspect of vehicles traveling at reduced speed and keeping up with other traffic. Anytime a vehicle is traveling at a slower speed than what is posted it is in a position of being rear-ended on the interstate from a distracted driver who had their vehicle set on cruise control, following the local speed laws. It is obvious that these factors were not considered and must be brought to attention. We will not be ok with running a vehicle at derated speeds and will fix any issue, in a reasonable time frame. Our problem is we currently do not have enough time to get that vehicle to our shop or other service facility, but what we have now is astonishing that it was ever even put in place. To cripple a vehicle is extremely foolish and needs to be corrected immediately. [EPA-HQ-OAR-2019-0055-1241 and 1267]

[Additional comment by one company that joined this mail campaign:] Differing from freight carriers, passenger carriers are many times much further away from homebase as well as much more limited access to repair facilities. Many times under current rules the vehicles end up parked for days or have to be towed to closer facilities just for a simple repair, that given a longer derate schedule or exemption would not happen. This problem is even more exacerbated when we have a group of passengers on board and now we have to find alternate transportation to get them to their destination. [EPA-HQ-OAR-2019-0055-1199]

Each motorcoach you see on the road takes roughly 50 vehicles off the road. There are currently 3500 Motorcoach companies in the United State comprised of roughly 36,000 passenger buses. If the goal of the EPA is to reduce overall emissions, they should be lifting our industry up and encouraging group travel as opposed to other modes of transportation. The bottom line is simple Motorcoaches reduce pollution [Emphasis in original. EPA-HQ-OAR-2019-0055-1199]

Organization: *National Association of Clean Air Agencies (NACAA)*

EPA reasons that relaxing inducements would more effectively result in truck operators properly maintaining SCR and proposes that for high-speed vehicles the initial inducement would be 65 miles per hour (mph) and the final inducement no lower than 50 mph (up from the current final inducement of 5 mph). For low-speed vehicles, the proposed initial inducement is 50 mph and the final inducement no lower than 35 mph. Such inducements are too lax to encourage a truck operator to act in a timely fashion to fix a problem and should not be finalized. [EPA-HQ-OAR-2019-0055-1232-A1, p. 12]

Further, the proposed derate schedules would allow up to 60 hours of operation before the final inducement takes effect. That would be 60 hours of driving, without emission controls, through vulnerable communities, past schools and recreational areas and near homes and small-business and community hubs. This should not be finalized either. [EPA-HQ-OAR-2019-0055-1232-A1, p. 12]

If EPA believes changes to the inducement strategies are technologically necessary, NACAA offers the following recommendations. First, EPA’s proposed inducements, which would dramatically increase maximum speeds allowed under the derate schedules, should be revised considerably downward. Second, EPA should amend the definition of a low-speed vehicle from a 20-mph threshold to a 30-mph threshold so that these vehicles would be subject to a more appropriate low-speed vehicle derate schedule. Third, EPA should finalize derate schedules with less time between stages to reduce the total allowed hours of operation before the final inducement occurs. Finally, rather than just relaxing inducements and potentially allowing a truck with improperly maintained SCR to continue operating with nominal constraint, EPA should put in place measures that will hold manufacturers accountable for addressing the durability and sensor issues about which the agency, dealerships and manufacturers have received complaints. [EPA-HQ-OAR-2019-0055-1232-A1, p. 12]

Organization: *National Association of Small Trucking Companies (NASTC)*

A derate schedule for high-speed trucking of four stages, each having varying lengths that should allow long-haulers to return to their home base or a trusted repair shop.

This proposed approach to inducement would allow many vehicle owners to more efficiently address conditions that trigger inducements and save on costs. For long-haul carriers, the 12 and 60 mile hours allotted for the latter derating stages are certainly an improvement. NASTC believes that having 20 and 120 hours, respectively, for the later stages would enable many more carriers to reach home, and we urge adopting the longer time allotments, at least for long-haul trucking. The ability to return to a motor carrier's garage or a known and trusted local repair facility to attend to emission system problems is very important and desirable. Safety and security issues are heightened when one must attend to repairs and parts replacements on sophisticated systems and attempts self-repair. There are also heightened risks when one entrusts repairs to an unknown shop—there are some unscrupulous actors who take advantage of stranded truckers. The costs of repairs away from home escalate, due to the potential for delayed acquisition of new parts and the need of extended lodging for the duration of the delay. Meanwhile, when a truck is not moving, it isn't earning money. Contracts and customers become at stake of finding another carrier, making a much costlier experience that the current inducement regime imposes. Therefore, having sufficient time to avoid such conditions and risks would be a tremendous improvement. [EPA-HQ-OAR-2019-0055-1130-A1, p. 2]

These changes are crucial. Long-haul truckers must minimize down-time. A truck that is stuck in the shop, poking along the interstate at 5 miles per hour, being towed, or repeatedly having the same emissions system problems costs truckers and motor carriers. And that costs all of us. That is because trucks haul more than 80 percent of America's freight. Trucks bring the goods that stock store shelves and online vendors' warehouses. Trucking is vital to our nation's and our personal well-being, health, quality of life, our communities' viability, and our prosperity. [EPA-HQ-OAR-2019-0055-1130-A1, p. 2.]

Derate speeds for high-speed vehicles from 65 mph to 50 mph in four stages, each derating in 5 mph increments.

Specifically, NASTC applauds separate inducement schedules for high- and low-speed vehicles — making it easier for truckers to make repairs while on the road, using generic scan tools, and providing more, specific information like diagnostic codes — and better warranty coverage of emission system and parts failures so as to keep trucks that remain in service performing emissions reduction while reducing truckers' costs of servicing the systems for the actual life of a vehicle. [EPA-HQ-OAR-2019-0055-1130-A1, p. 2.]

Separate inducement schedules for high- and low-speed commercial vehicles. Longer derate time periods and faster speeds for high-speed trucking, and shorter times and slower speeds for low-speed vehicles, are a much superior approach to inducements. The proposed schedules are much better suited to significantly different types of trucking. The requisite speed differentials for fast- and slow-moving vehicles experiencing inducement (legitimately or from false positives) take a common-sense approach of designing different schedules for vehicles engaged in very different operational models in very different settings. While we can only speak to the high-speed schedule particulars, we support this proposal. [EPA-HQ-OAR-2019-0055-1130-A1, p. 2]

Organization: *Northeast States for Coordinated Air Use Management (NESCAUM)*

Should EPA instead promulgate Option 1, we urge the Agency to make the following changes to the proposed standards: The maximum speeds for low-speed vehicles given in Proposed Inducement Schedules, Table IV-13 as 50, 45, 40, and 35 miles per hour (mph) should be revised. NESCAUM recommends that the maximum speeds given for all four proposed engine hours of operation for low-speed vehicles be reduced. Owners of low-speed vehicles, which are often locally driven delivery vehicles, will not be induced to repair their vehicles quickly with the proposed maximum speeds given in Table IV-13. A locally driven delivery vehicle could operate at the lowest speed of 35 mph without much of a performance penalty in a congested traffic area. Many roads in urban areas have speed limits of 25 mph or lower. In addition, many of the problems cited by commentators that arise when an engine is derated would not greatly affect low-speed, locally driven vehicles, such as large towing expenses and stranding vehicles and drivers far from home. Therefore, it is not appropriate or necessary to allow locally driven low-speed vehicles to drive as fast as allowed in the proposed Inducement Schedule. [EPA-HQ-OAR-2019-0055-1249-A1, pp. 13 - 14]

Even for vehicles where the engine derating is an incentive to perform required maintenance, the new schedule allows for up to 60 hours of operation before the final inducement goes into effect. This could amount to 60 hours of driving on local streets, near schools, small businesses, and residences, without emissions control. We strongly urge EPA to reconsider the low-speed vehicle inducement schedule and make the derated vehicle speeds significantly lower. [EPA-HQ-OAR-2019-0055-1249-A1, p. 14]

Organization: *Owner-Operator Independent Drivers Association (OOIDA)*

OOIDA supports the proposed inducement schedules and various derate principles included in Section IV, D. These provisions focus on conditions that are within a driver’s control, implement a multi-step derate schedule, and a backup check to override false inducements. [EPA-HQ-OAR-2019-0055-1266-A1, p.5]

Organization: *Ozone Transport Commission (OTC) and Mid-Atlantic/Northeast Visibility Union (MANE-VU)*

Even for those vehicles where the engine derating is an incentive to perform required maintenance, the new schedule allows for up to 60 hours of operation before the final inducement goes into effect. This could amount to 60 hours of driving on local streets, near schools, small businesses, and residences without emissions control. We strongly urge EPA to reconsider the low-speed vehicle inducement schedule and make the derated vehicle speeds significantly lower. [EPA-HQ-OAR-2019-0055-1250-A1, p.15]

The maximum speeds for low-speed vehicles given in Proposed Inducement Schedules, Table IV-13 as 50, 45, 40, and 35 miles per hour (mph) should be revised. OTC and MANE-VU recommend that the maximum speeds given for all four proposed engine hours of operation for low-speed vehicles should be reduced. Owners of low-speed vehicles, which are often locally driven delivery vehicles, will not be induced to repair their vehicles in a timely manner with the proposed maximum speeds given in Table IV-13. A locally driven delivery vehicle could operate at the lowest speed of 35 mph without much of a performance penalty in a congested traffic area. Many roads in urban areas have speed limits of 25 mph or lower. In addition, many of the problems cited by commentators that arise when an engine is derated, such as towing expense and time lost when drivers and their vehicles are stranded far from home, would not greatly affect low-speed, locally driven vehicles. Therefore, it is not appropriate or necessary to allow locally driven low-speed vehicles to drive as fast as allowed in the proposed Inducement Schedule. [EPA-HQ-OAR-2019-0055-1250-A1, p.15]

Organization: *Scruggs Company*

The Truck engines that out in the industry today have become cleaner from engineering a aftertreatment system. with that being said we ourselves have experienced several close calls on the roadway. letting these truck engine go further and of course derate the engines until they can get to a local shop without using towing companies or be put in an unsafe situation. [EPA-HQ-OAR-2019-0055-2800, p.1]

Organization: *Six Point Transport Incorporated*

65mph very good [EPA-HQ-OAR-2019-0055-2591, p.1]

Organization: *State Trucker Associations (1)*

The proposed changes for the freight sector reduce truck speeds in 5 mph increments beginning at 65 mph and ending at 50 mph at 60 hours of engine operation. Our member fleets have indicated this modification should ensure adequate time for drivers to reach repair facilities while avoiding operating at unsafe speeds or the need to have their vehicles towed which can cost thousands of dollars. Other considerations include providing adequate time for vehicles operating in remote areas to reach repair facilities as well as allowing drivers to finish their deliveries should the in-cab display appear during a shift. EPA's proposed modification will also allow fleets added time to access preferred repair facilities as opposed to the limited choices they may have under the existing derate schedules. [EPA-HQ-OAR-2019-0055-1075-A1, p.1]

[Additional comment by one of the 23 organizations that joined this mail campaign, EPA-HQ-OAR-2019-055-1185, P.2] Comments from Kennesaw Trans. people that deal with the Derate issues:

> "All for that here in the shop. We constantly have trucks going down on the NOx sensor codes. Luckily we keep them in stock, but out on the road that doesn't help. I cannot think of one instance where we had a truck have a fault code for a NOx sensor and it be anything more than the sensor malfunctioning. Right now with parts being hard to find, a

4 hour time frame before de-rate isn't sufficient time to have the repairs done on the road. This proposal would allow our trucks to seek repair facilities without long wait times or even make it back to our home terminal for repairs. This is all a win-win situation for us as it save us money on outside repairs, breakdowns, and deliveries wouldn't need to be repowered or rescheduled." Brandon Shuping - Shop Foreman

"I have always felt this was a huge safety concern that has been over looked for 10 years now. They did help somewhat recently with a countdown timer - allowing drivers to safety get to a dealership. If they propose changes as stated below, this would help tremendously. Not only safety of our drivers but everyone else out on the roads these days. –not to mention the savings to each commercial hauler in towing expense!" David H Rose Jr. - Maintenance Department

"I think this is a great idea. Cutting the speed to 5 mph is a big safety issue. This new plan will greatly increase the safety of our drivers and everyone else around them. Everyone seems to be a hurry these days. As for the money side, it will let us get our drivers and equipment to our preferred shops. Small local shops don't always have the programming or parts to repair our truck, which usually means towing to a dealership. It will save a lot of money on parts & towing." Evelyn Balsters – Former Driver

Organization: *States of California, et al. (The States)*

Notably, the proposed final derate speed restrictions—50 mph for high-speed vehicles and 35 mph for low-speed vehicles—equal or come just under the speed limits for roadways on which many of these vehicles will operate. For example, a heavy-duty tractor on certain urban interstates and major state highways in California, Connecticut, Delaware, Massachusetts, New Jersey, Oregon, and Rhode Island are subject to a 55 mph speed limit.83 EPA's statement that "final restricted speed of 50 mph prevents the vehicle from travel on most interstate highways with state laws regarding impeding traffic" is not true in most States, which, if they have minimum speeds at all, typically set those speeds at 40-45 mph.84 Low-speed vehicles such as a refuse hauler, street sweeper, or similar utility vehicle operating in residential neighborhoods and city streets will face typical speed limits of 25-35 mph.85 There is very limited incentive (or none at all) for these vehicles to replenish DEF levels even after 60 hours of inadequate maintenance under the proposed derate schedules. The States therefore disagree with EPA's statement that "the proposed derate schedules would be no less effective than the current approach,"86 and urge EPA to adopt a stricter schedule. [EPA-HQ-OAR-2019-0055-1255-A1, pp. 19 - 20]

83. Cal. Vehicle Code § 22406; Conn. Gen. Stat. § 14-219(a); Del. Code, tit. 21, § 4169(a)(5); Mass. Gen. Laws ch. 90, § 17; N.J. Stat. § 39:4-98(c) (50 mph limit); Or. Rev. Stat. § 811.105(2)(e); R.I. Gen. Laws § § 31-14-2(a)(2).

84. See, e.g., Conn. Gen. Stat. § 14-220(a) (40 mph); Mass. Registry of Motor Vehicles, "Rules of the Road," ch. 4 (40 mph minimum speed on Massachusetts Turnpike), available at https://www.mass.gov/doc/chapter-4-rules-of-the-road-0/download; N.C. Gen. Stat. § 20-141(c) (40-45 mph minimum speeds).

85. Cal. Vehicle Code § 22352(b)(1) (setting default 25 mph limit in residential zones); Colo. Rev. Stat. § 42-4-1101(2)(c) (30 mph in residential zones); Del. Code, tit. 21, § 4169(a)(2) (25 mph in residential zones); D.C. Mun. Regs., tit. 18, § 2206.2 (20 mph in residential zones); Honolulu Traffic Code, § 15-7.2(b) (25 mph default limit); 625 Ill. Comp. Stat. 5/11-601(c) (30 mph in urban district); Md. Transp. Code § 21-801-1(b)(2)-(3) (30-35 mph in residential districts); Mass. Gen. Laws ch. 90, §§ 17, 17C (25-30 mph limits in "thickly settled" or business districts); Minn. Stat. § 169.14, subd. (2) (20-35 mph speed limits for urban and residential zones); N.J. Stat. § 39:4-98(b) (25-35 mph speed limits for business and residential zones); N.C. Gen. Stat. § 20-141(b) (35 mph inside city limits); Or. Rev. Stat. § 811.105(2)(b), (d) (20-25 mph speed limits in business and residential zones); R.I. Gen. Laws § § 31-14-2(a)(1) (25 mph in business and residential districts); Wash. Rev. Code 46.61.400(2)(a) (25 mph on city and town streets); Wis. Stat. § 346.57(4)(e)-(g) (25-35 mph speed limits in cities and outlying areas).

86. 87 Fed. Reg. at 17,543.

The States support efforts to prevent false inducements, which are understandably frustrating for operators and undermine public buy-in for emission controls.87 But the false inducement problem calls for a technological fix from manufacturers; it does not justify relaxing the derate schedule. The States likewise are sympathetic to the safety concerns around a final derate speed restriction of 5 mph in certain high-speed conditions.88 However, these concerns can be addressed with a derate schedule that is still far stricter than that proposed. For example, final derate speed restrictions of 35 mph for high-speed vehicles and 20 mph for low-speed vehicles, especially in combination with a gradual schedule of progressive derates, would still allow all vehicles to safely exit freeways, finish routes, and find repair facilities if needed, while providing sufficient incentive to proactively maintain aftertreatment systems. [EPA-HQ-OAR-2019-0055-1255-A1, p. 20]

87. See id. at 17,538.

88. See id. at 17,539.

Organization: *Truck and Engine Manufacturers Association (EMA)*

EPA should also allow for transitions between the vehicle speed levels rather than step changes. [EPA-HQ-OAR-2019-0055-1203-A1, p. 124]

Organization: *United Motorcoach Association (UMA)*

UMA applauds these proposals; however, while the passenger carrier industry would prefer no inducements, similar to the emergency vehicle exemption, the schedule below reflects a widely supported schedule that helps meet the requirements of the consumer while working the inducement problem or making alternative arrangements.

Default maximum speed (MPH)	Commercial Passenger Vehicles
65	24 hours
60	48 hours
55	72 hours
50	96 hours

[EPA-HQ-OAR-2019-0055-1311-A1, p.4]

Organization: *Dennis Streif, Vandalia Bus Lines, Inc.*

I would hope that this regulation can be changed to allow more time (20 - 40 hours) for a vehicle to get to a safe operating spot and repair facility. This regulation is a burden and put operators and passengers in an unsafe predicament. We do want a clean air environment in this country and worldwide, however it would be a spirit of corporation for the EPA to provide some relief on the derate shut-down. Please give this another consideration [EPA-HQ-OAR-2019-0055-2811, p.1]

Organization*: Virginia Motorcoach Association*

It is important to note that there is a current exemption of inducements applied to emergency vehicles. Because of safety concerns and risk to supporting human health, in 2012, EPA issued a DFR for all emergency vehicles such as ambulances and firetrucks, preventing them from losing speed or power. This ruling provided OEMs the ability to offer new engine software calibrations that eliminated the chance of inducements that would cause delays to life saving measures. Motorcoaches also play an important role when a natural disaster occurs and people need to be evacuated. Each year this industry is asked to transport citizens out of an area that has experienced an environmental hazard such as a hurricane or wildfire. The industry is actively engaged in moving our nation’s military in time-sensitive situations, such as national guard deployments. With the multi-use purposes motorcoaches provide, including life saving measures, it would fall in line to include this industry in the derating exemption. [EPA-HQ-OAR-2019-0055-2715-A1, p.3].

This proposed rule change is not safe or sensible for our industry’s vehicles. Rather than further restricting the industry and causing additional undue burdens, we need flexibility and reasonable timeframes that allow operators to transport their passengers back to the point of origin to receive proper maintenance. The motorcoach industry transports people and should be separated from the freight transporters. [EPA-HQ-OAR-2019-0055-2715-A1, p.3].

Organization: *Volvo Group*

The Volvo Group supports the need to improve SCR (Selective Catalytic Reduction) inducements as noted by the following comment. In addition to replacing the 5mi/hr with a 50 or 35 mi/hr derate, we support introducing a bus exclusion to avoid potential safety issues. [EPA-HQ-OAR-2019-0055-1324-A1, p. 5]

Volvo Group recommends this change in inducement derate as well as an exclusion for buses to be implemented as soon as possible as these issues affect today the potential safety of buses. [EPA-HQ-OAR-2019-0055-1324-A1, p. 5]

Organization: *Wisconsin Department of Natural Resources (WDNR)*

EPA's proposed inducement schedules are not stringent enough to incentivize operators to address problems with malfunctioning SCRs in a reasonable timeframe. Robust engine emission standards lose significant effectiveness if control devices are bypassed in practice. [EPA-HQ-OAR-2019-0055-1162-A1, p. 3]

EPA Summary and Response

For the purpose of this section, each subtopic is summarized and responded to separately.

Comments on Exempting Motorcoaches

Motorcoach operators and trade groups commented that today's inducement approach has long created serious risk to life in their operations. Volvo commented that they supported exempting buses in this type of service as soon as possible because these issues affect potential safety of operations and uptake of advanced technology. ABA, Coach USA, Compass Coach Inc., and other motorcoach carriers requested that EPA allow motorcoaches to operate with the same exemption from inducements as emergency vehicles for one or more of the following reasons: (1) The transport of passengers requires different considerations that hauling conventional freight (e.g., need for food, water, and relief from climate extremes) and should not be stranded intentionally for hours while awaiting a rescue bus. (2) Motorcoach operators are already sufficiently compelled to perform proper maintenance and use DEF because they must reduce risk of breakdowns or damage to expensive engines – they depend on these engines for revenue. (3) Drivers are sufficiently motivated by warning lights to take action, and reducing the stress of a 5mph shutdown would allow them focus more on passenger safety. (4) Motorcoaches often serve in an emergency response capacity and should not be subject to artificial inducements that prevent performing this work. ABA noted that in FY2021, buses moved nearly 28,000,000 military personnel and in 2020 were critical to hurricane evacuation efforts. (5) Passenger motorcoach companies are driven to perform proper maintenance because operations are heavily dependent on passenger-driven schedules, any delay risks expensive reimbursements owed to passengers for missed events (e.g., airline tickets, theater tickets) and cost to reputation. For example, Motorcoach Companies. noted that even a 5mph speed decrease can cost an hour of time in a shift which can require a new driver be located for the bus (due to hours-of-service requirements that limit hours per day drivers can legally drive) and can disrupt schedules causing passengers to miss scheduled events. (6) Consistent with EPA's stated attention to environmental justice, an exemption would reduce risk of losing a key transportation option for underserved and price-sensitive communities which is sometimes the only mode of transportation available to connect to jobs, education, medical services, and other modes of transportation.
(7) There needs to sufficient time for the motorcoach to reach a safe location. It is not unusual for motorcoach routes to traverse remote stretches of the country. Also, there are not as many service locations available to a motorcoach, as opposed to those trucks.

Carerra Tours supports a schedule that enables them to safely deliver passengers and get to a safe place to repair a vehicle. Coach USA supports the proposed schedule but would support more time and is concerned the proposal doesn't take the unique concerns of motorcoach operations into account, noting that any speed below 65mph is unsafe on the highway. Compass Coach Inc. commented that they need time to find a safe place, get a vehicle looked at by a repair facility, acquire parts to fix a vehicle (noting most of the time it is a sensor failure that causes inducement) and that 72hours would be more appropriate.

Some motorcoach operators suggested an alternate derate schedule if the final rule did not include an outright exemption from inducements for motorcoaches. The alternate schedule started with derating to 65 mph, followed by further derates in 5 mph increments after every 24 hours of operation. The final derate condition would be 40 or 50 mph after 96 hours.

Response:

In a previous rule, EPA modified the definition of "Defeat device" at 40 CFR 86.004-2 to allow heavy-duty engine manufacturers to design their engines with auxiliary emission control devices to override SCR-related inducements for engines installed in ambulances or fire trucks (77 FR 34130, June 8, 2012). EPA adopted that rule to enable these dedicated emergency vehicles with diesel engines to perform mission-critical life- and property-saving work without risk of losing power, speed, or torque due to abnormal conditions of the emission control systems (79 FR 46356, August 8, 2014).

We recognize that motorcoach fleets operate with the grave responsibility of ensuring the safety of their passengers, and that they are also called into duty periodically for military support and various emergency response needs. All these functions depend on reliable engine performance to keep buses moving over long distances at typical highway speeds. This type of operation is not the same as that of the purpose-built function, mission, and typical operation of ambulances and fire trucks. Completely exempting motorcoaches from inducement provisions would leave many buses operating for most of their lifetimes lacking the assurances from inducements that maintenance of an adequate supply of DEF is reasonable likely to occur and that engine designs will deter SCR-related tampering.

In response to the suggested alternate derate schedule for motorcoaches, we have prioritized designing an inducement approach that allows for motorcoaches to have sufficient time and ability to reach a safe location, while maintaining inducement provisions to provide the assurance that SCR systems will continue to work properly. The inducements approach in this final rule involves modest speed derates to provide that assurance. We understand the comments explaining that motorcoach operators have various responsibilities to ensure that engines will serve reliably to complete their routes safely and on time. With this responsibility, it is clear that motorcoach operators will be highly motivated to perform any amount of maintenance that would be needed to avoid the risk of disrupting schedules or jeopardizing the well-being of their passengers. As a result, we believe an initial derate speed of 65 mph is appropriate because it should be effective in compelling motorcoach operators to address derates under normal circumstances. The final derate speed of 25 mph after 180 hours is intended to reflect the extreme emergency that would cause a motorcoach operator to continue operating without performing the maintenance necessary to resolve a fault condition causing the inducement.

We have provided a regulatory definition of motorcoach in 40 CFR 1036.810 to clarify that the alternate schedule applies for buses designed to travel long distances with row seating for at least 30 passengers. This is intended to include charter services available to the general public.

For the reasons described above, we do not expect that the inducement provisions adopted in this final rule will prevent motorcoaches from continuing to provide transportation for underserved and price-sensitive communities.

General Comments on EPA's Proposed Inducement Schedule

ABA commented that they believe adjusting the derate schedule with a more appropriate final inducement speed has merit but need additional time to review the merits with operators. ATA is supportive of the derate schedule and believes it is justified to improve access to repair facilities and avoid unsafe operating speeds. NASTC commented that the proposed schedule is an improvement over the existing schedule, but more time (120 hours) is needed to allow trucks to return to home base or a trusted repair shop which is extremely important. NASTC added that safety and security issues are heightened during breakdowns and add risk when one has to trust repairs to unknown facilities on an emergency basis where there can be unscrupulous actors who can take advantage of stranded truckers. The Scruggs Company commented that they have experienced several safety "close calls" on the roadway and trucks need more time and higher final inducement speeds to avoid an unnecessary tow or being put in an unsafe condition to get to a repair facility. Six Point Transport submitted comments in support of the proposal. Twenty-three individual State Trucking Associations submitted support for the proposal stating that the proposed schedule should allow drivers to reach preferred repair facilities while avoiding unsafe conditions and needless towing that can cost thousands of dollars.
CARB and ICCT proposed to apply speed derates to vehicles if the system detects a fault condition where the NOx override determines that the SCR catalyst is working properly. The recommended approach was to require a final derated speed of 35mph with a 40% torque derate for high-speed vehicles.

CARB suggested an alternative to EPA's proposed derate schedule that would result in a final speed of 5mph in 10 hours where the NOx override determines that the SCR catalyst is not working properly. CATF+ supported CARB's suggested derate schedule. CATF+ commented further that allowing 60 hours of operation before the final derate speeds would produce massive quantities of excess pollution; they also commented specifically that the proposed derate speeds are too high for low-speed vehicles. DOEE, NACAA, and the Wisconsin DNR stated they are concerned that the proposed schedule would not sufficiently compel operators to properly maintain vehicles. ICCT commented that similar to CARB's comments two schedules should be finalized, one that reduces speeds further after 60 hours if SCR efficiency loss is 10% or less, and 5mph after 12 hours (or 16 hours if safe harbor not implemented). The States of California et al. commented that although they are sympathetic to safety concerns with existing inducements, they have concerns that can be addressed with lower speeds than proposed.

Coach USA recommended increasing the time between the first and second stage of derated vehicle speeds, for faults other than low DEF, from six hours to at least 10 hours to allow for reaching a repair facility.

CARB, EMA, and Cummins suggested that we include a gradual transition to start each new derate speed to avoid abrupt changes in vehicle speeds while driving. CARB suggested that the derate should occur at a rate not to exceed 1 mph for every five minutes.
David Pedersen recommended an alternative approach, based on what applies for light-duty vehicles, of allowing vehicles to shut down, and then disallow engine starting if any component or system caused the engine to be noncompliant.

CARB commented that they do not support EPA's proposed derate schedule, that EPA has not and cannot demonstrate that the proposed schedule is permissible under the Clean Air Act ("CAA") because it could allow vehicles to operate for potentially unlimited periods of time even if those vehicles are emitting pollutants in excess of the standards, and that EPA has not established that the proposed schedule is more effective than the existing one to compel proper maintenance and deter tampering and is clearly arbitrary and capricious.

<u>Response</u>:

EPA has carefully reviewed all comments, and further reviewed and analyzed available data to finalize an adjusted schedule from that proposed that EPA expects will address many of the identified concerns (see Section IV of the preamble for further information on and the basis for the final schedule). The final speeds have been adjusted from the proposed rule in two ways. First, we have added a new category for medium-speed vehicles (see Section IV of the preamble for further discussion). Second, we have modified the low-speed category after consideration of concerns expressed in the comments (see our summary and responses in this section related to comments on low- and high-speed vehicle schedules). Further, EPA modified the time portion of the schedule for each of these speed categories, such that lower-speed vehicles have less time prior to final inducement due to different operating profiles and needs (see our summary and responses in this section related to comments on inducement schedule hours).

Inducements are a unique solution developed to ensure that SCR systems have adequate high-quality DEF and operators do not tamper with specific components that would render the SCR system inoperable. The revised schedule considers over a decade of experience with SCR systems and full market availability of DEF. The revised schedule also reduces the risk that owners will tamper due to an overly restrictive approach, for example, by allowing owners to spend money on repairs instead of unnecessary towing. It reduces that risk by creating more finely tuned derate schedules to prevent commercial operation of noncompliant vehicles, but without the additional burdens that may occur under a more restrictive approach.

Some commenters stated that the schedule was not sufficient for ensuring proper and timely maintenance. These commenters did not provide discussion or data of how EPA's balanced approach would result in more or less tampering and more or less compliance in the real-world. EPA recognizes that there is concern that trucks will operate for longer periods of time in need of repair, however commenters did not provide and we are not aware of data supporting that any potential emission increases from this would be more or less than the potential increase in emissions from tampering due to an overly restrictive inducement approach. Allowing trucks to return to their preferred repair shops can also result in more effective repairs, which can also serve to reduce emissions. Further, EPA has finalized a lower final speed after an additional period of time which will further encourage prompt and proper repairs, and should further decrease the already unlikely indefinite use of the vehicle without the operator addressing the cause of the inducement. Finally, as noted earlier in this response, EPA adjusted the schedules by developing a medium-speed category that results in a final inducement speed of 25mph faster than a high-speed vehicle and reduced the final inducement speed and schedule for low-speed vehicles as well. EPA's approach relies on the principle of selecting a derate schedule that accomplishes the intended effect using the least restrictive means. The proposed rule described how operators would be compelled to perform SCR-related maintenance with a derate schedule that avoided concerns raised by commenters about potential safety and cost problems associated with abruptly decreasing maximum vehicle speed to 5 mph. Commenters did not engage with the question of how a derate schedule could accomplish maintenance objectives using the least restrictive means. Rather, commenters focused simply on certainty of outcomes and potential consequences of any delay in performing maintenance. We note that even such an inducement approach provides no certainty in guaranteed emission reductions however, as it is possible for a fleet to substitute a derated vehicle (e.g., a school bus) with an older vehicle until the derated vehicle is repaired and returned to duty.

As further discussed in preamble Section IV, EPA has carefully analyzed NREL data to understand and categorize what effective final inducement speeds should be applied to a vehicle based on its recent vehicle operating profile. It would not be possible for vehicles operating primarily on the highway to continue to operate profitably if they can no longer operate on the highway. Commenters also provided no rationale to counter our assessment that a derate schedule allowing operators time to complete a job and return to a preferred repair facility without requiring a tow or rescue vehicle should reduce in-use real-world tampering rates. EPA believes the initial derate speeds we are adopting will be effective in leading operators to make timely repairs. Any increased emissions resulting from a delay in that maintenance would be dramatically offset by even a very small number of cases where operators installed SCR-delete kits to resolve their frustration with a more restrictive approach to inducements. NREL data show that even vehicles with lower average speeds will frequently travel at high speeds to accomplish their work. Removing the capability of achieving these high speeds will prevent operators from being able to complete necessary work and therefore provide proper incentives, while minimizing potential motivations for tampering that can result from over-restricted speeds and forcing the expense of repeated tows. See also our responses to similar comments related to operating hours in section.

EPA believes that the final derate schedule should allow operators to return to a preferred repair facility, which should help ensure that mechanics understand how to perform the necessary maintenance.

EPA agrees that inducements are an important part of the compliance program. EPA has considered that an overly restrictive inducement policy could increase operator frustration and lead to in-use tampering and that a lax inducement policy may not sufficiently compel owners and operators to maintain SCR systems with an adequate supply of high quality DEF. The inducement program in the final rule is expected to remove any reasonable possibility for operators to continue in commercial service without addressing detected fault conditions. The inducement program in the final rule recognizes the diversity of the fleet and appropriately applies speed reductions based on an individual vehicle's operating profile. Improved serviceability and more appropriate inducement schedules will reduce operator frustration that can create an incentive for tampering with emission control systems.

We agree that speed derates should include a gradual transition. We have modified the final rule to include CARB's suggested approach of specifying that derates occur at a rate of 1 mph for every five minutes. Manufacturers may apply this in steps or they may design the engine to apply derates as a continuous decrease in vehicle speed at the specified rate until the vehicle reaches the targeted speed.

Coach USA's comments on the time between first and second derate speeds are described in the context of motorcoach operations. See Section 8.3.1 for a discussion of this and other issues for motorcoaches. The response here addresses their concern as it applies for other types of vehicles. Years of in-use operating experiences has shown that many malfunctions present as a fault indicating low DEF level even though the DEF tank has good-quality DEF available. It would therefore be inappropriate to create a separate derate schedule for DEF fill level separate from other fault conditions. We selected six hours as the initial interval to allow for refilling DEF or taking other readily available actions to restore the engine to proper functioning. We also selected derate speeds in 5 mph increments to allow for continued operation while operators arrange for repair or take other actions to address the possible causes of the detected fault condition. This gradual escalation in the derate schedule is intended to achieve a balance between increasing the motivation to correct the fault condition with an understanding that operators may need more time to arrange for maintenance or repair that is best accomplished after returning to a home base.

CARB and ICCT proposed adopting a separate inducement schedule based on the NOx override determination that the SCR catalyst is working properly. The final rule does not include the requirement to include a NOx override as an input into inducement algorithms, so we are unable to consider whether to apply a separate derate schedule as CARB and ICCT suggested. Further, our proposal was based on the concept of applying inducements where fault conditions cause an increase in emissions. We proposed that the NOx override would only be used to prevent inducements from being applied when the SCR catalyst is working properly.

Other issues related to the number of operating hours specified in the derate schedule are addressed later in this section (see Section 8.3.6 of this document).

The comment from David Pedersen raises two separate issues. First is the recommendation to disallow engine starting in response to a detected fault condition instead of applying speed derates. Many operators of heavy-duty vehicles would keep their engines running indefinitely with a detected fault condition if that is what they need to do to continue operating. Letting engines run for long periods between trips would be an easy way to defeat the inducement; this would allow the combined adverse environmental of high emissions while operating and the additional impact of emissions during extended idle. Second is the recommendation to apply inducements for any malfunction leading the engine to exceed emission standards. Any inducements for components other than those SCR system components included in the proposal are outside the scope of this final rule; see preamble Section IV for our discussion on the final SCR system components covered by the final inducement provisions and the basis for those provisions.

For the reasons discussed directly below, EPA disagrees with CARB's comments that (1) we failed to consider important aspects of the inducement proposal intended to compel corrective actions by vehicle owners, and the corresponding emissions impacts, and (2) this failure constitutes arbitrary and capricious agency action, and contravenes U.S. EPA's statutory duty to ensure heavy-duty engines and vehicles comply with applicable emissions standards over their useful lives. Further, EPA disagrees with CARB's comments that EPA has not, and cannot, demonstrate that the proposed inducement strategy is permissible under the statute, that there are good reasons for it, and that the agency believes it to be better. EPA does not agree that the final inducement provisions violate the statute by allowing vehicles with emision system problems to continue operating. See preamble Section IV for a detailed discussion of the authority and basis for our final inducement provisions, which includes consideration of public comments on the proposed rulemaking and rationale for any changes from existing guidance in our final provisions. See also our response to inducement-related comments in section 8 of this document for further explanation, including why the final inducement schedules will not result in indefinite use of vehicles that are in inducement.

EPA has performed rigorous analysis, outreach, and request for comment in both the ANPR and NPRM, as well as fully considering the information provided in public comments, to develop this final rule. As discussed in those documents referenced above, EPA has carefully evaluated and finalized a final set of inducement requirements that EPA determined, through an assessment that balanced multiple considerations, will best ensure compliance without being so restrictive as to encourage tampering that may result in long-term noncompliance. While inducement strategies utilized over the past decade have relied on a final inducement speed set at 5mph, EPA believes, for the reasons explained in Section 8 of this document and Section IV of the preamble, that the different approach finalized in this rule will be as effective, if not more effective, in real-world compliance with emission standards and requirements overall and reduce tampering that can result in large emission increases long-term (including after vehicles have passed their regulatory useful life but remain in service). We believe a change in approach is also appropriate given that the prior guidance was developed (1) based on a different set of market conditions, such as the unknown availability of DEF, and (2) without giving as much weight as we now believe is appropriate, with the advantage of over a decade of experience to analyze, to the consideration of what is the least restrictive set of requirements necessary for manufacturers to be able to reasonably ensure use of adequate high quality DEF. Additionally, as we noted elsewhere in this section 8, in a 2010 evaluation of in-use vehicle inducement strategies performed by CARB, CARB concluded that "driving a truck with a 25 percent engine torque derate and a 55 mph speed limitation was neither acceptable nor tolerable, especially when trying to accelerate or driving up-hill, and would likely cause a driver to refill with DEF or correct the SCR problem as needed."[27]

Comments on the concept of a two speed (high- and low-) vehicle inducement proposal

ABA commented that there is merit to the proposed approach, but they were unsure how it would work in application for motorcoach operations and whether the inducement schedule would change if a vehicle's profile changed or fluctuated. Coach USA commented that they do not believe a high-speed vehicle should ever be treated like a low-speed vehicle for the purposes of inducement while ensuring passenger safety. Cummins supported the proposed development of a multi-speed inducement concept, but recommended EPA not finalize the dynamic switching from high- to low-speed vehicle inducement schedules because of software complexity and potential confusion for operators. EMA supported the concept of two different inducement schedules based on vehicle average speed. NASTC supported separate inducement schedules for high- and low-speed vehicles. NASTC added that longer derate time periods and faster speeds for high-speed trucking and shorter times and slower speeds for low-speed vehicles are a common-sense and superior approach to inducements and are better suited to significantly different types of trucking operations. OOIDA and Volvo supported the concept of two different final inducement speeds. ICCT suggested allowing a higher final speed derate if the truck exceeds an average speed based on typical line haul operation.

<u>Response</u>:

EPA has added a third category, medium-speed vehicles, to the final inducement schedules to provide a more appropriate way of considering the operation of the real-world diverse fleet; see Section IV of the preamble for more discussion on the final inducement schedules and why we think it is appropriate for the schedules to progress from higher speeds to lower speeds.

ICCT's suggested approach for a different derate schedule for line-haul trucks is a different way of describing why we are adopting a separate derate schedule for high-speed vehicles. Adding the medium-speed category allows for more carefully defining high-speed vehicles to include vehicles with substantial operation at highway speeds.

As proposed, the derate provisions in the final rule require that engines identify a vehicle's appropriate speed category based on average speed over the previous 30 hours of operation. As described in Section IV of the preamble, an individual vehicle is identified by speed category at the onset of an inducement. As suggested by commenters, the speed category for a given vehicles does not change after the system detects a fault condition. Instead, the derate schedule for each speed category accounts for the changing vehicle speeds as the vehicles progresses through the full derate schedule.

Comments on the Proposed High-Speed Vehicle Schedule

[27] See 76 FR 32889-32890 (June 7, 2011) for EPA's description of CARB's evaluation in a notice requesting comment on draft guidance for inducements.

ATA commented that the proposed high-speed schedule will impact operations and prompt a repair response prior to reaching the final inducement speed. CARB commented that EPA failed to propose an inducement schedule for high-speed vehicles that is unacceptable for typical driving, that the initial step of the high-speed inducement is insufficiently stringent based on CARB's vehicle speed data and would have a very limited impact on inducing operators to fix the problem. CARB commented that some states including CA have urban highway speeds of 55mph, and the final inducement speed for high-speed vehicles is not severe enough to induce the operator to make repairs and would not be as effective as the current 5mph guidance. CARB also objected to EPA's statement that minimum required highway speeds would prevent derated vehicles from operating on limited-access highways. DOEE commented that final derate speeds should be revised considerable downward. Coach USA commented that the proposed schedule is reasonable and effective to induce drivers to correct fault conditions and ensure proper maintenance but is concerned with any derate applied to motorcoaches with a speed of less than 65mph. ICCT recommend EPA adopt 35mph or less as a final inducement speed with a possible exception for line-haul trucks. NASTC commented that high-speed vehicles should have more time between stages of inducement and the first step should be 20 hours (not 12), and the final step should be at 120 hours, not 60 hours, to allow carriers sufficient time to reach home for long-haul trucking. States of California et al. commented that for high-speed vehicles the final inducement speed should be 35mph. UMA, Motorcoach Companies, and other motorcoach operators commented that while the motorcoach industry would prefer an emergency exemption, an alternative schedule that would help meet passenger requirements while operators work to resolve inducement-related problems or make alternative arrangements would have 24 hours between the four stages of the proposed high-speed inducement schedule resulting in a speed of 50mph after 96 hours. CARB, DOEE, NACAA, CATF+, and the States of California et al., commented that EPA should amend the definition of low- and high-speed vehicles by setting the average speed cutoff for low-speed vehicles at 30mph instead of the proposed 20mph, where high-speed vehicles would comprise the rest.

Response:

After consideration of comments and further assessment, EPA has determined that the proposed derate schedule for high-speed vehicles is appropriate for long-haul vehicles that are most often operating at highway speeds. At the same time, we recognize that defining high-speed vehicles to include all those with an average speed above 20 mph would include some vehicles that have a more even mix of highway and intra-city operation. Rather than changing the derate schedule for all high-speed vehicles, our additional analysis supports a conclusion that the best approach is to increase the average speed to qualify as a high-speed vehicle, and at the same time create a medium-speed vehicle category with derate speeds that fall between what we proposed for high-speed and low-speed vehicles. See preamble Section IV for further details.

CARB commented that speeds on urban highways are 55 mph for trucks, and EPA should take this into account. We recognize that it is common for highways near cities to have speed limits of 55 mph for trucks. We note, however, that high-speed vehicle operation will not be limited to urban areas. Rather, high-speed vehicle operation will include extensive driving between cities. All states except California, Washington, and Hawaii have rural speed limits on interstate highways that are at or above 65 mph.[28] For 47 states then, an initial derate speed of 65 mph will be meaningful and effective to prompt maintenance. Even though the initial derate speed in some of those cases matches the speed limit, it is clear that operators will be substantially motivated to avoid derates that prevent them from, for example, passing a truck that is operating slightly below the speed limit. Considering all these factors, we do not think that it would be appropriate in setting provisions at the national level to base the initial speed in the high-speed derate schedule on the speed limits that apply in only three states.

We understand that minimum specified highway speeds would sometimes not prevent vehicles from driving on limited-access highways or other specific roadways. Whether that would be limiting in certain cases or not, we believe the more important point is that the primary impact of any speed derates would simply be the practical effect on the driver's ability to maintain desired operating speeds.

CARB commented that speeds on urban highways are 55 mph for trucks, and EPA should take this into account. We recognize that it is common for highways near cities to have speed limits of 55 mph for trucks. We note, however, that high-speed vehicle operation will not be limited to urban areas. Rather, high-speed vehicle operation will include extensive driving between cities. All states except California, Washington, and Hawaii have rural speed limits on interstate highways that are at or above 65 mph.[29] For 47 states then, an initial derate speed of 65 mph will be meaningful and effective to prompt maintenance. Even though the initial derate speed in some of those cases matches the speed limit, it is clear that operators will be substantially motivated to avoid derates that prevent them from, for example, passing a truck that is operating slightly below the speed limit. Considering all these factors, we think it would not be appropriate here in setting provisions at the national level to base the initial speed in the high-speed derate schedule on the speed limits that apply in only three states.

Some commenters requested additional speed or time (up to 120 hours) for high-speed vehicles to return home. EPA developed the high-speed inducement schedule with the intent to provide operators of high-speed vehicles nearly three days to return home and bring the vehicle to a local repair facility. This would be tempered by allowable hours-of-service requirements that generally restrict driving to 10 hours per day. As explained elsewhere in this section 8 and preamble Section IV, EPA believes the initial stage of derate will be adequate to compel maintenance in almost all cases.

It would not be possible for vehicles operating primarily on the highway to continue to operate profitably if they can no longer operate on the highway. Commenters did not provide any data or rationale as to why removing the ability to travel on the highway would be ineffective as an inducement.

Comments on the Proposed Low-Speed Vehicle Inducement

[28] https://ww2.motorists.org/issues/speed-limits/state-chart/, accessed November 4, 2022.
[29] https://ww2.motorists.org/issues/speed-limits/state-chart/, accessed November 4, 2022.

CARB commented that the initial proposed inducement speed of 50mph for low-speed vehicles is insufficiently stringent to compel action and is concerned regional or urban vehicles may deviate routes to focus on traveling below the inducement speed limit. CARB also commented that the final inducement speed of 35mph is not severe enough and 5mph is more effective. CARB proposed a final speed of 20mph with a 40% torque derate for low-speed vehicles if the NOx override indicated that there was no emissions increase associated with the inducement-related fault. CARB also noted that they performed a survey which shows that severe derates are effective. Coach USA commented that for low-speed vehicles 50mp is below interstate/highway speeds and is potentially a safety risk. They added that the speed will prompt drivers to take action to address fault conditions, although this restriction is not necessary given driver's attention to warning lights, and any lower restriction would compromise safety without increasing compliance with inducements. Coach USA recommends an 80-hour window. ICCT recommends a final inducement speed of 20mph or less for low-speed vehicles and expressed concern that urban trucks may not be affected by the proposed low-speed inducement schedule. Maine DEP and NESCAUM commented that EPA's proposal does not provide sufficient inducement for low-speed vehicles, since locally operated vehicles could still potentially operate at 35mph in congested traffic to avoid remedying the problem. OTC commented that EPA should reconsider the low-speed inducement proposal and make speeds lower. DOEE commented that final derate speeds should be revised considerable downward, with the specific suggestion to set a final derate speed of 25mph for low-speed vehicles in 40 hours.

Response:

The proposal included a single low-speed derate schedule for all vehicles with average speeds below 20 mph. This would include a wide range of vehicles, including some mixed-use vehicles with some substantial operation at highway speeds and some vehicles that would rarely or never operate at highway speeds. Some vehicles with low average speeds might need to consistently operate at highway speeds, but others may operate at more consistent speeds in urban areas or in a confined space (such as a shuttle bus at an airport). As described above in the response to comment for high-speed vehicles, after further consideration, we determined that it was best to keep the low-speed vehicle category, but to add a medium-speed vehicle category with its own derate schedule for vehicles that have a mix of highway and urban driving. We agree that the proposed schedule of derating speed from 50 mph to 35 mph may not be as effective for ensuring an adequate supply of quality DEF for low-speed vehicles. We therefore determined instead that a better approach is to limit the low-speed vehicle category to vehicles with lower average speeds and set an appropriate final inducement speed lower than we proposed for this speed category. See Section IV of the preamble for more information on the final program.

There is no question that a derate speed of 5 mph will compel operators to perform necessary maintenance to keep SCR systems working properly; however, there are additional considerations that EPA believes are appropriate to balance in assessing true real-world compliance impacts, as discussed elsewhere in Section 8 of this document. As we described in the proposed rule, we developed the inducement provisions following several principles, which accounted for operator burden, cost, safety, the risk of frustration-induced tampering in addition to requiring that manufacturers design inducements to ensure an adequate supply of high-quality DEF is maintained in-use. CARB's comments on the proposed rule included a recommended alternative derate schedule that is similar to what engine manufacturers are doing today. As summarized and responded to earlier in this section 8, CARB's comments also included other, mostly conclusory statements claiming that EPA's proposed derate schedule would be insufficient to ensure maintenance of the SCR system. CARB's survey did not include a question on whether or not higher final inducement speeds would be equally effective for operators, and if so, what speeds should be considered. We have made several modifications to the proposed rule after consideration of comments, all in keeping with the principles described in the proposed rule which we maintain are the appropriate factors to balance. The resulting final rule represents our best effort to design an inducement program that ensures timely maintenance while taking into consideration real-world constraints associated with different types of commercial operation.

Comments on the Operating Hours Specified in the Derate Schedules

The sections above reference comments related to the timing aspect of the derate schedule—the number of hours the engine operates at each stage before the derate escalates to the next level. Commenters suggested that the derate schedule should allow more time, or less time before reaching greater levels of speed restrictions. These comments largely focused on outcomes, shifting the balance between minimizing adverse environmental outcomes and accommodating safety, technology, and business considerations. NESCAUM added a specific comment suggesting that the low-speed, locally driven vehicles are much less affected by problematic derates, which would support an accelerated derate schedule.

<u>Response</u>:

As described above, including a medium-speed vehicle category in addition to low-speed and high-speed vehicle categories in the final requirements resulted in a final time schedule for high-speed vehicles that is properly aligned with the human and logistical constraints associated with long-distance routes. We are finalizing as proposed the provision allowing high-speed vehicles to travel for up to 60 hours with derate speeds at or above 55 mph. This is enough to allow a truck driver to return home (and thus also allows operators to arrange for repairs after returning home). We continue to believe that this time schedule is necessary and appropriate for ensuring maintenance, but also accommodating the need for drivers of high-speed vehicles to be able to return home safely. Commenters did not provide specific rationale for why more time was needed. At the same time, we are aware that the long-distance driving considerations that led us to the proposed time schedule for all vehicles are very different for medium-speed and low-speed vehicles. Medium-speed and low-speed vehicles are much less likely to venture far from a home base. As a result, their derate time schedules should be shorter than the schedule for high-speed vehicles because there should be no need to account for several hours of driving to return home. We have compressed the final time schedule for medium-speed vehicles, and we further compressed the final time schedule for low-speed vehicles. See Preamble Section IV for additional information on the derate times and speeds for the final rule.

8.4 Logic for multiple faults, in-cab display, and deactivating derates and recurring faults

Comments by Organizations

Organization: *American Bus Association (ABA) (1070 and 1308)*

iii. Display Requirements – ABA is supportive of the proposed requirement that engine manufacturers display the triggering condition leading to an inducement and a countdown timer to estimate the time or distance till the next inducement stage. This information could be very useful to avoid the stranding of vehicles and passengers. The current display of numeric codes and not necessarily a dash icon light is extremely confusing and not easily discernable to many drivers. [EPA-HQ-OAR-2019-0055-1308-A1, p.10]

Organization: *California Air Resources Board (CARB)*

Adequate warning to the operator of impending inducement and at each step of the inducement is critical for providing adequate warning of the consequences of inaction to fix the fault before inducements occur. CARB staff supports the proposed in-cab display requirements and suggests the following additional specifications. In addition to indicating 'inducement pending,' the fault condition must be displayed such as 'low DEF' or 'poor DEF', so the operator is informed as to how to fix the problem. In addition, the inducement display at each step should identify at minimum what the derate in torque and/or maximum speed will be, so the driver is aware of the limitations of the vehicle. Finally, CARB staff recommends requiring progressively greater audible and visible warnings at each escalating inducement step to induce the operator to act more urgently to fix the fault. [EPA-HQ-OAR-2019-0055-1186-A2, pp.107-108]

The NPRM requests comments on the deactivating derate provisions. Once an inducement in activated, the means to deactivate the derate is important when the fault condition is fixed. Self-healing from an inducement is appropriate when the fault condition is fixed, and CARB staff concurs with the self-healing protocol of confirming the fault condition no longer exists and that the NOx efficiency override is within 10 percent of normal. However, staff has concerns with the use of a generic scan tool to clear codes and to deactivate derates. The generic scan tool was explicitly prohibited in the 2010 U.S. EPA and CARB July 2010 public workshop presentation. Abuse of using a generic scan tool to override the derate without fixing the fault condition is a high possibility because of the ease of obtaining generic scan tools. Using the generic scan tool over and over again to deactivate derates may become a strategy to tamper with the DEF system, resulting in excessive hours of vehicle operation where a fault condition has not been fixed and emissions are not compliant. It is reasonable, however, to allow the generic scan tool to be used to clear codes when repairs are done. CARB staff recommends a limit of up to two times to deactivate derates with a generic scan tool when reoccurring fault condition appears but only if the vehicle is not already at the final inducement step. For detecting a fault condition that may recur, CARB staff supports monitoring for 80 hours of engine operation for the same triggered condition, and if found, the vehicle would restart the derate at the same point that the system last deactivated the derate. [EPA-HQ-OAR-2019-0055-1186-A2, p.108]

Organization: *Coach USA, Inc. (Coach USA)*

EPA require manufactures to provide more precise information to drivers to alert them about DEF levels and how long remaining DEF volumes will last; this will allow drivers to plan accordingly to address a fault condition, while taking into account route schedules and stops. [EPA-HQ-OAR-2019-0055-1307-A1, p. 5]

Coach USA also recommends that EPA require manufactures to provide more precise information to drivers to alert them about DEF levels and how long remaining DEF volumes will last; this will allow drivers to plan accordingly to address a fault condition, while taking into account route schedules and stops. [EPA-HQ-OAR-2019-0055-1307-A1, p. 5]

Coach USA supports EPA obtaining information from engine manufacturers (mainly Cummins and Volvo for interstate buses) to understand options for easily notifying drivers of fault conditions. Coach USA supports a simple, informative alert for drivers to avoid inundating drivers with information that may compromise the driver's attention or passenger safety. While Coach USA opposes any inducement rule for the reasons noted above, it supports the proposed requirement at section 1036.111(f) that engine manufacturers display the triggering condition leading to an inducement and a countdown timer to estimate the time or distance until any next inducement stage is reached. Such a timer will promote safety to the extent it lowers the risk of a bus being stranded with passengers in a potentially dangerous highway setting. [EPA-HQ-OAR-2019-0055-1307-A1, p. 7]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §1036.111(b): With regard to the proposed fault conditions of paragraph (b), we note that it is critically important that sufficient notification be allowed before applying inducements. [EPA-HQ-OAR-2019-0055-1203-A1, p. 102]

- §1036.111(g)(1): "(1) Evaluate whether the detected fault condition continues to apply and reset the Active 100 Hour Array in the OBD system when the fault condition no longer exists. Deactivate derates if the engine confirms that the fault condition is resolved and the override factor for NOx conversion efficiency is at or below 0.10 for a full inducement drive schedule." EPA's proposed reset differs from CARB's requirement at 13 CCR 1971.1 (h)(5.3.6) to pause and resume data collection, while (for (h)(5.3.6)) employing the MIL-on bin (bin 17). We note that the proposal directly conflicts with the 13 CCR 1971.1 requirement that was incorporated by reference. Further, EMA recommends that EPA not make the proposed changes. However, in the future, if EPA wishes to make such changes: (i) it is imperative that the Agency coordinate with both CARB and the SAE standards committees to ensure standardization; and (ii) paragraph (g)(1) should be amended to state "Deactivate derates if the engine confirms that the fault condition is resolved and or the override factor for NOx conversion efficiency is at or below 0.10 for a full inducement drive schedule". [EPA-HQ-OAR-2019-0055-1203-A1, pp. 102 - 103]
- §1036.111(g)(2): "(2) Allow a generic scan tool to tentatively deactivate inducement related fault codes while the vehicle is not in motion. Reactivate the derate at the same point in the derate schedule if the engine detects the same fault condition during a full inducement drive schedule." EMA understands that this proposed capability may be implemented at the manufacturer's discretion. At issue is the fact that whether within the

four hours proposed in paragraph (g)(2), or the 80 hours proposed in paragraph (g)(3), there is no warning buffer if a similar fault code is detected within those warning periods, and the language indicates that you go back to wherever you were on the derate schedule (i.e., an operator believes that all is well, yet derate begins with little to no warning). This poses both a significant safety concern and contributes to customer dissatisfaction, as noted in previous comments cited throughout the preamble. EMA recommends that EPA consider a warning "buffer" or a specific hour requirement before activating derates. [EPA-HQ-OAR-2019-0055-1203-A1, p. 103]

- §1036.111(g)(3): "(3) Treat any fault condition that recurs within 80 hours of engine operation as the same triggering condition, which would restart the derate at the same point that the system last deactivated the derate." 80 hours represents up to 4,000 miles of travel; dual 125-gallon fuel tanks may be refilled up to four times in this same time period, and the accelerated derate may be faced by a different operator. This proposed provision would add additional complexity and would likely increase owner and operator dissatisfaction with the impact of the regulation on operations. [EPA-HQ-OAR-2019-0055-1203-A1, p. 103]

In addition, EPA proposes that the 100-Hour Array be reset upon confirming that corrective action has been taken (§1036.111(g)). Resetting the Active 100-Hour Array may be in conflict with CARB requirements. [EPA-HQ-OAR-2019-0055-1203-A1, p. 125]

There are additional concerns related to the proposed provisions for deactivating the inducement derates. Under §1036.111(g), the manufacturer must wait for the fault condition to no longer be detected, then reset the 100-Hour Array, and then wait for Bins 13 and 14 to populate with data to confirm NOx conversion efficiency is restored. That is a long chain of events for the system to be restored, especially for events that may not be related to failure to refill or tampering, such as blocked DEF lines. With respect to empty DEF tank inducements, EPA should allow for the derates to be deactivated as soon as the DEF level sensor indicates a level of refill. If the NOx override factor does not show adequate conversion (value greater than 10%), the derates could be quickly reactivated at the point where they were deactivated on suspicion of tampering. [EPA-HQ-OAR-2019-0055-1203-A1, p. 125]

In a related matter, EPA has proposed that engines must be compliant with any level of DEF concentration that does not trigger inducement (§1036.115(f)). That would not only mean that the DEF quality sensor ("DQS") must have a detection capability to support this outcome, linked to manufacturers' calibrations and compensation routines, but also that the NOx override function that CARB requires to confirm the "poor quality" DEF condition prior to triggering inducement must be supportive of the requirement. The role of the NOx override function is, of course, to confirm compromised emissions before triggering inducement. This means that §1036.115(f) and §1036.111(c) are in conflict with one another. As proposed, manufacturers would have to ensure compliance at the same level of emissions that they are confirming to be compromised emissions performance. That is obviously not workable. [EPA-HQ-OAR-2019-0055-1203-A1, p. 125]

Notwithstanding this clear conflict in the proposed requirements, manufacturers have too little experience with the complex future emissions control systems required to meet the proposed very stringent standards to know if compliance can be assured at the urea concentration limits detectable by DQS systems. EPA has made no such demonstration of that capability. The simple fact is that both the industry and EPA are uncertain whether the requirement can be met. EPA should regulate on the basis of data-based evidence, but no such evidence exists regarding this issue. EPA should not include §1036.115(f) in the final rule. [EPA-HQ-OAR-2019-0055-1203-A1, p. 125]

EPA Summary and Response

For the purpose of this section, each subtopic is summarized and responded to separately.

In-Cab display

ABA, CARB, and Coach USA expressed general support of EPA's proposal in §1036.111(f) to require an in-cab display showing the triggering condition that leads to an inducement and a countdown of time/distance until the next inducement stage. ABA commented that current notification systems are confusing to drivers. CARB notes that adequate warning of impending inducement is critical for operators to take appropriate action. CARB also included the following recommendations for an in-cab display: in addition to indicating "inducement pending" add the fault condition, inducement stage (i.e., include speed/time/torque limitations), and add "progressively greater audible and visible warnings" at each stage of derate to make the inducement more effective. Coach USA suggests a "simple, informative alert" (that avoids excessive information) will allow drivers to plan, avoid driver distraction, and lower the risk that a bus will be stranded. Coach USA also recommended EPA require manufacturers to provide more precise information to alert drivers to DEF levels and time remaining before DEF volumes fall to a level where inducement will occur. EMA commented that it is critical that sufficient driver notification be provided before inducements are applied.

Response:

EPA proposed in this rulemaking at §1036.111(f) that the in-cab display would include: the triggering condition (for active and pending inducements), the current stage of derating, and the time and distance until the next inducement stage. We are finalizing those provisions as proposed in the final §1036.110(c). For SCR-related inducements, we are requiring manufacturers identify the type of fault condition that is causing the inducement, specifically if it is related to DEF quantity, DEF quality, or tampering. These categories are enabled by our targeted list of triggers in 40 CFR 1036.111(b). We are also requiring manufacturers to display the fault code for the detected problem and a description of the fault code. This additional information will provide information to help the operator diagnose and correct the fault condition. The final rule also includes a requirement for manufacturers to provide troubleshooting information in the owners manual describing how to address potential inducement fault conditions (see final 40 CFR 1036.125). We are finalizing a similar set of requirements for other SCR- or DPF-related engine derates (see section IV.C. of the preamble for additional information). EPA is confident manufacturers will be able to make this information available in a way that it will not increase driver confusion while in operation.

The regulation at 40 CFR 1036.115(i) directs manufacturers to make DEF tanks big enough to correspond with typical refueling practices. This arrangement is intended to facilitate DEF refills in conjunction with refueling. If operators routinely refill DEF tanks when refueling the vehicle, there is no need for a separate DEF fill level indicator. At the same time, the regulation does not prevent manufacturers from providing this additional information in response to consumer demand. EMA's comment on the importance of notifying drivers in advance of applying inducements supports the expectation that manufacturers will include appropriate warning signals.

Deactivating derates and recurring faults

EMA recommends that EPA not adopt the provisions in proposed §1036.111(g)(1) that rely on the Active 100 Hour Array in OBD to deactivate a derate, citing a conflict with CARB's 13 CCR 1971.1 (h)(5.3.6). EMA suggests instead EPA state "Deactivate derates if the engine confirms that the fault condition is resolved and or the override factor for NOx conversion efficiency is at or below 0.10 for a full inducement drive schedule". In other words, EMA recommended deactivation if the engine confirms that the fault condition is resolved, independent of NOx emission rates; or if the engine detects successful NOx conversion even if the fault condition is not resolved. EMA notes that EPA's proposal to deactivate derates in §1036.111(g) involves a "long chain of events" that requires waiting for the fault condition to no longer be detected, and waiting for OBD REAL Bins to repopulate after being reset to confirm NOx conversion efficiency is restored. EMA states that this process may not be appropriate for all cases especially for issues that may not be related to tampering or lack of use of DEF (e.g., blocked DEF lines). EMA suggests that for DEF level faults derates should be deactivated as soon as the DEF level sensor indicates a level of refill; deactivation could resume if the system detects that NOx conversion efficiency is below 10% on suspicion of tampering.

CARB noted that allowing a generic scan tool to deactivate derates is currently prohibited; CARB is concerned that allowing the use of a generic scan tool to clear codes and to derate inducements could result in abuse. CARB is concerned use of a generic scan tool over and over again to deactivate inducements could become a strategy to tamper. However, CARB commented that it is, however, reasonable to allow a generic scan tool to be used when repairs are done and recommends limiting the use of the tool to deactivate derates to two times when a recurring fault condition appears but only if the vehicle is not in a final inducement step.

EMA commented that it is their understanding that the provisions of proposed 40 CFR §1036.111(g)(2) to allow inducements to be reset with a generic scan tool are at the manufacturer's discretion. EMA also warns that the four-hour period in the proposed §1036.111(g)(2) or the 80-hour period in §1036.111(g)(3) may restart inducements without warning. EMA suggests that EPA consider a warning "buffer" or a specific hour requirement before activating derates to avoid allowing a similar fault code triggered within the warning periods to avoid creating problems for safety or customer satisfaction.

EMA suggested that EPA's proposed 80-hour window to monitor for a fault condition would add complexity and likely increase operator dissatisfaction, noting that 80 hours could represent 4,000 miles of travel, several fuel tank refills, and potentially a switch to a new operator.

CARB supports monitoring for recurring fault conditions and restarting a derate at the same point that the derate was last deactivated if the same fault condition was triggered in the next 80 hours of engine operation.

EMA commented that they believe the proposed requirements in §§1036.111(c) and 1036.115(f) are in conflict. They state that EPA proposed that engines must be compliant with any DEF concentration that does not trigger an inducement, however they note that EPA also proposed to require that the NOx override must confirm "poor quality" DEF prior to triggering an inducement (via monitoring for higher emissions). EMA states this is a conflict because they would have to ensure compliance while simultaneously confirming emissions are compromised. EMA commented further that manufacturers do not have sufficient experience with the new technology that will be needed to meet existing guidance that states compliance can be assured at urea concentration limits detectable by DEF quality sensors. EMA commented that EPA has made no such demonstration of that capability, and given this uncertainty EPA should not include §1036.115(f) in the final rule.

Response:

As explained in preamble Section IV and section 8.2 of this document, EPA is not finalizing the proposed NOx override at this time.

EPA is finalizing, as proposed, the provision allowing operators to deactivate derates with a generic scan tool. We are not including any limitation on the number of resets. The fault conditions contemplated in the final 40 CFR 1036.111 are all detectable immediately. The final rule specifies, as proposed, that resets with a generic scan tool must occur while the vehicle is not in motion. The final rule also specifies that any fault condition that recurs during the 40 hours of operation following a reset or resolved fault condition would automatically resume engine derating at the same point. These provisions together make it completely impractical for an operator to operate for extended periods with an active fault condition by using a generic scan tool to repeatedly reset the system.

In particular, the operator would need to stop the vehicle, reset the system with the generic scan tool, and then resume driving. The system would detect within a very short time that fault condition was not resolved and resume derating. The operator could repeat that indefinitely but would likely not ever be able to exceed the currently applicable derate speed before the engine would reapply the derate and thus would achieve no net gain from such actions.
We note, consistent with the EMA comment, that provisions related to deactivating derates are much simpler without the proposed NOx override. Because the NOx override is not included in the final rule, there is no need to address the logic of allowing time for driving to determine whether the SCR system is controlling emissions appropriately.

EMA incorrectly read the proposed rule to allow them discretion on designing engines to reset fault conditions with a generic scan tool. EPA intended that the ability to reset inducements with a generic scan tool was a requirement for all vehicles. We are finalizing that requirement as proposed. EPA agrees with EMA that a warning buffer should be added prior to any inducement. The same requirement limiting each stage of derate to a maximum change of 1 mph over five minutes applies equally for recurring fault conditions.

EPA agrees with EMA's observation that 80 hours of operation, or about 4,000 miles, is too long for an operator to be subject to a new fault being treated as a recurring fault condition. EPA is therefore revising from proposal the final number of hours during which a recurring fault would occur, from 80 hours to 40 hours. This is also consistent with hours EPA has considered under existing guidance.

EMA's comments about a potential conflict between 1036.115(f) and 1036.115(c) are not at issue in the final rule because we are not adopting the NOx override provisions at this time. Fundamental to certification is the requirement for manufacturers to comply with emission standards throughout the practically adjustable range of adjustable parameters. We consider DEF quantity and DEF quality to be adjustable parameters based on the operators need to take steps to maintain an adequate supply and quality of DEF. This requirement has always applied under current regulations. The proposed rule in 40 CFR 1036.115 inadvertently required manufacturers to base the adjustable range for DEF quality on the range of values used to trigger inducements under proposed 40 CFR 1036.111. We are removing that proposed language from the final provision and will be instead continuing to rely on current guidance regarding physically adjustable range for DEF quality.

EPA is not finalizing the proposed provision that an inducement schedule is applied and tracked independently for each fault if multiple fault conditions are detected. Consistent with EMA's comments, at this time we have concerns about potential risks resulting from complexity in the software needed to apply and track multiple derate schedules and the final provision still ensures that the SCR system will receive an adequate supply of high quality DEF. Under the final provision, if a second fault condition starts while the engine already has an active inducement, the software would need to continue progressing through the derate schedule as specified. Once that fault condition is resolved, the engine would start at the beginning of the derate schedule for the new fault condition.

8.5 Retrofitting in-use engines and vehicles with software updates to incorporate new inducement regulation

<u>Comments by Organizations</u>

Organization: *California Air Resources Board (CARB)*

The NPRM requests comments on field fixes for in-use vehicles. As described in detail in a previous section, CARB staff does not support the SCR inducement strategy proposed by U.S. EPA and does not support allowing field fixes for in-use vehicles or to amend the certification application of current model year engines for the NPRM inducement strategy. The proposed inducement strategy is too weak compared to that recommended in the current inducement guidance to cause the operator to fix the fault condition and preserve low, controlled NOx emissions. However, CARB staff would support allowing field fixes for in-use vehicles or amending current certification applications only if an inducement strategy identical or similar to the one proposed by CARB staff is adopted in the Final Rule. [EPA-HQ-OAR-2019-0055-1186-A2, pp.108-109]

Organization: *Midwest Bus & Motorcoach Association*

We are requesting **all** current commercial passenger motor vehicles, 2008 and newer, that have an aftertreatment system, be recalibrated with an ECM update to eliminate any derate or inducement that would limit the power or speed of the motorcoach. This proposal must include all models 2008 and newer that would be subject to any condition leading to a derate. We cannot stress enough the importance of this stipulation in the proposed language so that it will require engine manufacturers to develop and implement a new adopted schedule for all currently operated vehicles to be eligible for the update. Without this adoption there will be no relief in the foreseeable future and the concerns we have addressed will be disregarded by the engine manufacturers. The current proposal indicates models 2027 and newer. We are requesting that wording be changed to 2008 and newer. [Emphasis in original; EPA-HQ-OAR-2019-0055-1158-A1, p.5]

Recommendation:

- Require OEM's to develop updated derate schedules for existing vehicles. Other aspects of the proposal do not apply such as retrofitting for secondary system checks. By changing the schedule in current equipment, it would provide the industry's needs. [EPA-HQ-OAR-2019-0055-1158-A1, p.5]

Organization: *Motorcoach Companies*

We are requesting that ALL current passenger transport CMVs (post 2008 and newer) that is fitted with an aftertreatment system be recalibrated with and ECM update to eliminate any sort of derate or inducement that would limit power or speed of a vehicle. This proposal must include ALL models 2008 and newer that would be subject any condition leading to a derate. We cannot stress enough the importance of this stipulation being directly spelled out in the proposal language, which will require engine manufacturers to develop and implement this new adopted schedule for all currently operated vehicles will be eligible for this update. Without this adoption we will not have any relief for the foreseeable future and the concerns we have addressed will be ignored by the engine manufacturers. This is a critical component to our comment and cannot be overlooked. As of now the proposal indicates models 2027 and newer, it must be reworded to include anything 2008 and up! [EPA-HQ-OAR-2019-0055-1149-A1, pp.4-5]

Recommendation:

1. EPA should direct or require OEM's to develop updated derate schedule for these existing vehicles only, all other aspect of proposal do not need to apply such as

retrofitting for secondary system checks. Simply changing the schedule in these vehicles would suffice for our needs. This would be relatively easy in recoding the software program to allow more time [EPA-HQ-OAR-2019-0055-1149-A1, p.5]

Organization: *United Motorcoach Association (UMA)*

Upon adoption of a final rule, UMA implores the EPA to require engine manufactures and/or original equipment manufacturers, at a minimum, to reprogram the existing fleet to the revised inducement standards. [EPA-HQ-OAR-2019-0055-1311-A1, p.5]

Reprogramming to the revised inducement standards will begin to restore the confidence in existing buses and motorcoaches, stimulate sales of new equipment, and reduce barriers to adopting new equipment that further reduces NOx emissions. [EPA-HQ-OAR-2019-0055-1311-A1, p.5]

The bus and motorcoach community takes considerable pride in their contribution to improving air quality by removing multiple cars from the road and adoption of market-ready equipment that further reduces emissions. [EPA-HQ-OAR-2019-0055-1311-A1, p.5]

We need dependable equipment. [EPA-HQ-OAR-2019-0055-1311-A1, p.5]

Organization*: Virginia Motorcoach Association*

We are requesting **all** current commercial passenger motor vehicles, 2008 and newer, that have an aftertreatment system, be recalibrated with an ECM update to eliminate any derate or inducement that would limit the power or speed of the motorcoach. This proposal must include all models 2008 and newer that would be subject to any condition leading to a derate. We cannot stress enough the importance of this stipulation in the proposed language so that it will require engine manufacturers to develop and implement a new adopted schedule for all currently operated vehicles to be eligible for the update. Without this adoption there will be no relief in the foreseeable future and the concerns we have addressed will be disregarded by the engine manufacturers. The current proposal indicates models 2027 and newer. We are requesting that wording be changed to 2008 and newer. [Emphasis in original; EPA-HQ-OAR-2019-0055-2715-A1, p.4].

Recommendation:

- Require OEMs to develop updated derate schedules for existing vehicles. Other aspects of the proposal, such as retrofitting for secondary system checks, do not apply. By changing the schedule in current equipment, it would provide the industry’s needs. [EPA-HQ-OAR-2019-0055-2715-A1, p.5].

Organization: *Volvo Group*

Consideration should be made to make these [inducement] changes an option retroactive to 2010 CMY vehicles. [EPA-HQ-OAR-2019-0055-1324-A1, p. 5]

EPA Summary and Response

Summary:

CARB would support allowing field fixes for in-use vehicles or amending certification applications for the current model year only if the modification involves an inducement strategy similar to the approach CARB recommends in comments on the proposed rule. CARB believes that any other approach would be too weak for preserving control of NOx emissions compared to what currently applies.

Motorcoach Companies want engine manufacturers to retrofit all model year 2008 and newer vehicles to eliminate any sort of derate or inducement that limits vehicle speed or power. Specifically, Motorcoach Companies recommend that EPA direct or require OEM's to develop updated derate schedule for model year 2008 and newer vehicles. They state that failing to address these retrofit needs would leave them without relief for the foreseeable future.

UMA implores EPA to require engine manufactures and/or vehicle manufacturers to reprogram the existing fleet to the revised inducement standards.

Volvo recommends that EPA consider making it an option to retrofit model year 2010 and newer engines to incorporate designs that conform to the newly adopted inducement specifications.

Response:

See Section IV.D.6 in the final rule preamble.

9 This section is Blank

10 Durability testing

10.1 Updating existing DF provisions for carry-across and engine dyno aging

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

- CARB recommends that U.S. EPA work with CARB staff to enhance the proposal in 40 CFR 1036.245 – Deterioration factors for exhaust emission standards. The current NPRM proposal does not consider the impacts of engine emission control component deterioration. CARB staff believes that a more comprehensive approach similar to what was adopted in the Omnibus regulation would enhance the durability demonstration process while establishing a level playing-field for all engine manufacturers. [EPA-HQ-OAR-2019-0055-1186-A1, pp.2-3]

CARB staff has significant concerns regarding the proposed methodology for demonstrating engine and aftertreatment system (EAS) durability and calculating the deterioration factors (DF) for HD diesel engines. [EPA-HQ-OAR-2019-0055-1186-A2, p.25]

On page 17548 of the NPRM, U.S. EPA requests comments regarding the proposed options for DF determination. [EPA-HQ-OAR-2019-0055-1186-A2, p.25]

CARB staff opposes the option to use fuel-based accelerated aging as proposed in 1036.245 (b)(1). Recently published documents54,55 clearly indicate that fuel-based accelerated aging procedures do not yield deteriorated emissions results that are representative of real-life, in-use HD diesel engine operations. [EPA-HQ-OAR-2019-0055-1186-A2, p.25]

> 54 EPA. ‘‘Guidance on Deterioration Factor Validation Methods for Heavy-Duty Diesel Highway Engines and Nonroad Diesel Engines equipped with SCR.’’ CD–2020–19 (HD Highway and Nonroad). November 17, 2020. https://dis.epa.gov/otaqpub/display_file.jsp?docid=51377&flag=1
>
> 55 PUBLIC WORKSHOP TO DISCUSS METHODS OF HEAVY-DUTY DIESEL AND OFF-ROAD DIESEL ENGINE DETERIORATION FACTOR VALIDATION. Mail-out #ECC-2020-03 [REVISED]. https://ww3.arb.ca.gov/msprog/mailouts/ecc202003/ecc202003_ada.pdf

Given the poor track record of fuel-based accelerated aging procedures, CARB staff opposes this option and recommends the elimination of this methodology. Instead, CARB staff recommends a comprehensive method that combines dynamometer aging (with no fuel-based acceleration factors) combined with aftertreatment bench aging. A complete description of this comprehensive durability demonstration process
56 is described in the Omnibus regulation diesel test procedures. [EPA-HQ-OAR-2019-0055-1186-A2, pp.25-26]

> 56 California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles. Pages 53-68. https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hdomnibuslownox/frob-1.pdf

Organization: *Truck and Engine Manufacturers Association (EMA)*

EPA is proposing new test procedures to determine deterioration factors (“DF”) for certification purposes. The most onerous of those new requirements is a manufacturer’s obligation to conduct DF testing for the Full Useful Life (“FUL”) of the engine’s primary intended service class, rather than using extrapolation as is permitted today. The limitations caused by FUL testing are significant, resulting in increased development costs, but more importantly such extended testing requirements present multiple challenges to OEMs' product development, verification and certification timelines. EPA's new requirements would be tempered somewhat by the flexibility manufacturers are given in defining aging cycles, and OEMs' option to bench-age aftertreatment systems, which would allow a much more favorable timeline for DF determination. Still, EMA recommends several improvements to these new provisions to make them workable. [EPA-HQ-OAR-2019-0055-1203-A1, p. 110]

The DF test is one of the many tests in a multi-year process to design, build and test for certification demonstrations. The prototype hardware and software included on the DF engine must be of sufficient design and manufacturing process maturity to establish that the test will "represent the deterioration expected from in-use engines over the useful life." (§1036.245) Once the test begins, the hardware and software revisions are frozen for the duration of the test, which has traditionally taken approximately 25-36 weeks for a typical MHDD or HHDD engine, when aged to 35% of FUL. [EPA-HQ-OAR-2019-0055-1203-A1, p. 110]

One undesirable outcome of FUL DF testing is that it requires that the DF test be started earlier on the project timeline, limiting the manufacturer's ability to iteratively introduce newer technologies that could provide additional GHG or emission benefits. EMA recommends that the Agency continue to allow manufacturers to run DF tests to 35 to 50% of FUL, and extrapolate results as is permitted today. Those extrapolated results could be used for certification purposes. A manufacturer could then be required to conduct DAAAC aging on the DF engine's aftertreatment system to FUL, submitting the subsequent FUL emissions data with the next model year's application, which would apply the new FUL DF results. [EPA-HQ-OAR-2019-0055-1203-A1, p. 110]

As mentioned, extending the DF testing requirement to 100% of FUL without extrapolation forces manufacturers to finalize hardware and software designs earlier in the development process. Currently, there is no regulatory flexibility to make hardware or software changes once the DF test is initiated. Because some of the components are necessarily fabricated from pre-production processes, they may, despite being representative of production intent, be prone to premature or even catastrophic failure. If severe, this can force manufacturers to restart the DF test, putting even more stress on an already challenging production launch schedule. EMA recommends that EPA provide greater flexibility to allow manufacturers to make hardware or software adjustments on the DF engine to facilitate timely test completion, while preserving the integrity of the test. This consideration should also extend to address replacement service parts, which may include sensors, catalysts or EGR components. [EPA-HQ-OAR-2019-0055-1203-A1, p. 110]

For example, downpipes and bellows can easily fatigue with extended dyno testing. Those components are not emissions-critical but cannot be replaced without EPA approval. NOx, PM and NH3 sensors currently are not robust enough to survive for 435,000 miles, let alone 800,000 miles. In the event of an engine failure that causes the aftertreatment system to be damaged, it would be desirable if the aftertreatment components could be rapidly aged to the last interim emissions measurement point. The bottom line is that EPA should offer more options and flexibilities to recover from those kinds of issues during the course of a DF test. [EPA-HQ-OAR-2019-0055-1203-A1, p. 110 - 111]

EPA has traditionally approved accelerated DF aging cycles based on fuel-burned or work completed equivalent metrics. When defining those aging cycles, manufacturers must balance the severity of the cycle against the design limitations of the individual components to replicate representative in-use wear without causing premature failure. EMA supports that EPA has proposed to allow the use of accelerated aging cycles to manage the total cost and duration of the DF test. EMA also supports that the Agency has not included requirements to stop and restart the engine at intervals during the service accumulation, as this has little or no bearing on the DF results. However, §1036.245(b)(1)(i) requires that the service accumulation "must also include light-load operation (or alternating light-load and high-load operation) representing in-use behavior that may contribute to aging of aftertreatment devices or systems." Light-load operation is not considered to be a contributor to engine component wear or aftertreatment degradation. We recommend that the Agency eliminate the obligation to include light-load operation. For example, the provision could be modified to state, "However, if you anticipate that including light-load operation may contribute to aging of aftertreatment devices or systems, you must also include light-load operation (or alternating light-load and high-load operation)." [EPA-HQ-OAR-2019-0055-1203-A1, p. 111]

An important issue that the Agency has failed to address in its proposal is how a manufacturer must conduct deterioration factor testing, either through dyno-aging or bench-aging processes, particularly in the case where the manufacturer will include major emissions-related maintenance actions to comply with the extremely stringent emissions standards and extended useful life requirements. For example, if a manufacturer recommends aftertreatment system replacement at 300,000 miles (before the 435,000 mile intermediate useful life interval for which results are required by the proposal), the manufacturer should be able to propose an alternative DF test plan, including a test at 300,000 miles, but eliminating the 435,000 mile test interval. Data-fitting processes also need to be reviewed. EMA is willing to work with the Agency to develop appropriate alternative procedures. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 111 - 112]

In sum, EMA supports the flexibility offered by the various options EPA proposes in the determination of deterioration factors and the DF verification procedures. [EPA-HQ-OAR-2019-0055-1203-A1, p. 115]

Perhaps even more concerning are the necessary data-generation projects that are completely unplanned at this time. More specifically, EPA intends to complete this rulemaking without having access to the following: Durability testing to determine whether cylinder deactivation (CDA) is a viable technology suitable for the rigorous demands of heavy-heavy-duty engines, or to determine whether it should be expected that NVH concerns can be managed over the broad and diverse range of products and applications unique to the commercial truck industry, or to assess if CDA is capable of lasting 800,000 miles without a major service intervention. CDA is a cornerstone technology for EPA's technical feasibility demonstration, critical to meeting the low-load NOx emission requirements that are a focus for this rulemaking. Yet no data regarding the feasibility of CDA in this context will be in the rulemaking record. [EPA-HQ-OAR-2019-0055-1203-A1, p. 172]

EPA Summary and Response

Summary:

The above comments address several aspects of the proposed revisions to the existing deterioration factor provisions, including for carry-across and engine dynamometer aging.

With regard to aging in general, CARB commented that they oppose using fuel-based accelerated aging as the emission results are not representative of real-life, in-use HD diesel engine operations. Instead, CARB recommend adopting the comprehensive methods set out in their Omnibus regulation that combines dynamometer aging (with no fuel-based acceleration factors with bench aging).

With regard to specific aspects of Full Useful Life (FUL) deterioration factor testing, EMA indicated their support for several aspects of the proposal such as the use of accelerated aging cycles to manage the total cost and duration of the DF test, and not including requirements to stop and restart the engine during service accumulation. However, EMA raised concerns about several other aspects and suggested certain revisions to the proposed program.

EMA noted that FUL DF testing would require testing to begin earlier and limit manufacturers to iteratively introduce technologies that may provide additional emission and GHG benefits. EMA noted that this concern could be addressed by allowing a manufacturer to run DF tests to 35-50% of FUL and extrapolate the results. EMA noted that the manufacturer could be required to conduct DAAAC aging on the DF engine's aftertreatment system to FUL and report that with the next model year's certification application, which would apply the new FUL DF results.

EMA also noted that FUL DF testing would require testing using hardware and software fabricated from pre-production processes, which may be prone to failure and could require restarting the DF testing. EMA noted that this concern could be addressed by allowing manufacturers to make hardware or software adjustment on the DF engine to facilitate timely completion while preserving the integrity of the test. EMA also suggested that consideration should also extend to address replacement service parts, which may include sensors, catalysts or EGR components.

EMA stated they do not support including light-load operation during service accumulation. EMA asserted that light-load operation does not contribute to engine component wear or aftertreatment degradation. However, EMA noted that light-load could be included if a manufacturer anticipates light-load operation may contribute to aging of aftertreatment devices or systems.

While EMA supports bench-aging of aftertreatment systems, they stated there is no need to define a minimum number of engine hours of dynamometer aging beyond what is needed to stabilize the engine and aftertreatment. EMA also said that EPA failed to define how a manufacturer is to conduct DF testing, either through dyno-aging or bench-aging, particularly in the case where the manufacturer will include major emissions-related maintenance actions to comply with the extremely stringent emissions standards and extended useful life requirements and that they are willing to work with the Agency to develop alternative procedures.

Finally, EMA noted their concern that EPA intends to finalize the rule without having access to certain important information on durability of CDA and NVH.

Response:

See preamble Section IV.F for our responses to many of these comments on the proposed options for determining the DF and our rationale for the final provisions for determining DF.

EPA thanks EMA for their support of the use of accelerated aging cycles to manage the total cost and duration of the DF test, and not including requirements to stop and restart the engine during service accumulation.

EPA agrees with EMA that FUL DF engine testing would require testing to begin earlier. This is why EPA proposed an option to use accelerated reactor bench aging of the emission control system, requiring as little as 400 hours of testing on an engine dynamometer. This option allows the DF determination to be completed within 90 days. EPA opposes EMA's request to allow an engine-based DF determination out to 35-50% of UL with extrapolation to UL, as this methodology has been shown historically to be inaccurate at determining deterioration.[30,31] See preamble Section IV.F for further discussion on this. EPA also disagrees with EMA's request to allow the manufacturer to determine DF using an engine-based test out to 35-50% of UL and following up that testing with DAAAC aging on the engine's aftertreatment system to UL with reporting of the DAAAC aging results with the next model year's certification application. Given our concerns with the accuracy of an engine-based tests out to 35-50% of UL, EPA thinks it is appropriate to require DF determination out to the service accumulation hours based on full useful life as determined in 40 CFR 1036.245(c) and that this be complete prior to application for certification for every model year; all final options to meet the DF determination requirements include that requirement.

EPA does not agree with EMA's suggestion that we should allow manufacturers to make hardware or software adjustment on the DF engine to facilitate timely completion, as this may affect the rate of deterioration compared to the initial configuration. EMA would also like this extended to service parts, which may include sensors, catalysts or EGR components. See section 6 of this document for the final maintenance provisions, including revisions to minimum maintenance intervals that generally match intervals manufacturers are specifying for components today. We expect manufacturers will continue to schedule replacement of components as needed to meet the DF testing requirements and to accurately represent the maintenance needs of engine in the field. Manufacturers can work with EPA if a component (pre-production or otherwise) unexpectedly fails during service accumulation. The final 40 CFR 1036.425(c) allows for critical emission-related scheduled maintenance, described in 40 CFR 1036.125(a), during service accumulation. As noted in Sections III and IV.A of the preamble to this final rule, we set final standards and useful life periods that will not require manufacturers to plan for scheduled replacement of catalysts. If manufacturers opt to replace their catalysts as part

[30] U.S. EPA. "Guidance on Deterioration Factor Validation Methods for Heavy-Duty Diesel Highway Engines and Nonroad Diesel Engines equipped with SCR." CD-2020-19 (HD Highway and Nonroad). November 17, 2020.
[31] Truck and Engine Manufacturers Association. "EMA DF Test Program." August 1, 2017.

of scheduled maintenance, at the expense of the manufacturer, manufacturers could request approval of an alternate DF test plan using existing provisions.

EPA disagrees with EMA regarding not including light-load operation during service accumulation for the reasons given in the discussion above and in preamble Section IV.F regarding required aging duty-cycles for determining deterioration.

EPA disagrees with EMA's comment that there is no need to define a minimum number of engine hours of dynamometer aging beyond what is needed to stabilize the engine and aftertreatment when the aftertreatment is bench aged. In this final rule, we are requiring a minimum number of testing hours on an engine dynamometer, with the allowance for the manufacturer to add additional hours of engine dynamometer-aging at their discretion. The minimum required hours, beyond what is needed to initially stabilize the engine and aftertreatment, are by primary intended service class and as follows: 300 hours for Spark-ignition HDE, 1,250 hours for Light HDE, and 1,500 hours for Medium HDE and Heavy HDE. EPA disagrees that we failed to define how a manufacturer is to conduct DF testing, either through dynamometer-aging or bench-aging, particularly in the case where the manufacturer will include major emissions-related maintenance actions to comply with the final rule emissions standards and final rule useful life requirements. We are finalizing critical emission-related scheduled maintenance as described in 40 CFR 1036.125(a)(2) and 1036.245(c) in this final rule. Under this final rule, manufacturers may make requests to EPA for approval for additional emission-related maintenance actions beyond what is listed in 40 CFR 1036.125(a)(2), as described in 40 CFR 1036.125(a)(1) and as allowed during deterioration testing under 40 CFR 1036.245(c).

10.2 DF procedures based on bench aging of aftertreatment devices

<u>Comments by Organizations</u>

Organization: *California Air Resources Board (CARB)*

On page 17548 of the NPRM, U.S. EPA requests comments regarding the proposed options for DF determination. [EPA-HQ-OAR-2019-0055-1186-A2, p.26]

The proposed aftertreatment bench aging procedures offer reduced durability testing time upfront with the requirement to prove compliance using in-field testing after certification. While this reduces the length of the product development cycle, any hardware or software component issues, especially on the engine, will be missed and require an overreliance on warranty or On-board Diagnostics (OBD) to detect those issues later. [EPA-HQ-OAR-2019-0055-1186-A2, p.26]

Common examples of durability issues that would not be demonstrated using 100 percent bench aged aftertreatment are fuel injector drift or premature failure of turbocharger components such as oil seals. Additionally, interactions between the engine (upstream) and the aftertreatment system (downstream) have been demonstrated to reduce the overall efficiency of the NOx aftertreatment system over time. In fact, such an interaction occurred during CARB's Stage 3 low NOx demonstration program57 where a faulty exhaust gas recirculation (EGR) valve caused damaged to the downstream zone-catalyzed soot filter. Although this failure could have been the result of component defect, it could have also been the result of poor engineering design that caused the component to fail prematurely. By limiting the durability demonstration program to focus strictly on aftertreatment bench aging, U.S. EPA's proposal would arbitrarily and capriciously fail to account for upstream/downstream interactions on the deterioration of aftertreatment systems, State Farm, 463 U.S. at 43, and would therefore not provide a reliable and accurate method of assessing durability of aftertreatment components and systems in real-life operating conditions. [EPA-HQ-OAR-2019-0055-1186-A2, p.26]

57 Low NOx Demonstration Program – Stage 3. Pg. 117. https://www.arb.ca.gov/lists/com-attach/79-hdomnibus2020-Uj4AaQB2Aj8FbAhw.pdf

CARB staff therefore opposes the allowance to demonstrate full UL durability that is dependent on only aftertreatment bench aging process as described in 1036.245 (b)(2). CARB staff recognizes the importance of allowing aftertreatment bench aging as part of the UL durability demonstration when the UL is significantly increased in 2027 and subsequent model years. California's Omnibus regulation allows for a combination of EAS engine dynamometer aging and further aftertreatment bench aging (comprehensive durability demonstration program) to demonstrate overall comprehensive EAS durability demonstration to full UL. This comprehensive methodology provides a level of assurance that all emission related components, including components that are not part of the aftertreatment system, demonstrate an acceptable level of durability. [EPA-HQ-OAR-2019-0055-1186-A2, pp.26-27]

If the durability of these components is not demonstrated at the time of certification, it is likely that some products with systemic design problems will be introduced into commerce, resulting in excess emissions and increasing fleet downtime to complete repairs. Under U.S. EPA's proposal, the lag time between the vehicles reaching the field and the verification of the deterioration of these products proposed in 1036.246 would be at a minimum 3 years. In that time, unchecked systemic failure of emission-related components could have significant impacts to air quality and public health. [EPA-HQ-OAR-2019-0055-1186-A2, p.27]

U.S. EPA's failure to analyze the scope and extent of the increased emissions resulting from this proposal, and their impacts on the public's health and welfare constitutes a failure to consider an important aspect of this proposal, State Farm, 463 U.S. at 43, and an impermissible abdication of U.S. EPA's duty under CAA section 202(a) to ensure affected HDEs and vehicles comply with applicable emissions standards throughout their useful lives. CAA sections 202(a)(1), 202(a)(3), Chevron, 467 U.S. at 842-843. (See CARB comments in section 5.a, infra). [EPA-HQ-OAR-2019-0055-1186-A2, p.27]

It should also be noted that currently light-duty diesel vehicles do not rely solely on aftertreatment bench aging to demonstrate durability. Instead, aging on a chassis dynamometer is used to verify component durability and establish the deterioration factors. [EPA-HQ-OAR-2019-0055-1186-A2, p.27]

On page 17548 of the NPRM, U.S. EPA requests comments regarding the proposed options for DF determination. [EPA-HQ-OAR-2019-0055-1186-A2, p.27]

CARB staff strongly recommends that U.S. EPA work with CARB staff and adopt a comprehensive durability demonstration program similar or identical to what is described in the Omnibus regulation. Such a comprehensive process should include a reasonable period of EAS aging on an engine dynamometer (without any fuel-based acceleration factors) to verify engine side emission-related component durability and to account for possible upstream/downstream interactions between the EAS as described earlier. A significant portion of the aging process could then utilize aftertreatment bench aging, provided that the accelerated aftertreatment aging method has been verified through correlation studies. [EPA-HQ-OAR-2019-0055-1186-A2, pp.27-28]

It should also be noted that the current version of the proposed CTP regulatory language does not provide a pathway for manufacturers to use a combination of EAS and accelerated aftertreatment aging, such as allowed in California's Omnibus. Thus, the only way for a manufacturer to meet the durability demonstration for both CARB and U.S. EPA would be to fully age the EAS on an engine dynamometer, which would be challenging for engines certified to future UL standards of up to 800,000 miles. [EPA-HQ-OAR-2019-0055-1186-A2, p.28]

CARB staff believes that the Omnibus comprehensive durability demonstration program is representative of in-use aging, cost-effective, and does not adversely impact the manufacturer's product development cycle. In terms of costs, the overall cost of the comprehensive durability demonstration program was estimated to make-up only 1.4 percent of the total cost of the Omnibus regulation.58 Therefore, additional durability demonstration costs are not going to have a major impact on the implementation of the proposed rule. The detailed methodology for calculating the incremental costs for the Omnibus durability program is provided in the Standardized Regulatory Impact Assessment document.59 [EPA-HQ-OAR-2019-0055-1186-A2, p.28]

58 Responses to DOF's comments on SRIA. Pg. 6. https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hdomnibuslownox/noticeattach.pdf

59 Omnibus - Standardized Regulatory Impact Assessment. Pg. 80-88. https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hdomnibuslownox/appc1.pdf

With regards to scheduling and product development, the required hours of aging for the Omnibus durability demonstration program ranges anywhere from 2,870 hours (LHDD) to 5,210 hours (HHDD) for 2031 and later MYs. CARB staff does not believe this would have an adverse impact on the product development plans. Although this could be a change for some certified on-road engines, many off-road compression-ignition (CI) engine manufacturers have used a 50 percent of UL (4,000 hour) durability demonstration program since the 2012 model year without reporting any product development issues. CARB staff estimates that running an additional 1,210 hours (5210-4000) would translate into an additional two months of aging. As such, there should not be any significant concerns regarding the length of the durability demonstration program. [EPA-HQ-OAR-2019-0055-1186-A2, p.28]

At a minimum, CARB staff strongly urges U.S. EPA to provide a pathway in the CTP regulations to allow CARB's comprehensive durability demonstration program as a substitute for satisfying U.S. EPA certification requirements. Without this, manufacturers may be required to expend substantial time and testing resources to comply with both California and Federal durability requirements. [EPA-HQ-OAR-2019-0055-1186-A2, p.28]

On page 17550 of the NPRM, U.S. EPA requests comments regarding the proposed Diesel Aftertreatment Rapid-Aging Protocol. [EPA-HQ-OAR-2019-0055-1186-A2, p.30]

CARB staff supports the codification of the protocols for rapid aging of the HD diesel aftertreatment system. By incorporating the methodology and procedures for aging the aftertreatment system, all manufactures would follow a well-defined and prescriptive process for rapid aftertreatment aging. A portion of the aging process in the Omnibus regulation relies on rapid aging of the aftertreatment, so codifying these procedures would be an important step in setting up a standardized process for all manufacturers. [EPA-HQ-OAR-2019-0055-1186-A2, p.30]

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

The Proposal's durability demonstration is substantially weaker than the Omnibus requirements, and it undermines the standards' effectiveness. 87 Fed. Reg. 17,547–48. In particular, EPA's demonstration allows for bench-aging of aftertreatment systems but does not require full testing of engines to ensure their emissions performance over their useful life. Given the centrality of engine design to emissions performance, that failure is likely to produce significant oversights in durability testing. Commenters ask EPA to adopt the comprehensive durability testing used in the Omnibus, combining dynamometer aging (with no fuel-based acceleration factors) with aftertreatment bench aging.242 [EPA-HQ-OAR-2019-0055-1302-A1, p.62]

> 242 See CARB, California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles (Aug. 27, 2020), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hdomnibuslownox/frob-1.pdf.

Organization: *Cummins Inc. (Cummins)*

Currently, determining emissions deterioration factors through testing requires long-hour engine dynamometer tests to age the entire engine + aftertreatment system. Even with accelerated test cycles and extrapolation to full useful life, engine dynamometer-based DF aging is time consuming, costly, and burdensome. A recent test program undertaken by engine manufacturers showed consistent engine out emissions over the full useful life, demonstrating little benefit to continuing long-hour aging of the base engine. EPA's proposed new provisions for determining DFs in §1036.245 include a new testing option using bench-aged aftertreatment, together with a stabilized emission-data engine. Manufacturers would be allowed to use an EPA-approved bench aging procedure to account for thermal and chemical degradation of aftertreatment or propose an equivalent bench aging procedure. Cummins supports inclusion of the aftertreatment bench aging option as a more efficient and accurate method for determining DFs for on-highway engines. Cummins also supports including the option in §1036.245(a) to request approval for DFs using engineering analysis from similar on-highway or nonroad engines. [EPA-HQ-OAR-2019-0055-1325-A1, p. 11]

Organization: *Ford Motor Company (Ford)*

We support the regulatory provisions that allow the use of bench aging-based emission deterioration factors for both spark- and compression-ignition engines. Allowing bench aging of aftertreatment systems will be critical to achieving development cycles which are executed with production-representative engine hardware and software. [EPA-HQ-OAR-2019-0055-1300-A1, p. 4]

Organization: *National Association of Clean Air Agencies (NACAA)*

NACAA does not support the proposed new option for durability demonstration. [EPA-HQ-OAR-2019-0055-1232-A1, p. 12]

EPA proposes a new option for determining a deterioration factor (DF) that would significantly weaken vehicle durability testing requirements. Under this new DF demonstration option, "to limit the burden of generating a DF over the proposed lengthened useful life periods," EPA would allow manufacturers to conduct dynamometer testing of an engine and aftertreatment system to a mileage less than regulatory useful life. Manufacturers would then bench age only the aftertreatment system to regulatory useful life, put it back on an engine representing the engine family, run the combined engine and bench-aged aftertreatment system for at least 100 hours and then collect emissions data to determine the DF. [EPA-HQ-OAR-2019-0055-1232-A1, p. 13]

EPA should discard this proposed option, which does not adequately simulate engine aging and, because the focus is on aftertreatment bench aging without consideration of engine-related component durability, could allow the certification of engines that do not meet the engine standards. EPA should continue to include both significant engine operation and accelerated aftertreatment aging in the DF determination, as is required by the Omnibus, and work with California to align the programs. [EPA-HQ-OAR-2019-0055-1232-A1, p. 13]

Organization: *Ozone Transport Commission (OTC) and Mid-Atlantic/Northeast Visibility Union (MANE-VU)*

Deterioration factor demonstration: EPA has proposed to establish a new deterioration factor determination option, where manufacturers would be able to perform dynamometer testing of an engine and aftertreatment system to a mileage that is less than regulatory useful life. Manufacturers would then bench age the aftertreatment system to regulatory useful life and combine the aftertreatment system with an engine that represents the engine family. Manufacturers would run the combined engine and bench-aged aftertreatment for at least 100 hours before collecting emission data for determination of the deterioration factor. OTC encourages EPA to continue to include the engine in the deterioration factor determination.

While it may be possible to move to the proposed new bench-aged aftertreatment option with more data, we do not believe there are sufficient data to ensure this method accurately evaluates the durability of the emission-related components in a certified configuration. We encourage EPA to align with CARB on the procedure for the deterioration factor determination. We believe both significant engine operation and accelerated aftertreatment are needed, and not accelerated aftertreatment aging alone. [EPA-HQ-OAR-2019-0055-1250-A1, pp.16-17]

Organization: *PACCAR, Inc (PACCAR)*

PACCAR supports that the Proposed Rule currently contemplates two ways in which OEMs may determine deterioration factors: either '[o]perate the emission-data engine in the certified configuration on an engine dynamometer to represent the useful life' or '[d]etermine deterioration factors based on bench-aged aftertreatment.' 1036.245(b)(1)-(2). PACCAR respectfully requests that EPA promulgate a third option that is essentially a combination of the two described above. [EPA-HQ-OAR-2019-0055-1346-A1, pp.46-47]

EPA appears to have contemplated including this third option – a combination of engine dynamometer aging and accelerated bench-aged aftertreatment aging. The preamble states: 'In addition, under our proposed new DF determination option, manufacturers would be able to perform dynamometer testing of an engine and aftertreatment system to a mileage that is less than regulatory useful life. Manufacturers would then bench age the aftertreatment system to regulatory useful life and combine the aftertreatment system with an engine that represents the engine family. Manufacturers would run the combined engine and bench-aged aftertreatment for at least 100 hours before collecting emission data for determination of the deterioration factor.' 87 Fed. Reg. at 17548. PACCAR therefore recommends that EPA promulgate this third option, which also would be consistent with CARB's regulatory approach. See FINAL California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles at B1.1.1.4. [EPA-HQ-OAR-2019-0055-1346-A1, p.47]

In addition, the proposed bench-aged aftertreatment option would require that the OEM '[c]reate a linear curve fit if testing includes intermediate points.' 40 C.F.R. 1036.245(2)(iv) (proposed). But EPA should amend this provision to allow for a nonlinear curve fit if there is sufficient supporting data. The common curve degrades quickly initially and then has a more gradual slope over the majority of the useful life. [EPA-HQ-OAR-2019-0055-1346-A1, p.47]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EPA has proposed to allow bench-aging of aftertreatment systems as an alternative to traditional dyno-based aging processes. EMA fully supports this approach for HDOH engines. Expanding the utilization of bench-aging would significantly improve the product development cycle, reducing the costs and risks associated with traditional DF demonstrations (especially when extended FUL testing is required), while also improving the opportunity to deploy the latest technologies into the manufacturer's engine and aftertreatment designs. The SwRI-developed DAAAC protocol is an excellent example of a method that can be utilized to support bench-aging. EMA also supports EPA's proposal that alternatives to "EPA-approved" bench-aging procedures may also be approved. In that regard, EMA does not see the need for EPA to define a minimum number of engine hours of dynamometer aging beyond what is required to stabilize the engine and aftertreatment if a manufacturer were to utilize that bench-aging approach. Allowing for bench-aging of the aftertreatment system (after stabilization), without any prescribed minimums of dynamometer aging, would be the most time-efficient method of determining deterioration factors, and would be consistent with the findings of the “Industry DF” program. Such a provision would optimize the opportunities for engine manufacturers to include the latest technologies into their products, and would reduce testing costs and burdens. [EPA-HQ-OAR-2019-0055-1203-A1, p. 111]

EPA Summary and Response

Summary:

The state and environmental organizations (CARB, CATF, NACAA, and OTC) that commented on this aspect of the proposal did not support the proposed aftertreatment bench aging provision. While these commenters recognized certain benefits of the proposal, including reduced durability testing time upfront and improved product cycle timelines, they stated that the risks of hardware or software issues being missed means that this is not a reliable and accurate method of assessing durability of aftertreatment components. All of these commenters preferred the Omnibus approach. CARB recommended that EPA provide a way for manufacturers to use a combination of EAS and accelerated aftertreatment aging, and at minimum allow the Omnibus method as a substitute method. OTC also noted that there is not sufficient data to support using the bench-aged approach.

The engine manufacturers (Cummins, Ford, PACCAR, and EMA) that commented on this aspect of the proposal supported the proposed aftertreatment bench aging provision with some qualifications. Cummins noted that a recent engine manufacturer study shows there is little benefit to continuing long-hour aging of the base engine to determine deterioration. PACCAR recommended a 3rd option combining the two proposed options (dynamometer and bench-aged aftertreatment), and noted that EPA described consideration of this option in the proposed rule preamble, and that it is consistent with the Omnibus approach. PACCAR also recommended that EPA allow a nonlinear curve fit if testing includes intermediate points, if there is sufficient data to support that approach. EMA noted that the SwRI DAAAC protocol is a method that can be used to support bench-aging, and supported allowing alternatives to EPA-approved benching-aging procedures. EMA also noted that there is no need to define a minimum number of engine hours of dynamometer aging beyond what is needed to stabilize the engine and aftertreatment.

Response:

See preamble Section IV.F for our responses to many of these comments on the proposed options for determining the DF and our rationale for the final provisions for determining DF. While the purpose of EPA’s DF determination procedure is to determine emission performance degradation over the useful life of the engine, we acknowledge that there is value in performing some engine dynamometer aging. We are finalizing requiring a minimum number of testing hours on an engine dynamometer, with the allowance for the manufacturer to add additional hours of engine dynamometer-aging at their discretion. The minimum required hours, beyond what is needed to initially stabilize the engine and aftertreatment, are by primary intended service class and as follows: 300 hours for SI, 1,250 hours for Light HDE, and 1,500 hours for Medium HDE and Heavy HDE. These changes also allow manufacturers to include additional engine dynamometer testing above the minimum requirements, thus allowing the Omnibus method under the final requirements' options if manufacturers perform engine dynamometer testing to meet the Omnibus requirements and test over either of the Omnibus service accumulation cycles. Prior approval will not be needed for testing over the Omnibus cycles because the EPA required duty cycles include the engine shutdown and extended idle operation that the Omnibus cycles include. EPA disagrees with OTC that there is not sufficient data to support using the bench-aged approach. EPA has been evaluating accelerated aging methods under contract at SwRI and has provided data in the record for the final rule showing that the methods we have added to 40 CFR part 1036 will determine deterioration results that are comparable to those determined by testing out to useful life on an engine dynamometer and achieve a significant time and cost reduction for DF determination.

EMA noted that the SwRI DAAAC protocol is a method that can be used to support bench-aging and supported allowing alternatives to EPA-approved benching-aging procedures. EPA is finalizing as part of this rule in 40 CFR 1065.1131 through 40 CFR 1065.1145 a variation of the SwRI DAAAC accelerated aging protocol that was used in the accelerated aging test program that SwRI carried out for EPA under contract. The final requirements also include the option for manufacturers to use their own accelerated aging method with prior EPA approval.

10.3 Verifying deterioration factors

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

On page 17548 of the NPRM, U.S. EPA requests comments regarding the minimum number of hours required to stabilize the emissions from engines. [EPA-HQ-OAR-2019-0055-1186-A2, p.29]

CARB staff supports the provision to update the definition of 'low-hour' in 1036.801 to include 300 hours of operation for engines with NOx aftertreatment to be considered stabilized. This methodology harmonizes the emission stabilization requirements with the Omnibus regulation. [EPA-HQ-OAR-2019-0055-1186-A2, p.29]

On page 17548 of the NPRM, U.S. EPA requests comments regarding the proposed number of engines tested under the proposed DF verification procedures. [EPA-HQ-OAR-2019-0055-1186-A2, p.30]

CARB staff agrees that any DF created using a bench aged aftertreatment needs to be verified in-use. The Omnibus comprehensive durability demonstration program requires any engine family using a DF generated from a bench aged system to submit in-use emission data reports for more than 20 percent of the engines in the field for three consecutive years. The U.S. EPA proposal, based on the interim DF Validation program undertaken by U.S. EPA and CARB beginning in

2021, would test only a small sample (2 to 7) of in-field engines with up to 85 percent of UL miles. [EPA-HQ-OAR-2019-0055-1186-A2, p.30]

While the goal of these programs is the same, the requirements of the programs are not equivalent and could potentially require manufacturers to submit different data to each agency to satisfy the requirements. CARB staff believes the Omnibus approach is robust because the mandatory dynamometer aging requirements would address many durability concerns at the time of certification and would have a large dataset to identify unforeseen compliance issues in the field. The U.S. EPA approach would remain blind to durability concerns at time of certification with no dynamometer aging requirement and a relatively small sample size of test engines for DF validation that may not be statistically representative of the in-use population. [EPA-HQ-OAR-2019-0055-1186-A2, p.30]

Furthermore, U.S. EPA’s proposed DF validation program was never intended to become regulation; only to serve as an interim stop gap measure because of non-compliance issues revealed by the Truck and Engine Manufacturers Association durability study and because California was in the process of developing a comprehensive durability program as part of Omnibus beginning with 2024 MY engines. So even if such a DF verification approach were to be considered, further work needs to be performed to better assess the representativeness of the DF process to field engines prior to implementation. Again, CARB staff recommends that U.S. EPA evaluate the Omnibus durability program and work with CARB staff to address any concerns in the hope to establish a unified national durability demonstration program. [EPA-HQ-OAR-2019-0055-1186-A2, pp.30-31]

Organization: *Cummins Inc. (Cummins)*

In §1036.246, EPA is proposing to require one of three methods for verification of DF values by manufacturers using aftertreatment bench aging: engine dynamometer testing, PEMS testing, or onboard NOx sensor measurements, for several years each on successively higher mileage engines in production. The engine dynamometer testing verification option requires testing at least two engines annually, and the PEMS testing verification option requires testing at least five engines annually, for multiple years. However, the onboard NOx measurement verification option requires collecting 1 Hz data over a shift day of driving for at least 50% of engines produced annually for multiple years. Aside from the question of whether NOx sensors can even meet the verification, startup, and continuous operation requirements proposed by EPA in §1036.246(d)(3)(i), the 50% minimum is extremely high compared to the other verification options and to the existing EPA guidance CD-2020-19, upon which the proposed verification option is based. That guidance calls for testing a minimum of seven engines annually. Additionally, the telematics systems which EPA envisions manufacturers using do not collect 1 Hz data. EPA should work with manufacturers to determine a more reasonable, statistically valid requirement for DF verification using onboard NOx measurement for the final rule. Also, as it is unlikely that systems will exceed emissions standards early in their useful life, manufacturers should be permitted to propose alternate DF verification schedules for any of the three methods, such as testing smaller sample sizes prior to the 85% of useful life final verification point. [EPA-HQ-OAR-2019-0055-1325-A1, p. 11]

Organization: *Ford Motor Company (Ford)*

For spark-ignition engines which utilize the bench aging option, we recommend that the requirement to perform in-use verification testing of the emission Deterioration Factors be eliminated. Spark-ignition engine bench aging has followed a similar process to spark-ignition light-duty vehicle bench aging for many years and the deterioration levels of bench aging are well-aligned with aftertreatment deterioration observed from on-road vehicles. Further, eliminating in-use verification does not present risks of excess air pollution because vehicle on-board diagnostic systems will identify premature deterioration of the emissions control systems. [EPA-HQ-OAR-2019-0055-1300-A1, p. 4]

Organization: *Northeast States for Coordinated Air Use Management (NESCAUM)*

Should EPA instead promulgate Option 1, we urge the Agency to make the following changes to the proposed standards: EPA has proposed to establish a new deterioration factor determination option, where manufacturers would be able to perform dynamometer testing of an engine and aftertreatment system to a mileage that is less than regulatory useful life. Manufacturers would then bench age the aftertreatment system to regulatory useful life and combine the aftertreatment system with an engine that represents the engine family. Manufacturers would run the combined engine and bench-aged aftertreatment for at least 100 hours before collecting emission data for determination of the deterioration factor. NESCAUM encourages EPA to continue to include the engine in the deterioration factor determination. While it may be possible to move to the proposed new bench-aged aftertreatment option with more data, we do not believe there is sufficient data to ensure this method accurately evaluates the durability of the emission-related components in a certified configuration. We encourage EPA to align with CARB on the procedure for the deterioration factor determination. We believe both significant engine operation and accelerated aftertreatment are needed, and not accelerated aftertreatment aging alone. [EPA-HQ-OAR-2019-0055-1249-A1, p. 15]

Organization: *PACCAR, Inc (PACCAR)*

Corresponding changes would need to be made as well, including to the deterioration factor verification provisions. Specifically, 1036.246(c)(4) should be amended to allow using engines that undergo replacement or repair per the revised provisions above. [EPA-HQ-OAR-2019-0055-1346-A1, p. 45]

Certain aspects of the proposed deterioration factor verification provisions should be revised. First, PACCAR requests that EPA revise its proposal to make clear that DF verification testing is not required on model years that use carry-over DF data from previous model years. EPA should add clarifying regulatory language to proposed 1036.246, such as: ‘Carry-over of Deterioration Factors is allowed if there are no major hardware changes (e.g., a change in catalyst technology) that affect the deterioration of emissions; as such a single verification of deterioration factors on the first model year using the specific DFs should suffice to verify the validity of the DFs.’ [EPA-HQ-OAR-2019-0055-1346-A1, p.48]

In addition, PACCAR submits that proposed 40 C.F.R. 1036.246(d)(1)(i) requires clarification. Currently, the proposed section provides: 'Test at least two engines using the procedures specified in subpart F of this part and 40 CFR part 1065. Install the aftertreatment system from the selected in-use vehicle, including all associated wiring, sensors, and related hardware and software, on one of the following partially complete engines.' PACCAR respectfully requests that EPA clarify that this proposed provision would require testing two aftertreatment systems and that the testing can be done on a single engine. [EPA-HQ-OAR-2019-0055-1346-A1, p.48]

Proposed section 1036.246(d)(3) also needs to be revised. EPA proposes to require data from 50% of the engines produced for Option 3, as opposed to only 2 engines for Option 1, and 5 engines for Option 2. The option proposed by EPA requires 1Hz data, meaning that physical recorders must be installed in the vehicles to measure the required data. PACCAR proposes to reduce the demonstration requirements for Option 3 to five engines as in Option 2. [EPA-HQ-OAR-2019-0055-1346-A1, p.49]

PACCAR respectfully requests that EPA remove the proposed requirement that measured emission results must be adjusted for IRAF. See proposed 1036.246(d)(2)-(3) (requiring IRAF be added to the measured emission results). Although infrequent regeneration adjustment factors are determined during FTP, RMC and LLC test cycles, no IRAF values exist for in-use testing. In fact, the EPA proposed in-use test requirements in 1036.515 specifically exclude emissions during regeneration, i.e., no IRAF adjustment is required. [EPA-HQ-OAR-2019-0055-1346-A1, p.49]

Organization: *Truck and Engine Manufacturers Association (EMA)*

Regarding the DF verification procedures of proposed section §1036.246, EMA recommends a modification that will streamline those processes without impacting the integrity of the program. Regardless of the verification procedure selected, it is unlikely that systems will exceed emissions standards early in their useful life. EPA acknowledges this point by not requiring testing for the first two model years of production. EMA recommends extending this principle to the first years of validation testing by reducing sample size requirements in, for example, years 3 through 6. The number of tests required in years 7 and 8 could also be reduced if the results in years 3 through 6 demonstrate sufficiently compliant results. Indeed, it is unclear how relevant slightly elevated levels at early intervals might be. Accordingly, it may be reasonable to provide that a manufacturer has the option to perform these verifications only in the last stage of UL (the 85% of UL stage) if that manufacturer chooses to take the risk of failing results and potential recalls. EMA is willing to work with the Agency to establish appropriate streamlined parameters that will provide the Agency with the same level of assurance the DF verification process was intended to provide, but with reduced overall burdens for manufacturers. [EPA-HQ-OAR-2019-0055-1203-A1, p. 112]

It is noteworthy that the DF verification procedures were originally developed in guidance to confirm the validity of DF's developed through extrapolation of test results based on demonstrations conducted over less than FUL. The application of bench-aging would enable FUL DF determinations. As proposed, the extensive and burdensome DF verification testing requirements do not sunset. Manufacturers would be required to fulfill the DF verification requirements long after bench-aging has been confirmed as a reliable method of determining DFs. EMA recommends that the DF verification requirements sunset no later than 2035. [EPA-HQ-OAR-2019-0055-1203-A1, p. 112]

It is unclear why a manufacturer should be required to include non-emissions deteriorating components (wiring harnesses, DEF tanks and related sensors) when obtaining engine and/or aftertreatment systems for the engine dynamometer DF verification option. EMA recommends that the manufacturer be given more flexibility to propose a reduced list of necessary components. [EPA-HQ-OAR-2019-0055-1203-A1, p. 112]

There are additional DF verification provisions that require clarification. For example, the pass/fail criteria in section §1036.246(d) for all three verification options should clearly state that a manufacturer fails the verification test if "fewer than 70%" of the test samples pass. Additionally, sections §§1036.246(d)(1)(ii), (d)(2)(ii) and (d)(3) instruct the manufacturer to "apply infrequent regeneration adjustment factors as specified in §1036.522." EMA recommends clarifying this language to say "apply infrequent regeneration adjustment factors as included in your application for certification" to avoid any confusion that new adjustment factors should be generated or confirmed. EMA also recommends that EPA include flexibility allowing a manufacturer to propose alternative plans in the event that engines meeting the minimum mileage (or hours, for non-road or other applications for which hours are appropriate) requirements cannot be located or otherwise made available for testing. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 112 - 113]

The DF verification requirements from 40 CFR 1036.246 are triggered by the initial model year that relied on the DF determined per 40 CFR 1036.245. In the context of a new emissions rulemaking causing multiple engine families to start production in the same model year, the DF verification requirements would prove very burdensome for the manufacturer with no option to delay or stage each of the various stages of the DF verification program. We recommend adding a provision to limit the total number of DF verification test programs a manufacturer would be required to perform during a single year to no more than three (3). [EPA-HQ-OAR-2019-0055-1203-A1, p. 113]

Regarding the option to perform DF verification by utilizing on-board NOx sensors, EMA recommends some revisions for the final rule. The first item of concern is the requirement to include at least 50% of the manufacturer's production volume in this assessment. That could amount to a tremendous number of evaluations, all to be post-processed according to the complex 3B-MAW in-use test protocol. The reporting requirements of section §1036.246(f) include numerous details from each test, including VIN and serial numbers, and statements that "tested engines have been properly maintained and used and describe any noteworthy aspects of each vehicle's maintenance history," as well as explanations why data was "invalidated." Such detail cannot be automated for reporting processes. Providing 1Hz data on each test would require voluminous datafile submittals. All of these factors render the "50% of production volume" sample requirement completely unworkable. [EPA-HQ-OAR-2019-0055-1203-A1, p. 114]

EMA recommends that the number of engines to be included under the NOx sensor-based DF verification provisions be significantly reduced. Reducing the sample size to 20% or even 5% may still be unnecessarily onerous. EMA suggests that EPA use the same quantity of units as mentioned in the DF validation guidance (7 or more per year) if utilizing this DF verification option, or any number of sampling methods available to complete a statistically rigorous assessment in a less burdensome, more cost-effective way. EMA is willing to work with the Agency to propose a statistically sound basis for defining the number of engines to be included. If EPA finalizes the rule with a direct percentage, it should be a direct percentage of the parent engines produced. [EPA-HQ-OAR-2019-0055-1203-A1, p. 114]

With regard to §1036.520, which specifies the test procedures to submit NOx sensor-based data, including collection of 1Hz data and post-processing results according to the 3B-MAW protocol, EMA is again supportive of this forward-looking approach. There are, however, limitations as to the type of data that can be made available. For example, current telematic systems cannot transmit 1Hz data. CARB intends to modify REAL requirements in future OBD amendments, requiring that REAL include the capability to determine and store bin emissions according to the 3B-MAW requirements included in the Omnibus Regulations (and proposed in the NPRM). But that capability will not be in place until perhaps 2031. In the meantime, it could be possible for EPA to utilize the current REAL capabilities for the purpose of supporting DF verification requirements. Once 3B-MAW results are available, the process could incorporate those results for DF verification and in-use testing purposes. [EPA-HQ-OAR-2019-0055-1203-A1, p. 114]

There are other concerns with the proposed NOx sensor-based data acquisition requirements. For example, the requirement that on-board measurement capability must be verified as described in §1065.920(b) is unworkable. The replicates test option of §1065.920(b)(6)(ii) would not be available with the 6 to 9 hour road cycle, because that process does not include replicates in the same way that the current NTE-based requirements do when applied to §1065.920. The requirement that the NOx sensor be active within the first 100s of operation and remain active throughout the day is unworkable. Modern NOx sensors are not sufficiently robust to withstand all operating conditions, and must be turned off to avoid failure when dew point conditions are experienced in the exhaust stream. The ECU is switched off at key-off, so the NOx sensors are down under key-off conditions as well. Additionally, there is much to work out concerning CO2 emissions estimation from fuel delivery, calculation of CO2-specific results, and many other details. EMA stands ready to work with the agency to develop the appropriate processes to enable NOx sensor-based data acquisition capabilities. [EPA-HQ-OAR-2019-0055-1203-A1, p. 114]

EMA supports EPA’s proposal to allow a manufacturer to reverse a fail determination under the PEMS-based or NOx sensor-based verification procedures by applying the engine dynamometer-based procedures. This provision provides a reasonable method for addressing the potential shortcomings of the other methods. [EPA-HQ-OAR-2019-0055-1203-A1, p. 115]

EMA also requests that consideration be given to coordinating and streamlining manufacturer activities related to DF verification and the HDIUT program. The EPA/CARB in use test orders could be scheduled to coincide with DF verification obligations. EMA recommends that the Agency consider this opportunity to reduce manufacturer burdens. [EPA-HQ-OAR-2019-0055-

1203-A1, p. 115] However, for spark-ignition engines which utilize the bench-aging option, EMA recommends that the requirement to perform in-use verification testing of the emission Deterioration Factors be eliminated. Spark-ignition engine bench-aging has followed a similar process to spark-ignition light-duty vehicle bench-aging for many years, and the deterioration levels produce by bench-aging are well-aligned with aftertreatment deterioration observed from on-road vehicles. EMA stands ready to work with EPA to develop improvements to streamline those processes in the final rule. [EPA-HQ-OAR-2019-0055-1203-A1, p. 115]

EPA Summary and Response

Summary:

The above comments provide both general and specific comments on several aspects of the proposed procedures to verify deterioration factors.

NESCAUM stated they do not support the bench-aged aftertreatment option because of the lack of data to accurately evaluate the durability of emission-related components. NESCAUM stated that instead both significant engine operation and accelerated aftertreatment aging are necessary, and NESCAUM recommends EPA align with CARB on this.

EMA commented that the DF verification requirements should sunset no later than 2035, because bench-aging will be confirmed as a reliable method to determine deterioration factors before then.

With respect to bench-aged aftertreatment, CARB agreed that any deterioration factors created using this method must be verified in use, but stated that the number of engines tested in EPA's approach (would test only a small sample (2 to 7) of in-field engines with up to 85 percent of UL miles) is different from the Omnibus approach (data submitted from in-use engines for more than 20% of the engines in field for 3 consecutive years) and is less robust. CARB stated that, as a result, EPA's approach does not reflect durability concerns at the time of certification and may not be statistically representative of the in-use population, and it would also require manufacturers to develop two sets of data, one for CARB and one for Federal DF compliance. Finally, CARB commented that the EPA verification program that was originally in guidance and proposed in this this rulemaking was originally intended as an interim measure, and to date, enough data hasn't been collected to assess the representativeness of the DF verification process to field engines.

With regard to the requirements, there were many suggestions from multiple commenters to revise the proposal, including: limiting the number of DF verification tests per year to no more than three; reduced sample size requirements after the third year, and even in the 7th and 8th years if the results in earlier years are compliant, and allow an option to perform verification in only the 85% of useful life stage. To support these suggestions, these commenters stated that they were reasonable because systems are unlikely to fail early in useful life. Some commenters stated that manufacturers should also be allowed to propose alternate DF verification schedules for any of the three methods, such as testing smaller sample sized prior to the 85% useful life final verification point. One commenter suggested reducing the number of engines required to be tested in Option 3 to less than five, like Option 2. The commenter also suggested giving manufacturers more flexibility to propose a reduced list of necessary components, since some of those currently on the list are not emission-deteriorating (e.g., wiring harnesses, DEF tanks and related sensors), and suggested allowing manufacturers to propose alternative plans if engines meeting the minimum operation requirements (miles or hours) cannot be located or made available for testing. Finally, one commenter asked EPA to remove the requirement for measured emissions to be adjusted for IRAF, since no IRAF values exist for in-use testing. The comment also stated that the proposed in-use test requirements exclude regeneration emissions, so no IRAF adjustment is required. EMA recommended clarifying the IRAF language to say “apply infrequent regeneration adjustment factors as included in your application for certification” to avoid any confusion that new adjustment factors should be generated or confirmed for the verification.

There were several comments about the onboard NOx sensors approach for deterioration factor verification, and several manufacturers noted they are willing to continue to work with EPA to develop a reasonable, statistically reliable onboard NOx measurement method. With regard to the number of engines tested using this option, commenters said a requirement to test 50% of production volume is too high, compared to the other methods, and instead the number in EPA’s current DF validation guidance should be used (7 or more per year). Several commenters noted that current telematic systems cannot transmit 1 Hz data, and EPA should allow using REAL capabilities until 3B-MAQ results are available. Also, some commenters stated that there is more work needed to develop NOx sensor-based data acquisition capabilities. Some commenters stated that the requirements that on-board measurement capability must be verified and that the requirements that the NOx sensor be active within the first 100s of engine start up and remain active throughout the day are unworkable. Some commenters stated that they supported the EPA approach to allow manufacturers to reverse a fail determination under a PEMS-based or NOx sensor-based verification procedure by applying engine dynamometer-based procedures. Finally, there was a request to coordinate DF verification and the HDIUT program to reduce manufacturer burdens.

EMA commented that §1036.246(d) should clearly state that a manufacturer fails the verification test if “fewer than 70%” of the test samples pass, for all 3 verification options.

EMA commented that §§1036.246(d)(1)(ii), (d)(2)(ii) and (d)(3) should say “apply infrequent regeneration adjustment factors as included in your application for certification” to avoid any confusion that new adjustment factors should be generated or confirmed.

PACCAR commented that §1036.246(d)(1)(i) should be clarified that it would require testing two aftertreatment systems and that the testing can be done on a single engine.

PACCAR commented that §1036.246(c)(4) should be amended to allow using engines that undergo replacement or repair.

<u>Response</u>:

Regarding NESCAUM's statement that they do not support the bench-aged aftertreatment option because of the lack of data to accurately evaluate the durability of emission-related components, the accelerated bench aging method that we are finalizing has been shown to properly assess emission control system durability. See also preamble Section IV.F for our responses to comments on the proposed options for determining the DF and our rationale for the final provisions for determining DF.

As discussed further in the final rule preamble section IV.F.2, the final DF determination requirements do not include a requirement to verify the DF unless EPA specifically requests such verification, see final 40 CFR part 1036.246. EPA disagrees with EMA's request that the DF verification requirements sunset no later than 2035. EPA intends to request verification of DF if it suspects there is an issue with the DF generated by the manufacturer and thus does not think that a sunset date would be appropriate for the final DF verification requirement. EPA anticipates that a verification request may be appropriate due to consideration of, for example, data submitted to EPA from the manufacturer run in-use test program, or publications from test programs that indicate an engine family's deteriorated emissions are higher than the standard.

EPA disagrees with Ford's comment that in-use verification of DF is not needed due to the OBD system detecting premature deterioration. We are finalizing OBD thresholds that are many times higher than the final NO_x standards, so the emissions will have to deteriorate to emission levels many times the standard before the OBD system will detect it. We maintain that the option for EPA to require in-use verification of DF is appropriate.

In general, commentors provided many suggestions to revise the proposal regarding the specifics of a required verification program. See preamble Section IV.F.2 for what changes from proposal EPA is making in the final verification requirements, including our discussion of why we are not including the option for on board NO_x sensor-based verification at this time. Other than not including that option, for the reasons explained below and preamble Section IV.F.2, EPA is not finalizing any of the commenters' suggested changes. We are clarifying in the final provision that EPA will discuss with the manufacturer the number of verifications required in the event EPA requires verification, as described in section IV.F.2 of the preamble.

EPA disagrees with PACCAR who asked EPA to remove the requirement for measured emissions to be adjusted for IRAF. IRAF emissions are included in the DF determination, under the final requirement. EMA provided comments on 40 CFR 1036.246(d)(1)(ii), (d)(2)(ii) and (d)(3) (redesignated 40 CFR 1036.246(b)(1)(ii), (2)(ii), and (3)) and EPA agrees that those sections should say "apply infrequent regeneration adjustment factors as included in your application for certification" to avoid any confusion that new adjustment factors should be generated or confirmed. EPA is, however, retaining the option to request that manufacturers perform a new determination of IRAF emissions for engines tested using the engine dynamometer testing option in 40 CFR 1036.246(d)(1) (redesignated 40 CFR 1036.246(b)(1)), in the event that EPA has concerns regarding the effect of the higher-than-expected deterioration on IRAF emissions. Thus, where verification is requested by EPA, manufacturers must either 1) use the IRAF developed at the time of certification, or 2) develop new IRAFs during verification if EPA requests, to adjust the emission results during verification testing. EPA has updated this section for the final rule.

EPA also notes that the proposal included an option to reverse a fail determination under a PEMS-based or NOx sensor-based verification procedure by applying engine dynamometer-based procedures. As explained in preamble Section IV.F, we are finalizing this for PEMS-based testing where EPA requests DF verification.

EMA provided comments on proposed §1036.246(d) (redesignated 40 CFR 1036.246(b)) and EPA agrees that as proposed the requirement was not clear on whether the threshold was at or below 70% and it should clearly state, as originally intended, that a manufacturer fails the verification test "if fewer than 70% of the tested engines" pass, for both of the verification options. EPA has updated this section for the final rule.

EMA provided comments on §§1036.246(d)(1)(ii), (d)(2)(ii) and (d)(3) (redesignated 40 CFR 1036.246(b)(1)(ii), (2)(ii), and (3)) and EPA agrees that those sections should say "apply infrequent regeneration adjustment factors as included in your application for certification" to avoid any confusion that new adjustment factors should be generated or confirmed. EPA has updated this section for the final rule.

PACCAR provided comments on §1036.246(d)(1)(i) (redesignated 40 CFR 1036.246(b)(1)(i)) and EPA agrees that it should clearly state that it requires testing two aftertreatment systems and that the testing can be done on a single engine, as the engine is just being used as an emission source to test the aftertreatment performance against. EPA has updated this section for the final rule.

PACCAR stated that §1036.246(c)(4) (redesignated 40 CFR 1036.246(a)(4)) should be amended to allow using engines that undergo replacement or repair. 40 CFR 1036.246(c)(4) already allows the use of an engine that has undergone repair as long as it still has its original critical emission-related components. If the engine does not have its original emission critical components, this creates a disconnect between the age of the engine emission control components and the aftertreatment. EPA disagrees that we should allow testing of engines that have been replaced, because this will result in a mismatch of the age of any engine critical emission-related components and the aftertreatment system.

10.4 Certification decisions

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

On page 17548 of the NPRM, U.S. EPA requests comments regarding the use of standardized aging cycles. [EPA-HQ-OAR-2019-0055-1186-A2, p.29]

CARB staff strongly recommends the adoption of the standardized aging cycles based on certification test cycles, known as cycle-1 and cycle-2 as described in the Omnibus durability demonstration program. [EPA-HQ-OAR-2019-0055-1186-A2, p.29]

Historically, manufacturers have proposed and used customized duty cycles for aging the EAS. CARB staff believes that such an approach is problematic for two reasons:

- First, using customized aging cycles means that there is no level playing-field between different manufacturers when it comes to durability demonstration. It is not recommended to have different aging duty cycles for durability demonstration, as currently implemented.
- Second, certified HDEs are used in a wide variety of vehicle applications, so derivation of a customized cycle intended to represent the majority of vehicle operations is misleading. Typically, an engine family is certified to be used in both vocational and tractor applications with a wide range of power ratings. It is unclear how each manufacturer can design a single customized aging cycle which could represent such a large spectrum of vehicle applications. [EPA-HQ-OAR-2019-0055-1186-A2, p.29]

Omnibus cycle-1 and cycle-2 include the standard engine and chassis certification test cycles and have been derived by examining the operations of HD vehicles in a holistic fashion. They represent stop-and-go city operations, highway operations and also include large segments of idling, so CARB staff firmly believes that these cycles are appropriate for demonstrating durability and establish a level playing-field for manufacturers. [EPA-HQ-OAR-2019-0055-1186-A2, p.29]

Organization: *Eaton Vehicle Group (Eaton)*

Agency Request / Topic: In addition, we are interested in stakeholder input on our proposed approaches for the durability demonstration that manufacturers are required to include their application for certification (see Section IV.F for details). [EPA-HQ-OAR-2019-0055-1252-A1, p.9]

Eaton Comment Strategy / Materials: Same comments as above for the Eaton key components designed for the life of the truck. Our designs will be durability tested as part of our normal design practices and durability represents the value we bring to the system integrators. [EPA-HQ-OAR-2019-0055-1252-A1, p.9]

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

EPA also requested stakeholder input on their proposed approaches for the durability demonstration that manufacturers are required to include in their application for certification. Highly Accelerated Life Testing (HALT) does not provide good data on the frequency of a failure's occurrence. Longer warranty terms may lead to higher costs and EPA data may significantly underestimate the cost impacts due to limited or extrapolated data. We do not have enough data to support this and even if a vehicle passed durability testing, certain in-use duty cycles may have additional failures. OEMs may have the required information, but typically not part and system suppliers. We are not the best group to comment on this, but we are concerned. [EPA-HQ-OAR-2019-0055-1322-A1, pp. 7 - 8]

Organization: *PACCAR, Inc (PACCAR)*

Finally, EPA should revise proposed 1036.246(h)(3). As proposed in the NPRM, this provisions essentially provides that a new deterioration factor must be established after one additional model year if verification testing indicates that the emissions do not meet legal requirements. However, OEMs must have sufficient time to perform a new DF procedure, and, for proposed MY 2027 regulations, this may take nine to twelve months. To illustrate this challenge, if an OEM were to determine in December 2028 that its MY 2027 DF verification test failed, it would likely take until early 2030 for the OEM to complete a new DF program, notwithstanding that the certification application for the MY 2030 program will need to be submitted by mid-2029. Because OEMs would reasonably need more than one model year to comply with the proposed requirements in (h)(3), PACCAR respectfully requests that EPA allow OEMs to carry-over the existing DF for two additional model years, rather than the proposed 'one additional model year.' [EPA-HQ-OAR-2019-0055-1346-A1, p.49]

EPA Summary and Response

Summary:

The above comments address different aspects of the certification-related provisions of the proposed durability testing requirements. With regard to the duty cycles themselves, CARB recommends EPA adopt Omnibus cycle-1 and cycle-2 aging cycles. CARB states that allowing customized duty cycles will not provide a level playing field between manufacturers. CARB also raises concerns about how customized aging cycles would be designed, since they state that it would be difficult to represent the range of vehicle applications in a single customized aging cycle. PACCAR recommends that a manufacturer be allowed to carry over the duty cycle for two years instead of just one year after a verification test shows emissions exceeds the standards. PACCAR stated that two-year carry-over is necessary because one year is not enough time to perform a new DF program. MEMA commented that it is concerned about the ability of Highly Accelerated Life Testing (HALT) to provide good data on failure frequency. MEMA stated that, when combined with longer warranty terms, the result may be higher cost impacts. Finally, Eaton commented that their designs will be durability tested.

Response:

See preamble Section IV.F for our responses to comments on the proposed options for determining the DF and our rationale for the final provisions for determining DF.
As EPA explained in section IV.F.2 of the preamble, the final DF requirements only require verification upon request from EPA. Regarding PACCAR's comment, see further discussion in Section IV.F.2 of the preamble regarding how EPA will address verification results where the DF is shown to be deficient. We note that we generally disagree that a manufacturer should be allowed to carry over the duty cycle for two years after a verification test shows emissions exceed the standards.

While Eaton's comment on durability testing indicated that their products will be durable, they did not comment specifically on the DF test procedure that engine manufacturers would use for certification. MEMA's comment suggested that Highly Accelerated Life Testing (HALT) does not represent in-use failure rates and costs of longer warranty periods. We clarify that we are finalizing an option for accelerated aging to assure manufacturers can certify their engines to our longer final *useful life* periods. Our DF test procedures are intended to demonstrate durability at time of certification, which manufacturers and suppliers would build into their products in their pre-certification development programs. We agree that the accelerated aging procedure does not represent the cost of longer warranty periods. We estimate the final warranty periods as impacting indirect costs for manufacturers and operating costs for owners. See section IV.B.1 of the preamble to this rule for more discussion of our final warranty periods and chapter 7 of the RIA for a discussion of the updated costs.

11 Off-cycle standards and Test Procedures

11.1 Windowing, Binning, and Test Procedures (Preamble III.C.2.i)

11.1.1 Three-bin MAW Structure (windowing and binning)

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

CARB staff agrees with U.S. EPA's characterization of the current not-to-exceed (NTE) method used in the HD in-use testing (HDIUT) program as deficient. CARB staff identified similar shortcomings of the current program in the staff report for the Low NOx Omnibus rulemaking.126 CARB staff analysis showed a significant percentage of tests without any valid NTE operation, and also indicated that valid events represent an extremely small fraction of total test time operation. A majority of engine operations and NOx emissions were also outside of the valid NTE region with the current method. In fact, even with a modified NTE analysis where data exclusion and limits were relaxed to include more valid operation, the method remained deficient. CARB staff agrees with the conclusion that European heavy duty-engine products performing better in-use than their U.S. counterparts is related to the moving average window method used in the Euro VI regulations. [EPA-HQ-OAR-2019-0055-1186-A2, p.57]

126 https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hdomnibuslownox/isor.pdf

U.S. EPA requested comments to elements of the off-cycle standards and test procedures. CARB staff supports the replacement of the NTE procedures with off-cycle test procedures for 2027 and later model year engines. The off-cycle test procedures are mostly in alignment with the adopted 3B-MAW procedures in CARB's Omnibus program.127 CARB staff believes the proposed off-cycle test procedures would overcome the shortcomings of the current NTE method by providing more valid test data and by including low load operation. The CO2 binned approach would allow emission evaluation with similar certification cycle emission rates. [EPA-HQ-OAR-2019-0055-1186-A2, p.57]

127 https://ww2.arb.ca.gov/rulemaking/2020/hdomnibuslownox

CARB staff supports the windows size, binning structure based on the normalized average CO2 rate, 3 bins (idle, low load, and high/medium load), minimum window requirements of 2,400 for each bin, equation for emissions rate proposed in 40 CFR 1036.515, limited data exclusion criteria, and additional requirements for PEMS to limit environmental conditions influence on the accuracy and precision of PEMS. [This comment is also in 11.6.3] [EPA-HQ-OAR-2019-0055-1186-A2, p.57]

CARB staff has concerns with the language in 1036.420(c) stating: 'You may idle the engine anytime during the shift day to increase the number of windows in the idle bin. Increasing idle operation in the middle of a shift day would contradict trying to capture real world operation by the fleet operators. CARB staff suggests adding language adopted in the Omnibus regulation to allow for idle operation if necessary at the end of the shift day for a minimum of forty minutes and a maximum of 60 minutes if less than 2,400 windows are in the idle bin. [EPA-HQ-OAR-2019-0055-1186-A2, p.64]

U.S. EPA requested comment on elements of the proposed off-cycle testing section elements. CARB staff supports the changes to 1036.515 test procedures for off-cycle testing with a few concerns. The procedures for field testing provide important guidelines such as the emissions measurement procedures, engine start temperature requirements, test interval or window size, handling of key-off in the middle of testing, window creation procedures, excluded operation, valid operation, calculation of window emissions, binning of windows, calculating bin emission values needed for manufacturer-run in-use testing and administrator run in-use testing programs. [EPA-HQ-OAR-2019-0055-1186-A2, p.65]

CARB staff supports the inclusion of a cold start requirements, exclusion criteria, 300 second windowing definition, the creation of windows, valid operation, calculation of window emissions, binning of windows, and calculating bin emissions. [EPA-HQ-OAR-2019-0055-1186-A2, p.65]

135 Low NOx Demonstration Program – Stage 3. Pg. 131. https://www.arb.ca.gov/lists/com-attach/79-hdomnibus2020-Uj4AaQB2Aj8FbAhw.pdf

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

As part of Option 1, EPA proposes several changes to its laboratory-based duty cycle tests, in-use (sometimes called ‘off-cycle’) testing procedures, and verification testing. The current regulations must be revised to better regulate low load emissions and protect public health in communities overburdened by vehicle pollution. Commenters generally support making changes to close gaps in the current duty cycle and in-use testing procedures to reduce the amount of dangerous air pollution breathed by individuals living, working, and attending school in near-road communities. But Commenters oppose EPA’s proposed ‘flexibilities’ that would weaken verification testing. [Comment also included in Chapter 3.4] [EPA-HQ-OAR-2019-0055-1302-A1, p.54]

EPA also proposes changes to its in-use testing program to consider data across a wider range of operational conditions. Each 300-second moving average window of data would be sorted into one of three bins—idle, low load, and medium/high load, each of which would be subject to a different numerical emissions standard—based on the average power of the engine over that 300-second period, with measurement of the CO_2 emissions rate being used as a surrogate for engine power. 87 Fed. Reg. at 17,473. A complete in-use test would require at least 2,400 moving average windows per bin. 87 Fed. Reg. at 17,473. EPA still proposes to exclude certain data from consideration, specifically data that captures engine operation during times when: the engine is off, ambient temperatures are below a certain level, the engine is operating at more than 5,500 feet above sea level, an auxiliary emission control device is active, or periodic PEMS zero and span drift checks or calibrations are occurring. 87 Fed. Reg. at 17,474. [EPA-HQ-OAR-2019-0055-1302-A1, p.56]

Commenters support adopting in-use testing procedures that capture the higher emissions that occur when engines are at low load or idling so that the test captures the full range of real-world emissions. [EPA-HQ-OAR-2019-0055-1302-A1, p.56]

Organization: *Cummins Inc. (Cummins)*

EPA proposes to implement a new protocol, the Three-Bin Moving Average Window (3B-MAW) approach, for assessing in-use emissions against new off-cycle standards and to revise existing manufacturer-run in-use testing (IUT) provisions for MY 2027 and later CI engines. See §1036.104(a)(4), §1036 Subpart E, and §1036.515. 3B-MAW would replace the current Not-to-Exceed (NTE)-based approach for assessing emissions during in-use tests with Portable Emissions Measurement Systems (PEMS). [EPA-HQ-OAR-2019-0055-1325-A1, p. 12]

Cummins is supportive of efforts to improve real-world emissions and to expand coverage of in-use testing over a broader range of operation. However, many concerns and questions remain related to the accuracy and suitability of the 3B-MAW approach and associated in-use testing revisions. Cummins has been involved in an EMA study conducted by West Virginia University (WVU) to collect extensive in use NO_x data from 100 vehicles. WVU and EMA analyzed the collected data using numerous variations of 3B-MAW approaches. The comprehensive analyses highlight many concerns such as the need to balance collecting enough data vs. test time, issues caused by return-to-service events after idle or restarts unacceptably influencing Bin 3 emissions, and issues with use of the CO_2-normalized metric. [EPA-HQ-OAR-2019-0055-1325-A1, pp. 12 - 13]

EMA's comments and associated reports describe those issues and many others in detail, pointing to the need for continued work by both EPA and industry to evaluate improvements that should be implemented for the final rule, not just in the test and analysis protocols, but also with respect to compliance measures and stringency. As stated before, Option 1 is not feasible, including the proposed Option 1 off-cycle standards. For Option 2, a higher interim in-use conformity factor should be considered while manufacturers gain experience with new technologies and new 3B-MAW protocol. Also mentioned before, if EPA does finalize increases to today's useful life periods, it will need to account for additional uncertainty and variability in the deterioration of engines operated in the field by prescribing additional in-use margins to the off-cycle standards. [EPA-HQ-OAR-2019-0055-1325-A1, p. 13]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

Daimler Truck endorses EMA's comments detailing a number of over-arching concerns related to the proposed 3-B MAW protocol. These concerns are detailed in the '3-BAW and In use Testing' section of the EMA comments, the highlights of which are as follows:

- The proposed NOx-binning approach will result in individual seconds of data appearing multiple times in each of the 3 bins;
- The proposed methodology will result in a sorting, in effect a 'smearing,' of the same emission data points across all of the proposed bins;
- The 3-bin approach will disproportionally weight certain emission results over others (i.e., some data points will be included up to 300 times, while other points will not); [EPA-HQ-OAR-2019-0055-1168-A1, p.44]

Daimler Truck endorses EMA's comments detailing a number of over-arching concerns related to the proposed 3-B MAW protocol. These concerns are detailed in the '3-BAW and In use Testing' section of the EMA comments, the highlights of which are as follows:

- There is no discernible correlation among the data points that end up being binned together —the data variability and spread do not yield any consistent trends or significant differences among the 3 bins of data;
- The proposed binning method can result in randomly-binned data; [EPA-HQ-OAR-2019-0055-1168-A1, p.44]

Organization: *Manufacturers of Emission Controls Association (MECA)*

The proposed rule sunsets the NTE program and replaces it with a moving-average-windows (MAW) type of emissions analysis based on similar methodology to the in-service conformity (ISC) requirements used in Europe. ICCT has shown that in Europe, where a MAW analysis has been required during ISC testing since 2013, the same type of aftertreatment systems used on Euro VI compliant trucks achieve much lower emissions than U.S. 2010 technology trucks at the low speeds often experienced in the real world [23]. CARB's in-use testing has confirmed the limitations of the current compliance program based on the Not to Exceed (NTE) requirements for trucks that currently certify to the FTP standard of 0.2 g/bhp-hr. Over real duty-cycles and the many exclusions allowed by the NTE program the trucks must meet a 0.3 g/bhp-hr on the road. CARB has shown and the ICCT has confirmed (in the report above) that only about 5% of the tests meet the conditions of a valid NTE. [EPA-HQ-OAR-2019-0055-1320-A1, p.19]

> [23] F. Posada, H. Badshah and F. Rodriguez, 'In-use NOx emissions and compliance evaluation for modern heavy-duty vehicles in Europe and the United States,' 2020.

When the NTE was first adopted as part of the U.S. compliance program, there were no aftertreatment systems on trucks and the program was effective at ensuring that engine calibrations were not being modified at highway speeds. However, after 2010 when SCR systems were installed, CARB and EPA began to observe that because the SCR catalyst operates at reduced efficiency below exhaust temperatures of about 200â„ƒ, in-use trucks are emitting multiple times higher NOx emissions than the FTP certification limit, resulting in high NOx emissions in urban areas, communities and ports where truck speed is low. The proposed three bin approach with 30 second windows is a better methodology than a power-based window approach or CO2 equivalent based approach since it more evenly weights different engine operating modes, including extended idle and low power periods of operation. [EPA-HQ-OAR-2019-0055-1320-A1, pp.19-20]

Organization: *Moving Forward Network (MFN)*

EPA has appropriately proposed to revamp its in-use compliance program entirely. The "not-to-exceed" (NTE) test protocol have proven woefully inadequate for modern diesel engines—recent data shows that just 9.7 percent engine operation time is covered under the current NTE protocol.119 While the small number of NTE events averaged 0.18 g NOx/bhp-hr,120 total route emissions were more than double that, at 0.42 g/bhp-hr. Importantly, these ignored events are not random—low-speed operation is almost entirely excluded, even though it represents roughly half of the operational time for many vehicles, particularly in urban settings. Worse, it is exactly these low-speed operating conditions where modern diesel emissions controls are most likely to fail. [EPA-HQ-OAR-2019-0055-1277-A1, p. 28]

> 119. Badshah, H., F. Posada, and R. Muncrief. 2019. Current state of NOx emissions from in-use heavy-duty diesel vehicles in the United States. White paper from the International Council on Clean Transportation, November 26, 2019. Online at https://theicct.org/publication/current-state-of-nox-emissions-from-in-use-heavy-duty-diesel-vehicles-in-the-united-states/
>
> 120. Where possible, mg/bhp-hr are used, to directly compare with EPA's proposed standards. However, in research papers, such accuracy is not always reported. In response to EPA's request for comment on the use of SI standard units (87 FR 17472), we generally support the use of mg/bhp-hr and think it more accurately reflects the precision and accuracy of the standards and tools to enforce those standards.

We support EPA's proposal to move forward with the moving-average-window (MAW) approach, which will better capture all real-world behavior. [EPA-HQ-OAR-2019-0055-1277-A1, p. 29]

Organization: *Navistar, Inc. (Navistar)*

In particular, we support: A workable HDIUT protocol and standard that is robust and supports the lower NOx level [EPA-HQ-OAR-2019-0055-1318-A1, p. 3]

Often the entry and exit conditions dictate which bin an otherwise identical point may be in the represented bin. That is, the identical point can fall into either bin. This becomes more problematic due to the wide range of duty cycles represented in heavy-duty. We believe it would be more representative to combine bins 2 and 3 into a single bin to account for the variability seen in the heavy-duty context. In this, we further point EPA to the analysis in the EMA comments. [EPA-HQ-OAR-2019-0055-1318-A1, pp. 4 - 5]

Organization: *PACCAR, Inc (PACCAR)*

In particular, PACCAR agrees with the following aspects of EMA's comments: EPA has not sufficiently validated the new proposed in-use low-NOx standards and '3B-MAW' testing protocols, particularly those associated with 'Bin 3.' [EPA-HQ-OAR-2019-0055-1346-A1, p.2]

The proposed revisions to the HDIUT program include two major features that change the regulatory landscape. First, the Proposed Rule imposes a new Three Bin Moving Average Windowing ('3B-MAW') protocol that attempts to assign periods of engine operation to bins that represent three different ranges of load. Second, the Proposed Rule sets forth a new paradigm in which off-cycle standards are set at levels [EPA-HQ-OAR-2019-0055-1346-A1, pp.19-20]

PACCAR opposes the new 3B-MAW requirements because this protocol is ineffective. The 3B-MAW method seeks to distribute overlapping five minute periods of operation among three bins based on load. The idea is to classify similar operation together so that different standards can be applied to each bin to ensure the maximum appropriate level of control is applied to each type of operation. This protocol does not work well in practice due to varied operating conditions and lack of load correlation. PACCAR incorporates by reference the rationale set forth in EMA's comments, and submits the additional information below. See EMA Comments at 45. [EPA-HQ-OAR-2019-0055-1346-A1, p.20]

One practical issue with the 3B-MAW requirement is that MAW windows capture a variety of operating conditions that are not in character with the bin description to which they are assigned due to transient load changes that can occur within a window. Furthermore, emissions commonly do not correlate to load, especially for new technology engines that will employ better SCR heating strategies. These SCR heating strategies will result in operation at higher SCR temperatures, which in effect leads to very good emissions control at low loads. The test results from the SwRI demonstration engine confirm as much by demonstrating little NOx difference between bins. [EPA-HQ-OAR-2019-0055-1346-A1, p.20]

In the following example, a truck with a research engine is fitted with a PEMS and undergoes a cold start followed by operation on a test track in a linehaul driving mode. The entire cold start was captured in Bin 3, which elevated the Bin 3 BSNOx window result by 2.4 times after 2,400 windows relative to the rate observed under stabilized linehaul driving conditions observed between 6,000 and 12,000 seconds. Expanding the number of windows to 10,000 reduced the BSNOx in bin 3 but it was still 1.5 times the steady emissions rate. [EPA-HQ-OAR-2019-0055-1346-A1, pp.20-21]

In this example, 3B-MAW was not successful at characterizing the steady emission rate under linehaul conditions during a test designed to be exclusively linehaul driving. NOx breakthroughs can be more frequent under other driving conditions, as demonstrated in the following figure during the grocery delivery cycle. In this example, the Stage 3 engine was tested at SwRI and showed that it is even more unlikely that operating conditions imagined for Bin 3 can actually be captured in Bin 3 without also capturing data uncharacteristic of Bin 3. [EPA-HQ-OAR-2019-0055-1346-A1, pp.21-22]

Similar periods with transient emissions spikes are possible after engine braking, coasting, idling, and post regeneration which we can call return-to-service ('RTS') events. RTS events can be captured in any bin and have lasting impact on the final bin results. Even a hot start begins with a period where emissions controls need to stabilize and reestablish various models such as for ammonia storage. [EPA-HQ-OAR-2019-0055-1346-A1, p.22]

A successful in-use compliance strategy will need to target the lowest possible NOx emissions level at all times to pay for unavoidable NOx breakthroughs. Test results for Bin 2 and Bin 3 may be very similar in terms of level; however, because of the different standards, Bin 2 complies with excess margin, while Bin 3 fails to demonstrate compliance with adequate margin. [EPA-HQ-OAR-2019-0055-1346-A1, p.22]

Another 3B-MAW shortcoming is that bins can be left underpopulated when a drive cycle is either heavily loaded or lightly loaded causing the assignment of the vast majority of the windows to one bin or the other. Lightly populated bins do not have enough data to characterize the typical operation for the engine in that bin. The EMA comments discuss this topic in depth and support the conclusion that 10,000 windows is the minimum number needed to have an acceptable convergence level. EMA Comments at 77. The most effective way to collect 10,000 windows and still complete testing in one shift day is to combine Bins 2 and 3. [EPA-HQ-OAR-2019-0055-1346-A1, p.23]

Second, proposed 1036.420(c) contemplates 2,400 as the minimum number of windows in each bin. However, 2,400 windows is insufficient for a stabilized test result and is also too many windows to reliably finish a test in a shift day. Because there are no practical number of windows that could support the proposed binning scheme, Bins 2 and 3 should be combined into a single bin and EPA should establish 10,000 as the minimum number of windows. [EPA-HQ-OAR-2019-0055-1346-A1, p.56]

PACCAR further encourages the EPA adopt: The 3B-MAW in-use compliance protocol should be modified as follows:

- Bins 2 and 3 should be combined
- There should be a 10,000 window minimum in the combined bin [EPA-HQ-OAR-2019-0055-1346-A1, p.31]

The 3B-MAW in-use compliance protocol should be modified as follows:

- Bins 2 and 3 should be combined
- There should be a 10,000 window minimum in the combined bin[EPA-HQ-OAR-2019-0055-1346-A1, p.60]

Organization: *Truck and Engine Manufacturers Association (EMA)*

It is important to highlight from the outset that while there are various details of EPA's rulemaking proposal (particularly with respect to Option 1) that EMA and its members fundamentally disagree with, there are multiple major points of substantial agreement. In that regard, EMA agrees with EPA that:

> (ii) The current NTE-based in-use testing protocols to assess the in-use emissions performance from HDOH engines and vehicles should be revised to cover all in-use operations and should, at least in part, incorporate a moving average window ("MAW")-based "binning" scheme for assessing those in-use emissions; [EPA-HQ-OAR-2019-0055-1203-A1, p. 5]

In order to ensure the adoption of fully achievable and cost-effective HDOH low-NOx regulations, and notwithstanding our broader agreement, the Agency should revise the proposed standards in the following manner: The proposed 3B-MAW in-use compliance protocol should be revised to ensure that a sufficient quantity of data is acquired for a robust compliance assessment without the need for multiple test-days. Later in these comments, EMA proposes an alternative to achieve this goal, while also guarding against additional potential infeasibility issues, especially those associated with the proposed medium/high load "Bin-3" standards. [EPA-HQ-OAR-2019-0055-1203-A1, p. 7]

EMA has additional over-arching concerns related to the 3B-MAW protocol, including as follows: (i) the proposed NOx-binning approach will result in individual seconds of data appearing multiple times in each of the 3 bins; (ii) the proposed methodology will result in a sorting, in effect a "smearing," of the same emission data points across all of the proposed bins; (iii) the 3-bin approach will disproportionally weight certain emission results over others (i.e., some data points will be included up to 300 times, while other points will not); (iv) the proposal for "concatenating" data across key-off/key-on cycles will result in an unrepresentative binning of dissimilar data, which will yield wide spreads in the binned results; (v) there is no discernable correlation among the data points that end up being binned together – the data variability and spread do not yield any consistent trends or significant differences among the 3 bins of data; (vi) the proposed binning method can result in randomly-binned data; and (vii) despite EMA's best efforts to find a workable NOx-binning protocol, it is clear that using normalized CO2-rate parameters alone is not sufficient to yield a protocol for binning reasonably correlated in-use NOx data in three separate bins with three separate standards. [EPA-HQ-OAR-2019-0055-1203-A1, p. 49]

EMA was an initial proponent of moving to a new in-use-based emissions assessment paradigm, where each vehicle would become, in effect, its own mobile emissions lab. Such a new in-use paradigm, ultimately coupled with telematics, could allow for significant regulatory streamlining and greater assurance of real-world emissions control. EMA remains highly motivated to find a new in-use emissions-assessment protocol that can provide the framework for this new in-use regulatory paradigm. [EPA-HQ-OAR-2019-0055-1203-A1, p. 49]

In the interim, EMA and its members have devoted significant amounts of time and expense to exploring the strengths and weaknesses of MAW-based emissions binning tools and other potential in-use protocols. To that end, as noted above, EMA contracted with WVU to equip 100 HDOH vehicles with measurement technology capable of tracking emissions in real-world heavy-duty applications over extended periods. EMA has used that vast accumulation of fleet emissions data to evaluate numerous iterations of "binning" and other in-use emissions assessment approaches. Those iterations have included windowing techniques of various durations, exponentially-weighted moving windows, non-overlapping windows (or "tip-to-tail" windows), 1Hz-based approaches without windowed averages, and methods to better differentiate windowed emissions data on the basis of the engine's short-term operational history. EMA's research has included compliance evaluations not only on the basis of binning techniques, but also on the basis of the vehicle's shift-day "sum-over-sum" emissions. EMA's work also has included evaluation of adaptations to the Euro VI-based in-use testing protocol. Idle-bin boundaries based on vehicle and engine speed were studied, as were higher power level boundaries based on afterteatement thermal state to promote thermal management strategies, as well as brake-specific, CO2-specific, time-specific, and distance-specific metrics. [EPA-HQ-OAR-2019-0055-1203-A1, p. 49]

Unfortunately, notwithstanding EMA's and WVU's extensive efforts (which are detailed in WVU's Report, see Exhibit "A"), EMA has not been able to identify a suitably robust bin-based in-use emissions-data assessment protocol. While EMA is continuing its investigations, one thing has become abundantly clear: EPA's proposed 3B-MAW protocol – which the Agency has copied from CARB – is not a well-reasoned regulatory framework for assessing in-use emissions compliance. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 49 - 50]

Consistent with the spirit and purpose of those comments, EMA has specific recommendations for how to revise the B-MAW approach so that it can serve as the basis for a new more-comprehensive in-use testing program. EPA requested comments on whether the 3BMAW process should be modified, and more specifically whether combining bins might be a valid improvement over the protocol as proposed. As detailed later in these comments, EMA is recommending a modified two-bin approach. [EPA-HQ-OAR-2019-0055-1203-A1, p. 50]

The proposed 3B-MAW in-use testing method and standards do not sufficiently distinguish between modes of in-use engine operation, and so cannot adequately separate in-use emissions into separate bins of idle, low-load, and medium-to-high load operations. As demonstrated by the extensive analyses performed by WVU, the proposed 3B-MAW method can spread (or "smear") and comingle in-use emissions data across and among all of the three proposed bins. As WVU's work reveals, the binned data under the 3B-MAW method have no adequate correlation, trend lines, consistency, repeatability or reliability of results to support the establishment of separate regulatory standards for the three proposed bins. Moreover, EPA has not supported the proposed NOx-binning method with any actual in-use testing data derived from compliant test articles or a low-NOx HDOH prototype vehicle in-use. It is significant that the Agency originally committed to undertake real-world in-use testing of the proposed 3B-MAW protocol utilizing a Stage 3 prototype engine installed in a vehicle, but then reneged on that commitment, claiming that the Agency has run out of time. [EPA-HQ-OAR-2019-0055-1203-A1, p. 50 This comment is also in section 11.3.1]

WVU has prepared a comprehensive report of its findings and conclusions regarding the 3B-MAW in-use protocol. As noted, a copy of the WVU Report is appended hereto as Exhibit "A." The WVU report is based on emissions data acquired from WVU's testing of 100 vehicles of multiple vocations operating primarily in Southern California. The chart below shows the wide range of vehicle categories that WVU tested, and the number of tested vehicles in each category. [EPA-HQ-OAR-2019-0055-1203-A1, p. 50]

Each tested vehicle was equipped with NOx-measurement instrumentation for a period of approximately one month, accumulating 20 to 30 test-days per vehicle. The second-by-second emissions and supporting engine and vehicle data were recorded and stored, and subsequently post-processed by the WVU Center for Advanced Fuels, Engines and Emissions ("CAFEE"). Of particular relevance, WVU has post-processed the large in-use emission data set using the proposed 3B-MAW protocol, and several variations thereof. WVU's results highlight the multiple problems inherent with the proposed 3B-MAW in-use protocol. [EPA-HQ-OAR-2019-0055-1203-A1, p. 51]

As an initial matter, the three proposed MAW-based "bins" do not actually represent idle, low-load, and medium-to-high load operations. Instead, they amount to a varying amalgam of all three bins when the binning methodology is applied. Moreover, in the end, the 3B-MAW protocol, with three separate in-use standards for each "separate" bin, in effect amounts to three potentially random chances to fail the 3B-MAW-based program. [EPA-HQ-OAR-2019-0055-1203-A1, p. 51]

By moving the proposed 300-second windows forward on a second-by-second basis, each measured one-second data point is included in up to 300 windows. Those windows are then sorted into one of the three bins. That means that single one-second data points end up being sorted typically 300 times into some varying combination of the three bins. For example, when second-by-second emissions data were recorded on a vehicle tested over CARB's "Southern Route," 25% of the datapoints fell into two bins, and 7% fell into all three B-MAW bins, rendering the "data segregation" among the three bins a metaphorical mixed bag. Consequently, under the proposed approach, much of the in-use data ends up being sorted and, in effect, "smeared" across two or even all three of the proposed bins. One consequence of that smearing of results is that the binned data will have limited correlation to any emissions standard that might be applied to the "separate" bins, which undermines the rationale for applying separate regulatory standards to the "separately"-binned emissions data. [EPA-HQ-OAR-2019-0055-1203-A1, p. 51]

WVU's analysis demonstrates the degree to which the 3B-MAW approach can randomly assign data to the 3 "operational" bins. In the graph below from their report, WVU shows how often single data points fall into two or even three bins over the course of a test day, as assessed for the various vehicle categories included in WVU's 100-vehicle test program.11 The percentage ranges shown for datapoints in one or more "bins" for a given vehicle category represent the range of individual test-day outcomes for all vehicles in the category. The chart that accompanies WVU's graph shows that, in the aggregate, more than 26% of the measured datapoints end up in two bins at the end of the accumulated test-days. That level of cross-binning of data demonstrates that the 3B-MAW protocol does not effectively sort emissions data according to the targeted binned engine-operating normalized-power characteristics. [EPA-HQ-OAR-2019-0055-1203-A1, p. 51]

> 11 WVU's nomenclature often refers to the three bins this way: "Bin 1" is the idle bin, "Bin 2" is the low-load bin, and "Bin 3" is the medium/high-load bin.

Another very important consequence of the overlapping window approach is that while some measured datapoints will be included in the data set of a particular bin up to 300 times, other points will be included only once, and other data points anywhere in between. That has the effect of variably weighting individual datapoints in the dataset as a whole, and especially within a given bin. The fact that some datapoints can have up to 300 times greater influence on the averaged bin emissions – most acutely at the start of a vehicle's work day when the emissions system may not be fully warmed up – is not consistent with with a fair compliance assessment protocol. [EPA-HQ-OAR-2019-0055-1203-A1, p. 52]

WVU depicts this variable weighting phenomena in the figure below, which indicates the number of times individual data points are used in each of the 3 bins after a shift-day of line-haul vehicle operation. (To understand how to interpret the graph, consider Bin 2: approximately 40% of the datapoints are used 100 or fewer times, 85.4% are used less than 300 times, and 14.6% are used 300 times.) Again, this does not seem to be a fair way to weigh in-use emissions data. [EPA-HQ-OAR-2019-0055-1203-A1, p. 52]

EPA acknowledges the importance of variable datapoint weighting in the draft RIA. In section 2.2.3.2, EPA writes: In what we believe to be an improvement to a work-based window, we are proposing a moving average window (MAW) approach consisting of time-based windows. Instead of basing window size on an amount of work, the proposed MAW includes a window size of 300 seconds. The time-based windows are intended to equally weight each data point collected. [emphasis added] [EPA-HQ-OAR-2019-0055-1203-A1, p. 53]

Later in section 2.2.3.4 of the RIA, EPA considers data point weighting as justification for their proposal regarding concatenating data over excluded data segments. Here, EPA writes: Except for the data points as the beginning and end of the test and those around long data exclusions, this methodology equally weights emissions at each data point during the in-use testing. We believe this is appropriate, as the under-weighted data points consist of a small percentage of the HDIUT data, which contain a minimum of 10,800 1- Hz data points. [emphasis added] [EPA-HQ-OAR-2019-0055-1203-A1, p. 53]

EPA underscores the importance of equal data point weighting in both of those instances, but fails to consider arguments regarding unequal data point weighting in the instance where it matters most – in the accumulated 1Hz data within any bin where compliance judgments are made. [EPA-HQ-OAR-2019-0055-1203-A1, p. 53]

WVU has broken down the bin placement of data over an almost 4-hour segment of the CARB NTE Southern Route. The second graph in the figure below depicts the bin placement overlap (where bins overlap, and data is being distributed with unequal weighting in the bins), and the fourth graph tracks how many times individual data points are being used in each of the 3 bins.

With every transition from one bin to the next, there is a slow walk of uneven data point weighting. In this data segment of less than 4 hours, there are no less than 13 bin transitions, where a transition culminates into finally achieving equal datapoint weighting in a bin (300 times per data point). It is important to point out that these 13 transition observations are without regard to all of the "partial" transitions where the 300x equal data point weighting goal is not even reached before the transition reverses due to a change in engine load. These data clearly shows a major departure from the equal data point weighting objective. Thus, EPA's emphasis on the value of equal data point weighting falls apart under this analysis, revealing overlapping windows as one of the more serious flaws of the 3B-MAW protocol. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 53 - 54]

The additional graphs below from WVU's report represent approximately 6 hours of data from a line-haul truck (EMFAC category 1a). The upper graph depicts the number of times individual data points (any point along the X-axis) are placed into Bins 1, 2, and/or 3. Based on those data, WVU concludes that it is "obvious from [the figures] that transitioning between different bins results in un-equal weighting of an individual data point in a given bin," which could undermine the objective to regulate in-use emissions in a reasonable and representative manner. [EPA-HQ-OAR-2019-0055-1203-A1, p. 54]

The fundamental problem with this highly variable data point weighting system is that within a bin, when assessing emissions against a bin standard, some data segments (e.g, 20 seconds of data) will be given 10, 20, even 30 times more weighting in the compliance assessment for that bin than other 20 second stretches of data. While EMA has shared this concern with EPA multiple times, the Agency has not even tried to address the issue. [EPA-HQ-OAR-2019-0055-1203-A1, p. 55]

WVU also highlights (in the yellow shaded area in the figure above) a period of 55 to 60 mph sustained highway speed over a period of about 17 minutes. Illogically, the 3B-MAW protocol places the majority of this operation in the idle bin (demarked by the green line). As WVU states, "It is clearly evident from the vehicle speed trace that this type of operation is definitely not typical idle operation that should be compared to the idle emissions standard." [EPA-HQ-OAR-2019-0055-1203-A1, p. 55]

Another example of illogical data placement is presented in the data WVU has captured on a line haul vehicle below. Two segments of data are worthy of note in this test. The first is a 3.3 minute stretch of 55 to 60 mph crusing data, for which all datapoints are included in windows that are placed solely in Bin 1, the "idle" bin. Some 15 minutes later in the same test trace is a 2.3 minute data segment of curb idle operation, for which all data points are included in windows that are placed only into Bins 2 and 3, the "low power" and "medium/high power" bins. [EPA-HQ-OAR-2019-0055-1203-A1, p. 55]

In another assessment of whether the proposed 3B-MAW approach effectively segregates emissions data according to engine-operation characteristics, WVU analyzed the medium/high bin (Bin 3) windows from multiple days of testing of a single line-haul vehicle, and separated those data into three ranges of vehicle speed: urban (<31 mph), rural (>31 and ï,£ 46.6 mph), and highway (> 46.6 mph). WVU's graph below shows the variability in day-to-day emissions results from the three speed ranges within Bin 3, the supposed medium/high bin. Clearly the lower speed ranges of the urban cycle produce overall higher emissions results than the higher speed ranges, and show much greater variability from one day to the next. Thus, there are factors in play that have a more significant effect on the level and variability of in-use emissions than the normalized-power-based bin boundaries that EPA has borrowed from CARB. [EPA-HQ-OAR-2019-0055-1203-A1, p. 56]

Significantly, none of the WVU analyses concerning the problems with the proposed 3BMAW approach, with the exception of the vehicle speed breakdown in the medium/high load bin, has anything to do with specific tailpipe emissions levels or low-NOx technologies. Those results (and problems) would bear out, and the resultant concerns hold true, regardless of whether the analyses involved assessments using today's emisions control systems, enhanced emissions control technologies, or even EPA's Stage 3 RW prototype. Thus, the concerns with the 3B-MAW approach will be present no matter which low-NOx technologies are envisioned.12 [EPA-HQ-OAR-2019-0055-1203-A1, pp. 56 - 57]

12 WVU's Report, Exhibit "A" hereto, contains a more detailed explanation and demonstration of each of the multiple flaws inherent with CARB's unverified and untested 3B-MAW protocol.

Perhaps the most compelling analysis in the WVU Report is a series of figures showing the real-time percentage of operation at normalized CO2-rate data points compared to how the 3BMAW method distributes those same data into the three bins. The figures below break that information down for each of the vehicle-types that WVU tested. As depicted below, the 3B-MAW process distorts the vehicles' true operating characteristics, capturing and redistributing the data in a way that simply does not match the reality of the vehicles' actual operations on the road. The actual real-time second-by-second operation of a category 1b short-haul vehicle, for example, exhibits predominantly idle and very light load operation with a relatively flat distribution of data at low levels of frequency across the rest of the normalized CO2 rage. Compare that true 1Hz operation (in red), however, with the 300-second 3B-MAW windowing process distribution in blue, which shows the same vehicle as having a strong peak of operation at the boundary separating the low and medium/high load bins, an operating profile that clearly and markedly differs from reality. [EPA-HQ-OAR-2019-0055-1203-A1, p. 57]

Similarly, comparing real-time and 3B-MAW distributions of data for a more vocational vehicle application, such as a category 6b food/beverage delivery vehicle, results in a distortion of data that is even more apparent. [EPA-HQ-OAR-2019-0055-1203-A1, p. 57]

Another concerning aspect of the binning process that WVU has analyzed is presented in the following graphics. The basis for the analysis is represented in the two graphs below, which depict the bin placement of the first second of each valid 3B-MAW window when deployed over the FTP cycle. Each data point in the graph is the first data point of a 300 second 3B-MAW window. The horizontal dashed lines represent the bin boundaries (6% and 20%), and the y-axis position of each data point reports the average normalized CO2 level for the window that starts with that 1Hz data point. As shown, the first approximately 300 seconds of the FTP cycle is initiating windows that fall into Bin 2 (between 6 and 20% normalized CO2). Window placement then transitions into Bin 3 where the line turns blue (though the transition takes 5 minutes in total before all data points in those Bin 3 windows have normalized CO2 levels greater than 20%). The windows eventually fall back into Bin 2 over the last portion of the cycle.13 [EPA-HQ-OAR-2019-0055-1203-A1, p. 58]

> 13 The FTP cycle is 20 minutes, or 1200 seconds long. The graphic stops at 900 seconds, because it reports data on the basis of the first datapoint of each window. After 900 seconds, no new 300 second windows are completed (are valid). The last valid window is the one which has its first second of 1Hz data at 900 seconds.

The graph to the right is specific to data that falls into Bin 1 when the FTP cycle is processed through the 3B-MAW protocol. Recalling that any window can be comprised of individual data points with widely varying average normalized CO2 levels (or, practically speaking, average power levels), we can see in the graph at right, for Bin 1, the percentage of the 1Hz data points that were at <6% normalized CO2 (that is, were representative of what EPA calls Bin 1 operation). The percentage of data points in each window that were at Bin 2 and Bin 3 normalized CO2 level can be similarly reported. [EPA-HQ-OAR-2019-0055-1203-A1, p. 58]

With that explanation of the analysis technique, the next graphic indicates the compositional breakdown of three 3B-MAW windows recorded during the FTP cycle. [EPA-HQ-OAR-2019-0055-1203-A1, p. 59]

The first window selected for consideration (where the first 1Hz data point is circled in black in each of the graphs above), is a window that, by the 3B-MAW process, was placed into Bin 2 (as can be seen in the upper graph). That window is comprised of 300 data points, 80% of which are <6% normalized CO2 (and so representative of Bin 1 operation), 7% of which are between 6 and 20% normalized CO2 (representative of Bin 2 operation), and 13% of which are greater than 20% normalized CO2 (represntative of Bin 3 operation). Remarkably, this window, which was placed into Bin 2 (and judged against the Bin 2 standard), has a mere 7% of its 1 Hz data points coming from operation that EPA has determined to be “Bin 2” operation. The other two data points isolated for consideration (circled in blue and red in the graphic above) demonstrate similar gross imbalances in operational representation relative to bin placement when 3B-MAW is applied to the FTP cycle. A similar analysis of the LLC cycle evaluated by the 3B-MAW technique reveals similarly counter-intuitive outcomes (the window initiated at 3400 seconds falls into Bin 2, despite that fact that only 9% of the 1Hz data points are recorded at normalized CO2 levels within the 6% and 20% Bin 2 boundaries.) Clearly, this analysis shows that 3B-MAW is not a logical, reliable system for binning emissions, and, therefore, not a legitimate, representaitve system for setting and enforcing in-use standards. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 59 - 60]

When considering the results of the above analysis, it is important to point out that the FTP is not a “one-off” cycle rarely represented in real world operation. Indeed, the FTP has been the cornerstone of emissions demonstration cycles for more than four decades. Moreover, this imbalance in bin composition will play out in every real world duty cycle. It is also very telling that the FTP cycle, 41% of which, on a time bais, is comprised of idle operation, produces not a single idle bin window when evaluated using the 3B-MAW protocol. That simple fact alone raises serious concern about the validity of the protocol, which has not been validated by even a single minute of real-world chassis testing. [EPA-HQ-OAR-2019-0055-1203-A1, p. 60]

Based on the foregoing, WVU has concluded that the “proposed bin boundaries are misaligned with actual in-use vehicle operations.” EMA fully agrees with WVU’s assessment. Accordingly, significant revisions to EPA’s proposed 3B-MAW protocol are required. [EPA-HQ-OAR-2019-0055-1203-A1, p. 60]

If EPA maintains the 3B-MAW approach in the final rule, which EMA opposes, EMA recommends that the 20% normalized CO2 boundary between Bins 2 and 3 be increased to 25%. EMA bases this recommendation on the emissions characteristics of the 100-vehicle testing conducted by WVU in Southern California. Examining the sum-over-sum emissions characteristics of the fleet is informative. The graph below shows the average sum-over-sum emissions of the fleet as a function of the average normalized-CO2 level for each recorded shift day. The red line indicates the average NOx emissions of all vehicle test-days where the average normalized CO2 level was less than the x-axis value. The blue line indicates the average NOx emissions of all vehicle test-days where the average normalized CO2 level was more than the x axis value. An inflection point in the low average normalized CO2 level data (the red line) is clearly evident at 25% normalized CO2. Accordingly, EMA recommends that the 3B-MAW boundary between the low-power bin and the medium/high power bin be established at 25% normalized CO2 in lieu of the proposed 20% level. [EPA-HQ-OAR-2019-0055-1203-A1, p. 60]

All of the analyses above raise the fundamental question of why EPA is proposing to process data in overlapping windowed segments. Both EPA and CARB have argued that capturing data in windowed segments permits data to be evaluated, at least in part, on the basis of a segment of operating “history.” That argument appears to be reasonable, because the efficiency of the most effective NOx reduction tool, SCR, is dependent upon the catalyst temperature, and therefore the “recent history” of the exhaust temperature profile. The problem with that argument, however, is that the 3B-MAW protocol actually makes no distinction whatsoever regarding the characteristics of engine-operating history within any given window. A window’s bin placement, and therefore its linkage to any relevant in-use standard, is based solely on the average normalized CO2 level (effectively the average power) of that window, without any consideration of the “history” that purportedly compelled EPA to “window” emissions data in the first place. Two windows can end up having mirror-image time traces (engine speed, torque, etc.), one with rising SCR temperature, the other with falling SCR temperature, which can certainly yield very different emissions results. An example of this phenomenon, represented with actual data recorded by WVU, is captured here: [EPA-HQ-OAR-2019-0055-1203-A1, p. 61]

Notwithstanding the clearly different emission results, the 3B-MAW protocol would bin those two differing windows identically, and hold them to the same in-use emissions standards. Consequently, while EPA’s rationale is that engine operating history is important, the 3B-MAW protocol does nothing to account for the particular details of that operating history, and therefore completely undermines the “operating history” rationale for the Agency’s proposal. [EPA-HQ-OAR-2019-0055-1203-A1, p. 62]

The fact that windowing data serves no useful purpose could perhaps be tolerated if the new in-use protocol also did not raise the other concerns at issue, including imbalanced data point and data segment weighting, and illogical bin placement that is disconnected from any vehicle's actual duty-cycle. Yet despite EMA's repeated demonstrations of the need for revisions to the 3B-MAW protocol – again, a protocol that EPA simply copied from CARB – EPA has simply refused to engage on those important issues. In particular, EPA staff have rejected out-of-hand EMA's proposal to adopt a much more straightforward, more representative view of emissions impacts through a "sum-over-sum" approach to assessing a day's emissions performance. Therefore, later in these comments, EMA will make specific recommendations for revising and improving upon the proposed 3B-MAW protocols. [EPA-HQ-OAR-2019-0055-1203-A1, p. 62]

Other problems with the proposed binning proposal become evident when the new Low Load Cycle (LLC) certification test is processed according to the 3B-MAW in-use protocol. A significant number of windows, especially those including long periods of idle followed by a high load "return to service" period of operation, end-up in the medium/high-load bin. Consequently, the portions of the LLC most vulnerable to NOx "breakthroughs" would have to comply with the in-use standard linked to the more stringent FTP/RMC standards, not the higher LLC standard. More specifically, those LLC windows which would fall into the medium/high load bin would have to meet an Option 1 standard of 0.030 g/bhp-hr, established on the basis of the FTP/RMC standard multiplied by the conformity factor (1.5). If a vehicle is in a generally low-load application, a long idle period followed by a high-load return to power could be the only, or otherwise dominant, operating condition where data is placed into Bin 3, putting the in-use test at high risk for a non-compliance determination. The high (and potentially unfair) risk of noncompliance would stem from the fact that the limited amount of Bin 3 data would be the exact type of data that most likely would not meet the Bin 3 standard. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 62 - 63]

EPA envisions that the 3B-MAW protocol will assess emissions performance for all or almost all of a HD engine's operation over its entire shift-day. Indeed, that expectation is one of EPA's primary objectives in implementing a new in-use protocol, given the relatively limited coverage of in-use operations provided by the current NTE method. EMA agrees with that objective. The NTE protocol was often problematic for manufacturers as well, because if there were only a handful of NTE events recorded over a vehicle's in-use test day, just one NOx breakthrough event could mean failing to meet the minimum NTE-based "pass" ratio. Despite EPA's intent, however, a similar risk exists still with the 3B-MAW protocol. A day's testing may very well capture 99% of the vehicle's operating time, yet, depending on the duty cycle, any single "bin" still may have a minimal amount of in-use emissions data stored for assessment. Consequently, EMA supports including a minimum data requirement for each bin, expressed as a number of windows, or total operating time, or a similar metric. [EPA-HQ-OAR-2019-0055-1203-A1, p. 68]

EPA's proposal is to require a minimum of 2,400 windows in each of the 3 bins. When conducting an in-use test, if a day's testing does not accumulate at least 2,400 windows in each bin, the manufacturer must test for as many additional days as necessary to accumulate at least 2,400 windows in each bin. As stated above, EPA supports including a minimum window count requirement because it is important that the HDIUT requirements not create a situation where an engine's emissions compliance is judged on the basis of a small sample of data. However, EMA is concerned about the specific proposal for minimum window counts. [EPA-HQ-OAR-2019-0055-1203-A1, p. 68]

As an initial matter, we are concerned that 2,400 windows, as proposed, could be insufficient to make a robust determination of compliance. EMA understands that this figure, which could represent as little as 40 minutes of data (though in most cases it will include more "real-time" data) is based upon the duration of typical test cell certification cycles. However, test cell certification cycles are not a good reference for this purpose, because there is much more randomness to the duty cycles, ambient conditions, engine operating conditions and other factors that can influence emissions during an actual in-use test compared to the strictly controlled cycle and conditions of a certification test in an emissions laboratory. Data convergence to a reasonably representative level has to occur during the test-day. For this reason, we believe that much longer time periods (i.e., much longer than 40 minutes) are necessary for a fair and reasonable assessment in-use. EPA should demonstrate with representative data how many windows are sufficient to reasonably represent a vehicle's emissions performance in any bin during an in-use test. [EPA-HQ-OAR-2019-0055-1203-A1, p. 68]

To analyze the practical consequences of the proposed 2,400 window threshold, we can turn again to real-world data as recorded by WVU on the 100-vehicle fleet in Southern California. Presented in the table below are the percentage of test-days where <2,400 windows were recorded for the day. The table includes the view for the entire fleet, and for two of the worst-case categories for bin window-count. [EPA-HQ-OAR-2019-0055-1203-A1, p. 68]

It is clear from this data that manufacturers will very frequently encounter test-days that fail to accumulate the proposed requisite number of 2,400 windows in each bin. The data presented here from the 100 vehicle test fleet indicates a higher percentage of vehicles requiring more than one test day than the data EPA presents in Figure 2-24 of the RIA. That data is based on 168 shift days of testing, from which it is estimated that about 8% of test days would fail to meet the 2,400 window minimum in the Idle Bin, about 3% in the Low-load Bin, and less than 2% in the Medium/high load Bin. [EPA-HQ-OAR-2019-0055-1203-A1, p. 69]

WVU's analysis presented in the table above, however, is based on a much more robust and statistically significant 2077 days of testing, and therefore provides a more reliable projection of the probability of the need for additional test days. WVU's analysis also includes assessments of particular vehicle types. To the extent that EPA may select an engine family that is dedicated to light load applications, such as food and beverage or drayage, we can plainly see the very high probability of multiple test-day requirements. Based on more than 400 test-days' experience, drayage applications would require a second day of testing about 34% of the time. Food and beverage distribution would require a second day of testing roughly 70% of the time, based on more than 300 days' worth of testing. That in-use testing burden is not practical or sustainable. [EPA-HQ-OAR-2019-0055-1203-A1, p. 69]

Examination of the likelihood of the idle bin not accumulating 2,400 windows in a test day is especially concerning. EMA therefore supports EPA's proposal to permit the manufacturer to intercede "anytime during the shift day to increase the number of windows in the idle-bin." Due to the “hands-off” nature of the in-use test program, the only real option for manufacturers to make any kind of effort to idle the vehicle for the sake of accumulating windows is at the end of the shift day. EMA nonetheless considers this a reasonable approach and supports the manufacturers’ opportunity to fulfill idle bin requirements in that way. [EPA-HQ-OAR-2019-0055-1203-A1, p. 69]

Unfortunately, if a vehicle is equipped with an automated 5-minute shutdown timer, as required under various state and local regulations, it will not idle for the required time of the proposed amendment without shutting down. The same would be true if the fleet from which vehicle is being tested has programmed the vehicle for automated shutdown after a period of time. The Agency should allow the manufacturer to override the automated shutdown feature where possible, or to “blip” the throttle periodically as needed to reset the automated shutdown timer. [EPA-HQ-OAR-2019-0055-1203-A1, p. 69]

While the option to accumulate additional windows in the idle bin by idling the engine for a period of time is a workable solution to meet the idle bin minimum window count requirements for most vehicles, there are no convenient options to address the minimum window count requirements of Bins 2 and 3 – requirements that will, according to WVU’s analysis, all too frequently require additional test-days. EMA recognizes that there is a tension between having enough data to make a responsible judgment about bin compliance on a test article, while also needing to limit the data requirements to avoid an excessive number of test-days to fulfill the minimum data needs. In the next section, EMA will present additional WVU analyses that demonstrate the need for window count requirements much greater than 2,400 windows to ensure that an accurate and robust assessment is made based on data that has reasonably converged on the average emissions performance of the test article in each bin. The greatly increased number of additional test-days that would be required to accumulate that elevated minimum window count requirement will also be assessed. Additionally, EMA will propose a modification to the 3BMAW process that is responsive to EPA’s request for comments regarding the possibility of combining 3B-MAW bins, and that should largely overcome both the data convergence issue and the multiple test-days issue that undermine the feasibility of the current 3B-MAW proposal. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 69 - 70]

As discussed above, EPA has proposed a minimum window-count requirement for each bin to ensure that sufficient data has been acquired on a test vehicle to accurately judge its emissions control performance in-use. EMA recognizes the importance of that goal, as it is the only fair way to conduct an in-use compliance assessment. We have expressed concern earlier in these comments, however, that EPA’s proposal for establishing a minimum window count of 2,400 lacks a sufficient technical basis. While not discussed in the preamble or the RIA, it is understood from earlier discussions with EPA staff that 2,400 windows was selected as a minimum window count requirement for each bin because the equivalent duration of time represented by 2,400 windows, 40 minutes (actually 45 minutes considering the 5-minute window length), is the time required to complete the RMC steady-state emissions dyno test. [EPA-HQ-OAR-2019-0055-1203-A1, p. 70]

EMA requested that WVU conduct a deeper investigation of data convergence tendencies during in-use testing under 3B-MAW requirements using the 1Hz data recorded from the more than

2200 days of testing of the 100-vehicle Southern California fleet. The results of that analysis are presented in the graphics that follow (the complete summary analysis is included in Exhibit "H"). [EPA-HQ-OAR-2019-0055-1203-A1, p. 70]

By way of explanation, consider the graphs below, which report bin emissions results over one day of emissions testing of a line-haul vehicle. Each graph tracks the bin's sum-over-sum emissions results as they develop, window by window, from the very first window to the very last window acquired in the test day. For each bin, the red line is reporting individual window results as they come in (and is thereby highly variable). The blue line is reporting the bin's cumulative emissions results from all accumulated windows up to any window count point (on the horizontal axis). For example, the first window in Bin 1 had a NOx level of about 14 g/hr. At the time the 2000th window was captured, that 2000th window had a NOx level of approximately 2 g/hr, whereas the cumulative Bin 1 results by that time (representing essentially the average emissions from all 2000 windows per the 3B-MAW process) calculates to just over 14 g/hr. By the end of the test day, some 3,600 to 3,700 windows had accumulated in Bin 1, with the day's Bin 1 results at approximately 19 g/hr. It is interesting to observe how the more extreme instantaneous results "pull" the average up or down. The Bin 2 and Bin 3 results are presented in a similar manner, but using the appropriate metric of g/bhp-hr as required by the 3B-MAW process. By this analysis technique, one can see how individual window results vary widely depending on operating speeds and loads and other varying conditions throughout the day, but, with the accumulation of sufficient windows, the data "settles in" to the reported average day's emissions. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 70 - 71]

If we focus on the "blue line" cumulative bin results, and graph multiple days from a single test vehicle in the same plot (again, for each bin), we can see below how the data convergence trends develop with each test day. The horizontal dashed line represents the average NOx emissions from all of the test days combined. [EPA-HQ-OAR-2019-0055-1203-A1, p. 71]

To support the data-convergence assessment desired from this analysis, it is helpful to normalize individual-day data traces relative to the average emissions results from all test days. This allows us to see the convergence trends more clearly, reducing the effects that the day-to-day variation of bin emissions results can have on clouding the picture of when sufficient convergence is achieved. This is especially helpful when reporting the results from multiple test days with multiple vehicles, and so helps to avoid the disproportionate impacts from the unique emissions characteristics of individual trucks. The results from the normalized data highlight the convergence we are trying to identify, as depicted below: [EPA-HQ-OAR-2019-0055-1203-A1, p. 71]

Also shown in this set of graphs above are the 90th and 10th percentile results (the red lines) from the multiple vehicle, multiple test-day results for these line-haul vehicles. As should be expected, these 90th and 10th percentile levels are very high or very low (respectively) during the earliest portions of each test day, until the windows accumulate, and the data begins converging toward each vehicle's representative emissions. [EPA-HQ-OAR-2019-0055-1203-A1, p. 72]

The most important thing to observe in these graphs is that by the 2,400th accumulated window in each bin, the data (it is best to consider the 90th and 10th percentile trends) appears to have not yet adequately converged to a "settled" level of emissions. This is especially evident in Bin 3, where sufficient convergence does not occur until perhaps 15,000 windows. [EPA-HQ-OAR-2019-0055-1203-A1, p. 72]

These analyses point to the need for significantly more than 2,400 windows in a test day to accurately and fairly assess a vehicle's "nominal" emissions results in each of the proposed 3BMAW bins. The complication that finding presents, however, is a potential need for multiple test days to accumulate the requisite number of windows. For this reason, WVU pulled the test-days' correlation into this data convergence analysis. The process for estimating test-day requirements for various assumed window count requirements was again based on analysis of the 20 to 30 test days conducted on each of the 100 vehicles tested in Southern California. By capturing the number of windows accumulated in each bin from each test day, WVU strung together multiple combinations of test days to generate essentially random effects of combined test day window counts. The technique is explained here: [EPA-HQ-OAR-2019-0055-1203-A1, p. 72]

Probabilities to test multiple days were developed for each vehicle category (line-haul, short-haul, drayage, and so on). Some of the vehicle categories' results are presented in the following pages, along with tables that report the probability of having to test one, two, three or even more days depending upon various minimum window count assumptions. The tables also report the benefits of including the end-of-day idle option to accumulate windows in Bin 1 if necessary (the assumption is that Bin 1 will never compel a second test day on its own). To illustrate, by way of example, a line haul vehicle will have an 81.5% chance of requiring more than 1 day of testing if a minimum window count of 10,000 windows per bin were applied, a 36.3% chance of requiring more than 2 days of testing, and a 15.8% chance of requiring more than 3 test-days, even while utilizing the end-of-day idle test option. [EPA-HQ-OAR-2019-0055-1203-A1, p. 73]

For the Short-haul category: In this case, WVU is also showing the benefits of using vehicles in applications where the engine's activity included a minimum of 3 hours of non-idle operation. [EPA-HQ-OAR-2019-0055-1203-A1, p. 74]

For the entire fleet (all categories combined): In this case, only the 90th and 10th percentiles are plotted by category for clarity (see the table near the introduction of this section to understand the category references in the legend). [EPA-HQ-OAR-2019-0055-1203-A1, p. 76]

In each of the vehicle-category examples presented above, it is clear that the 2,400 minimum window count requirement that EPA has proposed is not adequate to ensure a fair and accurate assessment of a vehicles' emissions performance. It is also clear from the test-day requirement tables that increasing the minimum window-count requirements to more appropriate levels, perhaps 10,000 to 15,000 windows, to ensure a reasonable probability of data convergence, will very frequently lead to two, three, and occasionally even four days of testing as a matter of regular practice. Obviously, that is an untenable situation, as it will present undue burden for manufacturers, and undermine customers' willingness to support the HDIUT program. [EPA-HQ-OAR-2019-0055-1203-A1, p. 77]

There is a question regarding the relevance of the results and conclusions of the foregoing analysis because it is based on test results from engines compliant to US10 emissions standards, rather than engines designed and calibrated to the protocols and the range of emissions standards that EPA is proposing in this rulemaking. In response, EMA first points out that the analyses that relate number of required test-days to minimum window count provisions are completely independent of the emissions levels in question. The consequences are strictly related to operational activity, which is not expected to be altered by the proposed regulations. [EPA-HQ-OAR-2019-0055-1203-A1, p. 77]

Regarding the data convergence tendencies, it is correct that the data that served as the basis for these analyses were recorded on US10 vehicles. However, the relevant data variability will increase, not decrease, relative to the proposed low-NOx emissions standards. That additional variability can be attributed to several of the issues raised in these comments, including (1) the inability to control tailpipe emissions with greater precision than today, without any significant improvements in sensor accuracy or actuator precision, (2) the inaccuracies of PEMS equipment relative to the anticipated standards, (3) other sources of production variability expected to lead to similar absolute levels of tailpipe uncertainty, yet with lower absolute tailpipe emissions levels, and (4) the impacts of system degradation, including SCR efficiency loss, on a control system that depends even more heavily on high catalyst conversion efficiencies than today's US10 systems. Accordingly, it is unlikely that data convergence will occur over fewer windows with future technologies. [EPA-HQ-OAR-2019-0055-1203-A1, p. 77]

If EPA staff believes that this is an invalid assessment, they should produce the data necessary to demonstrate that 2,400 windows are adequate to make an accurate and fair assessment of any vehicle's emissions in any bin. Unfortunately, the Agency's testing of "future technology" is limited to test cell demonstrations, with at most 3 protype test articles, primarily run over dyno based certification cycles, with only a handful of road cycle simulations, also run on an engine dyno. Without creating the robust data to make a better case than EMA has made on these important issues, EPA should use the best available data. The best available data is the 100 vehicle SoCal study conducted by WVU, which is the basis for EMA's analysis. [EPA-HQ-OAR-2019-0055-1203-A1, p. 78]

In the preamble to the NPRM, EPA requests comments on ways to improve the 3B-MAW in-use protocol, including, specifically, combining certain of the bins. The bin combination that EPA discusses briefly in the NPRM is combining Bin 1 and Bin 2. EMA does not find that type of combination to be practical or justified. First, the emissions characteristics of Bins 1 and 2 are very different and less consistent, especially when compared to the greater similarities in the Bin 2 and Bin 3 results. More specifically, the SwRI 800,000-mile results show average brake-specific Bin 1 emissions as calculated by the 3B-MAW process (but in g/bhp-hr to enable comparison of results) across the five road cycles tested to be 0.081 g/bhp-hr, whereas the Bin 2 average is 0.042 g/bhp-hr, and the Bin 3 average is 0.030 g/bhp-hr. The spread in those results (delta from lowest to highest) is significantly more consistent between Bins 2 and 3 than Bins 1 and 2 (Bin 1 spread = 0.113 g/bhp-hr. Bin 2 = 0.015, Bin 3 = 0.024). Secondly, there is interest to have an independent evaluation of the idle condition that EPA proposes to control with the optional low-NOx idle standards. EMA supports that EPA is not proposing a stand-alone vehicle-level idle test such as that CARB proposed in its Omnibus regulations, and instead has proposed to assess idle or near-idle emissions within the 3B-MAW protocol. For these reasons, EMA does not recommend combining Bins 1 and 2. [EPA-HQ-OAR-2019-0055-1203-A1, p. 78]

Instead, EMA and WVU have considered a modification to the proposed 3B-MAW protocol that would overcome the identified data-convergence and multiple test-days issues. One promising modification in that regard is to combine the Low Power (Bin 2) and Medium/High Power (Bin 3) windows into a single bin. [EPA-HQ-OAR-2019-0055-1203-A1, p. 78]

As noted above, EMA finds that the end-of-test idle option is a reasonable approach to meeting the 2,400 minimum window-count requirement in Bin 1. No such convenient method exists, however, to ensure adequate window-count, and thereby adequate data convergence, in Bins 2 or 3 after a day of testing. To remedy that, EMA proposes to combine Bins 2 and 3 into a single bin when determining bin emissions levels. Adding the Bin 2 and Bin 3 windows will greatly improve the chances to avoid multiple test-days when window-count requirements are set to levels that reasonably assess – and converge around – a vehicle's nominal emissions characteristics. [EPA-HQ-OAR-2019-0055-1203-A1, p. 78]

The Bin 2 and Bin 3 definitions with respect to normalized CO2 cut-points can be maintained as a means to ensure that vehicle activity is reasonably distributed across the operating spectrums represented by those bins. By combining those two bins before calculating a combined Bin 2+3 emissions level, to be evaluated for compliance against an appropriate combined Bin 2+3 emissions standard, data convergence can be achieved without the onerous need for multiple test-days to achieve reasonable convergence in the combined Bins 2 and 3. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 78 - 79]

Combining Bins 2 and 3 not only resolves the data convergence and test-day requirements of 3B-MAW as proposed, it is also supported by the Stage 3 RW engine data as reported by SwRI. When this future technology configuration was tested over the five road cycles discussed earlier, the NOx emissions levels of Bins 2 and 3 were largely the same. The enhanced thermal management routines and LO-SCR improvements to control Bin 2 emissions result in Bin 2 NOx levels on par with those in Bin 3, as seen from the Stage 3 RW results (at 435,000 miles equivalent) below.16 [EPA-HQ-OAR-2019-0055-1203-A1, p. 79]

> 16 As mentioned earlier, these results do not consistently comply with the 2031 NOx standards EPA has proposed.

As mentioned, the Agency's proposed Bin 2 and Bin 3 definitions could still play an important role to ensure that manufacturers are demonstrating emissions compliance over a broad range of operational modes. For example, EPA could require that among the total windows accumulated in the combined Bin 2+3, at least some minimum percentage of those windows would need to be Bin 2 windows, and a similar minimum percentage would need to be Bin 3 windows. Such a fleet-level operational activity requirement in the in-use test program would ensure that manufacturers' compliance demonstrations include emissions generated from multiple types of operations consistent with EPA's 3B-MAW definitions. [EPA-HQ-OAR-2019-0055-1203-A1, p. 80]

Consistent with the foregoing discussion, EMA proposes the following adjustments to the 3B-MAW protocol as proposed: Minimum data requirements: Minimum 3 hours of non-idle operation; Minimum 3 hours of non-idle operation should also be an acceptable vehicle screening criteria.; Minimum engine coolant temperature of 20°C. Idle bin (Bin 1) minimum data requirement should be 2,400 windows as proposed: End of test-day idling option should be adopted. Bin 2 + Bin 3 minimum window count requirement: 10,000 windows. Test additional days if not met [EPA-HQ-OAR-2019-0055-1203-A1, p. 80]

Consistent with the foregoing discussion, EMA proposes the following adjustments to the 3B-MAW protocol as proposed: Emissions calculations: Bin 1: As proposed by EPA. Bin 2 + Bin 3: Calculate emissions from all combined Bin 2 and Bin 3 windows as if a single bin. [EPA-HQ-OAR-2019-0055-1203-A1, p. 80]

In the proposal outlined above, the 3 hour non-idle operation requirement is consistent with acquiring adequate data to make a fair and accurate assessment of a vehicle's compliance. With the recommended requirements on fleet-level minimum Bin 2 and Bin 3 activity, manufacturers can modify their vehicle recruitment path as they progress in the test program to meet these targets (with EPA approval as necessary). [EPA-HQ-OAR-2019-0055-1203-A1, p. 81]

Regarding the minimum Bin 2+3 window-count requirement for any test-day, EMA is proposing 10,000 windows. We believe this is the appropriate window-count requirement that balances data-convergence concerns and risks to test multiple days. There is considerable uncertainty with respect to the in-use emissions performance that should be anticipated from the types of emissions control packages that EPA has investigated as the basis for this rulemaking. Considering the infinite number of road cycles that will be encountered in-use, the barely evaluated impacts of NOx breakthroughs (especially those involving cold-start emissions, or resulting from return-to-service events that can be numerous under some untested duty cycles), the range of ambient conditions, the known SCR-degrading impacts of "any commercially available" fuels, the untested durability of cylinder deactivation technology, and all of the other factors that EMA has outlined regarding compliance margin requirements, the need to ensure robust data convergence in this matter is paramount. [EPA-HQ-OAR-2019-0055-1203-A1, p. 81]

In setting the standard for the combined Bin 2+3, EPA must take all of this uncertainty into account, as well as the simple fact that EPA has so far demonstrated that the Stage 3RW package is incapable of meeting the proposed standards, both dyno certificaton standards and in-use standards, despite its having been operated solely in the carefully-controlled laboratory setting. In that regard, EPA cannot simply establish emissions standards on the basis of "wishful thinking." Accordingly, EMA proposes that the Bin 2+3 emissions standard be set at the average of Option 2-like LLC and FTP/RMC standards, adjusted upward by the appropriate in-use conformity factor, which should be 2.0 for at least seven model years before dropping down to 1.5. [Also included in section 11.3.1 EPA-HQ-OAR-2019-0055-1203-A1, p. 81]

SwRI also highlighted what WVU's analyses have revealed: the MAW-based method does not yield any clear trends in emissions behavior, and can disproportionally weight brief spikes in

NOx emissions (i.e., NOx “breakthrough events”). SwRI’s specific observations on those issues is discussed below. [EPA-HQ-OAR-2019-0055-1203-A1, p. 83]

First, SwRI observed that the MAW-based approach “indicates no clear trend [in emissions] other than a high frequency of very low numbers, but the rest of the distribution is scattered somewhat randomly between 0.05 and 0.35 g/bhp-hr.” (SwRI Report, CARB ISOR Reference 191, p.77.) (Emphasis added.) SwRI also noted that the MAW-based approach “provides little information about where emissions are coming from in terms of engine operating modes.” (SwRI Report, CARB ISOR Reference 191, p. 79.) SwRI depicted that overall variability in the MAW-based emissions data as follows: [EPA-HQ-OAR-2019-0055-1203-A1, p. 83]

Second, SwRI, like WVU noted, that the MAW-based approach tends to overweight “return to service events after a long low-load period,” which “could result in an overemphasis of those relatively brief spikes in a Low NOx environment,” with “a large number of windows being driven by a small number of breakthroughs.” (SwRI Report, CARB ISOR Reference 191, pp. 66, 69 and 74.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 83]

EPA Summary and Response

Summary:

There is broad agreement among commenters that the previous in-use not-to-exceed (NTE) testing methodology was insufficient and improvements in the methodology are appropriate. CARB and MFN comment that the NTE method used in the HDIUT program is deficient. Likewise, Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club support HDUIT procedures that capture more of the full range of in-use emissions. Cummins supports a HDIUT testing that includes a broader range of operation, and Navistar supports a workable HDIUT protocol that supports a lower NO_x level. Additionally, EMA comments that the current NTE-based testing process should be revised to incorporate a moving average window (MAW)-based “binning” scheme.

CARB comments that they support a three-bin MAW structure with 300-second windows and 2400 minimum windows per bin. CARB also support the cold start requirements and exclusion criteria in the proposal. Likewise, MFN supports the adoption of the proposed MAW approach. MECA comments that the three-bin MAW approach is better than the current NTE method.

EMA and Daimler comment that the windowing approach proposed by EPA will result in individual seconds of data appearing in multiple bins, effectively “smearing” the data across bins and disproportionately weighting some data points within bins. EMA and Daimler also state that, within a bin, some individual 1 Hz data points are weighted disproportionately, and in particular that brief spikes in NO_x emissions (breakthrough events) can be disproportionately weighted. EMA and Daimler further comment that this process results in uncorrelated data being placed in the same bin. In support of their comment, EMA cites a WVU study that shows more than 26% of the measured datapoints end up in multiple bins. EMA additionally cites examples of data points being included in bins that do not appropriately reflect the 1 Hz operation.

PACCAR comments that they oppose the 3B-MAW requirements, stating that the process will assign a variety of operating conditions to a specific bin, some of which will be inappropriately assigned.

EMA comments that accumulating 2400 windows in each bin for a wide array of vehicle types may be difficult. EMA presents a study by WVU showing that in some application a second shift day would be required for many tests, and state that the additional test burden is not sustainable.

EMA further comments that accumulating 2400 windows in the idle bin in a shift day can also be difficult, and that they support allowing manufacturers to intercede "anytime during the shift day to increase the number of windows in the idle-bin." They also state that the only real option for adding windows is at the end of the shift day.

In addition, EMA states that some vehicles are equipped with an automated 5-minute shutdown timer, required under various state and local regulations, which will turn off the engine after five minutes of idle. They recommend that manufacturers be allowed to override the automated shutdown feature where possible, or to "blip" the throttle periodically as needed to reset the automated shutdown timer.

CARB comments that the provision in §1036.420(c) allowing additional idle to increase the number windows in the idle bin allows additional idle "anytime during the shift day." They state that allowing the additional idle in the middle of the shift day would contradict the real-world behavior of the vehicle, and that additional idle should be restricted to the end of the shift day, for times between 40 and 60 minutes.

Additionally, EMA and PACCAR comment that 2400 windows are inadequate to adequately characterize the operation in non-idle bins. EMA and PACCAR present data, stating that at least 10,000 windows are required for the data to converge and to adequately characterize the operation in non-idle bins. Furthermore, EMA presents data they state shows that, if 10,000 windows were required in both bin 2 and bin 3 in a single shift day, a high percentage of tests would require more than one shift day, leading to an unreasonable test burden. Thus, EMA and Navistar recommend combining bins 2 and 3 into a single bin, and requiring a minimum of 10,000 windows in the combined bin. EMA further states that, optionally, some minimum percentage of the windows in the combined bin could be required to be "bin 2" windows and "bin 3" windows, in order to demonstrate compliance over a range of activities.

EMA further comments that the combination of bins 2 and 3 is supported by the Stage 3 RW engine data as reported by SwRI, where the NOx emissions levels of Bins 2 and 3 were largely the same. EMA recommends that the standard for the combined bin be set at the average of Option 2-like LLC and FTP/RMC standards, adjusted upward by the appropriate in-use conformity factor.

EMA comments that if the current three-bin stricture is maintained, the dividing line between bins 2 and 3 should be moved from 20% normalized CO_2 to 25%.

<u>Response</u>:

EPA has considered comments on combining bins 2 and 3, and setting the minimum number of windows for a valid test. Discussion of these comments is contained in the preamble Section III.C.2.a. Additionally, EPA believes that there is no need to have minimum percentage of operation for bin 2 and bin 3 as the intent is that the engine operation should be representative of how that vehicle operates over the shift day.

EPA agrees with CARB that allowing additional idle in the middle of the shift day is contrary to the intent of real-world testing. EPA also notes that EMA states that the end of the shift day is the only realistic time to add idle windows. EPA's response to these comments and final regulations are described in preamble Section III.C.2.a. The final regulations specify that the ability to add idle time is restricted to the end of the shift day.

EPA's response to comments on individual seconds of data being "smeared" over multiple bins are addressed in preamble Section III.C.2.a. EPA further notes that alternative approaches suggested by commenters like using shorter windows, or even the instantaneous 1-Hz data, can result in segments of data within larger macro-operation being mis-categorized. For example, creep operation (categorized in bin 1) can result in frequent spikes that instantaneously increase CO_2 emissions above the bin 1-2 threshold. Alternatively, short decelerations during high-speed operation will have instantaneous CO_2 emissions under the bin 1-2 threshold, mis-categorizing this operation as idle. Thus, windows of any size would likely result in some data being placed in what might be considered inappropriate bins. The 300 second window length proposed provides an adequate averaging time to smooth any anomalous emission events. See Section III.C of the preamble for a description of the binning structure and how this structure addresses these comments.

EPA also acknowledges some commenters' concerns that individual 1-Hz data points can be weighted differently within the same bin. However, EPA notes that reducing the number of bins from three to two will ameliorate this concern to some extent. EPA further notes that all 1-Hz data points (save those at the beginning and end of the day, and around long exclusions) will be equally weighted across both bins.

11.1.2 Normalizing CO_2 emissions for power

<u>Comments by Organizations</u>

Organization: *California Air Resources Board (CARB)*

CARB staff supports the windows size, binning structure based on the normalized average CO2 rate, 3 bins (idle, low load, and high/medium load), minimum window requirements of 2,400 for each bin, equation for emissions rate proposed in 40 CFR 1036.515, limited data exclusion criteria, and additional requirements for PEMS to limit environmental conditions influence on the accuracy and precision of PEMS. [Also in 11.6.1] [EPA-HQ-OAR-2019-0055-1186-A2, p.57]

Organization: *Cummins Inc. (Cummins)*

The 3B-MAW approach uses the engine's FTP CO2 FCL in calculations to determine both placement of each window into one of the three bins and the brake specific emissions for a bin. However, using the FTP CO2 FCL is not always representative of engine thermal efficiency on other duty cycles such as those encountered during in-use testing. Additionally, CO2 does not always correlate well to power produced, such as when excess fuel is burned for thermal management. Using the FTP CO2 FCL will result in higher emissions calculated for more efficient duty cycles, which penalizes manufacturers with more efficient engines. Cummins shared data as CBI with EPA in May 2020 showing inaccuracies between CO2 and power. One approach to address this issue could be to reconsider the use of broadcast torque to determine work for bin placement and emissions calculations, instead of normalizing by CO2 and scaling by FCL. [EPA-HQ-OAR-2019-0055-1325-A1, p. 13]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

Daimler Truck endorses EMA's comments detailing a number of over-arching concerns related to the proposed 3-B MAW protocol. These concerns are detailed in the '3-BAW and In use Testing' section of the EMA comments, the highlights of which are as follows:

- Despite EMA's best efforts to find a workable NOx-binning protocol, it is clear that using normalized CO2-rate parameters alone is not sufficient to yield a protocol for binning reasonably correlated in-use NOx data. [EPA-HQ-OAR-2019-0055-1168-A1, p.44]

A g-NOx/g-CO2 thresholds approach could have the unforeseen effect of dis-incentivizing improvements in CO2 perfo1mance of an engine. For example, if a new technology is developed that would significantly improve fuel economy, and consequently CO2 emissions, that technology could not be implemented without similar improvements to NOx performance. A theoretical example at low load might be the following engines shown in Table 8, where Engine A and Engine B are two different engines, with similar NOx rates but Engine B has significantly improved CO2 em1ss10ns. [EPA-HQ-OAR-2019-0055-1168-A1, p.48]

Engine B in the example above objectively emits less NOx and less CO2, and is consequently better for the environment than Engine A on any metric. However, when evaluated on a g-NOx/g-CO2 threshold in-use emissions standard, as shown in the example, it would appear that Engine B ranked worse than Engine A. [EPA-HQ-OAR-2019-0055-1168-A1, p.48]

A g-NOx/g-CO2 in-use metric will have the effects of (1) penalizing the development of enhanced fuel economy, i.e. , CO2 measures that can be implemented in the future, and (2) incentivizing worse CO2 performance in certain operating conditions for better a NOx/ CO2 metric. In summary, an engine that is more fuel-efficient is penalized in terms of in-use NOx emissions thresholds compared to engines which are less fuel-efficient. EPA must consider the adverse impacts of such rules-lest they limit potential future CO2 improvements, or worse, cause manufacturers to backslide on CO2 emissions to meet their NOx obligations. [EPA-HQ-OAR-2019-0055-1168-A1, p.48]

Organization: *Truck and Engine Manufacturers Association (EMA)*

The CO2-specific metric that EPA proposes as the basis for assessing in-use emissions under the 3B-MAW protocol includes a factor in the bin emissions calculation that attempts to "correct" for engine efficiency variances. More specifically, the engine family's certified CO2 emissions performance over the FTP cycle is included in Equation 1036.515-5 (calculation of emissions for the low-load bin and medium/high-load bin) as shown below: [EPA-HQ-OAR-2019-0055-1203-A1, p .65]

Including the FTP CO2 correction factor (eCO2FTPFCL) is sensible on its face, because otherwise, reduced CO2 emissions (from a more efficient engine) accumulated in the denominator would increase measured emissions results for a given amount of criteria emissions accumulated in the bin. Multiplying that result by the certified CO2 emissions performance of that engine family would, in theory, inversely reduce the net emissions result, correcting for this issue. ("Efficient" engines having lower FTP CO2 levels generate reduced bin emissions, all other things being equal.) Unfortunately, the FTP CO2 emissions result is not necessarily an accurate assessment of the in use CO2 emissions from an engine. Indeed, it can be quite inaccurate for this purpose. [EPA-HQ-OAR-2019-0055-1203-A1, p. 65]

To demonstrate this point, we turn to additional WVU analysis of the 100 vehicle SoCal test fleet14. In the plot below, each data point represents a single vehicle's performance over approximately 20 to 30 days of testing. The graph compares actual in-use CO2 emissions (in g/bhphr, as would have been accumulated in Bin 2) to the certified FTP CO2 emissions used as the correction factor in Equation 1036.515-5. (The category breakdown is a reference to the various EMFAC categories under which each vehicle application falls). [EPA-HQ-OAR-2019-0055-1203-A1, p. 65]

> 14 WVU presentation, "eCO2 vs bsCO2 comparison for FTP/RMC-FCL;" April 21, 2022.

Examining the two circled vehicle data-points, we have an example where the Category 1a vehicle and the Category 1b vehicle have very similar certified eCO2FTPFCL levels (shown as "eCO2" on the y-axis), yet very different average in-use CO2 emissions over the 20 to 30 days each was tested (as plotted on the x-axis). So, while Equation 1036.515-5 uses the certified FTP CO2 value for each of those engines to "correct" for their inherent efficiency characteristics, the reality is that the more efficient Category 1a engine (the more environmentally favorable engine) would have to accumulate 28% less NOx in the bin (per unit work) to generate emissions results equivalent to those of the less efficient Category 1b engine. Said another way, the more efficient engine in the real-world example above would effectively be held to a 28% more stringent emissions standard. That would be true for all of the criteria emissions constituents. This is an inherently unfair consequence of the in-use emissions protocol that EPA proposes. The fact that the data plotted above was not tested with Stage 3 low-NOx technology or equivalent has absolutely no bearing on the unlevel and unfair outcome described here. One approach to address this issue could be to reconsider the use of broadcast torque to determine work for bin placement and emissions calculations, instead of normalizing by CO2 and scaling by FCL. [EPA-HQ-OAR-2019-0055-1203-A1, p. 66]

EPA Summary and Response

Summary:

CARB comments that they support the use of a binning structure based on the normalized average CO_2 rate.

EMA, Cummins, and Daimler comment that the FTP CO_2 FCL is not always representative of engine thermal efficiency, and using this value in calculations will result in penalizing more efficient engines that produce lower CO_2. In support, EMA presents data showing two different engines could have similar NO_x rates, but very different CO_2 emissions. EMA and Cummins state that one approach to address this issue would be using broadcast torque to determine work for bin placement and emissions calculations.

Response:

In response, EPA disagrees with commenters suggestion to use broadcast torque rather than normalized average CO_2 rate. The data provided by EMA appears not to account for cycle variations in the in-use data; i.e., a high or low percentage of idle from engines of the same efficiency also greatly affects the actual in-use brake-specific CO_2 mass rate. Further discussion on the use of a CO_2 specific metric is contained in Section III.C.2.i of the preamble. As detailed in Sections III.B and III.C of the preamble, we have demonstrated that the off-cycle standards can be met without increasing the CO_2 emissions from the engine over the duty cycles or the fuel mapping test procedures.

11.2 Test procedures (Preamble III.C.2.ii)

11.2.1 Exclusions and data concatenation

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

CARB staff supports the inclusion of a cold start requirements, exclusion criteria, 300 second windowing definition, the creation of windows, valid operation, calculation of window emissions, binning of windows, and calculating bin emissions. [EPA-HQ-OAR-2019-0055-1186-A2, p.65]

CARB staff has concerns with the handling of exclusion events lasting longer than 300 seconds in 1036.515(b)(3)(ii), where windows are cut off and restarted after the invalid period. Aftertreatment devices can maintain thermal management passively through the thermal inertia of the system. Temperatures can be maintained for 10 minutes (i.e., 600 seconds) after transitioning from a heated catalyst to a lower load or idle operation. Emissions control after going into idle operation for an extended period has been demonstrated on the Low Load cycle where similar operation is observed between 4,250 seconds and 5,000 seconds.135 CARB staff adopted 600 seconds as the cut off for restarting the window to account for this. CARB staff suggests inclusion of language similar to language in the Omnibus regulation that creates new windows after 600 seconds. [EPA-HQ-OAR-2019-0055-1186-A2, p.65]

135 Low NOx Demonstration Program – Stage 3. Pg. 131. https://www.arb.ca.gov/lists/com-attach/79-hdomnibus2020-Uj4AaQB2Aj8FbAhw.pdf

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

Daimler Truck endorses EMA's comments detailing a number of over-arching concerns related to the proposed 3-B MAW protocol. These concerns are detailed in the '3-BAW and In use Testing' section of the EMA comments, the highlights of which are as follows:

- The proposal for 'concatenating' data across key-off/key-on cycles will result in an unrepresentative binning of dissimilar data, which will yield wide spreads in the binned results; [EPA-HQ-OAR-2019-0055-1168-A1, p.44]

Organization: *Truck and Engine Manufacturers Association (EMA)*

The proposed provisions at 1036.515(b)(3) relate to managing window concatenation when invalid data segments are recorded. Those provisions specify that a window cannot close unless more than 300 continuous seconds of invalid data are encountered. Otherwise, the window must continue to accumulate data until 300 seconds of valid data are captured to close the window. [EPA-HQ-OAR-2019-0055-1203-A1, p. 66]

Careful management of the procedures regarding concatenation is very important, as an analysis of the WVU 100-vehicle Southern California fleet data shows. EMA supports EPA's decision to reduce the 600s continuous invalid data criteria that CARB finalized in their Omnibus regulation to 300s. When WVU examined the impact of this change on tests of EMFAC Category 6b vehicles (Heavy towing/moving),15 the improvement in maximum window length is significant, as seen here: [EPA-HQ-OAR-2019-0055-1203-A1, p. 67]

15 WVU analysis, "Summary Results – 3B-MAW – Window Size Analysis CARB vs EPA;" April 1, 2022.

It makes no sense to allow windows to be open for extended periods of time, as much as 1000s (16 minutes) or more, when any connection that may actually exist between operational characteristics and emissions rates (according to EPA's own arguments) is completely lost. The longest window duration WVU observed when using the 300s continuous invalid data criteria is 1976s (more than 30 minutes). That is far too long. EMA supports the adoption of the proposed 300s concatenation criterion, but recommends that EPA limit that maximum size of any window to 900s (three times the nominal window length). [EPA-HQ-OAR-2019-0055-1203-A1, p. 67]

EPA appropriately proposes to exclude data that includes regeneration events (§1036.515(c)(3)). EPA should also provide an exclusion for windows accumulated for a period of time after the regeneration event is complete, to allow emissions control to be restored in a way similar to that provided for in proposed §1065.680. The SAE J1939/J1979 standards may require updating to support this proposal. [EPA-HQ-OAR-2019-0055-1203-A1, p. 67]

EPA Summary and Response

Summary:
CARB comments that they support the exclusion criteria. However, CARB states that windows should be concatenated across exclusions up to 600 seconds in length, rather than 300 seconds. In support, CARB states that aftertreatment temperatures can be maintained for 600 seconds after transitioning from a heated catalyst to a lower load or idle operation.

EMA and Daimler comment that they support the 300 second continuous invalid data criterion but recommends that the maximum length of real time any window can be concatenated across be limited to 900 seconds. They state that, without this limitation, a WVU study showed some windows could be concatenated across over 30 minutes of real time, and that concatenating this wide band of data would result in grouping of dissimilar data.

Response:

EPA agrees with CARB that windows should be concatenated across exclusions up to 600 seconds in length, rather than 300 seconds. In the preamble of the proposal, we proposed concatenation across exclusions up to 600 seconds; however, the proposed regulation amendatory text inadvertently stated 300 seconds. Consistent with the intended proposed requirements, the final regulation text we are promulgating in this final action specifies that concatenation across exclusions is limited to 600 seconds or less.

EPA disagrees with EMA and Daimler that concatenating data across a wide span of real time is likely to combine dissimilar data into a single bin. We see no reason to limit the maximum real time length of any window to 900 seconds. The only scenarios that justify starting a new window is when an extended period with the engine off results in the engine cooling off. Repeated short exclusions are unlikely to cool off the engine and aftertreatment. For this reason, we do not see a reason why repeat exclusions events would make combining data into a single window invalid. EPA also disagrees that the limit on concatenating data should be 300 seconds as the engine and aftertreatment have not cooled off enough over 300 second to adversely affect emission performance. Therefore, we are finalizing 600 seconds as proposed. This is further supported by the fact that the soak period between the cold and hot test intervals of the FTP is 1200 seconds.

11.2.2 Ambient temperatures and temperature exclusions

Comments by Organizations

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

Apart from the concerns highlighted above and detailed in the EMA Proposed Rule Comments, we elaborate below on a number of major pitfalls of associated with the proposed 3B-MAW in use analysis protocol, namely issues related to: (1) in-use cold start; (2) the lack of in-use real-world test data; (3) interactions with OBD requirements; and (4) the fact that in-use g-NOx/g-CO2 metrics fail to adequately scale for emissions. [EPA-HQ-OAR-2019-0055-1168-A1, p.44]

EPA's Stage 3 technology demonstration fails to prove technological feasibility, as real world environmental boundaries are not reflected in the proposed in-use testing procedures. For cold conditions, EPA's technology demonstration work was done in the test cell for cold FTP. EPA did not perform vehicle testing in the technology demonstration and hence there has been no environmental testing beyond the test cell conditions. It is well-known that engine oil and coolant temperature limits at the start of the engine crank for a valid cold FTP are in the range of 20 to 30 degrees Celsius. The Stage 3 technology demonstrated by EPA at SWRI was never tested in conditions characterized by engine coolant/oil temperature outside of the range accepted for cold FTP testing, and no data is available for cold starts with coolant and oil temperature below 20 degrees Celsius. Some of these Stage 3 demonstrated technologies, such as cylinder deactivation and EGR cooler bypass, can be affected by engine oil and coolant temperature due to combustion instability, increased load due to increased oil viscosity and friction losses, and EGR condensation. [EPA-HQ-OAR-2019-0055-1168-A1, pp.44-45]

The proposed 3B-MAW in-use testing procedure as written in the Proposed Rule extends the engine cold start boundaries down to -7 degrees Celsius ambient temperature, which is the same boundary condition in the current in-use NTE test procedure, but the proposed 3B-MAW test procedure would remove any exclusion of data based on coolant/oil temperature. Moreover, it does not offer any weighting protocol for the data collected immediately after cold start. In a test cell, the cold FTP emission data contribution to the final composite FTP is 1/7, but there is no such reweighting of the cold emission data in the in-use test procedures. This creates a significant mismatch between what is demonstrated in a test cell on a cold FTP versus what it is feasible in more challenging real world environmental conditions. [EPA-HQ-OAR-2019-0055-1168-A1, p.45]

By way of illustration, imagine the engine block, pistons, crank shaft and all the engine hardware cold soaked at -7 degrees Celsius—and the engine is supplied with air and fuel at these same cold temperatures. These cold temperatures will necessarily affect combustion kinematics and limit the options that manufacturers can use to control their emissions. The longer ignition delays impact combustion stability and efficiency due the combustion reactions starting late in the combustion cycle, leading to HC and white smoke emissions. High EGR under these conditions further increases the ignition delay, further negatively impacting combustion. Additionally, the control setpoints and functions needed to perform effective thermal management may not always be feasible in real-world conditions during the cold start with coolant/oil temperatures below 20 degrees Celsius, down to -7 degrees Celsius. These effects combine to slow the rate at which the system can warm the aftertreatment, significantly increasing emissions in the period when the catalyst has not reached reaction temperatures. EPA is aware of these effects but has not evaluated the effectiveness of its system during even moderately cool conditions. In fact, EPA and SWRI have not tested the system outside of test cell conditions, with a minimum ambient temperature of 20 degrees Celsius. [EPA-HQ-OAR-2019-0055-1168-A1, p.45]

EPA cannot claim to have demonstrated feasibility of the proposed standards without evaluating the system in all conditions in which it will be evaluated for compliance, especially in cold ambient temperatures that directly affect the system's ability to comply. EPA must either evaluate its system performance in these conditions or concede that the proposed standards are not feasible and adjust their rulemaking accordingly. Daimler Truck provides several recommendations to remedy this issue in Section III.E of these comments (regarding in-use test procedures). [EPA-HQ-OAR-2019-0055-1168-A1, p.45]

One notable deficiency of the EPA technology demonstration program is the lack of in-use real-world data. EPA Stage 3 testing at SWRI has shown emission results of the UL NOx system on test cell cycles that could be defined as 'vehicle simulation cycles.' These vehicle simulation cycles were created using real-world data; however, playing a repeat of engine speed and torque in a test cell is not fully representative of the challenges of an in-use test, including ambient conditions, real world fuel, aftertreatment hysteresis effects, and more. [EPA-HQ-OAR-2019-0055-1168-A1, p.45]

First, these vehicle simulation cycles were run at standard test cell conditions. Combustion air temperature, coolant temperature and humidity were well-controlled, the engine was already warmed up, and no cold start data was included in the study. Moreover, no cold start representative of – 7 degrees Celsius ambient temperature was ever performed, thus leaving doubts about the feasibility of running engine modes characterized by high rates of EGR and cylinder deactivation in these conditions. [EPA-HQ-OAR-2019-0055-1168-A1, p.46]

EPA's Off-Cycle Testing requirements should exempt in-use emissions data at coolant and oil temperatures less than 20 degrees Celsius, and ensure that shift-days contain, at a maximum, the same fraction of cold start testing as a Cold/Hot FTP, to ensure comparability with On-Cycle testing. [EPA-HQ-OAR-2019-0055-1168-A1, p.64]

It should be expected that all temperature-dependent emission control systems have reduced effectiveness at lower temperatures. This is evident in the early start portions of the FTP, but is exacerbated in colder temperatures, as it takes the engine longer to warm up a cold aftertreatment. The issue is further complicated by the fact that many engine temperature management strategies, which are effective in the conditions demonstrated on the FTP, or on the relatively warm in-use simulations performed, are not useable at the cold ambient temperatures and cold engine coolant/oil temperatures that EPA proposes. Specifically, aggressive combustion functions such as multiple injections, aggressive EGR rates, reduced boost, and cylinder deactivation strategies may not be useable, or may have reduced effectiveness, in these conditions. [EPA-HQ-OAR-2019-0055-1168-A1, p.66]

EPA makes no effort to evaluate whether any proposed technology is capable of providing the required emissions reductions at ambient and engine temperatures below 20 degrees Celsius. Nonetheless, the proposed off-cycle requirements would hold engine manufacturers responsible for all emissions, including cold start emissions, in ambient conditions as low -7 degrees Celsius, with no allowance for cold coolant/oil temperatures. [EPA-HQ-OAR-2019-0055-1168-A1, p.66]

In the existing in-use test protocol, EPA currently excludes emissions from in-use testing below a moderate coolant temperature threshold (roughly 70 degrees Celsius), because the Agency rightly acknowledges some emissions control mechanisms are not effective or feasible with cold engine conditions. Daimler Truck recommends that EPA analyze the state of emissions technology and its applicability at cold coolant and oil temperatures, and how this technology might be evaluated in-use under the current proposal—such as cold start emissions control on days with ambient temperature at or below 0 degrees Celsius. Without this analysis, EPA cannot determine the extent of emissions reduction that are feasible in such conditions. [EPA-HQ-OAR-2019-0055-1168-A1, p.66]

In other words, the off-cycle emissions test (intended to validate that engines are providing the same emissions performance they were originally certified to) must not hold the engine to emission standards and testing regimes that EPA's emissions standards do not attempt to test (such as cold ambient conditions), and whose feasibility has not been demonstrated. [EPA-HQ-OAR-2019-0055-1168-A1, p.66]

Daimler Truck believes that such an analysis will show that EPA must create an exclusion for these very cold coolant/oil temperatures, below the conditions on the Cold FTP. To resolve this issue, **we recommend that EPA create targeted cold start exemptions in the area where it is expected emissions controls will not, and cannot, be fully effective.** [EPA-HQ-OAR-2019-0055-1168-A1, pp.66-67]

Specifically, EPA should exclude cold start data when the engine coolant and oil temperatures are lower than 20 degrees Celsius. Given the opportunity to warm up the engine, we expect that the same emissions controls demonstrated on the FTP could be leveraged to rapidly warm the system and reduce NOx emissions at the same level demonstrated on the FTP—even when ambient temperatures are as low as -7 degrees Celsius. [EPA-HQ-OAR-2019-0055-1168-A1, p.67]

The relative effect of such an exclusion on the overall representativeness of the off-cycle test would likely be negligible, as it would only ever come into effect on days when the engine was completely cooled down to ambient temperatures, and the ambient temperature was below 20 degrees Celsius. While these cold start conditions are expected to occur relatively frequently, their duration is expected to be very short—engines warm up quickly, and, as they do, coolant/oil temperatures would rapidly exceed this 20-degree threshold. Further, all engines are already required to have diagnostics to detect failures that prevent the engine from warming up to thermostat operating temperatures—much higher than the threshold proposed here. This would ensure that all vehicles warm up, or otherwise illuminate a malfunction indicator light (MIL) indicating their need for repair. [EPA-HQ-OAR-2019-0055-1168-A1, p.67]

In Figure 29 below, Daimler Truck provides an analysis of the EMA-WVU data referenced in Section III.B, which shows that, in this dataset, the proposed coolant/oil temperature exclusion would have no effect on most shift-days of operation. [EPA-HQ-OAR-2019-0055-1168-A1, p.67]

Even when the dataset is filtered for only shift-days when the exclusion becomes active, the vehicles warm up so quickly that less than 1% of the shift-day's data is excluded. [EPA-HQ-OAR-2019-0055-1168-A1, p.67]

While other datasets in colder ambient conditions may contain slightly more data in these conditions, Daimler Truck expects that they would number in the minutes per shift-day. [EPA-HQ-OAR-2019-0055-1168-A1, p.68]

EPA's off-cycle test procedure must provide for adequate weighting of cold engine operation, to ensure the proposed standards are achievable. [EPA-HQ-OAR-2019-0055-1168-A1, p.68]

EPA's proposed off-cycle test procedure would, for the first time, test significant cold operation. EPA already rightly recognizes, in the proposed FTP procedure, that cold engine operation must be weighted less heavily than equivalent hot operations. The Agency adjusts for this by weighting the emissions contribution from the Cold Start FTP at 1/7th, and the Hot Start FTP at 6/7th, of the total emissions evaluated in the FTP. Any engine would exceed EPA's proposed emissions standards if only its Cold FTP emissions results were compared to the standard, without being adequately weighted against hot operation. [EPA-HQ-OAR-2019-0055-1168-A1, p.68]

Since EPA's proposed test measures cold operation, and bases the proposed off-cycle emissions standards for each bin on the on-cycle emissions standards, it is critical that the applicable test procedures do not result in a higher fraction of cold operation than what is included in the underlying on-cycle tests. As explained above, the off-cycle emissions test must not hold the engine to stricter standards than the on-cycle emissions tests. Under EPA's proposal, it is possible that engine off-cycle emissions could be evaluated in conditions with significantly more cold operation than represented by the FTP. [EPA-HQ-OAR-2019-0055-1168-A1, p.68]

Daimler Truck recommends that EPA control for this by requiring a maximum amount of cold operation weighting during any evaluated shift day. We recommend that each bin in the off cycle test be evaluated for the percent of windows that resemble 'cold start' operation. If this value exceeds the percentage as measured on the FTP for the same engine, the results could be weighted to resemble the FTP. An example equation is provided below: Bin SOS NOx = [(1/Ccold) * (NOx/CO2)cold windows + (1- 1/Ccold) * (NOx/CO2)hot windows] x FTP FCL (Where Ccold represents the relative weighting of Cold operations on the FTP, as determined by a proxy such as coolant temperature or cumulative engine work.) [EPA-HQ-OAR-2019-0055-1168-A1, pp.68-69]

Organization: *Navistar, Inc. (Navistar)*

Navistar is also concerned that EPA has not adequately addressed the return-to-service events in 3B-MAW procedure. The nature of vocational pick-up and delivery, as well as other commercial truck operation, requires drivers to periodically stop and unload freight or conduct other work operations. The "dwell" period at each discrete stop may be minutes or hours in duration depending on the application. The 3B-MAW protocol should take each of these events into consideration and address them in a consistent manner. The primary concern is that aftertreatment temperature may drop to a level, which will not provide a high initial conversion efficiency when the truck returns to service. Consequently, any high load transient event would result in a momentary spike in emissions that may display the emissions control system has malfunctioned, when in fact the system is transitioning up to normal operating temperatures. We recommend that engine coolant temperatures below 70C immediately after a return-to-service event be excluded from binning. Only when coolant temperature exceeds 70C would data collection resume. We further recommend that the proposed -7C ambient test exclusion be increased to 20C to more accurately reflect real-world conditions that may contribute to ozone formation. [EPA-HQ-OAR-2019-0055-1318-A1, p. 5]

Organization: *PACCAR, Inc (PACCAR)*

Exclusions – EPA should consider a higher threshold for the proposed ambient temperature exclusion of -7 °C. For the current HDIUT program the NTE cold temperature operating exclusion is based on a formula that considers intake manifold temperature and pressure. For PACCAR trucks the exclusion becomes active at an ambient temperature between 5 and 20 °C depending on conditions. The new HDIUT program will drive considerable changes due to the -7 °C ambient temperature threshold and much lower standards. The amount of heat needed to maintain an effective SCR temperature increases exponentially as temperature decreases. This is due to exhaust temperature being proportional to intake temperature and secondly as ambient temperature decreases heat loss through the walls of the exhaust system increases. More heat is needed and less is available, so manufacturers would need to design and calibrate their heating strategies to deliver an exponentially increasing large amount of energy into the exhaust as temperature decreases to meet in-use NOx limits at very cold ambient temperatures. While technologies exist that can aid in raising exhaust temperature (i.e., CDA) those technologies will have already been leveraged so the vast majority of the marginal energy increase for exhaust heat will come from increased fuel consumption. Furthermore, the capacity to deliver the necessary energy to the exhaust at -7 °C could require hardware changes that drive significant costs. [EPA-HQ-OAR-2019-0055-1346-A1, p.30]

The commercial trucking industry in the United States annually consumes about 40 billion gallons of diesel fuel so even a 0.2% fuel consumption increase will add nearly one million tons of CO_2 to the atmosphere annually. Because roughly half of truck operation occurs in conditions that are too cool to form ground level ozone, there is a significant opportunity to mitigate climate change by considering the ambient temperature exclusion for in-use NOx emissions. [EPA-HQ-OAR-2019-0055-1346-A1, p.30]

A more targeted approach would be to keep the ambient temperature exclusion at -7 °C and add another exclusion that would be active only when catalytic aftertreatment temperatures are below 250 °C that extends to a higher ambient temperature. This which would be similar to the exclusion for catalytic aftertreatment temperatures as codified in 40 C.F.R. 86.1370(g), except this exclusion would only be allowed during cold ambient conditions. This could be thought of as a 'GHG exclusion for cold ambient,' and would ensure engines continue to meet standards under most operating conditions while not being compelled to deliver an extreme amount of energy to the exhaust when the CO_2/ozone cost benefit is disproportionately high. Emissions control systems would still be required to be functioning in the exclusion zone due to requirements for Auxiliary Emission Control Device (AECD's). The nuance is that the -7 °C ambient temperature exclusion as proposed in the NPRM drives up the design target for the maximum capacity of the heating strategy increasing cost, possibly excluding technical options, and causing more GHG emissions. PACCAR believes the proposed exclusion is narrow enough to have no meaningful impact on formation of ozone or secondary PM. [EPA-HQ-OAR-2019-0055-1346-A1, pp.30-31]

PACCAR further encourages the EPA adopt: Ambient temperature exclusion: Increase the threshold for the ambient temperature exclusion proposed at -7 °C to a higher value or add a new exclusion only active under both the following conditions: · Catalytic aftertreatment temperature below 250 °C · Ambient temperature below a more modest threshold than -7 °C. [EPA-HQ-OAR-2019-0055-1346-A1, p.31]

PACCAR respectfully submits that EPA should revised proposed 1036.515(b)(1). Specifically, EPA should increase the allowable maximum engine coolant temperature at start of testing to 40°C rather than 30°C. If EPA chooses not to exclude cold starts in this manner, and also chooses not to combine Bins 2 and 3, then all cold start activity should be excluded from Bin 3, and only the first cold start should be included to prevent cold-start operation from being improperly over weighted during the test (i.e., successive cold starts should be excluded as should engine operation with a coolant temperature below 20°C). Moreover, data should be excluded completely or excluded from Bin 3 for five minutes post regen due to ammonia storage depletion that is caused by the regen event. [EPA-HQ-OAR-2019-0055-1346-A1, pp.58-59]

Ambient temperature exclusion: Increase threshold for the ambient temperature exclusion proposed at -7 °C to a higher value. [EPA-HQ-OAR-2019-0055-1346-A1, p.60]

Organization: *Truck and Engine Manufacturers Association (EMA)*

The issue of return-to-service events unduly impacting Bin 3 NOx emissions is exacerbated by conditions where the return-to-service emissions are generated shortly after a cold start. On occasions where a vehicle is started for the first time in the day, or started after an extended key off condition on a cold day, and soon after enters into a high-load condition, those emissions could almost exclusively be placed into Bin 3. It would take a considerable amount of Bin 3 operation under fully warmed operating conditions to dilute the cold start emissions to a level compliant to the very stringent Bin 3 standard. There can be no guarantee, of course, that sufficient operating time will accumulate in Bin 3 to do so. To address this issue, EMA recommends that EPA include a process to avoid accumulating cold-start emissions in the very stringent Bin 3. Cold-start engine conditions are associated with low SCR core temperatures, which are more representative of EPA's goal to segregate Bin 2 low-load emissions. Cold-start emissions therefore should be held to the Bin 2 emissions standard. EMA recommends that all Bin 3 windows recorded when the coolant temperature is less than 70°C at any point in the window should be placed in Bin 2 instead of Bin 3. The coolant temperature threshold of 70°C is consistent with CARB's cold operation exclusion applicable to MY 2024 through 2026 engines, and is a reasonable threshold to apply in this case. [EPA-HQ-OAR-2019-0055-1203-A1, p. 63]

The cold-start emissions profile is one that requires serious consideration. If EPA were to adopt a modified version of 3B-MAW, for example, the proposal that EMA details in subsections h. and i., below, the Agency would need to consider alternative methods to accommodate the very high emissions that would result if the engine were heavily loaded shortly after restart. This is especially true for a vehicle that may be stopped for prolonged periods of at least 30 minutes, 2 to 3 times or more per day. If the aftertreatment cools to levels unsupportive of NOx conversion, the initial NOx emissions surge could be impossible to recover from over the course of the remainder of the day's operation. This problem becomes even worse under conditions approaching EPA's minus7oC proposed ambient temperature threshold. One approach to limiting the impact that cold start emissions can have on the NOx compliance assessment is to limit the effective "weighting" that cold-start emissions can have in any bin. That would involve mathematically ratioing-back the time-based or work-based content of the cold-start emissions in the bin to some maximum regulated level. That would permit capturing and using all the data, but without unduly jeopardizing the compliance assessment because the day's operation included multiple cold-starts, potentially even in cold ambient conditions. [EPA-HQ-OAR-2019-0055-1203-A1, p. 63]

In that regard, the total impact of cold-start emissions associated with EPA's Stage 3RW engine and aftertreatment have barely been evaluated during this rulemaking. The FTP compliance evaluation with the Stage 3 engine only included a cold-start from 20 to 25oC. (tellingly, that cycle generated a non-compliant result, measuring 0.022 g/bhp-hr, so it is clear that there is little room for compromised NOx control due to cold starts from even colder temperatures.) The few tested road-cycles included cold-start operation, but again, never at temperatures less than the engine dyno 20 to 25oC range. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 63 - 64]

This discussion of cold ambient operation brings us back to the fundamental question of the technical feasibility of the proposed standards. The NPRM has been drafted without any testing experience in cold ambient conditions. But, as mentioned, EPA is requiring compliance down to minus-7oC. The Stage 3 engine has demonstrated only marginal or even non-compliant results over the 3B-MAW test protocol under the favorable test cell conditions. There is absolutely no on-road experience with this technology package, leaving it without any evaluation in cold ambient conditions at minus-7oC. In addition, EPA has no plans to conduct any testing under those extreme ambient temperatures before the regulation is finalized. In the absence of any direct evidence of how EPA's stringent requirements will be impacted by cold ambient conditions, it is imperative that the Agency provide protections from non-compliance determinations under those types of conditions. Accordingly, EMA recommends that EPA include a coolant temperature exclusion threshold of 20oC. [EPA-HQ-OAR-2019-0055-1203-A1, p. 64]

Maintaining compliance to the very stringent NOx standards that EPA is proposing all the way down to minus-7°C (20°F) ambient temperatures would require aggressive thermal management strategies to maintain exhaust temperatures conducive to high SCR NOx-conversion efficiency. Aggressive thermal management strategies under those very cold conditions (minus- 7°C, or 20°F) will lead to high levels of CO2 emissions as the controls work to heat the SCR. Those high CO2-emitting strategies will be active under cold ambient conditions where ozone formation does not even occur. The Agency should seriously consider whether the minus-7°C compliance threshold is striking the right balance in the CO2/NOx tradeoff. EPA should consider increasing the ambient temperature exclusion to a level closer to where ozone formation might be expected. Such a revision in the final rule would avoid the need to deploy high GHG-emitting thermal management strategies during operations in cold ambient conditions when ozone formation does not occur. [EPA-HQ-OAR-2019-0055-1203-A1, p. 64]

Returning to engine cold-start conditions, EPA has proposed to invalidate a test is if the engine coolant temperature at the point of first engine start for the day is more than 30°C (86°F). Such a requirement is overly restrictive, especially given the ambient temperature conditions typical over much of the southern U.S. For example, consider the proposed requirement in the context of the typical in-use test scheduling process. Should a manufacturer cancel all in-use testing for the day because the engine's coolant temperature failed to drop below 30°C during the course of the evening? What judgment is the in-use test team supposed to use to feel confident enough to start the engine and not witness the flow of warmer water resting in the engine block immediately increase to temperatures >30°C as that water flows past the temperature sensor? [EPA-HQ-OAR-2019-0055-1203-A1, p. 64]

Any such outcome would render the scheduling, time, resources and inconvenience to the customer's operations for naught if the test were to be declared invalid as EPA proposes. The Agency should remove the maximum coolant temperature criteria at engine-start, or at least increase it to 40°C to reduce the chances of this kind of wasteful outcome. The additional 10°C lower threshold that EPA proposes adds very little to the representativeness of the test data in terms of assessing compliance to in-use standards. EMA is not recommending to eliminate any data in the day's testing by this recommendation. Indeed, we are only recommending a small adjustment to the parameter that would declare a test fully invalid. [EPA-HQ-OAR-2019-0055-1203-A1, p. 64]

EPA Summary and Response

Summary:

Daimler, Navistar, PACCAR, and EMA disagree with the proposed rule's exclusion of data when ambient temperatures are below -7°C from being subject to the off-cycle standards. Daimler and EMA state that an additional exemption should be incorporated, exempting in-use emissions data at coolant and oil temperatures below 20°C. In support of EMA's position, they state that the Stage 3 technology demonstrated by EPA was never tested below 20°C; they further state that some of the technology in the demonstration will be adversely affected by colder oil/coolant temperatures, making it infeasible to maintain low NO_x emissions.

Daimler further comments that the effect of an oil and coolant temperature exemption below 20°C would be negligible, as the time duration of the exclusion would be short. In support, Daimler cites a WVU analysis of an in-use data set, which they state shows that this exclusion would affect a minority of the shift days in the dataset, and for those where the exclusion would be active, less than 1% of the data are excluded. EMA further comments that aggressive thermal management strategies used at very cold temperatures where ozone formation does not occur would lead to high levels of CO_2, and thus the CO_2/NO_x tradeoff over the temperature range should be re-evaluated.

Navistar also states that the low temperature ambient threshold should be set to 20°C. Navistar further states that data with engine coolant temperature below 70°C be excluded. They state that after extended dwell periods in which engine coolant and aftertreatment temperatures drop, a return to service event may cause a momentary spike in emissions. PACCAR further states that the ambient temperature threshold should be raised, or as an alternative, a more targeted approach could be adopted, which would be to exclude operation with catalyst temperatures below 250°C.

Additionally, Daimler and EMA comment that cold engine operation should be weighted, such that each bin of the in-use test contains a percentage of windows that resemble "cold start" operation which is no higher than the percentage as measured on the FTP for the same engine. They state that cycles which place most cold start emissions in any one bin would unduly jeopardize the compliance assessment.

PACCAR and EMA comment that the allowable maximum engine coolant temperature at start of testing should be raised to 40°C rather than 30°C. EMA further states that the limitation is overly restrictive, given the typical in-use test scheduling process and ambient temperature conditions typical over much of the southern U.S., and that maintaining the 30°C threshold may lead to wasteful delays in testing.

PACCAR also comments that data should be excluded completely or excluded from Bin 3 for five minutes after regeneration due to ammonia storage depletion that is caused by the regen event.

PACCAR and EMA comment that, if Bins 2 and 3 are kept separate, then cold start data in Bin 3 should be treated separately, to prevent over-including these high emissions in the stringent Bin 3. PACCAR states that all cold start activity should be excluded from Bin 3, and EMA states that all Bin 3 windows recorded when the coolant temperature is less than 70°C at any point in the window should be placed in Bin 2 instead of Bin 3.

Response:

After further consideration, EPA agrees with the concerns of Daimler, Navistar, PACCAR, and EMA regarding exclusion of data when ambient temperatures are below -7 °C and that the temperature limit EPA proposed was too low. EPA has received and reviewed data from SwRI testing the Stage 3 system at low temperatures over the Southern NTE route and Low Load Cycles. EPA is increasing the ambient exclusion temperature and incorporating an adjustment to the numerical value of the standard for temperatures below 25 °C, as described and for the reasons explained in Section III.C.2.ii of the preamble.

EPA disagrees with Navistar's recommendation that operation with coolant temperatures below 70°C be excluded. EPA also disagrees with PACCAR's proposal that operation with catalyst temperatures below 250°C be excluded. In both cases, important initial cold start operation would be excluded from all tests, and a number of return to service events would also be excluded. These are important operational regimes, and the MAW protocol is intended to capture emissions over the entire operation of the vehicle. Moreover, these exclusions would create incentives for manufacturers to cool down the aftertreatment or oil temperatures in order to exclude return to service events, thus increasing total emissions during in-use operation.

Additionally, because the moving average window test procedure averages data collected over the shift day, the time where the coolant temperature is below 70 °C should only be a small percentage of the total time in the bin, which will only have a small impact on the binned emissions over the entire shift day.

EPA disagrees with Daimler's comment that operation with coolant and oil temperatures below 20°C should be excluded. As discussed in preamble Section III.C, the standards are feasible without excluding this operation. Regarding any increase in CO_2 emissions from controlling NO_x under this operation, we have determined that the overall potential impact on CO_2 is small since, as stated by Daimler, the time when coolant and oil temperature are below 20°C is a small percentage of the total time the engine is operated over the entire shift day.

EPA disagrees with Daimler and EMA's comments that bins should be re-weighted to ensure cold-start operation is not over-represented. The shift day and the minimum window count are sufficiently long that true cold start operation – i.e., that operation at the very beginning of the shift day – is a small portion of the total. Other operation during the day where the aftertreatment temperature decreases can be managed with appropriate aftertreatment technology.

In regard to comments on re-allocating windows between bins 2 and 3, EPA's final requirements include a two-bin structure as described in Section III.C of the preamble, which EPA expects should address commenter's concerns.

EPA has considered comments from PACCAR and EMA on the maximum allowable engine coolant temperature; see our discussion in preamble Section III.C.2.b.

11.2.3 Process for stop-start vehicles

Comments by Organizations

Organization: *Truck and Engine Manufacturers Association (EMA)*

There is also a special case to consider where a manufacturer utilizes stop-start technology to reduce criteria emissions and GHG emissions. Engine shutdown would likely occur almost immediately upon entering an idle condition. Depending on how the manufacturer has implemented the technology, there may be no opportunity to override the stop-start function. That feature, implemented for emissions reductions reasons, could make it impossible to accumulate idle bin windows in almost all vehicles where it is deployed, regardless of application. EMA therefore recommends that EPA establish a policy that stop-start engines will not be held accountable to Bin 1 standards. [EPA-HQ-OAR-2019-0055-1203-A1, p. 69]

EPA Summary and Response

Summary:

EMA also comments that manufacturers may utilize stop-start technology, in which case the engine shuts down rather than idle. EMA states that, furthermore, manufacturers may make this feature impossible to override, which would make it impossible to accumulate idle windows. EMA recommends that stop-start engines not be held accountable to bin 1 standards.

Response:

EPA agrees with EMA that some manufacturers may utilize automatic engine shutdown (AES) and stop-start technologies, and agrees that special provisions should be incorporated for these vehicles. However, EPA disagrees that those engines should be automatically exempt from Bin 1 (idle bin) standards, as Bin 1 incorporates operation where the engine would be expected to be on, even for vehicles utilizing AES and stop-start technologies. Rather, in the final rule, EPA has included requirements applicable when testing vehicles with AES and/or stop-start technology as described in Section III.C.2.ii of the preamble.

11.3 Off-cycle Standards and feasibility (Preamble III.C.2.iii and III.C.3)

11.3.1 Off-cycle criteria pollutant standards, conformity factor, and feasibility

Comments by Organizations

Organization: *Allison Transmission, Inc. (Allison)*

EPA has also proposed updates to off-cycle emission testing and off-cycle emission standards for compression-ignition engines that would apply during MYs 2027 – 2030 and MY 2031 and later.64 EPA has requested comment on the proposed standards, which are differentiated as between Option 1 and Option 2, including the level of the standards in and the specific operating range covered by each "bin" of EPA's proposed 3-bin approach (i.e., idle, low-load and medium-to high-load). EPA has additionally requested comment on whether off-cycle standards and in-use testing should also apply for SI engines.[EPA-HQ-OAR-2019-0055-1231-A1, pp.30-31]

64 87 Fed. Reg. at 17,423, proposed 40 C.F.R. §1036.104(a)(4).

Allison would first note that off-cycle expands the area under the torque curve window where NTE events could occur. Therefore, Allison agrees that revised off-cycle could measure emissions across a broader range of engine operating conditions and therefore capture additional areas of "real world" operation. This, in turn, would help ensure that the actual emission performance of vehicles in the field would be closer to EPA's promulgated emission standards. [EPA-HQ-OAR-2019-0055-1231-A1, p.31]

However, although Allison recognizes the benefits of this more comprehensive emissions measurement, we remain concerned about insufficient validation for vocational drive cycles in Southwest Research Institute's emissions system durability testing. Allison cautions EPA regarding setting aggressive stringencies for new test procedures such as Low Load Cycle and off-cycle, as seen within Option 1 or the Alternative. Instead, Allison would recommend EPA take an approach with sufficient compliance margin across these new test procedures to recognize the research and development challenges of validation across vocational drive cycles and mitigate associated risks to vocational customers regarding technology availability and productivity. [EPA-HQ-OAR-2019-0055-1231-A1, p.31]

Organization: *California Air Resources Board (CARB)*

For in-use testing, U.S. EPA is proposing Option 1 off-cycle standards125 which are 2 times the Option 1 certification standards for the first 4 years, beginning with the MY 2027, to address the initial uncertainty in how the emissions control technologies deteriorate beyond current UL on a variety of HD vehicle applications. [EPA-HQ-OAR-2019-0055-1186-A2, p.55]

125 NPRM, at page. 17474. TABLE III–17

EPA's rationale for proposing higher in-use standards for off-cycle standards fails to consider the fact that other aspects of its proposal, such as the elements that establish more rigorous durability demonstration requirements (Section IV.F), and that lengthen the emissions warranty periods (IV.B.1), will individually and collectively effectively help to reduce any perceived uncertainty regarding how emissions control technologies used in heavy HDEs deteriorate when used to power a variety of heavy-duty vehicle applications, and also overlooks the fact that data relevant to such deterioration will be available prior to 2033, because the California Omnibus regulation's primary NOx emission standards will apply to 2024 and subsequent model year engines and vehicles using almost identical in-use testing method. U.S. EPA's rationale for the flexibility provisions is accordingly inconsistent with the evidence before the agency, and does not articulate a rational connection between the facts and its proposal. State Farm, 463 U.S. at 43. [EPA-HQ-OAR-2019-0055-1186-A2, p.55]

U.S. EPA requested comments to elements of the off-cycle standards. CARB staff supports the general structure of the off-cycle standards. CARB staff prefers the Alternative proposal where the off-cycle standards are a multiplier of 1.5 times the certification standards since U.S. EPA is considering also including a 10 percent measurement accuracy margin. The proposed structure would provide assurance that in-use emissions more closely align with certification standards. CARB's Omnibus standard provides a 2.0 multiplier margin (conformity factor) to the emission standards used to determine bin emission compliance for 2027 through 2030 MY engines and a 1.5 conformity factor for 2031 and later MY engines. A table summarizing the off-cycle thresholds in the Omnibus, Option 1, Option 2 and the Alternative are provided in Table 6-1. [EPA-HQ-OAR-2019-0055-1186-A2, p.58]

Although the Omnibus structure is similar to Option 1 where the off-cycle standards are 2.0 times the engine cycle standards for 2027 to 2030 MY engines, Option 1 is less stringent than the Omnibus proposal and the Alternative when including a measurement accuracy margin. Option 2 has a much higher standard, resulting in much higher off-cycle standards that are amplified with the application of a measurement accuracy margin that is a multiple of the standard plus conformity factor imbedded within the proposed off-cycle standards. Also, CARB staff suggests defining the off-cycle standards for the idle bin, if the engine is certified to the idle standards. [EPA-HQ-OAR-2019-0055-1186-A2, p.59]

Additionally, CARB staff suggests adding and defining an 'off-cycle emissions threshold' that is the sum of the off-cycle standard and applicable margins as described in 1036.420, similar to the existing structure of the NTE threshold in 86.1912. The proposed off-cycle emissions standard does not clearly identify the maximum emissions limit of off-cycle testing because it does not include the proposed PEMS measurement allowance margin. For example, the Omnibus establishes an in-use threshold and describes the maximum allowable emissions limit that is based on the standard and a sizable margin (conformity factor). The conformity factor in the Omnibus is large enough to account for both in-use operation variability and the use of field PEMS measurements. [EPA-HQ-OAR-2019-0055-1186-A2, pp.59-60]

U.S. EPA requested feedback on the in-use testing proposal. CARB staff supports most of U.S. EPA’s proposed Option 1 changes to the in-use testing procedures and programs applicable to both the manufacturer and U.S. EPA administrator for 2027 and later model year compression ignition engines and makes recommendations to change some provisions. [EPA-HQ-OAR-2019-0055-1186-A2, p.63]

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

While Commenters prefer the more stringent numerical emissions standards of Option 1 to the unjustifiably lax standards of Option 2, we urge EPA to further strengthen the standards in certain key areas: (1) duty cycle and in-use (off-cycle) standards, (2) idle standards, and (3) the FEL cap. EPA should also reject its proposed two-step approach for Option 1, finalizing the more stringent standards in MY 2027 instead of delaying their application until MY 2031 [EPA-HQ-OAR-2019-0055-1302-A1, p.57]

Increased stringency is particularly warranted for the low-load and idle bins of the in-use standards and the LLC of the duty cycle standards. The Proposal notes that European vehicles with similar highway-speed NOx emissions as American trucks have lower low-load emissions. 87 Fed. Reg at 17,472. EPA is correct to interpret this information as suggesting ‘that manufacturers are responding to the European certification standards by designing their emission controls to perform well under low-load operations, as well as highway operations.’ Id. Manufacturers of American HDEs should likewise be able to design emissions controls that perform well both under highway and low-load conditions. A number of available technologies can increase exhaust temperature at low load and thereby increase the effectiveness of SCR-based emissions controls, including cylinder deactivation and other forms of variable valve actuation. And some engines are able to currently achieve EPA’s proposed 2031 standard with compliance margins of 50% for the low-load bin. See Comments of MFN, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022. CARB also notes that its testing data supports the feasibility of an LLC standard stricter than that included in Option 1 or the Omnibus. See Comments of CARB, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022. [EPA-HQ-OAR-2019-0055-1302-A1, p.58]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

EPA's low-NOx demonstration using the Stage 3 / RW system assumes that the conditions specified by SWRI for system performance and aging are representative of an upper limit of combined real world conditions including: o Measurement tolerances; o Production tolerances; o Catalyst aging; o Direct NOx impacts from biodiesel, as well as fuel-quality related additional catalyst degradation; and o Installation/temperature drop. [EPA-HQ-OAR-2019-0055-1168-A1, p.26]

Aftertreatment catalysts age through a variety of mechanisms, most simply binned as thermal or chemical aging. While the Diesel Aftertreatment Accelerated Aging Cycle (DAAAC) protocol developed by SWRI and applied to the EPA demonstration system makes great progress toward capturing aging impacts, the accelerated aging protocol applied in this study has not been validated by any field data with a similar system layout. A single, controlled test does not fully capture the range of variability that real world systems experience in 600-800k miles, including but not limited to: o Metal contamination due to field fuel quality; o Variation in catalyst performance due to changes in fuel properties; o Ingestion of dust or road salt through the intake air system; and o Intrusion of contaminants via the Diesel Exhaust Fluid (DEF) system due to poor quality DEF, inappropriate DEF storage or mishandling, or failure to properly replace DEF tank caps. [EPA-HQ-OAR-2019-0055-1168-A1, p.26]

The thermal and chemical aging protocol applied by SWRI does not account for the above sources of degradation and instead assumes: o Constant engine oil formulation over lifetime; o Expertly handled lab grade ULSD and DEF; and o Controlled lab environment. [EPA-HQ-OAR-2019-0055-1168-A1, p.26]

Figure 3 below shows one example of the difference in SCR performance in a controlled, OEM on-highway fleet test setting (purple) versus an uncontrolled customer system (gray). These two systems ran similar duty cycles with similar mileage accumulation (approximately 435k) and thermal aging characteristics. The OEM fleet system ran on a standard ASTMD975 B5 fuel, whereas the uncontrolled test system filled at fleet or retail stations en route. For both SCR formulations shown below, the 435k mile field return system performs similarly to or worse than the 650k mile fleet test vehicle. The delta shown below in NOx conversion efficiency observed between a controlled test and uncontrolled test is significantly more degradation than what is observed in the test cell simulated 800,000 miles aftertreatment during EPA Stage 3 and rework investigations. We expect similar deltas as shown in the Figure 3 below between a lab-aged environment and fleet-aged environment: [Comment also included in 11.5.4] [EPA-HQ-OAR-2019-0055-1168-A1, pp.26-27]

Apart from the concerns highlighted above and detailed in the EMA Proposed Rule Comments, we elaborate below on a number of major pitfalls of associated with the proposed 3B-MAW in use analysis protocol, namely issues related to: (1) in-use cold start; (2) the lack of in-use real-world test data; (3) interactions with OBD requirements; and (4) the fact that in-use g-NOx/g-CO_2 metrics fail to adequately scale for emissions. [EPA-HQ-OAR-2019-0055-1168-A1, p.44]

Secondly, running a replay of engine speed and torque at the test cell inevitably links the emission results to the unique specification of the vehicle that originally collected the data in the real world. The specific payload and road speed limit, transmission, rear axle ratio, and tire dimensions all play a role in terms of how the engine operates on a particular route. In some quite different applications (e.g., down speed fleet day cab versus construction vocational truck), the engine operating points may differ substantially, thus affecting exhaust flow rates, fuel consumption (directly linked to the CO2 denominator of the 3B MAW), and NOx emissions. Therefore, the EPA Stage 3 demonstration at SWRI cannot be considered a valid representation of in-use data (because the demonstration system was never successfully tested in a vehicle running in the real world). Furthermore, it also fails to consider the great deal of variability that is intrinsically associated with vehicle testing due to multiple vehicle configurations, varying environmental conditions, and background emissions. [EPA-HQ-OAR-2019-0055-1168-A1, p.46]

To illustrate these observations, Figure 15 shows data from a current Detroit Diesel heavy duty engine installed in a real vehicle. This data was processed and binned according to EPA's proposed 3B-MAW protocol. When tested on a dyno, these engines emit well below the FTP/RMCs 0.2 g/hp-hr NOx limit. However, when installed in a vehicle and measured according to the 3B-MAW protocol, measured emissions are not representative of test cell emissions, as shown in Figure 15 below. In contrast, Figure 16 shows a very narrow spread of distribution of 3B-MAW moving average windows on a Detroit Diesel GEN5 heavy duty engine when tested on an engine dynamometer. [EPA-HQ-OAR-2019-0055-1168-A1, p.46]

We believe this difference is due, in part, to variability induced by different routes, payload, ambient conditions, and other variability only ever encountered in the real world. EPA asserts that this mismatch between 3B-MAW performance and test cell performance of current engines is a function of the inadequacies of existing technologies, and that the technologies the Agency has demonstrated with SWRI will improve this correlation. However, EPA has never demonstrated this to be true. We believe that, while some improvements can be made at low loads and temperatures, this lack of correlation is a fundamental consequence of the 3B-MAW procedure, which EPA has not considered in its feasibility analysis. [EPA-HQ-OAR-2019-0055-1168-A1, p.46]

To summarize, EPA never tested the low-NOx technology demonstration in the vehicle, and EPA must perform such an analysis to determine whether the NOx emission standards it has proposed are feasible under real-world conditions. [EPA-HQ-OAR-2019-0055-1168-A1, p.46]

As described above in this section of Daimler Truck's comments, there are a number of reasons why the SWRI test data does not demonstrate the feasibility of EPA's proposed NOx standards. To summarize:

- The EPA demonstration system configuration for low-NOx feasibility at SWRI testing was performed on the shortest possible exhaust length and most favorable rating;
- Necessary design margins—due to field fuel quality and fuel impacts—were not considered in evaluating the feasibility of the proposed standards;
- The test cell demonstration SWRI system does not package on the vehicle;

- The EPA preliminary vehicle paper study itself shows significant compromises with reduced SCR volumes than was demonstrated in the test cell; and
- The technology demonstrated never met the Phase 2 MY 2027 GHG standards, even with the shortest exhaust length configuration. [EPA-HQ-OAR-2019-0055-1168-A1, p.49]

In addition to these issues detailed above, EPA also fails to acknowledge the increased N2O emissions (shown in Figure 17), and, most obviously, that the demonstration results for PM reflect an emission rate of 0.007 g/hp-hr during some tests (as shown in Figure 18), notwithstanding the SWRI statement that all numbers from the demonstration are ‘below the new 0.005 g/hp-hr standard even after 800k miles.’ Further, we note that PM IRAF’s were not developed for the demonstration program, thus this factor would need to be added on the top of the failed demonstration result. These results clearly show failing PM in-use test results after the DPF ash-cleaning procedure. In other words, the data shows that the engine fails to comply with EPA’s proposed PM standards and raises questions about N2O compliance feasibility. [EPA-HQ-OAR-2019-0055-1168-A1, p.49]

Additionally, even taking into account the best technology (which cannot be installed on a vehicle) and test cell conditions (which are significantly favorable when compared to the conditions of vehicle testing), EPA’s demonstration results for field replay cycles in the test cell reflect failed NOx results at 10% above the standard as shown in Figure 19. The data clearly shows that EPA’s engine cannot demonstrate compliance with their proposed in-use standards. [EPA-HQ-OAR-2019-0055-1168-A1, p.49]

The EPA Stage 3 / RW engine, as demonstrated in a test cell, has CO2 emissions that are 5.3% higher than the MY 2027 HHD tractor CO2 emission standard, and 2.3% higher than the MY 2027 vocational engine CO2 standard. The technology considered for vehicle demonstration (which is demonstrated to be infeasible due to CO2 impacts, as discussed above) also shows significantly higher CO2 impacts (i.e., a 7.2% exceedance of the MY 2027 CO2 standard for HHD tractors and an 8.2% exceedance of the MY 2027 CO2 standard for vocational engines). The final SWRI calibration in the EPA test cell demonstration of the EPA Stage 3 / RW system does not meet the MY 2021 GHG standards and has CO2 emissions slightly higher than even the baseline MY 2017 Cummins X15 production configuration (from which the EPA Stage 3 / RW system was developed). [EPA-HQ-OAR-2019-0055-1168-A1, p.49]

SWRI in fact notes (in Figure 20) that despite all of their efforts, significant challenges still remain for EPA’s demonstration system to demonstrate the feasibility of EPA’s proposed standards. However, EPA considers this data as sufficient demonstration of feasibility. EPA must consider all of these factors, rightly mentioned by SWRI here, and detailed in these comments and in the comments of the EMA, in their feasibility analysis.[EPA-HQ-OAR-2019-0055-1168-A1, p.49]

To summarize, Daimler Truck submits that EPA’s proposed standards would not be feasible—and that the Agency has failed to show otherwise—for the following key reasons:

- EPA tests the best possible configuration and rating, in a configuration that cannot be installed in a vehicle.

- EPA's demonstration program tested technology that will not be available for commercial vehicles in 2027.
- The Agency did not attempt to test its demonstration system in cold ambient conditions, or with biofuel, nor did it age the system in a manner representative of real world aging and exposure to poisoning.
- EPA did not attempt to test the system in real-world, in-use performance against their proposed in-use emissions standard.
- Even under these extremely favorable conditions in which EPA's system was demonstrated, the Agency did not demonstrate that compliance with the proposed suite of requirements is feasible: the system fails PM emissions tests, fails EPA's proposed 3B-MAW evaluations, fails existing GHG Phase 2 CO2 standards, and provides insufficient margin with regard to NOx emissions and N2O emissions. [EPA-HQ-OAR-2019-0055-1168-A1, p.52]

As noted in Section I.B of these comments, Congress in the CAA set clear limitations on EPA's ability to prescribe emission standards for new heavy duty vehicles and engines, not the least of which is the requirement that EPA's standards reflect the 'greatest degree of emission reduction achievable' through the application of technology that EPA determines will be available for the model year to which such standards apply, giving 'appropriate consideration to cost, energy, and safety factors associated with the application of such technology.'80 While EPA has some discretion to project what future advances in pollution control technology may occur to facilitate compliance with its standards, this discretion is not limitless. Indeed, courts have recognized that the Agency's technological projections are 'subject to the restraints of reasonableness' and do not 'open the door to 'crystal ball' inquiry.'81 [EPA-HQ-OAR-2019-0055-1168-A1, p.52]

80 42 U.S.C. 7521(a)(3)(A)(i).

81 See NRDC, 655 F.2d at 328 (citation omitted).

In light of the shortcomings noted above, the demonstration results that EPA relies upon in support of the Proposed Rule amount to a 'crystal ball' inquiry into whether the standards proposed would be feasible in an actual vehicle operating under real-world conditions. EPA has thus failed to give reasoned explanation for believing that its feasibility projections are reliable. EPA must re-visit and substantiate its finding with greater data, or propose a suite of requirements that have in fact been adequately demonstrated—or that are supported by reasoned explanation as to why the Agency expects them to be achievable 'in the time remaining' before they will be enforced.82 [EPA-HQ-OAR-2019-0055-1168-A1, p.52]

82 Id. at 333.

EPA has not shown feasibility of its proposed off-cycle testing standards and has set standards that are not achievable with the technology that will be available. Daimler Truck provides significant evidence of this feasibility concern in Section II.B.3 of these comments. Many of the same concerns detailed in Sections III.B and III.C of these comments regarding the infeasibility of EPA's proposed FTP and RMC emissions thresholds inform our analysis of the Agency's proposed thresholds for in-use testing, which are similarly infeasible. Specifically, Daimler

Truck has significant concern about emissions variability that EPA has not accounted for in its analysis. As with the cycle emissions standards, EMA has calculated that various sources of variability for the off-cycle standards—including long-term deterioration due to fuel poisoning, ash and soot accumulation, increased emission due to biofuel's immediate NOx increases, and more—mean that manufacturers must design for emissions margin of at least 0.036 g/hp-hr NOx.87 The result is that EPA's proposed off-cycle standards and testing do not merely validate that trucks maintain their dyno-demonstrated emissions performance, but in fact create a level of technology forcing emissions stringency that goes beyond the cycle emission standards and procedures in the proposal. [EPA-HQ-OAR-2019-0055-1168-A1, pp.64-65]

87 See EMA Proposed Rule Comments.

Most importantly, EPA has never tested its proposed candidate UL NOx system in a truck. Daimler Truck believes that the system cannot be packaged in a vehicle as is, and its vibration and drivability characteristics may be unacceptable to the end users as designed. Accordingly, EPA has not demonstrated feasibility when considering the broad range of applications, operating conditions, environmental conditions, and aging effects that real trucks experience in the field. Since the system has never been installed in a truck, it has never been tested against EPA's proposed off-cycle standards. [EPA-HQ-OAR-2019-0055-1168-A1, p.65]

EPA and SWRI have performed some evaluation of the EPA Stage 3/RW System in an attempt to demonstrate feasibility. However, their data ultimately shows that, even in the limited conditions the EPA and SWRI have tested, the system is not capable of meeting EPA's proposed emissions requirements. The most recent results from EPA's investigation are shown below: [EPA-HQ-OAR-2019-0055-1168-A1, p.65]

These results demonstrate that the system cannot meet EPA's proposed standards, even though they:

- Do not test at Full Useful Life (435,000 miles instead of 800,000 miles);
- Do not expose the system to real-world fuel poisoning effects, or to biodiesel;
- Do not account for the wider variety of customer applications and maintenance procedures
- Only test on a limited number of cycles; and
- Most importantly, do not test in cold conditions that challenge the emissions control of the system. [EPA-HQ-OAR-2019-0055-1168-A1, p.66]

As Daimler Truck explains in Section III.B of these comments, most emissions in any UL NOx system occur during the initial cold conditions, before the system has come up to operating temperature. Despite this fact, EPA makes no effort to demonstrate the emissions in conditions colder than the FTP, which starts at a temperature of 20 degrees Celsius. [EPA-HQ-OAR-2019-0055-1168-A1, p.66]

Organization: *Eaton Vehicle Group (Eaton)*

Agency Request / Topic: We are also requesting comment on several aspects of the proposed off-cycle standards for heavy-duty CI engines, including the levels of the standards in proposed Options 1 and 2 and the specific operating range covered by each bin, and whether off-cycle standards and in-use testing should also apply for SI engines [EPA-HQ-OAR-2019-0055-1252-A1, p.8]

Eaton Comment Strategy / Materials: Eaton supports off-cycle testing for both certification and in-use testing. Compared to European regulations, the off-cycle limits seem to be equivalent to conformity factors of 1.5 to 3. We would suggest a revision of that factor, given that option 1 emissions post IUL are already elevated to account for emissions controls degradation. [EPA-HQ-OAR-2019-0055-1252-A1, p.8]

Organization: *International Council on Clean Transportation (ICCT)*

The latest SwRI results from April 2022 demonstrated excellent and consistent performance with respect to the proposed off-cycle NOx standards. For bin 1, the idle bin, the Option 1 proposal is 10 gr/hr for MY2027-2030 and 7.5 g/hr after that. The SwRI off-cycle NOx results demonstrate compliance below the standards with a margin of 60%, even at 800k miles with an aged system. For bin 2, the low load operation bin, the results demonstrate a 70% compliance margin, even at 800k miles of aging. For bin 3, the middle to high load operating bin, the aged system performs well at 800k miles, achieving compliance margins between 25-50%. For bin 3 the results are better at 800k miles than at 435k miles. Thus, SwRI results indicate that even more stringent limits can be adopted for off-cycle NOx compliance, especially at idle and low load. [EPA-HQ-OAR-2019-0055-1211-A1, p. 10]

Organization: *Manufacturers of Emission Controls Association (MECA)*

MECA suggests that EPA consider tightening two categories of the Proposed Option 1 standards such that they are more stringent than those finalized in CARB's Omnibus. This recommendation is based on new, previously unavailable test results that have been released since the adoption of the Omnibus. Further testing on certification and real-world field cycles suggest that tighter standards are possible while retaining sufficient compliance margin that engine manufacturers need to account for manufacturing and field variability. We strongly encourage CARB to review this new test information and harmonize with EPA on more stringent standards. The two standards that can be tightened are the LLC standard and the idle standard. Similar to CARB's Omnibus, the idle standard should also be required for certification rather than an optional standard as currently proposed. There is significantly more data available from the SwRI demonstration program since CARB developed its Omnibus regulation. These data show that the LLC and idle standards finalized by CARB and proposed by EPA in Proposed Option 1 can be achieved with significant margin. The NOx level achieved over the LLC with systems fully aged to 800,000 equivalent miles is 0.037 g/bhp-hr, which includes the infrequent regeneration adjustment factor (IRAF) [6]. [EPA-HQ-OAR-2019-0055-1320-A1, p.5]

[6] EPA, 'Test Results from EPA Diesel Engine Demonstration,' 10 May 2022. [Online]. Available: https://www.regulations.gov/document/EPA-HQ-OAR-2019-0055-1082.

MECA recommends that EPA tighten the in-use compliance standards and moving average bin limits commensurate with a lower LLC certification standard. In the SwRI demonstration program, the 800,000 mile aged parts were also tested over several field duty cycles and results calculated with the new three bin moving average window (3B-MAW) in-use compliance methodology. The results for the low load bin (Bin 2) ranged from 0.033 to 0.048 g/bhp-hr, which provides 70% or more margin to the standard (0.15 g/bhp-hr). The results for the idle bin (Bin 1) ranged from 0.4 to 3.3 g/hr, which provides 60% or more margin to the optional standard (7.5 g/hr). Tightening the standards in line with test data and compliance margin would prevent emission backsliding over the life of the engine and ensure emissions are maintained as low as possible in underserved communities where low speed operation and idling operations are most likely to occur. [EPA-HQ-OAR-2019-0055-1320-A1, p.5]

MECA supports the proposed changes to in-use requirements that achieve low NOx emissions in the real world. However, it is feasible to tighten the in-use compliance limits for Bin 1 and Bin 2 operation. [EPA-HQ-OAR-2019-0055-1320-A1, p.19]

SwRI engineers have tested the Stage 3 aftertreatment system, that was engine-aged to an equivalent of 800,000 miles, on a dynamometer over a speed-load trace from several actual drive cycles. These driving cycles include the Southern NTE route, drayage cycle, grocery cycle and a European in-use compliance drive cycle. The Southern NTE has been used by CARB for Heavy-Duty In-Use Testing and lasts approximately three hours and includes several challenging profiles, such as coasting, motoring and high transient return to service that requires the aftertreatment to stay hot as it prepares for acceleration under load. The CDA system on the engine retained heat in the aftertreatment by shutting down valves and cylinders during these coasting events and prevented cold air from being pumped by the engine into the aftertreatment system, thus keeping the SCR hot for the next transient acceleration. Over these real-world cycles, the system achieved extremely low tailpipe NOx emission limits for each bin. The results for the mid-high load bin (Bin 3) ranged from 0.022 to 0.046 g/bhp-hr, which provides 25-50% margin to the proposed Bin 3 limit (0.06). The results for the low load bin (Bin 2) ranged from 0.033 to 0.048 g/bhp-hr, which provides 70% or more margin to the proposed Bin 2 limit (0.15 g/bhp-hr). The results for the idle bin (Bin 1) ranged from 0.4 to 3.3 g/hr, which provides 60% or more margin to the proposed Bin 1 limit (7.5 g/hr) [6]. These results confirm the tremendous efficacy of the Stage 3 system for reducing emissions across the range of real-world operating conditions, especially in areas where reductions are most needed such as in urban city centers. [EPA-HQ-OAR-2019-0055-1320-A1, p.20]

[6] EPA, ‘Test Results from EPA Diesel Engine Demonstration,’ 10 May 2022. [Online]. Available: https://www.regulations.gov/document/EPA-HQ-OAR-2019-0055-1082.

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

Furthermore, EPA should consider increasing the compliance margins for in-use standards. [EPA-HQ-OAR-2019-0055-1322-A1, p. 4]

Furthermore, EPA should consider increasing the compliance margins for in-use standards to make up for the lack of real-world in-use data. [EPA-HQ-OAR-2019-0055-1322-A1, p. 5]

EPA is requesting comment on several aspects of the proposed off-cycle standards for heavy-duty CI engines, including the levels of the standards in proposed Options 1 and 2 and the specific operating range covered by each bin, and whether off-cycle standards and in-use testing should also apply for SI engines. MEMA supports new HD NOx emissions standards and additional test cycles that will drive additional NOx emissions reductions on the road and encourages best-in-class technologies. These standards should be performance-based and technology-neutral and the test-cycles should reflect real-world use of vehicles. Both the standards and test cycles should enable multiple technology paths to achieve compliance. In addition, similar standards are important between CI and SI to avoid the unintended consequences of truck buyers switching between CI and SI as a way to “game” the regulatory standards. [EPA-HQ-OAR-2019-0055-1322-A1, p. 6]

Organization: *Moving Forward Network (MFN)*

We support EPA’s proposal to move forward with the moving-average-window (MAW) approach, which will better capture all real-world behavior. However, the numerical values used in this program in 2027 are wholly inadequate, arbitrary, and undermine the efficacy of the proposed NOx program. EPA itself even notes that its own system performed well below the Option 1 standards,123 and we’ve included Tables 1 and 2 to reinforce this point. [EPA-HQ-OAR-2019-0055-1277-A1, p. 29]

122. Ibid.

123. “As can be seen see from the results in Table III-18, the EPA Stage 3 engine performed well below the proposed Options 1 and 2 NOx standards,” 87 FR 17475.

In examining Table 1, it’s important to recognize that there is an additional compliance margin for the proposed MAW approach related to assumed measurement accuracy—as proposed, this is “10 percent of the off-cycle standard for a given bin.”124 Under EPA’s own proposed protocol, its demonstration powertrain already complies with the 2031 off-cycle requirements, for all load bins, under all representative test cycles. In fact, there is a compliance margin of more than 80 percent for the idle bin at intermediate useful life, and about 50 percent for the low-load bin even under the most stressing test cycle, well beyond what is reasonable. Even under the Omnibus regulation’s intermediate useful life requirements, which are more stringent in 2027-2030 than Option 1, there is more than sufficient margin for compliance, owing to the conservative approach taken by CARB in proposing those standards nearly two years ago. [EPA-HQ-OAR-2019-0055-1277-A1, pp. 29 - 30]

124. 87 FR 17477.

Table 2 shows that these margins are even greater over the full useful life of the vehicle for the low-load and medium/high-load bins—at 800,000 miles, the low-load bin has a 70 percent compliance margin, and the medium/high-load bin a 30 percent compliance margin. Given that this is an absolute worst case scenario, with more efficient test cycles showing as much as 80- or even 90-percent margins, this suggests that EPA should be setting off-cycle compliance standards that are even more stringent than those in the Omnibus regulation. [EPA-HQ-OAR-2019-0055-1277-A1, p. 30]

Moreover, it is not just EPA's data which shows that there is overly sufficient margins of compliance— Achates Power's test data on its own heavy-duty engine further confirms that it is possible to achieve CARB's limits.125 [EPA-HQ-OAR-2019-0055-1277-A1, p. 30]

> 125. "These results suggest that OP Engine can achieve future 2027 regulations with sufficient margin to satisfy the 800k mile warranty requirement, based on a 50% discount on aftertreatment degradation factors determined for zero to 435k miles applied to 435k to 800k miles," Salvi et al. 2022.

EPA has appropriately identified three bins which are representative of current test procedures (idle test, LLC, and FTP); however, EPA should maintain no worse than a 1.5X assumption on real-world operation (compared to the standards) under the proposed bin structure. [This comment also in Chapter 3.4] [EPA-HQ-OAR-2019-0055-1277-A1, p. 30]

At worst, we urge EPA to pull forward its 2031 off-cycle numerical requirements to the 2027 model year, and EPA should consider further tightening the limits of its idle and low-load bins, in particular, based on its own data. Communities cannot afford four more years' worth of trucks that are allowed to pollute well beyond what is technically achievable. [This comment also in Chapter 3.4] [EPA-HQ-OAR-2019-0055-1277-A1, p. 30]

Organization: *Navistar, Inc. (Navistar)*

In particular, we support: Establishing "in-use" compliance-assurance protocols throughout the (emissions/full) useful life to control emissions over a broader range of real-world operating conditions, provided such protocols include adequate compliance margins; [EPA-HQ-OAR-2019-0055-1318-A1, p. 2]

Organization: *PACCAR, Inc (PACCAR)*

Statistical analysis applied to test results from a research engine has predicted a log normal distribution of in-use results depicted in the upper right corner of the figure. The CFT fleet distribution is expected to take on that shape after application of new technology that will pull the peak toward the left and, to a certain extent, move the whole distribution to the left. Some operation missed by inactive NOx sensors would increase frequency counts to right of the peak if the fleet were measured with PEMS. Much of the long tail of the distribution can be addressed through OBD. However, we can expect frequency counts to remain higher than desired to the right of the peak over a considerable range of emissions levels. This area is shown as the 'challenge area' in the figure and will involve a mix of solutions:

- **Durability Improvement –** There is no evidence to support the idea that manufacturers will be better able to improve the durability of emissions control systems more effectively when motivated by the HDIUT program than when motivated by the strong incentives of the existing OBD regulations. Efforts to improve are continuous, but the scale of future improvements should not be overestimated. Further, the durability of new systems has not been proven, for example for CDA hardware and close coupled Catalysts, so it will be difficult not to move backwards. PACCAR believes that the off-cycle standards proposed by EMA are attainable through more modest improvements in durability in line with what PACCAR's experience has shown to be realistic but with significant risk in the early years when new technologies are deployed.

- **New Technology** – Application of improved technology will move the entire distribution to the left, but with limits. For example the proposed off-cycle standards will require greatly reduced transient emissions breakthroughs that are still present in test data from the SwRI demonstration engine and will require technology beyond that which was considered for the cost basis of the NPRM to meet option 1 standards. A technical solution can be imagined for every situation but there is a limit to what is cost effective. Other sections of this document go into more detail about technological limitations.
- **OBD** – OBD can be an effective tool when applied to the far right of the distribution. Application of OBD too far to the left side, without other solutions, will result in too much MIL illumination due to false detection or the misclassification of normal deterioration as component failure. It should be left to manufacturers to set the appropriate emission thresholds for each fault where root causes of malfunctions can be effectively identified.
- **Conformity Factor (CF) –** The conformity factor accounts for the variation caused by the drive cycle and values of 2 moving to 1.5 are implied by the NPRM. This makes a major contribution to why the in use test results fall along a spectrum. The cycle dependence of ultralow NOx engines is still largely unknown and remains a risk area for manufacturers.
- **Variability Allowance (VA) –** There are many variables that can affect the performance of a Low NOx system in the real world such as Sulfur in fuel, metals in biodiesel, differences in oil consumption, a spectrum of customer applications that leads to variation in aging, and variation among sensors. Variation could become significantly magnified under ultra-low NOx standards because sources of variation that are small by today's standards might not scale down in a linear way when new technology is applied contributing to sources of variation that are more significant relative to the standards. [Comment also in chapter 11.4.1] [EPA-HQ-OAR-2019-0055-1346-A1, pp.27-29]

Organization: *Truck and Engine Manufacturers Association (EMA)*

Similarly, the Agency has not fully demonstrated the feasibility of the new proposed "in use" bin-based low-NOx testing and compliance protocols, particularly with respect to "Bin 31," and, as noted, has not conducted any actual in-use testing with any prototype vehicles equipped with Stage 3 technologies. In that regard, EPA also has not adequately addressed the in-vehicle packaging requirements of the assumed low-NOx technologies (e.g., cylinder deactivation and close-coupled multi-stream dual aftertreatment systems) in any prototype HDOH vehicle, nor has EPA assessed whether current engine control units (ECUs) and data-processing protocols can be upgraded and reconfigured to accommodate the very significant data-processing demands that are associated with EPA's "3B-MAW" proposal. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 8 - 9]

> 1. Throughout these comments, the idle bin, the low-load bin, and the medium/high-load bin are alternatively referred to as "Bin 1", Bin 2", and "Bin 3."

Another of EMA's core concerns relates to the Agency's proposed new "3B-MAW" protocols and standards for assessing in-use compliance. Those in-use standards and protocols have not been developed simply to assess compliance with the underlying certification standards. To the contrary, the proposed 3B-MAW standards are, in effect, more stringent than the base certification standards, and will necessitate, among other things, larger catalyst volumes. That amounts to a fundamental paradigm shift in the scope and purpose of in-use testing. Heretofore, it was understood and agreed that in-use testing was a tool for assessing compliance with the corresponding initial certification standards, and was not intended to increase the stringency of those standards, or to compel additional emission-control technologies or hardware. That no longer will be the case under the 3B-MAW proposal. The Agency concedes as much: The proposed Option 1 in-use standard for the medium/high load bin [Bin 3] would likely require manufacturers to increase the volume of the SCR catalyst. We [also] project that the proposed off-cycle standards could be met through additional efforts to calibrate the duty-cycle technologies to function properly over the broader range of in-use conditions. We also recognize that manufacturers could choose to include additional technology. (87 FR at p. 17475.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 10]

The paradigm shift at issue raises the stakes of the feasibility issues that the Agency has failed to adequately address. Those issues are especially pronounced with respect to the proposed Option 1 "Bin 3" standards. Indeed, out of the five in-use off-cycle drive cycles that SwRI ran using EPA's Stage 3 prototype, two of those cycles yielded results that either just met or failed to meet the Bin 3 standard, even after additional "re-calibration" efforts at SwRI. [EPA-HQ-OAR-2019-0055-1203-A1, p. 10]

The Option 1 3B-MAW standards also are unrealistic because those in-use standards are at levels that essentially are equivalent to the emissions-detection capabilities of the latest portable emissions-measurement systems ("PEMS"), and an order-of-magnitude below the malfunction detection capabilities of the latest on-board diagnostic ("OBD") sensors and systems. EPA's proposed low-NOx regulations will rely on PEMS-based assessments and OBD sensor-based requirements to assure in-use compliance. But those systems cannot do so in a sufficiently reliable and consistent manner at the Option 1 NOx levels at issue. [EPA-HQ-OAR-2019-0055-1203-A1, p. 11]

Even in an emissions laboratory, PEMS NOx-detection technologies (based on nondispersive ultraviolet ("NDUV") detection methods for NO and NO2) have measurement "drift" that can be roughly equivalent to 20% of the proposed Option 1 in-use "Bin 3" NOx standard of 0.03 g/bhp-hr, before taking any in-use operational and environmental factors into account. Those factors include imprecise exhaust and fuel-flow estimations, time-alignment issues, adverse ambient conditions and vibration, and PEMS-installation concerns. [EPA-HQ-OAR-2019-0055-1203-A1, p. 11]

In that regard, it should be noted (again) that the Stage 3 prototype has not demonstrated robust compliance with the Option 1 3B-MAW standards. To the contrary, out of the five in-use drive cycles that SwRI used to test Stage 3 prototypes on an engine dynamometer, the Stage 3 system failed or just met the requisite standards over two of those cycles. If production families were to pass only at a rate of 3 to 4 out of every 5 vehicles tested, the vast majority of families would be determined to be noncompliant to the in-use requirements, and thereby potentially liable for recall. Thus, the feasibility of the Option 1 3B-MAW standards, like the Option 1 certification standards, has not been and cannot be established. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 48 - 49]

The proposed 3B-MAW in-use testing method and standards do not sufficiently distinguish between modes of in-use engine operation, and so cannot adequately separate in-use emissions into separate bins of idle, low-load, and medium-to-high load operations. As demonstrated by the extensive analyses performed by WVU, the proposed 3B-MAW method can spread (or “smear”) and comingle in-use emissions data across and among all of the three proposed bins. As WVU’s work reveals, the binned data under the 3B-MAW method have no adequate correlation, trend lines, consistency, repeatability or reliability of results to support the establishment of separate regulatory standards for the three proposed bins. Moreover, EPA has not supported the proposed NOx-binning method with any actual in-use testing data derived from compliant test articles or a low-NOx HDOH prototype vehicle in-use. It is significant that the Agency originally committed to undertake real-world in-use testing of the proposed 3B-MAW protocol utilizing a Stage 3 prototype engine installed in a vehicle, but then reneged on that commitment, claiming that the Agency has run out of time. [EPA-HQ-OAR-2019-0055-1203-A1, p. 50 This comment is also in section 11.1.1]

In setting the standard for the combined Bin 2+3, EPA must take all of this uncertainty into account, as well as the simple fact that EPA has so far demonstrated that the Stage 3RW package is incapable of meeting the proposed standards, both dyno certificaton standards and in-use standards, despite its having been operated solely in the carefully-controlled laboratory setting. In that regard, EPA cannot simply establish emissions standards on the basis of “wishful thinking.” Accordingly, EMA proposes that the Bin 2+3 emissions standard be set at the average of Option 2-like LLC and FTP/RMC standards, adjusted upward by the appropriate in-use conformity factor, which should be 2.0 for at least seven model years before dropping down to 1.5. [Also included in section 11.1.1 EPA-HQ-OAR-2019-0055-1203-A1, p. 81]

EPA’s proposed implementation of the 3B-MAW approach also includes the establishment of an in-use multiplicative conformity factor of 1.5 that links each of the three bins to a unique test-cell standard. But EPA has not demonstrated that the uniform 1.5 conformity factor was reasonably derived from an analysis of the three separate bins of NOx data, or is based on any independent assessment of technical feasibility. Nor has EPA demonstrated whether an additive rather than a multiplicative approach would be more appropriate. In that regard, and as discussed further below, the in-use conformity factor also needs to be assessed against the limits of detection of the instruments that will be used to assess in-use compliance. EPA’s proposal of a 10% NOx accuracy margin is neither sufficient nor adequately data-driven. These factors are addressed in more detail in the technical feasibility section of these comments. [EPA-HQ-OAR-2019-0055-1203-A1, p. 67]

Such a massive regulatory undertaking, with cost implications many times over any prior rulemaking directed at the heavy-duty engine and vehicle industry, should be supported by extensive research and analysis to prove-out and justify the very considerable expenses and burdens that will fall upon manufacturers and the public. Unfortunately, that is not the case here. To the contrary, there are many underlying research activities that are still underway, some which likely will not be completed by the time the rule is finalized, let alone when it was proposed, and there are other major gaps in the overall research effort that will not be filled at all. [EPA-HQ-OAR-2019-0055-1203-A1, p. 171]

The feasibility demonstration of the Stage 3 technology package that EPA proposes as justification for the proposed standards was incomplete when EPA drafted the requirements included in the NPRM. The initial 800,000-mile test results became available well after EPA staff had drafted the NPRM. [EPA-HQ-OAR-2019-0055-1203-A1, p. 171]

Dissatisfied that the results from the Stage 3 aging tests show multiple instances of noncompliance to the proposed standards, EPA has initiated testing of an “improved” technology package simultaneous with the release of the NPRM, with the hope of improving long-term emissions stability and reducing the significant increases in N2O emissions measured on the first attempt (N2O, has a 100-year scale global warming potential of 265 to 298.) Testing and aging of this new “System A” prototype is expected to extend out through October 2022, after the time EPA will be obliged to finalize this rulemaking so it can move on to inter-agency review, all in accordance with the Agency’s self-imposed year-end deadline for a published final rule. [EPA-HQ-OAR-2019-0055-1203-A1, p. 171]

Industry-funded testing of the EPA Stage 3 prototype technology package to understand tailpipe NOx sensitivity to sensor variabilities and cold weather operation will not be conducted until May or June of this year. The analyses of those data will require additional time. Without those industry-funded test results, there will be no assessment of those critical variabilities, which represent only a subset of the factors that “stack-up” into the compliance margin that manufacturers will need, but that EPA has yet to account for in this rulemaking process. [EPA-HQ-OAR-2019-0055-1203-A1, p. 171]

All of the critical research outlined above was not available or not completed in time to support the pending NPRM. Indeed, the vital research at issue is still in process, with much of it expected to be delivered just as the proposed rule is expected to “go final” in the fall, all to meet EPA’s goal of having the new low-NOx standards take effect in 2027. Thus, there is considerable risk that these critical data will be unavailable when these largely infeasible standards are to be finalized. [EPA-HQ-OAR-2019-0055-1203-A1, p. 172.]

Perhaps even more concerning are the necessary data-generation projects that are completely unplanned at this time. More specifically, EPA intends to complete this rulemaking without having access to the following: In-vehicle in-use testing of the Stage 3 low-NOx technology system, to understand if emissions compliance is really achievable over the full range of real-world ambient conditions and operating cycles covered under the completely revamped 3B-MAW in-use test requirements, and to see if the new multi-component system can even fit into the broad array of impacted trucks, will not be done. The rulemaking record will have no data from any vehicle equipped with a Stage 3-type engine system. [EPA-HQ-OAR-2019-0055-1203-A1, p. 172]

EMA has funded additional testing of the Stage 3 RW engine over five "road cycles." Engine parameters were recorded during five actual on-road cycles, and then set up for engine dyno testing. Those results were processed according to the new proposed "3-Bin Moving Average Windows" ("3B-MAW') in-use testing and compliance protocol. While only scratching the surface of the myriad cycles HD trucks will encounter in the field, the Stage 3 RW system (and the CARB Stage 3 system) failed one of the five initial road cycles (the EU ISC cycle, as developed by WVU according to EU In-Service Conformity requirements), since it yielded a NOx result that exceeded the most stringent in-use "Bin 3" (medium/high power bin) limit of 0.030 g/bhp-hr by 10%. A second of the five road cycles was just at the Bin 3 limit, which SwRI improved later by preconditioning the aftertreatment system to ensure robust pre-test ammonia storage, a preconditioning process not permitted according to the applicable manufacturer in-use testing requirements. [EPA-HQ-OAR-2019-0055-1203-A1, p. 25]

Actual in-vehicle road-testing of a Stage 3 system obviously would be highly informative to the rulemaking process. Unfortunately, EPA (and CARB) conducted no such actual in-use testing of a vehicle equipped with the Stage 3 prototype engine, despite earlier commitments to do so. Rather, EPA's proposal of aggressive in-use standards utilizing a completely new 3B-MAW emissions measurement protocol is based solely on the partially failed emission results generated with one prototype engine operated on an engine dyno over just five simulated road cycles. [EPA-HQ-OAR-2019-0055-1203-A1, p. 25]

It also is important to consider that the Stage 3 technologies that serve as the basis for EPA's feasibility demonstration offer little or no improvement to NOx emissions levels when operating over periods of sustained engine load, the types of operation that should be included in the medium/high-load bin ("Bin 3") of the proposed 3B-MAW protocol. For example, in the case of a line-haul vehicle pulling a load at highway speeds, a condition where SCR temperatures with current technologies would be at levels optimal for NOx conversion, none of the proposed Stage 3 technologies (i.e., cylinder deactivation, EGR-cooler bypass, LO-SCR, heated dosing, zone-coated catalyzed soot filters, switchback mixing tubes) would have any impact on lowering tailpipe emissions levels, save perhaps for some marginal effect from increased SCR sizing. Yet EPA's Option 1 "Bin 3" proposal includes a 90%-lower steady-state NOx standard associated with that type of already-optimized operation under quasi-steady-state engine operation. That is inherently infeasible. [EPA-HQ-OAR-2019-0055-1203-A1, p. 25]

The limited emissions test results generated with the Stage 3 RW prototype aftertreatment system, as aged in the laboratory environment, do not represent reasonable worst-case emissions performance, nor do they represent reasonable worst-case aging effects that can be expected from field-returned engines. There are in-use operating conditions and events experienced in the field that are not even considered in EPA's discussions of "technical feasibility," but for which diesel engine manufacturers are held accountable in assessing their compliance with EPA's emissions related requirements. [EPA-HQ-OAR-2019-0055-1203-A1, p. 26]

EPA Summary and Response

Summary:

CARB supports the general structure of the off-cycle standards, and prefers the Alternative proposal where the off-cycle standards are a multiplier of 1.5 times the certification standards. CARB states that other aspects of the regulation, (such as longer warranty periods and more rigorous durability demonstration) and the availability of data related to California Omnibus regulation's primary NO_x emission standards will reduce uncertainty regarding deterioration of emissions control technologies. Additionally, CARB suggests defining an "off-cycle emissions threshold" that is the sum of the off-cycle standard and applicable margins.

Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club comment that they prefer Option 1 standards to Option 2 standards. Additionally, they recommend further strengthening the standards, specifically in the idle and low load bins (bin 1 and 2). They further state that available diesel technologies can reduce emissions in these bins to a greater extent than determined by EPA.

MECA comments that it is feasible to tighten the standards for the idle and low load bins (bin 1 and 2). In support, they cite test data from SwRI on the Stage 3 aftertreatment system, that was engine-aged to an equivalent of 800,000 miles. These results provide 60% or more margin in bin 1 and 70% or more margin in bin 2. MFN also comments that standards for the idle and low load bins should be tightened. In support MFN refers to Achates Power's test data, stating the data demonstrate that there are overly sufficient margins for compliance. MFN also states that EPA should, at a minimum, pull forward the 2031 off-cycle numerical requirements to the 2027 model year.

Navistar comments that they support in-use compliance testing with adequate compliance margins and support a robust standard with a lower NOx level. PACCAR comments that a conformity factor of 1.5. to 2 is applied to account for the variations due to drive cycle, and an additional "variability allowance" should be included to account for variations due to contaminants in the fuel, oil consumption, aging differences, and other factors.

Allison comments that the off-cycle standards seen in option 1 may be too stringent, because there has been insufficient validation of vocational drive cycles in Southwest Research Institute's emissions system durability testing.

Daimler comments that the EPA Stage 3 demonstration at SWRI cannot be considered a valid representation of in-use data, as it does not include the variability intrinsically associated with vehicle testing. In support, they present data from a current Detroit Diesel heavy duty engine tested on a dyno and installed in a real vehicle, demonstrating the differences in measured emissions. Furthermore, they state that the EPA demonstration system configuration included the shortest possible exhaust length which cannot be packaged in a vehicle, did not consider necessary design margins, showed significant compromises with reduced SCR volumes, did not meet Phase 2 MY 2027 GHG standards, included technology that will not be available for commercial vehicles in 2027, did not test at cold temperatures or with biofuels, and did not age the system in a representative manner. They also comment that that the engine fails to comply with EPA's proposed PM standards and raises questions about N2O compliance feasibility. Finally, they state that demonstration results for field replay cycles in the test cell reflect failed NOx results at 10% above the standard. Thus, Daimler states that EPA has failed to show feasibility of the proposed off-cycle testing standards.

Daimler and EMA further state that the sources of variability mean that manufacturers need to design for tighter emissions levels than are required for the dyno-demonstrated emissions performance, creating a level of stringency beyond the cycle emission standards. In support, Daimler presents data comparing SCR performance in a controlled setting versus an uncontrolled setting. They state that the uncontrolled system shows significantly more degredation, and they would expect similar differences between a lab-aged environment and fleet-aged environment.

EMA comments that critical data from the SWRI Stage 3 testing is not available to EPA or industry to understand tailpipe NOx sensitivity to sensor variabilities. Additionally, EMA states that in-vehicle testing of the Stage 3 low-NOx technology system has not been accomplished, and that EPA committed to undertake real-world in-use testing but reneged on that commitment. They also state that the Stage 3 prototype system failed or just met the requisite standards over two of five in-use cycles.

EMA states that the Bin 2 and 3 emission standards should be set at the average of Option 2-like LLC and FTP/RMC standards, adjusted upward by the appropriate in-use conformity factor, which should be 2.0 for at least seven model years before dropping down to 1.5.

MEMA and Eaton recommend increasing the compliance margins for in-use standards. EMA also comments that the uniform 1.5 conformity factor and the 10% NOx accuracy margin are not sufficient and have not been derived from the data.

MEMA also comments that CI and SI engines should have similar standards to prevent truck buyers switching between CI and SI as a way to "game" the regulatory standards.

<u>Response</u>:

See preamble Section III.C.2 for the final off-cycle standards and Section III.C.3 for our feasibility analysis for those off-cycle standards.

EPA disagrees with Daimler and EMA that the final in-use off-cycle standards would be, in effect, more stringent than the new certification standards. See section 11.5.1 of this document for more detail.

EPA agrees with CARB on the general structure of the off-cycle standards and that the off-cycle standard multiplier of 1.5 times the certification standards is appropriate for this rule's final standards based on EPA's assessment of feasibility for the off-cycle standards as explained in preamble Section III.C.3. EPA disagrees with CARB that other aspects of the regulation, (such as longer warranty periods and more rigorous durability demonstration) will reduce uncertainty regarding deterioration of emissions control technologies to the extent that would result in more stringent standards than we are finalizing. EPA is finalizing standards and an interim in-use compliance allowance that take into account uncertainty that wasn't included in our technology demonstration, see Section III.C of the preamble for additional details. The off-cycle standards and applicable margins are clearly defined in 40 CFR 1036.104 and 1036.420.

EPA disagrees with Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club that available diesel technologies can reduce emissions in these bins to a greater extent and should result in lower emission standards than determined by EPA. EPA is finalizing standards that take into consideration technologies that are capable of achieving low NO_X emissions, but also take into account degradation in performance from in-use operation over the engine's useful life. We also take into consideration other sources of variability like the duty-cycles, fuel quality, test procedure variability, performance of other engine ratings, production engine variability, DEF quality, and the effects of sulfur, soot, and ash on aftertreatment performance. See preamble Section III.C for more information on how we consider each of these elements in setting the off-cycle standards.

EPA disagrees with MECA and MFN that the standards should be tightened for the idle bin because the idle standard needs to be met over much broader ambient conditions than were tested at SwRI. We are setting the standards to account for the effect of these conditions on engine emission performance. In regard to bin 2, for the reasons further explained in preamble Section III.C.3, we are combining bins 2 and 3 into a single bin with a standard that accounts for the additional margin that was demonstrated at SwRI at the 800,000-mile equivalent. EPA is finalizing a one-step program starting in MY 2027, and setting standards for spark-ignition, light, medium and heavy HDEs at the lowest level achievable taking into account the technology available starting in MY 2027, and giving appropriate consideration to cost and other statutory factors. See preamble Section III for details on how each of the standards were set.

EPA considered comments from MEMA, Eaton, and EMA on compliance margin, and Navistar and PACCAR comments that a conformity factor of 1.5 to 2 is needed to account for in-use variations. While EPA disagrees that a conformity factor of 2 is needed for these final standards based on our feasibility analysis explained in preamble Section III.C.3, EPA has set standards that provide adequate compliance margins to account for drive cycle variations as well as variation due to contaminants in the fuel, oil consumption, aging differences, and other factors as described in Section III.C of the preamble.

With regard to MEMA's comment on the stringency of CI and SI standards, we have not set standards at a level to encourage or prevent a purchaser from buying an SI engine over a CI engine or vice versa, but have set appropriate standards as discussed in preamble Section III for both CI and SI engines in a manner generally consistent with a fuel neutral approach, with the exception of CO for Spark-ignition HDE over the new SET duty cycle. We expand on our rationale for this deviation from fuel neutrality in preamble Section III.D.1.

Regarding Allison's comment, we are not finalizing as proposed all of the proposed Option 1 off-cycle standards after further consideration of feasibility and the other statutory factors for some of those standards, however we believe that the stringency of the final bin 2 (which is now combined with bin 3) should be increased and we have incorporated increased stringency in the final bin 2. We disagree with Allison that vocational vehicle operation was not captured within the five cycles tested at SwRI. These duty cycles were developed with consideration of input from engine manufacturers and incorporated field data consisting of in-use operation from hundreds of vehicles.

We disagree with Daimler that the standards we are finalizing do not include the variability intrinsically associated with vehicle testing. See preamble Section III.C regarding how EPA has accounted for the effects of in-use operation, as well as emission control system packaging and size, that were not accounted for within the SwRI Stage 3 testing. We also note that EPA is providing a process using the recall requirements in 40 CFR 1068.505 for a manufacturer to receive EPA approval to exempt test results from in-use off-cycle standards testing from being considered for potential recall if an engine manufacturer can show that the vehicle was historically fueled with biodiesel blends whose B100 blendstock did not meet the ASTM D6751–20a limit for Na, K, Ca, and/or Mg metal (metals which are a byproduct of biodiesel production) or contaminated petroleum based fuels (i.e. if the manufacturer can show that the vehicle was misfueled), and the manufacturer can show that misfueling lead to degradation of the emission control system performance. See preamble Section III.C.4 for further details.

Regarding Daimler's comment on meeting the Phase 2 GHG standards, the NO_X standards are incremental to the GHG standards, and the technology required to achieve both standards simultaneously can be independently applied to the engine. The Stage 3 engine was a MY 2017 engine that did not include the technology needed to meet the Phase 2 MY 2027 GHG standards. The demonstrated NO_x emissions were achieved without increasing GHG emissions from the base engine, and thus would have no adverse effect on GHG reductions achieved through the introduction of additional technology. See also discussion in preamble Section III. EPA expects that the four-year lead time will provide sufficient time for all of the technologies to become commercially available.

EPA has taken into account cold temperature effects on emission performance when setting the standards, as explained further in section 11.2.2 of this document. As discussed in preamble Section III.C.4, EPA is modifying the proposed approach to in-use off-cycle standards testing and will allow manufacturers to continue to exempt engines from in-use off-cycle standards testing if the engine is being operated on biofuel that exceeds the manufacturers maximum allowable biodiesel percentage usable in their engines, as specified in the engine owner's manual, as described in 40 CFR 1036.415.

EPA aged the Stage 3 emission control system using an established bench aging test procedure that has been validated and incorporated into 40 CFR 1065.1130, see preamble Section IV.F. With regard to "the mismatch between 3B-MAW performance and test cell performance", EPA agrees that the emissions from the EPA Stage 3 engine on the duty cycles do not fully match the emissions performance in each of the off-cycle bins, but we disagree that this means that there is a fundamental issue with the off-cycle test procedure or that the off-cycle standards are not feasible. As discussed in Section III.C of the preamble we have demonstrated that the off-cycle standards are feasible, with margin to account for effects that were not directly captured with the EPA Stage 3 demonstration. Furthermore, we have set the numeric level of the off-cycle standards independent of the duty cycle standards and at the most stringent level for MY 2027 engines after giving appropriate considering to cost and other statutory factors. EPA disagrees that the Stage 3 engine fails to comply with EPA's proposed PM standards. As further discussed in preamble Section III. the higher PM emission data points in the demonstration data occurred immediately following DPF ash cleaning, and the PM level returned to a level well below the 5 mg/hp-hr standard shortly after return to service once a soot cake layer reestablished itself in the DPF. These very short-term elevations in PM that occur after required maintenance of the DPF should not be the basis for the stringency of the PM standard. It has been shown that soot buildup in the DPF improves filtration efficiency and as with ammonia storage on SCR catalysts, EPA allows for preconditioning prior to carrying out the manufacturer's test of record for certification. This preconditioning not only establishes baseline ammonia storage on the SCR catalyst but reestablishes the DPF soot cake layer that was removed during the initial forced DPF regeneration that occurs prior to the preconditioning sequence. After considering the comments and evaluating the data from the Stage 3 engine, EPA is finalizing the proposed PM standard of 5 mg/hp-hr for the FTP, SET, and LLC and 7.5 mg/hp-hr for the bin 2 off-cycle standard. See preamble Section III for details on EPA's feasibility analysis for these standards. EPA disagrees with Daimler's concern regarding N_2O compliance feasibility, as the N_2O emissions from the EPA and CARB Stage 3 engine were below the N_2O standard, even after the aftertreatment was aged to the equivalent of 800,000 miles, which is beyond the final useful life for Heavy HDEs.

EPA agrees that the EPA Stage 3 engine had higher emissions than the most stringent off-cycle standards proposed, but as discussed in preamble Section III.C the level of the final off-cycle standards corresponds to at least a 40 percent compliance margin for the EPA Stage 3 engine.

EPA disagrees with EMA that NO_x sensitivity to sensor variabilities was not taken into consideration when setting the standards. Testing of the Stage 3 system at SwRI used production NO_x sensors and any variability associated with the use of those sensors was part of the test results. EPA acknowledges that in-vehicle testing of the Stage 3 low-NO_X technology system has not been accomplished, however we note that EPA has accounted for the effects on emission performance that were not included in the Stage 3 testing, which includes packaging and ambient effects as described in Section III.C of the preamble.

EPA disagrees with EMA that the 1.5 conformity factor and the PEMS NO_x accuracy margin were not derived from data. The PEMS accuracy margin that we are finalizing in 40 CFR 1036.420 was derived from data generated at SwRI with three commercially available PEMS units measuring emissions from the Stage 3 engine at NO_X levels that meet the standards. EPA is setting off-cycle standards as described in Section III.C of the preamble based on data from the Stage 3 engine tested over five representative field cycles.

In response to EMA's comment, EPA agrees the standard for the combined bin 2 and 3 should be based on the LLC and FTP/RMC standards and should be adjusted upward by the appropriate in-use conformity factor, but disagrees that the appropriate conformity factor is 2 based on EPA's assessment of the feasibility of the off-cycle standards. Further discussion of the proportionality of the off-cycle standards to the LLC and FTP/RMC standards is contained in the preamble Section III.C.2.c.

11.3.2 Other comments on criteria pollutant off-cycle standards

Comments by Organizations

Organization: *Center for Climate and Energy Solutions (C2ES)*

On-road NOx emissions are often concentrated in these communities, as they are produced by trucks traveling on highways located within or near them, as well as trucks idling at ports, warehouses, and other freight applications in these communities. Current lab testing cycles of these NOx levels may underestimate the true amounts of NOx emissions produced due to insufficient testing under real world conditions or artificially short regulatory useful life figures. [EPA-HQ-OAR-2019-0055-1165-A1, p.4]

Organization: *Odyne Systems, LLC (Odyne)*

Odyne worked with the U.S. Department of Energy to study emissions produced during Power Take-Off (PTO) operation by medium and heavy-duty vehicles. According to a report published by the National Renewable Energy Laboratory, very high NOx can be produced when vehicles are in a PTO mode. [EPA-HQ-OAR-2019-0055-1264-A1, p.2]

The PTO is a device that attaches near the engine and provides an output for rotational power. A PTO may receive power from the engine through a transmission, from a gear attached to the rear of an engine, such as a rear engine power take off or REPTO, or from a crankshaft, such as a front engine power take off, or FEPTO. The PTO provides power output from the engine to operate hydraulic pumps, compressors, and other devices. Devices such as hydraulic pumps rotate and enable vehicle mounted equipment to move, examples include bucket trucks, digger derricks, cranes, refuse compactors, cable pullers, dump trucks, tank truck and other applications. [EPA-HQ-OAR-2019-0055-1264-A1, p.2]

There are over 100,000 PTOs installed yearly on new chassis, per data from the NTEA, https://www.ntea.com , most on medium and heavy-duty vehicles. [EPA-HQ-OAR-2019-0055-1264-A1, p.3]

The typical operation of the chassis engine to power truck-mounted equipment through the PTO results in higher fuel consumption than idle and high emissions (GHG and NOx). [EPA-HQ-OAR-2019-0055-1264-A1, p.3]

The attached document provides information about high NOx output during PTO operation: https://www.nrel.gov/docs/fy20osti/75782.pdf File 75782 (attached) – Power Take-off (PTO) section on pages 35- 59 [EPA-HQ-OAR-2019-0055-1264-A1, p.3]

A side by side test of electrified PTO vs. conventional 100% engine power PTO was conducted by NREL, please see the attached report 75782: ‘Investigation of Emissions Impacts from Hybrid Powertrains’ Produced under direction of California Air Resources Board (CARB) by the National Renewable Energy Laboratory (NREL) under Work for Others Agreement number FIA-15-1802 and Task No WWGR.1000. Contract No. DE-AC36-08GO28308 January 2020 [EPA-HQ-OAR-2019-0055-1264-A1, p.3]

A typical chassis engine-driven PTO runs for long durations with relatively low loads, with occasional higher bursts of power output, such as when a hydraulic pump or compressor produces flow to move equipment or perform work. As a result of low loads and intermittent higher loads, the chassis engine emission control system is ineffective in PTO mode, resulting in very high NOx output, over three times as high as idling emissions, see page 54 and 55 of the NREL report. [EPA-HQ-OAR-2019-0055-1264-A1, p.3]

Many trucks operate PTOs for extended periods, often for many hours a day, as the trucks perform work at jobsites or when the trucks require stationary power, resulting in very high NOx output. [EPA-HQ-OAR-2019-0055-1264-A1, p.3]

Per the NREL report: ‘For explanation, the highest NOx emitting drive cycle was for the HHDDT transient cycle. If this cycle were continuously operated, it would average 30.8 grams/hour of NOx emissions out of the tailpipe.’ The conventional PTO operation produce more than twice as much NOx per hour as the HHDDT transient cycle, and typically operates for many hours. As an example, utility trucks often spend 75% of operational time in PTO mode. [EPA-HQ-OAR-2019-0055-1264-A1, p.4]

While the ‘EPA is proposing the addition of a low-load test cycle and standard that would require CI engine manufacturers to demonstrate that the emission control system maintains functionality during low-load operation where the catalyst temperatures have historically been found to be below their operational temperature,’ the proposed cycle does not appear similar to the engine operation of PTOs, where overall average power output of the engine is extremely low, followed by sudden power requirements (often still low compared to the output of the engine) and then followed again by idling. [EPA-HQ-OAR-2019-0055-1264-A1, p.4]

Note torque requirements above 50% require significant power which generates heat and increases the effectiveness of emissions systems. A PTO may require a fraction of the maximum torque output of the engine and will likely be at a much lower average power level due to the intermittent power requirements for many types of vehicle mounted equipment. [EPA-HQ-OAR-2019-0055-1264-A1, p.5]

For reference the Low Load Cycle (LLC), showing high torque requirements often over 50% https://ww3.arb.ca.gov/msprog/hdlownox/files/workgroup_20190926/staff/03_llc.pdf [EPA-HQ-OAR-2019-0055-1264-A1, p.5]

NREL report Page 54: Conventional PTO operation using 100% power for PTO from engine ‘…NOx emissions are at the highest rate during PTO use. This is likely due the nature of the engine and exhaust operating conditions during PTO work. The engine spends a majority of the time at idle which results in low exhaust temperatures and low SCR NOx conversion efficiency, but then work is commanded at abrupt segments very transient in nature resulting in large engine out NOx spikes. These spikes cannot be mitigated by the aftertreatment system because of the low temperatures which then results in high NOx concentration values out of the vehicle tailpipe.’ [EPA-HQ-OAR-2019-0055-1264-A1, p.5]

EPA: We request comment on the proposed Options 1 and 2 off-cycle standards, as well as the overall structure of the off-cycle program. We also request comment on the need for fewer or more than 3 bins. [EPA-HQ-OAR-2019-0055-1264-A1, p.5]

Odyne recommends adding a test cycle bin to the off-cycle standards that represents the operation of the vehicle engine when a typical power take-off (PTO) is operated, specifically very low average load with occasional relatively high spikes of power output. The U.S. Department of Energy's National Renewable Energy Laboratory (NREL) has further information on the operation of PTOs and likely duty cycles. The test cycle should apply to all powertrains that have the capability of readily installing a PTO, including those with transmissions that have an internal PTO gear within the transmission that would interface to a PTO when the PTO is installed. The test cycle would not apply to vehicles with transmissions that do not have the capability to accept a PTO, such as transmissions that are typically used for box trucks. [EPA-HQ-OAR-2019-0055-1264-A1, pp.5-6]

Odyne recommends that vehicles with an ePTO system should be operated in conformance with the operator's manual during the testing of the off-cycle PTO bin, including charging the battery through the grid if it is recommended as the primary means of recharging the ePTO system battery. The ePTO should be operated with the same load and duty cycle that would be applied to the ICE if it were to operate the PTO with a representative load. If the ePTO battery discharges to the point that the system would turn on the engine during a normal day, then the emissions should be measured and applied to the result. [EPA-HQ-OAR-2019-0055-1264-A1, p.6]

EPA: 'We are also requesting comment on a possible broadening of our in-use compliance strategy to cover more engines and more operation.' [EPA-HQ-OAR-2019-0055-1264-A1, p.6]

Odyne recommends that manufacturers include at least one vehicle with a Power Take-Off (PTO) in the group of vehicles that are subject to in-use compliance, if that manufacturer sells vehicles with PTOs. The vehicles with PTOs should be operated in a manner that is typical for work vehicles, such as turning on the PTO when the vehicle is stationary and operating a device powered by the PTO, such as an aerial bucket or small crane mounted to a truck, for many hours for one day. The PEMs should be active during the PTO test and the test should verify that the onboard diagnostics system is fully active during PTO operation. [EPA-HQ-OAR-2019-0055-1264-A1, p.6]

Based upon Odyne's interpretation of current regulations, portions of the diagnostic system, sometimes referred to as HDOBD, can be suspended during PTO operations, and no specific testing is performed to ensure that any emissions standards are met during PTO operations. [EPA-HQ-OAR-2019-0055-1264-A1, p.6]

For reference, see Section 4.5.2 of the HD OBD regulation, section 1971.1 of title 13, California Code of Regulations, link https://www.law.cornell.edu/regulations/california/13-CCR-Sec-1971-1 Note, the EPA commented that they often reference CARB regulations, so the CARB regulation is shown: (4.5.2) Within 10 seconds of the start of a PTO (see section (c)) operation that disables a monitor required to meet the monitoring conditions in section (d)(3.2), the OBD system shall disable further incrementing of the corresponding numerator and denominator for each monitor that is disabled. When the PTO operation ends, incrementing of all corresponding numerators and denominators shall resume within 10 seconds. ’Power Take-Off (PTO) unit’ refers to an engine driven output provision for the purposes of powering auxiliary equipment (e.g., a dump-truck bed, aerial bucket, or tow-truck winch). [EPA-HQ-OAR-2019-0055-1264-A1, pp.6-7]

Also note that idle shut-down regulations are not in effect when a PTO is activated, even if the equipment is not operated after the PTO mode has been selected. Some fleets report instructing their workers to select the PTO mode rather than turn off the engine, even if the PTO is not needed to power hydraulic equipment, so that the engine can remain on to power low voltage loads, such as a 12V lights and flashers and provide air conditioning and heat when the vehicle is used as shelter for workers. [EPA-HQ-OAR-2019-0055-1264-A1, p.7]

While in-use testing might address some scenarios, it remains unclear to Odyne whether comprehensive in-use testing of trucks with PTOs would be mandated to detect high NOx and GHG emissions. [EPA-HQ-OAR-2019-0055-1264-A1, p.7]

Based upon data from NTEA, Odyne estimates that approximately 30%+ of medium and heavy-duty vehicles operate a PTO, indicating that the number of vehicles is large, and testing of this operational mode is necessary. [EPA-HQ-OAR-2019-0055-1264-A1, p.7]

Odyne recommends that trucks tested for in-use compliance with an ePTO be fully charged as documented in the system operator’s manual, and then the equipment on the truck operated with the ePTO for the normal duty cycle and duration that is typical of a full day use. Emissions should be measured during the process, so that if the battery discharges and the engine turns on, emissions can be measured. [EPA-HQ-OAR-2019-0055-1264-A1, p.7]

Odyne supports efforts by the EPA to control air pollution for heavy-duty engines and vehicles. [EPA-HQ-OAR-2019-0055-1264-A1, p.9]

The currently proposed updated regulations appear to provide a potential loophole for a significant portion of annual medium and heavy-duty trucks produced in the U.S., those that operate power take-offs (PTOs), estimated to be approximately 30% of total U.S. production by Odyne. [EPA-HQ-OAR-2019-0055-1264-A1, p.10]

Power take off operation typically places engines under a different load cycle than the proposed low load cycle. Due to very low loads followed by occasional higher loads, the average load on the engine is very low and the higher loads cause high NOx emissions. Per testing by the U.S. Department of Energy, NOx emissions in grams/hour during conventional PTO operation, in which the engine is on continuously to power truck mounted equipment, can be more than three time higher than idle and twice that of high NOx output during driving. [EPA-HQ-OAR-2019-0055-1264-A1, p.10]

Odyne recommends changes to proposed Options 1 and 2 off-cycle standards to incorporate tests that represent PTO operation for vehicles that are configured to accept a PTO, such as those with a PTO gear installed internal to the transmission that would interface with a PTO. [EPA-HQ-OAR-2019-0055-1264-A1, p.10]

Odyne also recommends broadening in-use compliance standards to require the testing of one or more vehicles with the PTO operational, if that manufacturer produces vehicles that have PTOs installed in the field. [EPA-HQ-OAR-2019-0055-1264-A1, p.10]

Odyne also encourages the EPA to confirm that emission system diagnostics are required to be completely functional during PTO operation. [EPA-HQ-OAR-2019-0055-1264-A1, p.10]

Organization: *Valeria Trujilo Aguilar*

Evaluate Performance of HDVs Accurately

According to Badshah et al.[13], a disproportionate amounts of NOx emissions from HDV are emitted during low-speed operations, a characteristic of urban driving. A study conducted by the International Council on Clean Transportation (ICCT) found that vehicles operating at a speed lower than 25 mph results in 5 times more emissions than certification limit allows[14]. Also, this study found that single line-haul trucks emit the NOx equivalent of 100 cars under urban driving conditions[15]. The ICCT study states that EPA certified trucks under 2010 HDV diesel standards are not in compliance emitting 5-7 times more NOx under actual urban driving conditions than laboratory findings suggest[16].

[1] EPA, "Benefits and Costs of the Clean Air Act 1990-2020, the Second Prospective Study", Clean Air Act Overview, accessed May 15, 2022, https://www.epa.gov/clean-air-act-overview/benefits-and-costs-clean-air-act-1990-2020-second-prospective-study.

[13] Huzeifa Badshah, Francisco Posada, and Rachel Muncrief, "Current State of NOx Emissions from In-Use Heavy-Duty Diesel Vehicles in the United States", International Council on Clean Transportation, Aspen Institute, Environment and Climate Change Canada, November 2019, accessed May 15, 2022, https://theicct.org/sites/default/files/publications/NOx_Emissions_In_Use_HDV_US_20191125.pdf.

[14] Huzeifa Badshah, Francisco Posada, and Rachel Muncrief, "Current State of NOx Emissions from In-Use Heavy-Duty Diesel Vehicles in the United States", International Council on Clean Transportation, Aspen Institute, Environment and Climate Change Canada, November 2019, accessed May 15, 2022, https://theicct.org/sites/default/files/publications/NOx_Emissions_In_Use_HDV_US_20191125.pdf.

[15] Huzeifa Badshah, Francisco Posada, and Rachel Muncrief, "Current State of NOx Emissions from In-Use Heavy-Duty Diesel Vehicles in the United States", International Council on Clean Transportation, Aspen Institute, Environment and Climate Change Canada, November 2019, accessed May 15, 2022, https://theicct.org/sites/default/files/publications/NOx_Emissions_In_Use_HDV_US_20191125.pdf.

[16] Huzeifa Badshah, Francisco Posada, and Rachel Muncrief, "Current State of NOx Emissions from In-Use Heavy-Duty Diesel Vehicles in the United States", International Council on Clean Transportation, Aspen Institute, Environment and Climate Change Canada, November 2019, accessed May 15, 2022, https://theicct.org/sites/default/files/publications/NOx_Emissions_In_Use_HDV_US_20191125.pdf.

EPA Summary and Response

Summary:

C2ES and Valeria Trujilo Aguilar comments that current lab testing cycles may underestimate the true amounts of NO_x emissions produced in real world situations. Valeria Trujilo Aguilar also comments that low speed operation results in NO_x emissions 5-7 times higher than suggested by laboratory tests.

Odyne comments that PTOs are installed on over 100,000 vehicles yearly. They further comment that PTO operation leads to high NO_x output due to its duty cycle, which alternates idle operation with sudden high power transient operation. They recommend adding a bin to the off-cycle testing that represents PTO operation, and further recommend requiring manufacturers to include at least one vehicle equipped with a PTO (and exhibiting typical PTO operation) in their in-use testing.

Response:

EPA thanks C2ES, Valeria Trujilo Aguilar, and Odyene for their input and notes that the final laboratory duty cycles in conjunction with the new off cycles standards and moving average window test procedures will significantly reduce real world emissions, making up for the shortcomings of the current NTE standards and test procedures. EPA believes that the "idle" bin (bin 1) is defined in such a way that 300-second windows would capture PTO operation for inclusion in this bin.

11.4 HDUIT: Selecting engines and vehicles (Preamble III.C.5.ii)

11.4.1 Timing of the testing program

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

CARB staff has concerns with the changes in 1035.405(d) where testing must be completed within 18 months of the test plan approval. In this case, no firm timeline is provided because the time to produce a test plan is undefined. CARB staff suggests adding a timeline for test plan submission or using the previous language that states testing would need to be completed within 18 months after the administrator directed to test an engine family. [EPA-HQ-OAR-2019-0055-1186-A2, p.64]

Organization: *PACCAR, Inc (PACCAR)*

PACCAR respectfully requests that EPA amend certain aspects of the proposed manufacturer-run field-testing program. First, proposed section 1036.405(d) states: 'We will typically select engine families for testing and notify you in writing by June 30 of the applicable calendar year.' PACCAR submits that EPA should make its selection in January of the applicable calendar year, rather than June. EPA has proposed an additional step that requires OEMs prepare a test plan that EPA must approve. Because the 18-month 'clock' does not start running until the test plan is approved, the test period must begin earlier than June so OEMs have two summers and one winter (instead of two winters and only one summer) for testing. Winter testing is logistically difficult and has certain risks. For example, PACCAR uses a trailer, which weighs nearly 10,000 pounds and contains analyzers and other equipment worth up to $1 million, to support PEMS testing that is towed with a light-duty truck. Not only does conducting PEMS testing in the winter on icy roads create unnecessary risks, it also increases workplace safety risks that are inherent to working outside in icy conditions. EPA should therefore make its selection in *January* to accommodate additional summer testing. [EPA-HQ-OAR-2019-0055-1346-A1, pp.54-55]

In addition, proposed 1036.430(c) would require a number of testing and reporting notifications but the Agency has not specified the time in which such notifications must be submitted to the Designated Compliance Officer. PACCAR respectfully submits that 30 days would be a reasonable time frame in which to require OEMs to submit these notifications. In addition, EPA should remove proposed 1036.430(c), which would require notification if two out of five tests fail because OEMs can pass with an average of ten engines. [EPA-HQ-OAR-2019-0055-1346-A1, p.58]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EMA supports that EPA is maintaining similar requirements regarding vehicle recruiting routines, test processes, and reporting requirements to those that are in place today. There are, however, a few important issues in the proposal that the Agency should address before finalizing the regulation. [EPA-HQ-OAR-2019-0055-1203-A1, p. 91]

Regarding test plans to be submitted to the Agency, it is unclear whether the manufacturer must wait for EPA to approve the test plan before proceeding with setting up and executing the first tests. If EPA would require that they approve the test plan before it gets underway, EPA should specify that they will provide approval of, or specify changes to, the manufacturer's test plan within 30 days of its submittal. It is also unclear how EPA plans to coordinate with CARB on test plan approval to be sure to meet the 30-day response time. [EPA-HQ-OAR-2019-0055-1203-A1, p. 91]

Also with respect to timing and scheduling, EMA recommends that EPA (and CARB) issue annual in-use test orders earlier in the year than is the current practice. With the proposed 18-month period within which a manufacturer must satisfy all the requirements of the test order (from the date of plan approval), there is a significant benefit to manufacturers' ability to complete these requirements if the test orders are issued early in the year. More specifically, a manufacturer has a better chance of completing the testing over a period that includes a single winter rather than two winters if the test orders are issued sooner. Winter tests include the complication and inconvenience of PEMS installation and support in undesirably cold weather conditions, which can also introduce complications for PEMS performance and function. Winter tests also run a higher risk of inclement weather disrupting travel logistics for the manufacturers' test technicians, as well as last-minute interruptions to vehicle scheduling and completion of the shift-day as planned. Those complications and potential planning disruptions could be avoided if EPA and CARB issued in-use test orders by February 1st each year. [EPA-HQ-OAR-2019-0055-1203-A1, p. 91]

Regarding the various notifications described in §1036.430(c), those also do not include clearly stated requirements as to reporting deadlines from the actual events described. EMA recommends that manufacturers be required to submit any of those notifications within 30 days of the triggering event. [EPA-HQ-OAR-2019-0055-1203-A1, p. 92]

EPA Summary and Response

Summary:

CARB comments that section 1035.405(d) states that testing must be completed within 18 months of the test plan approval, but gives no timeline for test plan submission, leading to an undefined timeline. They suggest either adding a timeline for test plan or altering the language to require test completion within 18 months of the administrator's direction to test an engine family.

Both EMA and PACCAR request that rather than selecting engine families for testing by June 30, EPA instead make a selection by January. They state that the earlier selection would reduce test burden by allowing manufacturers more opportunities for warm-weather testing rather than the logistically more difficult cold-weather testing.

EMA comments that it is unclear whether the manufacturer needs to obtain EPA approval of a test plan before beginning testing. They recommend EPA should specify they will respond within 30 days. EMA and PACCAR also recommend that manufacturers be required to submit any notifications described in §1036.430(c) within 30 days. PACCAR also recommends that EPA remove the requirement for notification if two out of five tests fail because OEMs can pass with an average of ten engines.

Response:

EPA agrees with the commentor that the timeline to submit the test plan to EPA is open ended. We note, however, that the vehicle recruitment process can be challenging for an engine manufacturer, and EPA is therefore affording additional time in the final regulation for manufacturers to put together their test plan prior to the 18-month period that constitutes the testing and reporting time.

EPA does not agree with the commentors' request to change the engine selection test month to January. While EPA considered the issue raised by commenters, EPA also considered that we need time within the calendar year to determine which vehicles to have the manufacturer test. EPA notes that in both cases the 18-month period would encompass both winter and summer months and would not necessarily lead to more cold weather testing.

After consideration of comments, EPA's final requirements do not include a deadline for EPA approval of the test plan and the manufacturer is free to start testing once the test plan has been submitted. Once the manufacturer submits it, EPA intends to let the manufacturer know in a timely manner if there are any concerns with the plan.

EPA agrees with the commentors that a 30-day deadline is appropriate for any notifications required from manufacturers described in §1036.430(c), and the final 40 CFR 1036.430(c) includes a requirement to submit any notifications with 30 days.

EPA disagrees with the commentor, and the final regulation includes the requirement to provide the Agency with notification if only 2 out of the first 5 engines tested pass the emission standards. Under this scenario, a notification is appropriate so that EPA is informed of the failures as this is indicative of a potential engine family noncompliance. This notification does not alter that the manufacturer still can test 5 additional engines, for a total of 10, to show the engine family is in compliance as described in 40 CFR 1036.425(c).

11.4.2 MIL light illumination threshold: identifying malfunctioning vehicles in test program

Comments by Organizations

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

Another area of concern with of the proposed off-cycle test procedures is the mismatch between the applicable NOx emissions and the detection capabilities of state-of-the-art OBD systems. Current generation OBD systems are designed and calibrated to detect degradation of emission control systems before such degradation results in tailpipe NOx emission of 0.4 g/hp-hr as measured on the cold/hot FTP, and RMC cycles. This limit was intentionally set higher than the existing applicable emission standards to recognize the limits of detection capability. [EPA-HQ-OAR-2019-0055-1168-A1, p.47]

EPA does not propose any modification to the diagnostics emission limit, and in fact enshrines the current emissions thresholds in its new OBD proposal. EPA is tacitly acknowledging that current technology does not allow for the design of OBD systems with a higher detection sensitivity. [EPA-HQ-OAR-2019-0055-1168-A1, pp.47-48]

Today, manufacturers are protected from in-use liability for failed emissions control components by their OBD systems. With the current emissions thresholds and OBD emissions limits, it is very likely that the OBD system will detect a failure before the system's emissions are significantly increased. These vehicles will be identified and repaired- and would not be tested for compliance while an emissions failure is present. [EPA-HQ-OAR-2019-0055-1168-A1, p.48]

This protection against possible high emitters due to malfunctioning emission control systems is lost with EPA's proposed standards. With the proposed extremely low in-use limits for NOx emissions, manufacturers will be liable for the in-use emissions of vehicles with failed emissions control systems which the EPA acknowledges cannot be detected by OBD systems. [EPA-HQ-OAR-2019-0055-1168-A1, p.48]

Organization: *PACCAR, Inc (PACCAR)*

OBD is critical for ensuring in-use compliance by alerting the vehicle owner when an emissions-related repair is needed. This leads to truck servicing, a warranty claim, additional OEM costs, and customer inconvenience. As a result, there is a strong incentive for manufacturers to design their emission-control systems to be durable and to manufacture accurate OBD systems that can distinguish when the Malfunction Indicator Lamp ('MIL') must be illuminated. [EPA-HQ-OAR-2019-0055-1346-A1, p.23]

The new Off-Cycle standards set forth in the Proposed Rule create a major shift in regulatory strategy, because the limits are set at a small fraction of the current On-board Diagnostic Emissions Limit (OBDEL), and are well below what is technologically achievable for increased diagnostic sensitivity for most, if not all, fault monitors. This creates a new regulatory landscape where the manufacturer is incentivized to reduce MIL-on thresholds below regulatory requirements to manage the population of non-compliant vehicles in the field. [EPA-HQ-OAR-2019-0055-1346-A1, p.23]

OBD is a tool to detect malfunctioning trucks and is not intended to be used to reduce the population of units within the expected distribution of wear and deterioration. There are many factors such a technological feasibility, failure rates, emissions impacts, etc. that manufacturer are in the best position assess to optimize the OBD systems to correctly distinguish malfunction from normal wear at levels below the current OBDEL, helping to ensure in-use compliance. [EPA-HQ-OAR-2019-0055-1346-A1, p.24]

The figure below provides a graphical demonstration of how this new regulatory landscape could look. The green line represents how a future technology engine could perform during off-cycle testing, which will include considerable variability caused by the drive cycle and environmental conditions, production variability, and variability in deterioration rates. [EPA-HQ-OAR-2019-0055-1346-A1, p.24]

This graph illustrates a considerable slope representing the probability of setting a MIL. Diagnostics thresholds are based on an FTP, which is a controlled test, while off-cycle operation is more random and produces a broader spectrum of results. Also, some diagnostics may differ from others due to safety factors, and certain diagnostics can be affected by deterioration. [EPA-HQ-OAR-2019-0055-1346-A1, p.25]

There are limits to what is feasible for OBD diagnostic thresholds. For example, catalyst efficiency monitoring is limited by NOx sensor accuracy and has limited ability to pinpoint the cause, which leads the service technician to grapple with a complex troubleshooting tree and costly trial-and-error service actions. If this monitor is used too aggressively, there will be too many false fails and too many units in the normal deterioration range showing up in service bays where no clear service action can be identified to clear the fault. There is no new technological breakthrough for OBD monitors that would be analogous to the technology used for the Stage 3 demonstration engine. The proposed off-cycle limits are too low for OBD to be an effective or appropriate tool to limit the range of emissions rates expected in-use. [EPA-HQ-OAR-2019-0055-1346-A1, pp.25-26]

Statistical analysis applied to test results from a research engine has predicted a log normal distribution of in-use results depicted in the upper right corner of the figure. The CFT fleet distribution is expected to take on that shape after application of new technology that will pull the peak toward the left and, to a certain extent, move the whole distribution to the left. Some operation missed by inactive NOx sensors would increase frequency counts to right of the peak if the fleet were measured with PEMS. Much of the long tail of the distribution can be addressed through OBD. However, we can expect frequency counts to remain higher than desired to the right of the peak over a considerable range of emissions levels. This area is shown as the ‘challenge area’ in the figure and will involve a mix of solutions:

- **Durability Improvement –** There is no evidence to support the idea that manufacturers will be better able to improve the durability of emissions control systems more effectively when motivated by the HDIUT program than when motivated by the strong incentives of the existing OBD regulations. Efforts to improve are continuous, but the scale of future improvements should not be overestimated. Further, the durability of new systems has not been proven, for example for CDA hardware and close coupled Catalysts, so it will be difficult not to move backwards. PACCAR believes that the off-cycle standards proposed by EMA are attainable through more modest improvements in durability in line with what PACCAR’s experience has shown to be realistic but with significant risk in the early years when new technologies are deployed.
- **New Technology –** Application of improved technology will move the entire distribution to the left, but with limits. For example the proposed off-cycle standards will require greatly reduced transient emissions breakthroughs that are still present in test data from the SwRI demonstration engine and will require technology beyond that which was considered for the cost basis of the NPRM to meet option 1 standards. A technical solution can be imagined for every situation but there is a limit to what is cost effective. Other sections of this document go into more detail about technological limitations.
- **OBD –** OBD can be an effective tool when applied to the far right of the distribution. Application of OBD too far to the left side, without other solutions, will result in too much MIL illumination due to false detection or the misclassification of normal deterioration as component failure. It should be left to manufacturers to set the appropriate emission thresholds for each fault where root causes of malfunctions can be effectively identified.
- **Conformity Factor (CF) –** The conformity factor accounts for the variation caused by the drive cycle and values of 2 moving to 1.5 are implied by the NPRM. This makes a major contribution to why the in use test results fall along a spectrum. The cycle dependence of ultralow NOx engines is still largely unknown and remains a risk area for manufacturers.

- **Variability Allowance (VA) –** There are many variables that can affect the performance of a Low NOx system in the real world such as Sulfur in fuel, metals in biodiesel, differences in oil consumption, a spectrum of customer applications that leads to variation in aging, and variation among sensors. Variation could become significantly magnified under ultra-low NOx standards because sources of variation that are small by today's standards might not scale down in a linear way when new technology is applied contributing to sources of variation that are more significant relative to the standards. [Comment also in chapter 11.6.4] [EPA-HQ-OAR-2019-0055-1346-A1, pp.27-29]

Off-cycle standards are set far below the level at which OBD systems are able to detect emission control system malfunctions, which will contribute to a wider spectrum of results. Therefore, PACCAR supports pass/fail metrics to accommodate more non-passing engines. [EPA-HQ-OAR-2019-0055-1346-A1, p.57]

Organization: *Truck and Engine Manufacturers Association (EMA)*

Similarly, today's OBD NOx-sensor-based capabilities are insufficiently precise to detect in-use NOx emission as EPA is proposing, or to assess in-use emissions compliance or potential emission-control malfunctions down at the proposed Option 1 levels. To the contrary, the current OBD NOx-malfunction threshold is no lower than 0.40 g/bhp-hr. Tellingly, EPA is proposing to retain, not lower, that OBD NOx malfunction threshold under the new low-NOx regulations, implicitly recognizing that OBD NOx sensors and related emission-detection systems are not accurate or robust enough to allow for the implementation of lower in-use OBD malfunction and enforcement thresholds. That is very significant because the higher OBD thresholds could allow emissions to far exceed the proposed in-use NOx standards before detecting a fault or illuminating a MIL, which could increase manufacturers' potential in-use compliance risks, while, at the same time, reducing the benefits of the proposed emission standards by allowing potentially malfunctioning engines to operate without an indication of the need for emissions-related repairs. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 11 - 12]

In effect, then, EPA is proposing to maintain the NOx-related OBD in-use compliance assessment and enforcement criteria at a level that is an order of magnitude above the proposed applicable "3B-MAW"-based in-use NOx emission standards. The net result is that EPA is proposing in-use low-NOx standards (based on the Option 1 requirements) that could be below the ranges at which PEMS and OBD systems are able to accurately and consistently detect, measure or assess compliance with the proposed in-use NOx standards. Similarly, EPA has not assessed whether ECUs have the data-processing capacity and capabilities to implement the proposed 3BMAW program. [EPA-HQ-OAR-2019-0055-1203-A1, p. 12]

Yet another factor that EPA should consider before obligating manufacturers to stricter engine family pass/fail criteria is that manufacturers would be at much greater risk to recruit vehicles for testing that have a component failure in progress to the point of exceeding the in-use standards, but not yet progressed enough to have exceeded the threshold required to illuminate the OBD MIL. This much greater risk of recruiting such a "pre-MIL" vehicle, as well as tripling the number of standards against which compliance must be demonstrated under a broader range of operating conditions, should be considered when establishing the pass/fail criteria. [EPA-HQ-OAR-2019-0055-1203-A1, p. 87]

Today, the OBD "MIL-ON" emissions threshold requirement of 0.40 g/bhp-hr is 33% above the in-use NOx NTE standard of 0.30 g/bhp-hr. Since emissions rates during an NTE window tend to be lower than during the FTP, the provision that permits a manufacturer to exclude a vehicle from testing if it has an active fault effectively avoids recruiting an engine with a fault-based emissions exceedance into the test plan. Under the proposed Option 1 2031 MY requirements, however, the OBD MIL-on threshold of 0.40 g/bhp-hr is more than 13 times the medium/high bin in-use emissions standard of 0.030 g/bhp-hr. [EPA-HQ-OAR-2019-0055-1203-A1, p. 87]

Under current regulations, EPA clearly intends the in-use test program to be an assessment of a manufacturer's product conformance to applicable in-use standards when evaluated on properly functioning, well-maintained vehicles. That intention is clear from the vehicle recruiting practices that EPA requires under the current regulatory provisions of §86.1908, where a manufacturer "must" select vehicle/engine systems that "have been properly maintained" and "have not been tampered with, rebuilt, or undergone major repair." Importantly, among the conditions a manufacturer must satisfy is that "the engines do not have an illuminated MIL or stored OBD trouble code…" From the foregoing, it is abundantly clear that EPA did not intend for the in-use testing program to include vehicles with engines or aftertreatment systems that are operating in a manner inconsistent with manufacturers' design intent due to, among other things, an emissions-related component fault. [EPA-HQ-OAR-2019-0055-1203-A1, p. 88]

There are other provisions within the HDOH emissions regulations that serve to ensure that manufacturers have designed adequately robust components and systems for emissions control purposes (see emissions related warranty provisions proposed at §1036.120 and emissions defect reporting requirements at §1068.501.) The in-use testing program is clearly intended to confirm that manufacturers have designed and calibrated their properly-functioning products for compliant emissions control, which is why EPA requires that manufacturers confirm that recruited vehicles are properly maintained, without active diagnostic codes, and so on. The proposed in-use low-NOx standards, however, would work in contravention of that fundamental premise of excluding vehicles experiencing emissions-related component issues, simply due to the fact that current OBD systems cannot detect faults until emission levels significantly exceed the proposed in-use low- NOx standards. [EPA-HQ-OAR-2019-0055-1203-A1, p. 88]

The graphics below illustrate the difference between today's situation and the significantly expanded region of risk manufacturers would face under the proposed amendments. The area in yellow depicts the range of emissions a vehicle may exhibit without a MIL-ON condition, but which could produce a failing result of the in-use test. [EPA-HQ-OAR-2019-0055-1203-A1, p. 88]

To further illustrate the undue risk a manufacturer would face, consider the hypothetical example represented graphically below. In this example, an in-use test order has compelled testing of five vehicles, the fourth of which is experiencing a fault condition that has resulted in a Bin 3 NOx exceedance of 0.130g/bhp-hr (a level undetectable by the OBD system). The failure resulted in a sixth vehicle test which, in this example, failed the 3B-MAW requirements due to a minor NOx failure in Bin 1 or Bin 2, or perhaps a minor exceedance of another constituent. The manufacturer would be compelled to test four more vehicles in this case, and average each bin's NOx emissions from all ten vehicles (see proposed §1036.245). The Bin 3 NOx results for the ten vehicles in the example are as represented in the chart below. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 88 - 89]

With the exception of a single vehicle exceeding the Bin 3 NOx limit due to a component issue, and a second vehicle having a potentially minor exceedance in another bin or of another constituent, the engine family in this example is exhibiting excellent emissions control. However, because the average Bin 3 emissions exceeds the 0.030g/bhp-hr NOx limit, solely due to the fault-driven exceedance measured on vehicle 4, the family would not meet the requirements of the proposed family pass/fail criteria of §1036.425. Today, an exceedance of a percentage-magnitude like that exhibited by vehicle 4 would have excluded the vehicle from the in-use emissions assessment consistent with EPA's specific intention. That will change dramatically. The bottom line is that the proposed provisions would subject manufacturers to an increased risk of family-level failure, yet, at the same time, EPA is proposing even stricter family pass/fail criteria. That is untenable. [EPA-HQ-OAR-2019-0055-1203-A1, p. 89]

While it is true that the PEMS measurement accuracy provisions would change the arithmetic in the example above, it would not change the basic concerns with the outcomes. Indeed, the current 0.45g/bhp-hr measurement allowance-adjusted NTE limit is above the 0.30g/bhp-hr NTE NOx standard, providing almost complete assurance of excluding vehicles with engines experiencing an emissions-related fault, just as EPA intended. In contrast, EPA's proposed PEMS NOx accuracy margin of 10% of the standard (§1036.420(a)(4)), a mere 0.003g/bhp-hr in the case of the Bin 3 standard, would imperceptibly influence the pass/fail outcomes in the example above. It is important to recognize that the measurement allowances are not directly integrated into the relevant in-use standards. They are instead a means to compensate for potential measurement error, avoiding the case where a manufacturer's compliant product is incorrectly determined to be non-compliant simply due to weaknesses in state-of-the-art in-use measurement systems. [EPA-HQ-OAR-2019-0055-1203-A1, p. 89]

There is, then, a very real probability that a vehicle with a faulty or somewhat deteriorated component, a vehicle which EPA found important to exclude from in-use testing when designing the current in-use test program, could be recruited so as to cause, almost on its own, a family failure determination. The only question is the magnitude of that probability. The harsh reality is we do not know, nor does the Agency know, how the introduction of a much more complex technology package, being assessed with a new and very different in-use protocol, at extremely stringent levels, will impact that probability. But what we do know is that it is unrealistic and unreasonable to tighten the family pass/fail criteria in light of this significantly elevated risk. [EPA-HQ-OAR-2019-0055-1203-A1, p. 90]

As noted above, the NOx emission-assessment capabilities of current OBD systems and sensors could frustrate the implementation of EPA's proposed in-use low-NOx standards. Simply stated, current OBD systems and sensors are not capable of detecting and flagging emission exceedances at the proposed low-NOx levels. [EPA-HQ-OAR-2019-0055-1203-A1, p. 93]

Additional OBD issues also arise under the proposed regulations. EPA has rightly acknowledged that the multiple HD OBD requirements amount to real constraints on lowering emission standards, and that revising the current HD OBD requirements and monitoring thresholds as they would scale-down to the proposed low-NOx standards (i.e., at 2.0 x 0.020 g/bhp-hr) would further hinder the implementation of the technologies and multiple aftertreatment components necessary to achieving the types of low-NOx targets that EPA seeks to mandate. To mitigate that effect, EPA is proposing to leave the OBD thresholds where they are. (See 87 FR at p. 17527.) [EPA-HQ-OAR-2019-0055-1203-A1, pp. 93 - 94]

However, it still is not clear at what level of emissions impact a component will need to be measured by OBD systems to determine whether or not it has a meaningful impact on emissions. While that criteria is currently not measured directly against the emissions standard (e.g., a % of the NOx standard) it is often used as an informal metric of emissions impacts from a component failure. With the new proposed Option 1 NOx standards set to 0.020g/bhp-hr, a component failure that could have been considered to have no significant impact on emissions might now be considered significant if it approaches the level of the NOx standard. That could cause the new regulations to have a significant impact on OBD development costs and feasibility, even though EPA intends to keep the HD OBD standards as they are. This is yet another factor that shows the impracticality and infeasibility of the Option 1 requirements. [EPA-HQ-OAR-2019-0055-1203-A1, p. 94]

Even with respect to Option 2, it is very important for EPA to consider fully all of the impacts that the Low-NOx regulations will have on the myriad HD OBD requirements, and all of the necessary OBD revisions that should be included in the relevant OBD regulations. That necessary consideration will help to promote the implementation of revised HD OBD regulations in the future that do not frustrate the implementation of the Low-NOx Regulations. [EPA-HQ-OAR-2019-0055-1203-A1, p. 94]

As noted, EPA has tried to account for the technical infeasibility of scaling-down the OBD thresholds in a similar manner to the proposed reduced emission standards by maintaining the OBD thresholds at their current levels — e.g. 2x the existing NOx standard, and an additive 0.020 g/bhp-hr to their existing PM standard, for final OBD thresholds of 0.40 g/bhp-hr for NOx; and 0.030 g/bhp-hr for PM. However, the current in-use emissions standards also are tied to the certification-cycle emissions standards — e.g. 1.5 x the FTP NOx-threshold is the current NTE/In- Use emissions testing threshold. Today, that approach for correlating test-cell standards to in-use testing standards leads to an in-use NTE standard of 0.30 g/bhp-hr NTE NOx, with a 0.15g/bhp-hr additive measurement allowance, for an aggregate in-use NOx limit of 0.45 g/bhp-hr. The corresponding result, with respect to today’s standards, is an effective OBD NOx threshold of 0.40 g/bhp-hr, at which failed components must be detected and diagnosed. That currently leaves a small gap (0.05 g/bhp-hr) between the two emission values, where a component is required to be diagnosed, before a vehicle equipped with such a component could fail the PEMS-assessed in-use NTE standards. [EPA-HQ-OAR-2019-0055-1203-A1, p. 94]

Under the proposed new low-NOx standards, however, the in-use NOx standard would be lowered substantially, to 1.5x an Option 1 standard of 0.020 g/bhp-hr, with a corresponding OBD NOx threshold (if not adjusted) of 0.040 to 0.100 g/bhp/hr. The in-use PM standards would be similarly reduced. EPA acknowledges that it is impossible to diagnose emission thresholds at those values, and therefore would not require it for OBD at this juncture, but nonetheless is leaving the issue open for a potential tightening of the OBD thresholds through a follow-on OBD rulemaking. It is unrealistic to expect that OBD systems, strategies and calibration schemes will advance to the extent that EPA's proposed low-NOx standards might necessitate. If a manufacturer cannot diagnose an emissions-control system at such a low NOx level, then guaranteeing emissions performance at such low levels is inherently infeasible. EPA must take this into account fully before finalizing any new in-use emission standards. In that regard, EPA also should respect its own longstanding position that manufacturers should not be required to implement technologies that they cannot diagnose. Option 1 is clearly untenable in this regard. The Option 2 standards will still need to be adjusted upward to account for these issues. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 94 - 95]

EPA Summary and Response

Summary:

Daimler, PACCAR, and EMA comment that increasing the stringency of in-use standards will create a gap between the detection capabilities of OBD systems have and the in-use testing thresholds. They state that this affects in-use testing because, with the current in-use testing thresholds, it is likely that the OBD system would identify systems with incipient failure so these systems can be screened out before being tested. With the new lower in-use testing thresholds, there could be vehicles with failed emissions systems where emissions exceed in-use testing standards, but do not trigger the OBD diagnostic threshold.

PACCAR further comments that it is infeasible to lower the OBD diagnostic thresholds to a range which would be effective in screening out these faulty systems. They also state that the discrepancy between in-use testing standards and the OBD diagnostic threshold indicates that pass/fail metrics should accommodate more non-passing engines.

Response:

EPA disagrees with commenters that off-cycle standards or in-use testing should be adjusted because of the gap between OBD sensing capabilities and the off-cycle standards. EPA would like to point out that the current NTE standards were put in place well before the existence of OBD requirements for HD highway engines. The capability of emissions control diagnostics (which the statute left to the Administration's discretion to promulgate regulations for HD) should not dictate the stringency of the emission standards set under 202(a)(3). It is up to the manufacturer to devise a way to ensure that the engine and aftertreatment are functioning properly when verifying in-use compliance with the off-cycle standards.

11.4.3 Language clarifications

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

CARB staff has concerns with the addition of 1036.405(a)(3) because the language seems to conflict or contradict with 1036.405(c). In subsection (a)(3), the language states engine families with production volumes less than 100 would not be selected for testing. In subsection (c), it states any engine family regardless of sales volume may be selected for testing. CARB staff believes the current language already helps manufacturers when they have difficulty obtaining test engines of small families. In the history of the HDIUT program, CARB and U.S. EPA have never selected an engine family with a production volume of 100 or less. Thus, CARB staff does not understand why U.S. EPA is proposing this change and recommends keeping the current production volume provisions. Also, it is important that U.S. EPA has the ability to conduct in-use testing of all engines, so the regulatory language should make that clear. [EPA-HQ-OAR-2019-0055-1186-A2, p.63]

CARB staff supports U.S. EPA's proposal to remove the sentence in 1036.405(b): We will consult with you in reaching a conclusion whether clear evidence of a nonconformity exists for any engine family. If U.S. EPA has clear evidence of nonconformity as described in this subsection, then there is no need to consult with the manufacturers in selecting the particular engine family for in-use testing. Consulting with the manufacturer on engine families with clear non-compliance is not necessary and only serves to delay timely corrective action. [EPA-HQ-OAR-2019-0055-1186-A2, p.63]

CARB staff has concerns with the consistency of the applicability of 40 CFR part 86, subpart T. In 1036.601(b)(4), subpart T will continue to apply for 2026 and later model year engines. However, in 1036.401, subpart T will continue to apply for year 2026 and earlier engines. CARB staff suggests having the two sections being consistent where the 40 CFR part 86, subpart T would apply to 2026 and previous model year engines, and the requirements in 1036.401 apply for 2027 and later model year engines. [EPA-HQ-OAR-2019-0055-1186-A2, p.65]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EPA describes the proposed pass/fail criteria for an individual test article in §1036.420. The engine passes the requirements if the bin emissions result is equal to or less than the relevant bin standard for each constituent after accounting for the relevant measurement allowances. EMA recommends that EPA describe the sum of the in-use standards and their relevant measurement allowances as in-use "thresholds," to avoid confusion with the in-use standards. This would be consistent with the current practice related to NTE in-use standards and thresholds as described in §86.1912. The proposed §1036.420(c) refers to "windows" and "valid windows" interchangeably, without defining what characteristics provide for a valid window. Also §1036.420(d) provides that, "having no valid bins for a bin category over a shift-day does not disqualify an engine from pass-fail determinations under this paragraph (d)." It is unclear what EPA's intention is with provision. It is unclear what a "bin category" is, or what it means to "disqualify a vehicle from pass-fail determination under this paragraph (d)", where the cross-reference to paragraph (d) is unclear. EMA needs to have the opportunity to understand the intention behind this provision before we can comment further. [EPA-HQ-OAR-2019-0055-1203-A1, p. 93]

Overall, the various requirements that EPA has proposed regarding manufacturers' interaction with EPA in completing an in-use test order are reasonable and well stated. That said, the foregoing recommendations need to be implemented in the final rule. [EPA-HQ-OAR-2019-0055-1203-A1, p. 93]

EPA Summary and Response

Summary:

CARB has three separate comments:

1. They state that §1036.405(a)(3) seems to conflict with §1036.405(c), where one section states that engine families with production volumes less than 100 would not be selected for testing, and the other states any engine family regardless of sales volume may be selected for testing. CARB recommends keeping the current production volume provisions.
2. They support EPA's proposal to remove the sentence in §1036.405(b): 'We will consult with you in reaching a conclusion whether clear evidence of a nonconformity exists for any engine family.' CARB states that there is no need to consult with the manufacturers if evidence of non-conformity exists, and such consultation only serves to delay corrective action.
3. CARB notes that there appears to be an inconsistency between §1036.601(b)(4) and 1036.401, where the former states that part 86, subpart T will continue to apply for 2026 and later model year engines and the latter states that subpart T will continue to apply for year 2026 and earlier engines. CARB recommends that subpart T apply to 2026 and previous model year engines, and the requirements in §1036.401 apply for 2027 and later model year engines.

EMA has three comments:

1. To avoid confusion, they recommend the use of the term "threshold" rather than "standard" when referring to the sum of the in-use standards and their relevant measurement allowances.
2. They comment that the term "valid windows" is used without definition.
3. They comment that the statement in §1036.420(d) that, "having no valid bins for a bin category over a shift day does not disqualify an engine from pass-fail determinations under this paragraph (d)" is unclear, as "bin category" is undefined, and the reference to "paragraph (d)" is unclear.

Response:

EPA agrees with the commentor that proposed 40 CFR 1036.405(a)(3) appears to conflict with proposed 40 CFR 1036.405(c). EPA's intent in proposed 1036.405 was to exclude from selection engine families from a given model year if the manufacturer's total U.S.- directed production volume was less than 100 engines. We based the drafting of the proposed 40 CFR 1036.405 on 40 CFR 86.1905, which did not include the 100-engine production volume exemption. When we added the exemption into 40 CFR 1036.405(a)(3), we wrongly assumed that the engine family selection limit in 40 CFR 1036.405(c) would also cover the production volume limit in 40 CR 1036.405(a)(3). This was an oversight and to correct the mistake, we have modified the final 40 CFR 1036.405(c) from the proposed text to read as follows: "We may select any individual engine family for testing, regardless of its production volume **except as described in paragraph (a)(3) of this section**, as long as we do not select more than the number of engine families described in paragraph (a) of this section. We may select an engine family from model year 2027 or any later model year." We believe this exclusion is appropriate due to the additional burden associated with manufacturers trying to locate vehicles to test for engines with extremely low production volume.

EPA thanks the commentor for their comment regarding 40 CFR 1036.405(b).

EPA agrees that we should clarify in 40 CFR 1036.601(b)(4) how manufacturers transition to meeting the in-use testing requirements under 40 CFR 1036.401. EPA's intent in the proposed part 86 migration to part 1036 regarding part 86, subpart T, was that part 86, subpart T, would apply to model year 2026 and previous engines, unless a manufacturer chose to meet the exhaust emission standards under 40 CFR part 1036 before model year 2027. In addition, the intent was that part 86, subpart T, would no longer apply beginning with model year 2027 engines, unless a manufacturer chose to certify engines through model year 2029 to the part 86 criteria standards under the limited production allowance. We have modified the final 40 CFR 1036.601(b)(4) to make it clear that part 86, subpart T, applies for engines subject to criteria exhaust emission standards under 40 CFR part 86. The requirements in 40 CFR 1036.401 apply for all engines certified to meet the criteria exhaust emission standards under 40 CFR part 1036.

EPA disagrees with the commentors suggestion that "standard" should be replaced with "threshold" when talking about the in-use off-cycle standard plus any relative accuracy margin to account for in-use testing variability. The in-use off-cycle standard that must be met under the HDIUT program is the in-use off-cycle standard from 1036.104 plus the PEMS accuracy margin from 40 CFR 1036.420.

EPA agrees that there is arguably inconsistency in the proposed requirements' use of "valid" when it applies to windows as for all intents and purpose, all windows are "valid". Only data that is excluded from a window because it meets the exclusion criteria in 40 CFR 1036.530(c)(3) is really "invalid". Since part 1036 never talks about invalid windows, we will delete all occurrence of "valid windows" and replace with "windows".

The commentor requested clarification on the intent of proposed 40 CFR 1036.420(d). The intent of the last sentence was to state that a pass/fail is still determined for the engine, even if all of the bins are not valid because one or more of the bins does not contain enough windows. We note, however that 40 CFR 1036.420(d) requires you to test over additional shift days until the minimum number of windows is achieved for all bins. The last sentence in 40 CFR 1036.420(d) that the commentor requested clarification on serves no purpose because you will always test until you obtain the minimum number of windows for all bins. We have deleted the last sentence in 40 CFR 1036.420(d) (now 40 CFR 1036.420(e) with revisions from proposal to the section).

11.4.4 Other comments on selecting engines and vehicles.

<u>Comments by Organizations</u>

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

Daimler Truck Requests Clarification on the Proposed Changes to 40 C.F.R. 1036.235(a) Concerning Demonstration Engine Selection. [EPA-HQ-OAR-2019-0055-1168-A1, p.70]

EPA proposes to modify Section 1036.235(a) to merge the regulatory requirements for selecting test engines for criteria pollutant and GHG emission testing into one section. EPA's proposed modifications would require manufacturers to 'select and configure a single emission data engine from each engine family.'91 For criteria pollutant emission testing, Section 1036.235(a)(1) would require manufacturers to select the engine configuration most likely to exceed (or have emissions nearer to) an applicable emission standard for FEL identified in Section 1036.205(e)(1).92 For GHG emission testing, Section 1036.235(a)(1) would provide that the standards of Part 1036 apply with respect to emissions measured from 'this tested configuration.'93 Read together, these proposed changes to Section 1036.235(a) would require that manufacturers use a single engine—and specifically, the worst case engine for applicable criteria pollutant emission standards—for both criteria pollutant and GHG emission testing. [EPA-HQ-OAR-2019-0055-1168-A1, p.70]

91 Proposed Rule, 87 Fed. Reg. at 17,680 (proposed 40 C.F.R. 1036.235(a)).

92 Id. (proposed 40 C.F.R. 1036.235(a)(1)).

93 Id. (proposed 40 C.F.R. 1036.235(a)(2)).

Such a requirement would change how most manufacturers select demonstration engines, as we interpret current regulations to accommodate the use of engines with different ratings and configurations for testing under the criteria pollutant and GHG emission standards.94 Under the proposal, if the engine selected for criteria pollutant testing must also be used for GHG testing, manufacturers may end up having to test a significantly worse-performing engine for their CO_2 demonstrations, which would effectively increase CO_2 stringency. If, for example, the 'worst-case' engine for criteria pollutant emission testing is a manufacturer's lowest-horsepower engine, the manufacturer would be required to demonstrate that engine for GHG testing. If this engine has higher CO_2 emissions than an engine from the same family that would otherwise be selected for GHG demonstration under the current program (for example, as a function of reduced cycle work), the manufacturer would have to declare a higher FEL for the relevant engine family. We request clarification that this is not the intent of the proposed changes—or, if this is the intent, we request that EPA explain why it believes that this that these proposed changes are warranted and how they factored in to EPA's determination that the proposed new standards, as a whole, are achievable. Assuming that the change described above was not intentional, Daimler Truck submits that the proposed modifications to Section 1036.235(a) could be changed slightly, to read as follows:

(a) Select and configure a single emission-data engine from each engine family for both criteria pollutant emission testing and greenhouse gas emission testing, as described in this subsection.

(1) For criteria pollutant emission testing, select the engine configuration most likely to exceed (or have emissions nearer to) an applicable emission standard or FEL identified in 1036.205(l)(1). To the extent we allow it for establishing deterioration factors, select for testing those engine components or subsystems whose deterioration represents the deterioration of in-use engines.

(2) For greenhouse gas emission testing, select an engine configuration for demonstration. T~~t~~he standards of this part apply only with respect to emissions measured from ~~this~~ the testing~~ed~~ configuration that you select and other configurations identified in 1036.205(1)(2). Note that configurations identified in 1036.205(1)(2) are considered to be 'tested configurations' whether or not you test them for certification. However, you must apply the same (or equivalent) emission controls to all other engine configurations in the engine family. In other contexts, the tested configuration is sometimes referred to as the 'parent configuration', although the terms are not synonymous. This configuration may be, but is not required to be, the same configuration identified in 1036.235(a)(l). [EPA-HQ-OAR-2019-0055-1168-A1, pp.70-71]

> 94 As EPA explains in the Proposed Rule, '[i]n general,' the migration of criteria pollutant regulations for MY 2027 and later engines from their current location in Part 86 to Part 1036 'is not intended to change the compliance program previously specified in part 86, except as specifically proposed in this rulemaking.' Id. at 17,426

Organization: *PACCAR, Inc (PACCAR)*

Proposed section 1036.410(c) would require the manufacturer to notify EPA 'before disqualifying any vehicle.' PACCAR seeks clarification that this proposal is a reporting requirement, as opposed to a statement that the disqualification is contingent on EPA approval. [EPA-HQ-OAR-2019-0055-1346-A1, p.55]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EMA recommends that EPA permit manufacturers to install an "activity monitor," a physical device, on a test-candidate vehicle, where the device is capable of collecting data that determines bin-counts in each bin for that vehicle, and any additional information that would be helpful to the vehicle-recruiting process. The device could be prohibited from collecting any emissions data. Such an activity-assessment tool will improve a manufacturer's chances of recruiting vehicles that will successfully meet the bin-count requirements without multiple days of testing. EMA is available to help develop the complete list of acceptable activity-based parameters. [EPA-HQ-OAR-2019-0055-1203-A1, p. 91]

In proposed §1036.415(b)(1), EPA maintains the options to deal with a vehicle that has an illuminated OBD MIL or stored trouble code. Those options are fully appropriate because, as stated in the previous section, EPA's intention with the manufacturer-run in-use test program is to assess emissions compliance on vehicles with "healthy" emissions control systems, operating according to manufacturers' design intent. However, EPA stipulates that, "You may disqualify the vehicle only if MIL illumination or trouble code storage exceeds 12 hours." There is no reasonable justification for this minimum 12-hour constraint to be a condition for excluding such a vehicle from testing. If the OBD system has identified a component or system issue for which the manufacturer is compelled (by EPA's OBD regulations) to illuminate the MIL, why is the duration of the MIL illumination, or the time since a trouble code was stored, a material issue at all? A fault is a fault, regardless of whether it was identified one hour ago or 12 days ago. The emissions control system should be deemed as being in a compromised condition, so it should be disqualified from testing. Accordingly, EPA should not include the sentence regarding the 12-hour minimum condition in the final regulation. [EPA-HQ-OAR-2019-0055-1203-A1, p. 92]

EMA also recommends that a manufacturer be permitted to test a vehicle for more than a single test-day, even if all the requirements for a valid test are fulfilled at the end of the first test-day. Vehicle emissions can vary from one day to the next, subject to influences of ambient conditions, traffic conditions and, most especially, vehicle operation. With this degree of variability, it is conceivable that, on a given (first) test-day, a vehicle could have operated at the high end of its variable emissions performance. Supplementing the data with additional test-days could provide a more comprehensive view, a more representative picture of the vehicle's overall on-road emissions performance. For this reason, EMA recommends that manufacturers be permitted to conduct additional testing if the manufacturer elects to do so. Today, there is a similar provision in §86.1910(h), where EPA permits that, "You have the option to test longer than the two shift-day period described in paragraph (g) of this section." In a similar spirit, EMA recommends that proposed §1036.415 be revised to include a provision that additional test-days will be permissible at the manufacturer's discretion, whether the vehicle has passed or failed the in-use requirement at the end of any test-day. All additional data accumulated would be combined with, rather than replacing, earlier test-days' data. [EPA-HQ-OAR-2019-0055-1203-A1, p. 92]

EPA Summary and Response

Summary:

Daimler requests clarification on the process of merging the regulatory requirements for selecting test engines for criteria pollutant and GHG emission testing. They state that the process described appears to require the same engine be tested for both the criteria pollutant and GHG emission standards, which would effectively increase CO_2 stringency compared to the current process.

PACCAR requests clarification on whether the requirement that the manufacturer notify EPA 'before disqualifying any vehicle' is a reporting requirement, as opposed to a statement that the disqualification is contingent on EPA approval.

In their comments, EMA provided three recommendations:

1. EMA recommends manufacturers be permitted to install an "activity monitor" on candidate HDUIT vehicles to determine bin counts, and thus improve the chances of recruiting vehicles that will successfully meet the bin-count requirements without multiple days of testing.

2. EMA recommends that manufacturers be permitted to test a vehicle for more than a single test-day, even if all the requirements for a valid test are fulfilled at the end of the first test-day, to provide a more comprehensive view of vehicle performance if the first shift day has emissions on the high end of the variability range.
3. EMA recommends removing the condition that vehicles with MIL illumination can be disqualified only if MIL illumination or trouble code storage exceeds 12 hours.

Response:

EPA acknowledges the request for clarification from Daimler regarding the apparent proposed requirement to select and configure a single emission data engine from each engine family for criteria and GHG emission testing. It was not EPA's intent to require the same emission data engine for both criteria and GHG testing. We have modified the final 40 CFR 1036.235 from proposal to make it clear that the manufacturer can use separate emission data engines for testing criteria and GHG emissions.

EPA acknowledges the requests for clarification from PACCAR regarding proposed 40 CFR 1036.410(c), specifically whether the requirement that the manufacturer notify EPA 'before disqualifying any vehicle' is a reporting requirement, as opposed to a statement that the disqualification is contingent on EPA approval. As proposed, the final 40 CFR 1036.410(c) requirement is a reporting requirement. If EPA has any concerns with the disqualification of the vehicle, we intend to follow-up with the manufacturer.

EPA disagrees with EMA's recommendation to allow the installation of an activity monitor. This would allow manufacturers to sort through the duration and relative position of each operational mode and identify vehicles with the highest probability of maintaining aftertreatment temperatures over the shift day. Furthermore, EPA also disagrees with EMA's recommendation that manufacturers be permitted to test a vehicle for more than a single test-day, even if all the requirements for a valid test are fulfilled at the end of the first test-day. Adopting this recommendation would likely dilute the stringency of the rule, as manufacturers would be most likely to extend testing on those vehicles which have failed the first day's testing.

EPA agrees with EMA's recommendation to remove the condition from 40 CFR 1036.415(b)(1) that vehicles require a MIL illumination or trouble code storage of longer than 12 hours. Manufacturers may disqualify a vehicle for a MIL illumination of any time frame.

11.5 HDIUT (Preamble III.C.5.ii)

11.5.1 Elimination of Phase 1 testing

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

U.S. EPA requested comments on elements of the Heavy Duty in-use testing program. CARB staff supports the proposed changes to the HDIUT program of removing the HDIUT Phase 2 testing requirements in 40 CFR 86.1915 and the biodiesel fuel blend provisions in 40 CFR 86.1908(a)(6). These elements were also removed for 2024 and newer model year engines in the Omnibus regulation.128 [also in 11.2.1] [EPA-HQ-OAR-2019-0055-1186-A2, p.60]

128 https://ww2.arb.ca.gov/rulemaking/2020/hdomnibuslownox

The removal of Phase 2 testing would decrease the time to initiate corrective action for discovered non-compliance under the proposed HDIUT Phase 1 testing. The emission averaging of Phase 1 test engine bin emissions provides manufacturers an additional safeguard that eliminates the need for performing Phase 2 testing for confirming engine family non-compliance. [EPA-HQ-OAR-2019-0055-1186-A2, p.60]

Organization: *Navistar, Inc. (Navistar)*

EPA did not thoroughly evaluate the feasibility of the proposed rule with respect to its proposal for a new method for "binning" and evaluating in-use NOx emissions. The method uses a second-by-second moving-average window approach, with 300-second windows for collecting in-use NOx emissions, and a so-called 3-bin approach for evaluating in-use emissions based on average normalized CO2 rates (the "3B-MAW" protocol). The 3 bins are Bin 1 (Idle), Bin 2 (Low Power), and Bin 3 (Medium/High Power). As explained in EMA's comments, currently, if a manufacturer "fails" what is referred to as the "Phase 1" in-use testing of up to ten vehicles, then "Phase 2" testing is triggered, which can lead to a number of follow-up measures, but which does not automatically lead to engine recalls. The existing in-use testing requirements would change dramatically under the proposed rule. Under EPA's 3B-MAW proposal, "Phase 2" testing would be eliminated, and compliance would be assessed on the basis of the in-use test results from up to ten engines, which would likely lead to recall orders. [EPA-HQ-OAR-2019-0055-1318-A1, p. 4]

As a result, EPA's new 3B-MAW in-use compliance protocols effectively become the new emissions standards. This approach is unworkable. It underscores the need for EPA to include adequate compliance margins in the applicable NOx certification standards. It also demonstrates the infeasibility of the 3B-MAW standards under an Option 1 scenario, in which the in-use standards are equivalent to the emissions-detection capabilities of portable emissions-measurement systems ("PEMS"), and an order-of-magnitude below the malfunction-detection capabilities of the latest on-board diagnostic ("OBD") sensors and systems. [EPA-HQ-OAR-2019-0055-1318-A1, p. 4]

Organization: *Truck and Engine Manufacturers Association (EMA)*

The ramifications of the infeasible elements of the proposed off-cycle standards are further heightened due to the fact that the Agency is proposing to convert the in-use testing program into a de facto strict liability protocol. Currently, if a manufacturer "fails" what is referred to as the "Phase 1" in-use testing of up to ten vehicles, then "Phase 2" testing is triggered, which can lead to a number of follow-up measures, but which does not automatically lead to engine recalls. That would change dramatically under the NPRM. More specifically, under the Agency's 3B-MAW proposal, "Phase 2" testing would be eliminated in its entirety, and compliance would be assessed solely on the basis of the in-use test results from up to ten engines. In other words, recall orders seemingly would follow automatically from what before would have been only the “Phase 1” testing. The Agency’s truncation and conversion of the in-use testing protocols into a strict liability program augments the risks and costs of implementing what already are infeasible Option 1 standards, and likewise substantially augments the need for the robust compliance margins referenced above. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 10 - 11]

The new in-use 3B-MAW protocol and its related standards are integral components of the efficacy of the proposed low-NOx regulations. Consequently, that in-use methodology needs to be thoroughly evaluated to demonstrate its suitability and feasibility as a robust and effective in-use emissions-performance metric. The need to ensure a fully feasible 3B-MAW in-use compliance program is compounded by EPA’s proposal to convert that program into one that leads, in effect, to strict liability and automatic recalls. Heretofore, there have been two phases of in-use testing. If an engine family does not meet the passing requirements of “Phase 1,” then, following discussions with the OEM, “Phase 2” testing of 10 additional vehicles could be required to assess potential problems with emission controls. Even after that Phase 2 testing, however, engine recalls would not be automatic. By contrast, under the pending 3B-MAW proposal, all Phase 2 testing would be eliminated, and the need for engine recalls would be premised on strict compliance (or not) with the Phase 1 “pass” metrics. [EPA-HQ-OAR-2019-0055-1203-A1, p. 48]

That is a fundamental change in the rigor and consequences of in-use testing. Those consequences are further compounded by the fact that the in-use program, as proposed, will not merely assess real-world compliance with the underlying certification standards. Rather, and as noted above, EPA’s new proposed in-use emission requirements would be, in effect, more stringent than the new certification standards, and would require additional aftertreatment hardware and additional engine development. (See 87 FR at p. 17475.) In sum, EPA is changing the paradigm of the HDIUT program, and is doing so in the context of Option 1 standards that are not achievable. The resultant recall risks and costs to OEMs will not allow for an implementable program if the Option 1 standards are finalized. [EPA-HQ-OAR-2019-0055-1203-A1, p. 48]

EPA has proposed other procedural changes to the HDIUT program that are just as significant and problematic as the proposed numerical in-use standards. Those procedural changes will need to be revised in order to allow for an implementable in-use testing program. [EPA-HQ-OAR-2019-0055-1203-A1, p. 85] As noted above, EPA is proposing to eliminate “Phase 2” in-use testing, and to convert the “Phase 1” testing into what amounts to a strict liability program. Given the multiple uncertainties associated with the new proposed in-use testing protocols, that is not reasonable. [EPA-HQ-OAR-2019-0055-1203-A1, p. 85]

Under the proposed re-write of the HDIUT program, “failures” of the current “Phase 1” HDIUT procedures (where 5 out of 5, 5 out of 6, or 8 out of 10 vehicles need to “pass” the in-use compliance metrics) would be sufficient on their own to support a finding of “non-comformity” or “noncompliance,” and thus, presumably, sufficient for EPA to compel an HDOH engine family recall. [EPA-HQ-OAR-2019-0055-1203-A1, p. 85]

EPA's proposed amendment of the HDIUT program would impose unreasonable risks of recall liability on manufacturers. The HDIUT program (codified at 40 CFR Part 86, Subpart T, §§86.1901-86.1935) is a program that resulted from a negotiated settlement of litigation that EMA filed in 2001 challenging EPA's authority to require that manufacturers test previously-sold nonnew vehicles no longer in the manufacturers' possession and control. (See 70 FR at 34597.) As a result of a duly approved settlement agreement between CARB, EPA, EMA and manufacturers (which settlement was subject to a thorough public notice and comment process), the parties developed and specified the terms of the HDIUT program. (Id., n.2.) [EPA-HQ-OAR-2019-0055-1203-A1, pp. 85 - 86]

As negotiated and agreed, the current NTE-based HDIUT program does not compel recall or other noncompliance liability solely on the basis of an engine family failing to meet the engine family "pass" critieria (where 5 out of 5, 5 out of 6, or 8 out of 10 in-use vehicles pass) as tested under "Phase 1" of the program. Instead, under the current negotiated regulations, EPA enters into further discussions with the manufacturers regarding the extent of any appropriate follow-up steps, which steps can include no further testing, additional targeted "Phase 2" testing, engineering studies, or, if deemed necessary, targeted remedial actions. The core concept is that any initial "failure" of Phase 1 testing is simply a trigger for further discussions and assessments, not a trigger for strict noncompliance liability. (See 70 FR at pp. 34595-96, 34598 and 34601.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 86]

In light of the foregoing, EPA's proposed establishment of a de facto strict-liability HDIUT program — with automatic recall liability for any "failed" Phase 1 testing — is contrary to the foundational agreements and terms that created the HDIUT program. EPA should not alter the current HDIUT testing and flexible enforcement scheme. [EPA-HQ-OAR-2019-0055-1203-A1, p. 86]

EPA Summary and Response

Summary:

CARB supports removing the HDIUT Phase 2 testing requirements, stating that the removal would decrease the time to initiate potential corrective action, and that the emission averaging contained in Phase 1 provides manufacturers an additional safeguard that eliminates the need for performing Phase 2 testing.

EMA commented that EPA's new proposed in-use emission requirements would be, in effect, more stringent than the new certification standards, and would require additional aftertreatment hardware and additional engine development.

EMA and Navistar comment that the elimination of Phase 2 testing would likely lead to more recalls. EMA further comments that the removal of Phase 2 testing will automatically trigger a recall in the case of a failure in Phase 1 testing, rather than triggering further discussions and assessments. EMA stated that recall orders seemingly would follow automatically from what before would have been only the "Phase 1" testing. EMA stated that the Agency's truncation and conversion of the in-use testing protocols into a strict liability program augments the risks and costs of implementing what already are infeasible Option 1 standards, and likewise substantially augments the need for the robust compliance margins referenced above. EMA and Navistar state that the risk of failure is further compounded by the in-use emission requirements, which are effectively more stringent than the certification standards, and would require additional aftertreatment hardware and additional engine development.

Response:

EPA agrees with CARB that the emission averaging provided for in the Phase 1 testing adequately safeguards manufacturers, and that reducing time to initiate a corrective action likely has positive environmental impacts. Moreover, the HDUIT process proposed would not lead to an "automatic recall," as stated by other commenters, but as in the current process, would instead trigger further discussions between the manufacturer and EPA on the subsequent steps, as described in Section III.C.5.ii of the preamble. EPA has no intention of altering the process after an engine family fails from that currently followed for the NTE-based HDIUT program. Under the binned MAW test procedure that EPA is finalizing in this action, an engine family failing to meet the engine family "pass" criteria outlined in 40 CFR 1036.425 does not trigger an "automatic recall." EPA intends to continue the current process where we enter into further discussion with the manufacturer regarding the extent of any appropriate follow-up steps. While this can include further testing, engineering studies, or, if deemed necessary, targeted remedial actions; it will not include another "Phase" of testing under the HDIUT program. Thus any "failure" under 40 CFR 1036.425 is a trigger for further discussions and assessments, not a trigger for strict noncompliance liability.

EPA disagrees with EMA that the final in-use off-cycle standards would be, in effect, more stringent than the new certification standards. We acknowledge that complying with off-cycle standards is more challenging than meeting duty-cycle standards as there is more operational coverage off-cycle. We have taken this into account when setting the stringency of the off-cycle standards, including the conformity factor that was applied to the duty-cycle standards to arrive at the off-cycle standards. We have also included a PEMS accuracy margin on top of the off-cycle standards to account for the variability of field testing. Off-cycle standard field testing includes low ambient temperature operation which will require low temperature calibration, but as described in preamble Section III.C the numeric level of the off-cycle NO_x standards increase at lower temperatures based on EPA's consideration of the higher emissions performance of the EPA Stage 3 engine under low ambient temperature. As further discussed in Section III of the preamble, we have included an interim in-use compliance allowance for Medium and Heavy HDEs to account for additional in-use uncertainties from these engines at the final useful life values. For further discussion of feasibility and the considerations EPA took into account in setting the standards, see preamble Section III.

11.5.2 Pass criteria for engine families

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

CARB staff has concerns with the engine family compliance determination based only on the case of average of the sum-over-sum emissions of the ten tests. There could be cases where three or more tests fail for the same pollutant and same bin. Consistent deficiency for the same pollutant and bin is indicative of a defective emission control component causing non-compliance. CARB staff suggests adding language similar to what was adopted in the Omnibus regulation. An engine family is deemed to be noncompliant if the Phase 1 sum-over-sum emissions of the same pollutant and same bin exceed the off-cycle standards for three or more tests.' [EPA-HQ-OAR-2019-0055-1186-A2, p.64]

Organization: *PACCAR, Inc (PACCAR)*

Pass/Fail Determination – Under the current HDIUT program, if the MIL lamp is not illuminated then a passing HDIUT test result is almost guaranteed because the OBD emissions limit is similar to the in-use emissions limit, which allows the bar to be set relatively high to pass a test program. Beginning in MY 2027, EPA is proposing the same pass/fail thresholds of 5 out of 5 tests, 5 out of 6, and new for MY 2027 the program can be passed with the average of 10 test (for all bins and for all pollutants). This approach is flawed because the off-cycle standard is set far below the capability of OBD systems and within the range of expected in-use variation. PACCAR believes that this should be recognized with Pass/Fail metrics that accommodate more non-passing engines. Metrics of 4 out of 5, 5 out of 7, or the average of 7 or more would be more appropriate. The manufacturer should be allowed to test more than 7, and after some number of engines it would be appropriate to begin a discussion with EPA about the reason for the extended testing. Otherwise, these HDIUT tests are generally quite disruptive to OEM customers' businesses. This disruption drives the need for earlier consideration of the average emissions results after testing 7 engines. Testing a greater number of engines the non-normal distribution should be considered. While we could have an outlier on the high side we can never have an outlier on the low side by any significant margin (since negative emissions are not possible). A single outlier on the right side of the spectrum could be difficult to overcome through averaging and drive the need to test more engines. [EPA-HQ-OAR-2019-0055-1346-A1, p.29]

The NPRM does not adequately describe the consequences of a non-passing outcome from initial testing. EPA should include a provision for a consultation with the EPA if the pass/fail metrics are not being met to reach a common understanding of the issue and to agree on further actions to investigate the root cause before determining that the engine family fails to meet in-use standards. If the engine family fails to meet in-use standards, there should be an interim provision allowing the manufacturer to cover the non-compliance with credits to allow time for manufacturers to gain experience with the statistical nature of the distribution of in-use emissions rates for new technologies and a new in-use protocol. There should also be certain permanent alternatives to recall for bringing an engine family into compliance. [EPA-HQ-OAR-2019-0055-1346-A1, pp.29-30]

PACCAR further encourages the EPA adopt: Pass ratio:

- 4 out of 5
- 5 out of 7
- Or average of 7 or more
- Need provision to allow consultation with EPA if Pass Ratio is not being met

- An interim provision that allows HDIUT non-compliance to be covered with NOx credits [EPA-HQ-OAR-2019-0055-1346-A1, p.31]

EPA's proposed engine family pass criteria framework should be amended and focus more on averaging. Specifically, the initial criterion should require that at least four of the five tested engines pass; if not, at least five of the seven tested engines should be required to pass. EPA should allow (i) OEMs to take the average in each bin for each pollutant, reducing from 10 to seven the number of engines used to determine the test result and (ii) if the average of seven is above the standard that the manufacturer may elect to test more engines as such a reduction in engine number would decrease burdens on the OEM. Off-cycle standards are set far below the level at which OBD systems are able to detect emission control system malfunctions, which will contribute to a wider spectrum of results. Therefore, PACCAR supports pass/fail metrics to accommodate more non-passing engines. [EPA-HQ-OAR-2019-0055-1346-A1, p.57]

Pass ratio:

- 4 out of 5
- 5 out of 7
- Or average of 7 or more
- Add provision to allow consultation with EPA if pass ratio is not being met
- Add an interim provision that allows HDIUT non-compliance to be covered with NOx credits [EPA-HQ-OAR-2019-0055-1346-A1, p.60]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EPA proposes to establish two-stage NOx emissions standards for HHDE engines, where the second, higher standard is applicable to the later portion of useful life. These two-stage standards would apply to in-use emissions requirements as well. EPA's engine family pass/fail criteria under proposed §1036.425 involves, under certain conditions, averaging bin emissions from multiple vehicles. Those provisions, however, do not contemplate the possibility that some vehicles included in the test group may have mileages associated with the first-stage NOx standard, while others may have accrued mileages triggering the second-stage. As the two stages have distinct standards, it would not be appropriate to average their emissions as though they were compliant to a single unform standard. [EPA-HQ-OAR-2019-0055-1203-A1, p. 86]

EMA recommends that the provisions of §1036.425 be finalized to state that late-stage vehicles should have their emissions results reduced by multiplying them by the ratio of the first-stage standards to the second-stage standards before being averaged with the vehicles in the first-stage. This adjustment should be made after the applicable PEMS measurement accuracy allowance (proposed §1036.420) is added to the measured and calculated bin results. [EPA-HQ-OAR-2019-0055-1203-A1, p. 86]

EPA has proposed to modify the engine family pass/fail criteria that apply when a manufacturer has conducted an emissions compliance evaluation in response to an EPA in-use test order according to §1036.425. In addition to eliminating the option for "Phase 2" testing, EPA also is proposing to establish more strict requirements regarding the number of engines that must be demonstrated as meeting the emissions standards in order for the in-use test order to be satisfied. Because of the increased risk associated with the relationship between these new and more stringent in-use standards and current OBD detection capabilities, EMA recommends that the pass criteria be relaxed instead. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 86 - 87]

The family pass/fail criteria currently in place according to §86.1915 provide that a manufacturer should first test 5 vehicles equipped with engines from the engine family specified in the test order. If all 5 vehicles meet the minimum NTE pass-ratio, the manufacturer has satisfied the in-use test order, and may stop testing. If 1 or more of the 5 vehicles do not pass, however, a sixth vehicle must be tested. If after testing the sixth vehicle, 2 vehicles' results do not meet the minimum NTE pass-ratio, the manufacturer must test 4 more vehicles, for a total of 10 vehicles. If 8 out of the 10 vehicles have met the minimum pass-ratio, the test order has been satisfied, and the manufacturer may stop testing. If, however, at least 3 vehicles failed to meet the pass-ratio requirement, the manufacturer is obligated to enter into discussions with the agency concerning additional analysis, and potentially more testing. [EPA-HQ-OAR-2019-0055-1203-A1, p. 87]

To summarize the current family pass/fail criteria, a manufacturer can meet the requirements of the in-use test order if 5/5 ("5 out of 5"), 5/6, or 8/10 vehicles meet the NTE minimum pass-ratio. However, as noted, EPA's proposed amendments would impose stricter criteria for a determination that the test order has been satisfied. More specifically, while EPA has carried over the first two passing thresholds of 5/5 and 5/6, the passing threshold of 8/10 has been eliminated. EPA instead proposes that if a total of 10 vehicles are tested, the average emissions from all vehicles must be below the in-use standard for all bins and all constituents to meet the requirements of the in-use test order. EPA has thereby proposed to eliminate the condition that if 8/10 vehicles pass the in-use emissions requirements, the manufacturer's obligations under the test order have been satisfied, and no further testing required. [EPA-HQ-OAR-2019-0055-1203-A1, p. 87]

Importantly, these new, stricter pass/fail criteria are imposed simultaneously with the new 3B-MAW in-use emissions protocol and new very stringent standards. EMA believes that there are underlying conditions associated with the totality of the proposed amendments that make it unreasonable to impose stricter pass/fail conditions on the first phase of testing under an in-use test order. Those underlying provisions include the fact that, for each constituent, EPA has proposed 3 separate evaluations for compliance in the form of the 3 "bins" with distinct standards. [EPA-HQ-OAR-2019-0055-1203-A1, p. 87]

Considering the foregoing, EMA recommends that EPA relax, rather than tighten, the family pass/fail criteria under an in-use test order. Specifically, EMA proposes that EPA replace today's 5/5, 5/6 or 8/10 pass criteria with a passing condition at 4/5 or 5/7 vehicles. If more than 2 vehicles have failed the in-use test requirements after testing 7 vehicles, the manufacturer should be permitted test any number of additional vehicles, up to a total of 15 vehicles (including the original 7), until a passing condition is determined on the basis that the average result for each valid bin is at or below the standard (adjusted for PEMS accuracy) as described in §1036.420(d). At any point in the test program following the condition that more than 2 vehicles out of 7 have failed, the manufacturer should be permitted to initiate discussions with the Agency concerning options available to move forward with actions deemed appropriate by EPA. EMA recommends these “relaxed” family pass/fail criteria to address, at least in part, the increased risk and probability that a pre-MIL vehicle could be recruited into testing under an in-use test order. [EPA-HQ-OAR-2019-0055-1203-A1, p. 90]

EMA’s proposal is appropriate and fair considering all of the circumstances mentioned. If EPA were to simply retain the 5/5, 5/6 and 8/10 family pass/fail criteria in place with today’s in use test program, overly punitive outcomes would result. A second example makes this clear. Consider the hypothetical test order results below. After testing 10 vehicles, two vehicles (vehicles 4 and 9) have Bin 3 NOx exceedances of 0.040 and 0.050 g/bhp-hr, at least one of them due to a component failure not severe enough to be signaled by an OBD MIL, and a third vehicle has a mild exceedance in another bin or of another constituent. Even with an 8/10 pass threshold, this high-performing engine family would nonetheless fail the in-use test assessment. The Agency should seriously consider whether this level of in-use performance justifies the potential of an emissions-related recall, especially given the real possibility that the results will have been unknowingly influenced by a pre-MIL vehicle. [EPA-HQ-OAR-2019-0055-1203-A1, p. 90]

In light of the foregoing, EMA recommends that EPA implement the MY 2027 and later in-use program in a manner consistent with the current principles that restrict the in-use assessment to vehicles that are operating according to manufacturers’ design intent. The only way to protect against the increased risk manufacturers face given current OBD detection capabilities, a risk that puts the in-use testing program at odds with those long-standing principles, is to relax, rather than tighten, the engine family pass/fail criteria. EMA believes that our recommended pass/fail criteria would largely fulfill the preservation of those principles in a fair and reasonable manner. [EPA-HQ-OAR-2019-0055-1203-A1, p. 91]

EPA Summary and Response

Summary:

CARB comments that they have concerns with making an engine family compliance determination based only on the case of average of the sum-over-sum emissions of ten tests. Specifically, they comment that in some cases, multiple engines may fail the same pollutant in the same bin, indicating a defective emission control component. They recommend limiting the pass criteria so that an engine family is deemed to be noncompliant if the Phase 1 sum-over-sum emissions of the same pollutant and same bin exceed the off-cycle standards for three or more tests.

PACCAR and EMA comment that the discrepancy between the in-use standards and OBD diagnostic thresholds indicate that a more relaxed pass/fail criterion is warranted. They state that rather than pass/fail thresholds of 5 out of 5 tests, 5 out of 6, and the average of 10 tests, more appropriate thresholds would be 4 out of 5 tests, 5 out of 7 tests, or the average of 7 or more tests. For the last, EMA comments that, if the 5/7 threshold is failed, manufacturers should be able to test any number of vehicles up to 15 and average the result to demonstrate compliance.

Additionally, EMA comments that if late-stage vehicles with higher standards are included in testing, then the calculations for averaging emissions should be altered. Specifically, these vehicles should have their emissions results reduced by multiplying them by the ratio of the first-stage standards to the second-stage standards before being averaged with the vehicles in the first-stage.

Response:

EPA disagrees with commenters that more or less stringency in the proposed pass/fail criteria is warranted for the overall, long term HDIUT program's final pass/fail criteria. However, EPA believes that an interim approach with less stringent pass/fail criteria in the initial two years of the program is appropriate, as manufacturers transition to the final standards, test procedures, and requirements, while still providing overall compliance assurance during that transition. The final requirements for the HDIUT program's pass/fail criteria include a specified maximum number of test engines and, as proposed, the ability to average the results across the engines if the maximum number of engines are tested. For the MYs 2027 and MY 2028 interim provisions, the maximum number of test engines is 15. For MYs 2029 and later, we are finalizing as proposed that the maximum number of test engines is 10. For the overall long-term program in MYs 2029 and later, EPA believes this allows manufacturers sufficient opportunity to demonstrate effective aftertreatment systems without reducing the pass/fail thresholds for the five test engines and six test engines steps. EPA believes manufacturers should be able to demonstrate compliance with an average of 10 vehicles for MY 2029 and later, and only agrees the additional testing of five more vehicles is appropriate to allow for the first two years of the new standards when manufacturers are first transitioning into the final program. Regarding comments on changing the second step to five out of seven test engines passing, we believe that keeping the interim pass rate at 80 percent (eight out of ten test engines passing) between step one and two, versus going from 80 percent to 71 percent, is more appropriate, since with more tests there is more confidence that the tested engines represent the emissions performance of the whole family. See preamble section III for additional details regarding the first two steps of the final interim provisions and final overall provisions pass/fail criteria.

EPA also disagrees with CARB that failing three tests with the same pollutant in the same bin would indicate a failed result. If manufacturers are able to demonstrate compliance over the average of ten tests for the pollutant, the root cause is unlikely to be a defective emission control component.

Regarding EMA's comment about late-stage vehicles, the final emissions standards are a single step in MY 2027 and do not include an IUL standard, so this concern is not applicable to the final rule.

11.5.3 Onboard NO_x sensors

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

CARB staff supports opportunity for manufactures to meet in-use testing requirements through onboard NOx sensors data with approval of an alternative test plan with some concerns. Although CARB staff supports the requirements for NOx sensors to be on with 100 seconds of the engine starting and remaining functional the entire shift day, this could still miss the high emissions occurring during cold starts. Also, CARB staff has concerns with the accuracy, stability, and drift of current NOx sensors for determining in-use compliance. Specifications should be identified for the accuracy and stability of NOx sensors commiserate with the applicable standards. Additionally, there should be specifications for instrument drift of the NOx sensors. CARB staff suggests a minimum percentage of the vehicles reported emissions data and require any data collected by the manufacturer be submitted to U.S. EPA to avoid biased selection of data for submission. CARB staff supports a minimum of two test engines be tested with PEMS, as this would add data that includes cold start emissions and other criteria pollutant emissions. [EPA-HQ-OAR-2019-0055-1186-A2, pp. 63-64]

Organization: *Cummins Inc. (Cummins)*

EPA proposes in §1036.405(g) to allow manufacturers to request approval of an alternative test plan using onboard NOx sensors and telematics to collect emissions data from in-use engines instead of full reliance on PEMS data. It is uncertain how readily this option can be utilized given the stringent Part 1065 verification, startup, and continuous operation requirements for NOx sensors that are also proposed. However, Cummins is supportive of EPA contemplating such an approach. With improved sensor technology and more widespread use of telematics, the possibility exists for a future “new paradigm” of in-use compliance where data is gathered from a much broader population of in-use engines to provide a more complete picture of real-world emissions. Cummins intends to continue working with EPA and the rest of industry to explore such a concept. [EPA-HQ-OAR-2019-0055-1325-A1, p. 13]

Organization: *PACCAR, Inc (PACCAR)*

Second, proposed 1036.405(g) allows OEMs to use on-board NOx measurement system verification per 40 C.F.R. 1065.920(b) in lieu of PEMS testing. But it would be impossible for OEMs to comply with the requirements in 1065.920(b), including with respect to how long sensors would be required to function. Rather than codify this impossible-to-meet option, EPA should amend proposed 1036.405(g) and simply include the following language EPA has already proposed: ‘You must show us that the alternative program gives comparable assurance that your engines meet the NOx standards of this part.’ [EPA-HQ-OAR-2019-0055-1346-A1. p.55]

Organization: *Manufacturers of Emission Controls Association (MECA)*

In anticipation of tighter emission standards and longer durability requirements for heavy-duty trucks, manufacturers are improving the accuracy and durability of their sensors [55]. NOx sensors only operate above an exhaust temperature threshold to prevent water condensation and thermal shock of the ceramic element. This may make it difficult to measure NOx during low load and low speed operation. Manufacturers are developing more durable sensor designs and experimenting with sensor placement in the exhaust to minimize these limitations and extend the temperature range of their sensors and improve their durability. [EPA-HQ-OAR-2019-0055-1320-A1, pp.33-34]

[55] Y. Kawamoto, Y. Todo, H. Shimokawa, K. Aoki, M. Kawai and K. Ide, 'Development of High Accuracy NOx Sensor,' in SAE Technical Paper 2019-01-0749, 2019

MECA, CARB, EPA and EMA are participating in the Emission Measurement and Testing Committee (EMTC) sensor task force project at SwRI that is characterizing the sensor accuracy and capability to measure at ultra-low NOx levels that are 90% below current tailpipe concentrations. MECA is also a member of the On-Board Sensor Monitoring and Reporting Consortium (OSAR) along with EPA, CARB, SCAQMD, EMA and manufacturers. This program will evaluate emission monitoring, telematic reporting and sensor durability to assess their suitability for long-term compliance assurance. [EPA-HQ-OAR-2019-0055-1320-A1, p.34]

Organization: *Truck and Engine Manufacturers Association (EMA)*

Finally, EPA has introduced an option whereby manufacturers may use NOx sensor-based in-use test data instead of PEM-based emissions tests. EMA supports the interest to use on-board sensor technology in this manner. There are several issues that require consideration for this process to be workable, however, including how to account for NOx sensor accuracy, CO2 emissions estimation, the quantity of vehicles to be tested, the duration of the "test period" in question (the test-day equivalent), and others. EMA is nonetheless pleased with the opportunity to work with EPA between now and the final rule to develop workable solutions, if possible. [EPA-HQ-OAR-2019-0055-1203-A1, p. 93]

EPA Summary and Response

Summary:

All comments discussing EPA's proposal to allow the use of onboard NO_x sensors to supplement PEMS testing for in-use testing were generally supportive of the proposal with some qualifications.

CARB comments that they are concerned about the accuracy and drift of onboard NO_x sensors, and the potential to miss high emissions during a cold start. Therefore, CARB suggests EPA

1. identify appropriate specifications for onboard NO_x sensors,
2. require any data collected by the manufacturer be submitted to EPA to avoid biased results, and
3. require a minimum of two test engines be tested with PEMS to ensure some cold start data are collected.

Both PACCAR and Cummins comment that the stringency of the requirements for onboard NO_x sensor operation would be difficult or impossible to meet. Additionally, EMA comments that there are several issues to be solved to create a workable process. PACCAR further recommends that rather than codifying requirements for sensor operation, EPA simply state: 'You must show us that the alternative program gives comparable assurance that your engines meet the NO_x standards of this part.'

Response:

EPA currently agrees with commenters' concerns on the feasibility of this alternate in-use testing option and acknowledges that at this time there are no available technologies that will enable this type of testing. We provide more discussion on this topic in Section III.C.4.ii in the preamble.

11.5.4 Misfueling, particularly with biodiesel

Comments by Organizations

Organization: *American Petroleum Institute (API)*

API provided comments on the 21 January 2020 Advanced Notice of Proposed Rulemaking for this regulatory activity in response to concerns about the potential role of biodiesel in relation to metal and water contaminants in highway diesel fuel. We agree with the finding (stated by EPA in this proposal) that available fuel survey data indicate that biodiesel is compliant with the ASTM D6751-18 limits for Na, K, Ca, and Mg and that there is no 'widespread off specification biodiesel blend stock or biodiesel blends in the marketplace.'3 We also would like to draw EPA's attention to the following remarks:

EPA should consider the results of the SwRI study on the impacts of bioderived fuels on low NOx emission control technologies for heavy-duty engines before finalizing this rule. [EPA-HQ-OAR-2019-0055-1171-A1, p.1]

2 See https://www.regulations.gov/comment/EPA-HQ-OAR-2019-0055-0276

3 See text at 87 Federal Register 17563 (March 28, 2022) 'Biodiesel Fuel Quality'

The Coordinating Research Council (CRC) and the Truck and Engine Manufacturers Association (TEMA) are extending EPA's ongoing heavy-duty engine test program at Southwest Research Institute (SwRI) with additional research that complements the Agency's work in support of this regulatory effort. The CRC program (CRC project RW-120 'Impact of Bioderived Fuels on Low NOx Feasibility') is intended to provide insights on potential fuel-related impacts on heavy-duty engine and aftertreatment performance and durability. EPA's proposed emissions standards for model year 2027+ heavy-duty vehicles and engines are expected to increase the performance demands for aftertreatment systems. Consequently, it is imperative to understand the impact of alternative fuels on system performance as related to engine-out NOx and other criteria pollutant emissions. Fuels of interest in the CRC program include petroleum-derived ultra-low sulfur diesel (ULSD), biodiesel and renewable diesel blends with ULSD. The test fuel blends are B20 and B50 (20%v and 50%v biodiesel in ULSD), RD100 (100%v renewable diesel) and combination blends of RD/biodiesel/ULSD. Test engine operating conditions include low-load cycles and incorporate the aftertreatment system currently used in the EPA low NOx technology assessment at SwRI. Testing is scheduled to start in mid-June and a report on the study is expected by mid-August 2022. [EPA-HQ-OAR-2019-0055-1171-A1, pp.1-2]

As described in Section 3.1.4 of the Draft Regulatory Impact Analysis, EPA has concluded, based largely on the findings to date from the SwRI test program, that the technologies and strategies anticipated for meeting the proposed standards can be designed and implemented to achieve significant NOx reductions that are GHG-neutral.4 Given the potential significance of the CRC program in supplementing and expanding the EPA findings to include alternative fuels, we respectfully request that EPA consider its results before the rule is finalized. [EPA-HQ-OAR-2019-0055-1171-A1, p.2]

4 EPA, Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards Draft Regulatory Impact Analysis, March 2022

Organization: *California Air Resources Board (CARB)*

U.S. EPA requested comments on elements of the Heavy Duty in-use testing program. CARB staff supports the proposed changes to the HDIUT program of removing the HDIUT Phase 2 testing requirements in 40 CFR 86.1915 and the biodiesel fuel blend provisions in 40 CFR 86.1908(a)(6). These elements were also removed for 2024 and newer model year engines in the Omnibus regulation.128 [also in 11.5] [EPA-HQ-OAR-2019-0055-1186-A2, p.60]

128 https://ww2.arb.ca.gov/rulemaking/2020/hdomnibuslownox

With regards to the use of biodiesel, it has been and remains CARB staff's position that engine manufacturers are required to design their engines to operate on all commercially available fuels (including fuels containing biodiesel). For many years, most commercial diesel fuels sold at California service stations and at truck stops dispense diesel fuel containing up to 20 percent biodiesel. CARB certification staff has reviewed owner's manuals to confirm that manufacturers are not prohibiting diesel fuel that meets the definition of CARB's diesel fuel and is legal for sale. If any fuel limitation is found (such as 20 percent biodiesel), CARB staff would contact the manufacturer to better understand the need for any biodiesel restrictions below 20 percent and whether the durability demonstrated at the time of certification is representative and whether the manufacturer is required to rerun durability testing to confirm emission results with existing commercial fuels. [EPA-HQ-OAR-2019-0055-1186-A2, p.60]

CARB staff agrees with the proposal to not continue with the engine misfueled criteria outlined in 40 CFR 86.1908(a)(6). For 2024 and subsequent MY engines, the Omnibus regulations made the fueling requirement more explicit for in-use testing. CARB staff recommends harmonization with the Omnibus proposal timeline for this change with MY 2024. [EPA-HQ-OAR-2019-0055-1186-A2, p.60]

CARB staff supports the inclusion of all commercially available fuels, including fuels that contain biodiesel up to 20 percent, to be included in off-cycle testing. [EPA-HQ-OAR-2019-0055-1186-A2, p.64]

Organization: *Clean Fuels Alliance America (Clean Fuels)*

Clean Fuels has a long history of working with users, fleets, and the OEM community to conduct technically credible research that validates the performance and positive impacts of biodiesel when used in existing diesel engines. Part of that effort has been to conduct testing, evaluate fuel specifications, and implement changes needed to ensure the fuels we support not only work in existing engines but will also work in all future new diesel engines as diesel engine regulations and technology change. Our cooperative efforts continue with our OEM partners and the technical community to conduct the needed testing and research. As such, we would like to thank EPA for recognizing biodiesel quality and for proposing to allow vehicles to be tested for compliance with available biodiesel blends meeting ASTM D7467. This change validates not only the quality of these blends in the marketplace, but also the standards development process within ASTM, in which the global fuel community participates. [EPA-HQ-OAR-2019-0055-1248-A1, p.3]

Assessment of BQ-9000 Biodiesel Properties

As the National Biodiesel Board, now Clean Fuels Alliance America, provided in our comments on the 2020 ANPR, the most recent studies by the National Renewable Energy Laboratory (NREL) and the Association Quality Management Biodiesel (AGQM) show that metals contamination on average is well below the standards set both in the United States and in Europe.3 [EPA-HQ-OAR-2019-0055-1248-A1, p.2]

> 3 U.S. Environmental Protection Agency. ANPR Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine Standards, 85 Fed. Reg. 3,306 (January 21, 2020). available at https://www.federalregister.gov/d/2020-00542

Over the last five years, BQ-9000 accredited biodiesel producers have willingly submitted sample analysis results that have been compiled and statistically analyzed into annual quality reports. NREL has produced four reports on the Assessment of BQ-9000 Biodiesel Properties for 2017, 2018, 2019, and 2020.4 In each of these assessments of BQ-9000 biodiesel properties, NREL helped to collect and statistically analyze the data from U.S.- and Canada-based BQ-9000 member companies to determine the quality of their production lots versus the ASTM D6751 specification in calendar years 2017, 2018, 2019, and 2020. NREL surveyed current BQ-9000 members for their monthly data on 14 critical parameters (not limited to metals) and determined an average, minimum, and maximum monthly values for each parameter. The analysis shows U.S. and Canadian biodiesel almost always meets D6751 specification limits and the average sodium (Na) and potassium (K) was found to also meet the D6751 specification limits. [EPA-HQ-OAR-2019-0055-1248-A1, p.2]

> 4 Alleman, Teresa L. 2020. Assessment of BQ-9000 Biodiesel Properties for 2017. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5400-75795. https://www.nrel.gov/docs/fy20osti/75795.pdf; Alleman, Teresa L. 2020. Assessment of BQ-9000 Biodiesel Properties for 2018. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5400-75796. https://www.nrel.gov/docs/fy20osti/75796.pdf; Alleman, Teresa L. 2020. Assessment of BQ-9000 Biodiesel Properties for 2019. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5400-76840.

https://www.nrel.gov/docs/fy20osti/76840.pdf; Alleman, Teresa L. 2021. Assessment of BQ-9000 Biodiesel Properties for 2020, Golden, CO: National Renewable Energy Laboratory. NREL/TP-5400-79815. https://www.nrel.gov/docs/fy21osti/79815.pdf

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

Figure 3 below shows one example of the difference in SCR performance in a controlled, OEM on-highway fleet test setting (purple) versus an uncontrolled customer system (gray). These two systems ran similar duty cycles with similar mileage accumulation (approximately 435k) and thermal aging characteristics. The OEM fleet system ran on a standard ASTMD975 B5 fuel, whereas the uncontrolled test system filled at fleet or retail stations en route. For both SCR formulations shown below, the 435k mile field return system performs similarly to or worse than the 650k mile fleet test vehicle. The delta shown below in NOx conversion efficiency observed between a controlled test and uncontrolled test is significantly more degradation than what is observed in the test cell simulated 800,000 miles aftertreatment during EPA Stage 3 and rework investigations. We expect similar deltas as shown in the Figure 3 below between a lab-aged environment and fleet-aged environment: [Comment also included in 11.3.1] [EPA-HQ-OAR-2019-0055-1168-A1, pp.26-27]

Vehicles in the field do not run on lab-grade ULSD and most owners/operators are not specialists in fuel handling and maintenance. A recent study by the Fuels Institute found that only 21.6% of sites surveyed in the U.S., including both retail and fleet locations, reported performing any type of routine bulk fuel tank maintenance. Nozzle samples at these locations found that 27.9% of samples contained detectable levels of potassium and 20.5% of samples contained detectable levels of sodium.65 While these levels are low and meet the applicable ASTM standards, accumulation over lifetime can amount to significant catalyst degradation. For example, with the average contamination values reported in the Fuels Institute survey, the cumulative poisoning level introduced to the aftertreatment during a 435k full useful life (FUL) is more than double the maximum concentrations specified for DEF (which has recognized impacts on SCR aging), as illustrated in Table 5 below: [EPA-HQ-OAR-2019-0055-1168-A1, p.27]

65 See Fuels Institute, 'Diesel Fuel Sampling Study: An Evaluation of Diesel Fuel Sold and Consumed in the U.S. Market' (Dec. 1, 2021), https://www.fuelsinstitute.org/Research/Reports/Diesel-Fuel-Sampling-Study (Fuels Institute Diesel Fuel Sampling Study).

Daimler Truck's fuel sampling data aligns with the Fuels Institute survey findings and has been shared with EPA previously. We have observed metallic contamination at concerning levels in a significant number of samples collected from fleets, regardless of biodiesel content as shown in Table 6. These contamination levels will likely degrade catalysts considerably faster than the lab-grade fuel used in the EPA demonstration: [EPA-HQ-OAR-2019-0055-1168-A1, p.28] Daimler Truck recently collected data on real-world catalyst poison deposition in the field to evaluate degradation due to chemical aging. Poison deposition from aftertreatment catalysts was analyzed for a variety of trucks at approximately 250,000 to 650,000 miles, sourced from a variety of applications and fleets. From this study, a real-world representative poisoning level was determined for a variety of contaminants on the first catalyst exposed to exhaust flow. These contaminants were then applied to a copper zeolite close-coupled SCR catalyst, similar to the catalyst used in the SWRI demonstration system, via wet impregnation to accelerate poisoning. fu this study, we concluded that the three most detrimental contaminants on the copper zeolite technology were sodium, phosphorous, and potassium. Table 7 below summarizes the shift of T90 temperatures (temperature at which 90% SCR conversion occurs) due to the application of individual poisons compared to a hydrothermally aged (HTA) reference. Note that all poisoned samples are also hydrothermally aged: [EPA-HQ-OAR-2019-0055-1168-A1, p.29]

EPA's low-NOx demonstration utilized the DAAAC protocol, which accelerates oil borne poisoning (P, Ca, Mg, Zn) and sulfur. Based on these findings, we do not believe the applied DAAAC protocol fully represents a real-world use case, where sodium and potassium levels (from diesel fuel and other sources) are also of significant impo1tance for a copper close-coupled SCR. The CCSCR performance used in the EPA investigation to demonstrate low-NOx feasibility has only accounted for a portion of the degradation expected in real-world operation. EPA has asserted that aging and poisoning can be corrected by increasing the size of the catalyst; however, adding more catalyst volume does not necessarily offset the shift in light-off after chemical poisoning. Increasing catalyst volume also increases thermal inertia, which is counter to the fast SCR light-off required for low cold strut emissions. EPA also does not consider the packaging, cost, backpressure, and fuel economy impacts of simply adding additional catalyst. Daimler Truck does not see this as a workable solution to fuel poisoning. [EPA-HQ-OAR-2019-0055-1168-A1, p.29]

EPA did not adequately consider the effects of the alkali metals (Na and K) on SCR catalysts in the accelerated aging protocol applied at SWRI. Daimler Truck's data on field fuel quality and catalysts sampled from the field indicates catalyst poisoning levels in excess of what has been applied in the EPA demonstration. Additionally, Daimler Truck has observed significant variability in chemical contamination in the field and believes that the EPA demonstration is a best-case scenario, and is not proof of durability or feasibility for a product in the field. [EPA-HQ-OAR-2019-0055-1168-A1, pp.29-30]

In addition to long term aging impacts, tank-to-tank changes in fuel properties can also significantly impact engine-out emissions and catalyst performance. The chemical structure of fatty acid methyl ester (FAME) biodiesel causes an increase in engine-out NOx as compared to conventional diesel, regardless of engine make. This is demonstrated in the CARB Biodiesel Characterization and NOx Mitigation Study, where engine-out NOx increases were observed for both a 2006 Cummins ISM and 2007 MBE 4000 engine.66 At a B20 blend level, NOx increases of up to 6.6% were measured on the FTP cycle, an increase of up to 6.9% over 50 mph cruise cycle as shown in Figure 4.67 [EPA-HQ-OAR-2019-0055-1168-A1, p.30]

66 See CARB, Biodiesel Characterization and NOx Mitigation Study, available at https://www.arb.ca.gov/fuels/diesel/altdiesel/20111013_carb final biodiesel report.pdf.

67 Id.

More recent data (Figure 5) shows that this effect persists, even with more modern emissions control technologies. For example, CARB’s Low Emissions Diesel (LED) study shows that biodiesel blends above B20, even when blended with ULSD or Renewable diesel biofuel, produce significantly more engine-out NOx.69 [EPA-HQ-OAR-2019-0055-1168-A1, pp. 30-31]

> 69 See Durbin, et al., Low Emission Diesel Study: Biodiesel and Renewable Diesel Emissions in Legacy and New Technology Diesel Engines (Nov. 2021) at Table ES-2, available at https://ww2.arb.ca.gov/sites/default/files/2021-12/Low Emission Diesel Study Final Report 12-29-21.pdf ('CARB LED Study').

Internal Daimler Truck test results on more recent engine technologies align with the results of the CARB LED study, noting a direct engine-out NOx increase up to 7%, while showing no engine-out CO2 reduction on the composite FTP cycle with the use of B20. Daimler Truck expects that this impact will be significantly more important with the proposed ultra low-NOx (UL NOx) systems, which are much more sensitive to increased engine-out NOx and require much higher levels of NOx conversion efficiency across the aftertreatment. [EPA-HQ-OAR-2019-0055-1168-A1, p.31]

The data used at SWRI to support the CARB Omnibus regulation does not account for the adverse effects of biodiesel, either from the immediate emissions increases as demonstrated by this study, or from the long-term aging effects of biodiesel which are understood by the industry. These increases in emissions and associated harm to the environment are in the range of what Daimler Truck would expect from biodiesel blends and are in opposition to both industry and EPA goals. [EPA-HQ-OAR-2019-0055-1168-A1, p.31]

Additionally, when considering proposed blends of renewable diesel, biodiesel, and traditional ULSD, EPA should consider the chemistry and physics that govern blending outcomes. Renewable diesel fuels mix well with traditional ULSD, because they consist of the same hydrocarbon chain. These fuels, both individually and blended shed water and impurities well. By contrast, biodiesel and renewable diesel do not mix well. The culprit is the glycerin in biodiesel which is miscible with water, and therefore the blended fuel carries not only water but also impurities. This leads to fuel filter plugging, accelerated aging of after-treatment systems and ultimately increases emissions released into the environment. On a chemical level, to reduce these effects, any biodiesel fuel blendstock (B100) specification needs to include biodiesel distillation. Otherwise, blends of biodiesel and renewable diesel could carry the same impurities, and cause the same long term degradation to emissions control systems, as biodiesel alone. [EPA-HQ-OAR-2019-0055-1168-A1, pp.31-32]

We believe that the CARB LED Study and test cycles used are sufficiently representative and confirm the directional correctness of industry-known immediate impacts of biodiesel. No current technology exists that can mitigate the short- or long-term effects of emissions degradation from biodiesel, and the results in the CARB study confirm Daimler Truck's experience in this regard. [EPA-HQ-OAR-2019-0055-1168-A1, p.32]

EPA should further research negative emission impacts of biodiesel fuels, including both short-term effects and long-term degradation of emission control equipment, and use this information to inform the feasibility of new emission standards and whether these fuels should be approved or promoted. [EPA-HQ-OAR-2019-0055-1168-A1, p.32]

There is an ongoing CRC/EMA study that involves evaluating a range of market-available fuels on the SWRI demonstration system for both short term impacts and long term aging impacts. We expect the short term study to highlight critical fuel properties and their associated impacts on system performance. We encourage EPA to consider additional margin based on any findings of this study and/or pursue changes to fuel standards to minimize variation in the marketplace. Calibration efforts alone on the part of the manufacturer are not sufficient to ensure compliance with the stringent standards that EPA proposes under Option 1 or Option 2, and work best when critical fuel properties are known, which is not the case in real-world operation. Daimler Truck is aware of biodiesel detection algorithms (having introduced a method to detect B100, experimentally, in European applications), but we do not believe such algorithms meet the need that EPA's standards create—nor that they are feasible in combination with NAFTA onboard diagnostics (OBD) requirements. To date, no manufacturer has demonstrated the ability to accurately detect and correct for biodiesel content at the granularity required for UL NOx adjustments. No fuel quality or biodiesel content sensors are currently offered in the marketplace that are production-feasible. [EPA-HQ-OAR-2019-0055-1168-A1, p. 32]

We appreciate EPA considering a process for a manufacturer to reject heavy-duty in-use testing (HDIUT) results, given the catalyst poisoning concerns raised in the Proposed Rule and noted elsewhere within these comments. However, the method on which EPA requests comment in the Proposed Rule preamble is not reasonable or recommended.89 It is not feasible for the OEM to show a history of biodiesel where B100 does not meet the applicable ASTM standard, as fuel quality and recordkeeping by fleets and retail stations are not the responsibilities of the OEM. This method could be supported if a vehicle or HDIUT fleet were selected at start of mileage accumulation and a cooperative fuel sampling program put in place over lifetime. Setting up such program with a large pool of vehicles available for the Agency to select from would provide significant benefits for the Agency, manufacturers, and customers, in that it would provide fair, transparent, and auditable system for true FUL emissions performance evaluation. [EPA-HQ-OAR-2019-0055-1168-A1, p.69]

89 See Proposed Rule, 87 Fed. Reg. at 17,563 (requesting comment on a process for receiving EPA approval to exempt test results from in-use testing compliance (and test results being considered for potential recall) if an engine manufacturer can show that the vehicle was historically fueled with biodiesel blends whose B100 blend stock did not meet the ASTM D6751–20a limit for Na, K, Ca, and/or Mg metal).

Daimler Truck proposes that a manufacturer determine the level of poisoning on the aftertreatment's catalysts against a defined normal value for that product. This method would require the manufacturer invest in significant R&D work and sample a quantity of field aged catalyst systems to determine a normal range given typical exposure to approved fuels. Systems with abnormal results that significantly impact performance could be removed from the HDIUT analysis, and another system selected. This method would allow the manufacturer to fairly screen for abnormal chemical contamination without the burden of proof of the source, which is outside of the manufacturer's control. Normal chemical contamination via fuel borne metals, intrusion via the DEF system, and other potential sources is still significantly challenging for the proposed NOx stringency for FUL, and may result in costly catalyst replacement. EPA and ASTM must engage on reducing the sources of chemical contamination to enable significant NOx reductions. [EPA-HQ-OAR-2019-0055-1168-A1, p.69]

Under current regulation, manufacturers are allowed to specify maintenance procedures that are critical to the operation of their engines throughout their useful life. This has historically included specifying the required or recommended fuel types necessary to ensure that systems perform adequately and are not inappropriately degraded. Manufacturers are rightly allowed to later remove engines from in-use testing evaluations if the vehicles have not been maintained as directed, or if they have been fueled in a manner inconsistent with the instructions in their manuals. Similarly, manufacturers may limit their warranty liability and deny warranty claims when mis-fueling can be identified as the cause of an emissions control failure. [EPA-HQ-OAR-2019-0055-1168-A1, p.87]

EPA proposes to remove these manufacturer protections, which would expose manufacturers to liability regarding both in-use emissions performance and warranty. The Agency proposes to do so at the same time that it refuses to address the demonstrated fuel quality concerns in the field. The nation's collective fuel quality concern threatens the longevity of emissions control components and directly contributes to increased emissions, through immediate increases in NOx and through degradation of catalysts via metals contamination. Yet EPA simultaneously proposes to limit manufacturers' ability to control exposure to poor-quality fuel *and* to implement standards that are so stringent that manufactures must remove all potential sources of emissions variability and system degradation. [EPA-HQ-OAR-2019-0055-1168-A1, p.87]

EPA must mandate improvements to nationwide diesel and biodiesel fuel quality—or risk significant emissions impacts, or worse, the creation of an unfeasible emission standard with uncertainties that manufacturers cannot tolerate, leading to unavailability of product, and an eventual unwinding of EPA's proposed standards. [EPA-HQ-OAR-2019-0055-1168-A1, p.87]

Daimler Truck continues to engage in and support fuel quality improvement efforts in a variety of forums. We support ASTM in the ongoing proposed revisions to ASTM D7467 (B6- B20), which include moving metals values from the non-mandatory appendix to the mandatory table. The Company also supports the revision of the test method to lower the limit of detection and the lowering of metal content allowed in ASTM D6751 (B100 blendstock) to a 4ppm maximum limit. However, we do not believe these changes alone will serve the needs of modern UL NOx engines, as is evident by formations of groups like Top Tier, where manufacturers are working outside of ASTM to improve fuel quality at the pump. We believe it is necessary and appropriate for EPA to set finished fuel quality standards, measured at the pump, to enable their proposed emissions programs. [EPA-HQ-OAR-2019-0055-1168-A1, p.87]

In Section II.B.3 of these comments, Daimler Truck provides significant evidence that contaminants found in fuels contribute to catalyst degradation. We provide detailed information on this effect, and we present evidence of the metal contamination present in fuels in Section II.B.3, which addresses EPA's demonstration of feasibility. To summarize, chemical degradation from contaminants present in field fuel account for significant degradation beyond the 'best case fuel' degradation experienced in laboratory settings, which directly leads to increased NOx emissions as catalyst NOx conversion efficiency is reduced. This is illustrated in Figure 32 below: [EPA-HQ-OAR-2019-0055-1168-A1, p.88]

Degradation of ATS conversion efficiency, even by 1%, cannot be tolerated with EPA's proposed stringent standards. Fuel standards must be improved to prevent such degradation. [EPA-HQ-OAR-2019-0055-1168-A1, p.88]

Catalyst degradation via fluid impurities is widely acknowledged in this industry for other fluids outside of fuels. For example, ISO 22241-1 for DEF states 'The quality of the urea solution used for that technology needs to be specified to ensure reliable and stable operation of the SCR converter system.'111 As such, the contaminant limits for DEF are outlined in Figure 33 below: [EPA-HQ-OAR-2019-0055-1168-A1, p.88]

111 See ISO 22241-1:2019, 'Diesel engines — NOx reduction agent AUS 32 — Part 1: Quality requirements' (2019), https://www.iso.org/standard/66408 html.

These <0.5 mg/kg limits on DEF combined with the relatively low usage of DEF compared to fuel, result in lower overall contribution of contaminants from the diesel exhaust fluid. For example, a line haul vehicle with a 6 mpg fuel economy, and 3% DEF:Fuel ratio could consume up to 9.7 grams of sodium from DEF, and 21 grams of sodium from fuel based on the average value reported in the DFQC study. The <100 ppb contribution referenced by EPA in the NPRM results in significantly more contamination via fuel than DEF. Table 11 below outlines the maximum contribution from DEF compared to the average values reported in the DFQC survey, as well as the 100 ppb result referenced by EPA in the Proposed Rule: [EPA-HQ-OAR-2019-0055-1168-A1, p.89]

As fuel is consumed in much larger quantities than DEF, DTNA believes that the metallic contamination limits in finished fuel should be at least as stringent as DEF (0.5 mg/kg) or lowered to a level to result in similar levels of contamination, which requires a limit of approx. 40-50 ppb maximum. [EPA-HQ-OAR-2019-0055-1168-A1, p.90]

The chemical structure of fatty acid methyl ester (FAME) biodiesel causes an increase in engine-out NOx compared to conventional diesel, regardless of engine make, as demonstrated in the CARB Biodiesel Characterization and NOx Mitigation Study, where engine-out NOx increases were observed for both a 2006 Cummins ISM and 2007 MBE 4000 engine.114 At a B20 blend level, NOx increases of up to 6.6% were measured on the FTP cycle.115 [EPA-HQ-OAR-2019-0055-1168-A1, p.90]

114 See CARB, Biodiesel Characterization and NOx Mitigation Study, available at https://www.arb.ca.gov/fuels/diesel/altdiesel/20111013_carb final biodiesel report.pdf.

115 See id.

More recent data shows that this effect persists, even with more modern emissions control technologies. For example, the CARB LED Study shows that biodiesel blends above B20, even when blended with ULSD or Renewable diesel biofuel, produce significantly more engine-out NOx:117 [EPA-HQ-OAR-2019-0055-1168-A1, p.91]

117 See Durbin, et al., Low Emission Diesel Study: Biodiesel and Renewable Diesel Emissions in Legacy an New Technology Diesel Engines (Nov. 2021) at Table ES-2, available at https://ww2.arb.ca.gov/sites/default/files/2021-12/Low Emission Diesel Study Final Report 12-29-21.pdf.

Internal Daimler Truck test results on more recent engine technologies align with the results of the CARB LED Study noting a direct engine-out NOx increase up to 7%, while showing no engine-out CO2 reduction on the composite FTP cycle with the use of B20. Daimler Truck expects that this impact will be significantly more important with the proposed UL NOx systems, which are much more sensitive to increased engine-out NOx, and require much higher levels of NOx conversion efficiency. [EPA-HQ-OAR-2019-0055-1168-A1, p.92]

Low oxidation stability is a prominent issue among ULSD and biodiesel fuels, and it directly affects operability and durability of emission control components including fuel injectors. Internal Daimler Truck studies show that fuel containing 5% biodiesel aged to 6 hours of stability caused injectors to seize after 13 test cycles while ULSD aged to 6 hours of stability allowed injectors to complete 30 cycles. Additionally, water and acid content in fuel directly contribute to corrosion in the fuel system, leading to higher repair costs and replacement of emissions-critical components. EPA must address these concerns to ensure it has accurately assessed whether costs for the advanced emissions controls proposed are reasonably—especially at the extended useful life and warranty periods that the Agency proposes. [EPA-HQ-OAR-2019-0055-1168-A1, p.92]

Daimler Truck has presented significant evidence in these comments to show fuel quality is an important limiting factor for emissions performance and durability of emissions relevant components. To enable EPA's proposed new standards, ASTM and EPA must set fuel standards that meet the needs of modern engines. We recommend that EPA take steps to improve fuel standards and enforcement, similar to lowering sulfur content in ULSD to enable compatibility with EGR and aftertreatment. [EPA-HQ-OAR-2019-0055-1168-A1, p.92]

Specifically, we recommend a maximum biodiesel content of 20% nationwide. As evidenced by the CARB LED Study of higher biodiesel blends, the emissions impacts of biodiesel increase significantly as blend percentage increases. [EPA-HQ-OAR-2019-0055-1168-A1, p.92]

Additionally, Daimler Truck recommends the following fuel standards (enforceable at the pump) based on industry experience, experimental data, and supplier input: [EPA-HQ-OAR-2019-0055-1168-A1, p.92]

In addition to these finished fuel specifications, we recommend improvements to the B 100 blendstock specification, to help enable higher quality finished fuels with biodiesel content. The following Bl00 specifications and recommendations refer strictly to Bl00 as a blendstock (used for blending up to a maximum of B20) and not as a finished product. [EPA-HQ-OAR-2019-0055-1168-A1, p.93]

Daimler Truck recognizes and supports the use of renewable diesel (R l00) as a greener alternative to ULSD. This fuel has been validated and released in our current production engines, and in testing has shown superior stability and reductions in engine out emissions compared to biodiesel and ULSD. Our evaluation has shown that renewable diesel offers a 9% reduction in engine-out NOx on the composite FTP and 6% reduction in engine-out CO2 compared to B20, without sacrificing engine operability. Mandating renewable diesel penetration offers significant real world lifecycle CO2 improvement in addition to per vehicle CO2, NOx, and PM reduction. These improvements can be realized easily and inexpensively and provide dramatic emissions improvements to the commercial sector immediately—improvements that may be realized for trucks that have already been built, not just new, expensive UL NOx vehicles that will not be available in the marketplace for several years. [EPA-HQ-OAR-2019-0055-1168-A1, pp.93-94]

Additionally, Daimler Truck recognizes that biodiesel may have a lower carbon intensity score than ULSD and renewable diesel as well as the time value of carbon, but that the issues with the fuel discussed in these comments make it incompatible with UL NOx engines in high concentrations. We urge EPA to consider a uniform, nationwide biodiesel blending proposal (e.g. B5 standard for all diesel fuel sold). This allows for lifecycle GHG reductions to be realized while minimizing the negative effects of biodiesel on per vehicle GHG emissions and engine operability and durability. With lower maximum blend rates and wider distribution, the NOx increase is mitigated while wider lifecycle GHG reductions can be achieved, suppressing the negative environmental impacts over the course of a vehicle lifecycle. [EPA-HQ-OAR-2019-0055-1168-A1, p.94]

Organization: *Manufacturers of Emission Controls Association (MECA)*

Some metals found in engine oils can also result in deterioration in catalyst performance. Lube oil phosphorus is a non-selective poison that effectively masks surface active catalyst sites, independent of the type of catalyst formulation. Generally, phosphorus deposits heavily at the front end of the catalyst brick, and typically resides mostly on the surface of the washcoat. There is some concern that phosphorus could react with other poisons and a catalyst washcoat to form phosphates that persist on the washcoat surface and mask the catalyst sites [29]. More research is needed here to determine the durability requirements to meet future full useful life provisions; however, the results of the lube oil poisoning as accelerated in the SwRI program show good durability of the close-coupled SCR, which receives the bulk of the lube oil metal poisons. Possible future mitigation actions that catalyst suppliers can deploy include increasing catalyst volume and/or inclusion of poison-resistant catalyst designs. [EPA-HQ-OAR-2019-0055-1320-A1, p.24]

> [29] B. Bunting, K. More, S. Lewis and T. Toops, ‘Exhaust Phosphorus Chemistry and Catalyst Poisoning,’ in 2004 Department of Energy Diesel Engine Emissions Reduction Conference, 2004.

Other metals that are found in some fuels and oils, such as biodiesel, include calcium, sodium, potassium and magnesium. Calcium deposits uniformly across the catalyst and can physically block active sites. Elevated levels of sodium and potassium could displace the active metals and reduce the NOx conversion and N2 selectivity. At this time, MECA is not aware of any data that shows that magnesium has a negative effect on catalyst performance. Recent research has shown how biodiesel metal contaminants can affect emission control systems [30, 31]. Extensive testing of light-duty and heavy-duty aftertreatment systems exposed to biodiesel exhaust at the 10-ppm metal impurity specification for biodiesel has been published by NREL with funding from the National Biodiesel Board (NBB) and support from MECA. A medium-duty pick-up truck aftertreatment system equipped with a front-SCR was aged out to 150,000 accelerated miles on fuel doped with metals to the current maximum specification and met the FTP emission limit for that vehicle [32]. Similarly, in a later study, a heavy-duty 2010 style aftertreatment system architecture was aged in an accelerated fashion to represent 435,000 equivalent miles of thermal aging using a similar doped biodiesel fuel and met the FTP emission limit after aging [31]. [EPA-HQ-OAR-2019-0055-1320-A1, pp.24-25]

[30] A. Williams, J. Luecke, R. L. McCormick, R. Brezny, A. Geisselmann, K. Voss, K. Hallstrom, M. Leustek, J. Parsons and H. Abi-Akar, ‘Impact of Biodiesel Impurities on the Performance and Durability of DOC, DPF and SCR Technologies,’ SAE International Journal of Fuels and Lubricants, vol. 4, no. 1, pp. 110-124, 2011.

[31] M. Lance, A. Wereszczak, T. J. Toops, R. Ancimer, H. An, J. Li, L. Rogoski, P. Sindler, A. Williams, A. Ragatz and R. L. McCormick, ‘Evaluation of Fuel-Borne Sodium Effects on a DOC-DPF-SCR Heavy-Duty Engine Emission Control System: Simulation of Full Useful Life,’ SAE International Journal of Fuels and Lubricants, vol. 9, no. 3, pp. 683-694, 17 October 2016.

[32] A. Williams, R. McCormick, M. Lance, C. Xie, T. Toops and R. Brezny, ‘Effect of Accelerated Aging Rate on the Capture of Fuel-Borne Metal Impurities by Emissions Control Devices,’ SAE International Journal of Fuels and Lubricants, vol. 7, no. 2, pp. 471-479, 2014.

The metal content of B100 from field samples analyzed by researchers at NREL [33] [34] [35] have shown metal content far below the current specification for the vast majority of samples collected, and the impurity level has been coming down over the sample years in 2013 and 2019. MECA supports more stringent limits of fuel additives that contain metals including evaluating their potential impact on aftertreatment components. We have been working with NBB, OEMs and biodiesel producers to generate the necessary data that supports tighter ASTM specifications for metal impurities in biodiesel at or near the detection level of analytical techniques as a way to provide confidence to engine manufacturers that biodiesel fuels can be as clean as possible. [EPA-HQ-OAR-2019-0055-1320-A1. p.25]

[33] T. L. Alleman, L. Fouts and G. Chupka, ‘Quality Parameters and Chemical Analysis for Biodiesel Produced in the United States in 2011,’ National Renewable Energy Laboratory. NREL/TP-5400-57662, Golden, CO., 2013.

[34] T. L. Alleman, L. Fouts and E. D. Christensen, ‘Metals Analysis of Biodiesel Blends,’ National Renewable Energy Laboratory. NREL/TP-5400-72341, Golden, CO, 2019.

[35] T. L. Alleman, 'Assessment of BQ-9000 Biodiesel Properties for 2020,' National Renewable Energy Laboratory. NREL/TP-5400-79815, Golden, CO, 2021.

Current fuel quality in the market: CARB staff reported sulfur and metals levels in today's fuel supply for diesel engines without any applied corrections for volumes represented or market share of producers [36]. To better understand sulfur content and variability in the California fuel supply for diesel engines, CARB-collected over 400 fuel samples from California producers, importers and distribution terminals during 2017 to 2019 calendar years. These samples included diesel and some biodiesel and renewable diesel blends with maximum sulfur content observed of 13 ppm and an average sulfur content 4 ppm with a standard deviation of 3 ppm. These sulfur levels in current ULSD are adequate for engine and aftertreatment systems to meet the Proposed Option 1 standards. [EPA-HQ-OAR-2019-0055-1320-A1, p.25]

[36] CARB, 'Regulations.gov,' 25 February 2020. [Online]. Available: https://www.regulations.gov/document?D=EPA-HQ-OAR-2019-0055-0471.

CARB staff also collected and analyzed over 400 diesel and biodiesel blend samples collected at retail fuel pumps throughout California in 2019 [36]. The findings concluded that phosphorus and metal contents of biodiesel were significantly lower than current ASTM limits, which supports minimal impact of biodiesel metals and phosphorus on the full useful life durability of diesel exhaust aftertreatment systems. CARB staff also analyzed 27 B100 samples that EPA collected from biodiesel production facilities nationally and did not identify metals contamination. These results are consistent with trends seen in national biodiesel fuel surveys conducted by NREL and referenced above. [EPA-HQ-OAR-2019-0055-1320-A1, p.25]

[36] CARB, 'Regulations.gov,' 25 February 2020. [Online]. Available: https://www.regulations.gov/document?D=EPA-HQ-OAR-2019-0055-0471.

Organization: *Navistar, Inc. (Navistar)*

The recently published CARB Low Emissions Diesel ("LED") study1 demonstrates that fuel quality has a significant impact on emissions. Poor fuel quality, especially driven by the biodiesel production and distribution process is more prevalent in the U.S. as compared to Canada, European Union, and Japan. The current ASTM D975 and D7467 are inadequate when compared to EU and other worldwide standards. These inadequacies have led to increased downtime, and a risk of elevated and irreversible in-use emissions. Common fuel contamination from magnesium, zinc, calcium, potassium, sodium can irreversibly poison aftertreatment systems. Low oxidation stability can lead to significant increases in acid formation in the oil, which can cause corrosion and accelerated wear in bearing and sealing surfaces. Navistar recommends the adoption and enforcement of both Top Tier and EU biodiesel standards in lieu of the ASTM D975, D7467 and D6751 standards. [EPA-HQ-OAR-2019-0055-1318-A1, p. 6]

1. CARB Low Emission Diesel Study (LED): Low Emission Diesel (LED) Study: Biodiesel and Renewable Diesel Emissions in Legacy and New Technology Diesel Engines - Final Report: https://ww2.arb.ca.gov/sites/default/files/2021-12/Low_Emission_Diesel_Study_Final_Report_12-29-21.pdf

Organization: *Neste US, Inc*

Renewable fuels can be used by older engines equipped to run on fossil diesel, and can therefore be used to cut emissions immediately. Neste has worked with leading original equipment manufacturers (OEMs) to test renewable diesel in diesel engines. As a result, many OEMs, including Cummins, Volvo Trucks, Caterpillar, and Detroit Diesel endorse renewable diesel for use in their equipment. Last year, Neste's advanced biofuels helped our customers prevent 10.9 million tons of CO2 equivalent from entering the atmosphere. We want to get that number up to 20 million tons by 2030. [EPA-HQ-OAR-2019-0055-1225-A1, p.1]

Renewable diesel produced via hydrotreating removes metals, and other contaminants

The proposed rule mentioned biodiesel fuel quality and related compliance issues, expressing EPA's concerns that trace metals in biodiesel may adversely affect engines and emission control systems.6 However, the Agency ignores that renewable diesel produced via hydrotreating removes molecules of sulfur, nitrogen, oxygen and heavy metals such as P, Ca, and Mg from the same feedstocks to produce high quality diesel fuel for modern exhaust aftertreatment systems. Elimination of these contaminants means that renewable diesel has improved properties and removes significantly fewer contaminants on combustion, and that the product can be further treated catalytically without poisoning the catalysts used.7 Neste would also like to emphasize significant differences between biodiesel and renewable diesel, for EPA's consideration should the agency decide to address its concern about metals in biodiesel in a more formal way in the future. [EPA-HQ-OAR-2019-0055-1225-A1, p.4]

6 87 Fed. Reg. 17414, 17563 (Mar. 28, 2022).

7 Jack Reese, Ellen M. Silva, Shang-Tian Yang, Liang-Shih Fan, Industrial Applications of Three-Phase Fluidization Systems, in Fluidization, Solids Handling, and Processing, 582-682 (1999).

In addition to renewable diesel lowering GHG emissions by up to 75% over the fuel's lifecycle when compared with fossil diesel, our fuel also provides, depending on the age and make of the engine, a cost-effective solution for reducing transport-related local emissions and improving local air quality in cities, on average:

- 33% lower levels of fine particulates (and a smaller number of particulates in general)
- 30% less hydrocarbons (HC)
- 24% lower carbon monoxide (CO) emissions and reduced levels of polyaromatic hydrocarbons (PAH)
- 9% less nitrogen oxides (NOx) [EPA-HQ-OAR-2019-0055-1225-A1, pp.4-5]

Organization: *Renewable Energy Group*

[*From Hearing Testimony, April 13, 2022, Martin Haverly, Renewable Energy Group*] I'm the senior manager of research and development and innovation with Renewable Energy Group. As you've already heard from my colleague earlier, Renewable Energy Group is an industry leader delivering high-quality low-carbon biodiesel and renewable diesel fuel to markets in the U.S. and abroad. I would like to reiterate our support for the EPA and its finding that the pool of biodiesel available to vehicle and equipment operators across the country is of very high quality while biodiesel blends above 5 percent, or B5, are not expected to impede the performance of next-generation after treatment, devices developed to meet this proposed new tailpipe standard. According to findings, including the proposed rulemaking, EPA reports that the presence of metals and other quality metrics has greatly improved. These findings are derived from a robust fuel sampling survey conducted by the agency, the California Air Resources Board, and the National Renewable Energy Laboratory. The vast majority of fuel samples show the presence of impurities far below specified and allowable levels. We support EPA in its proposal to require engine manufacturers to provide detailed evidence to document claims of off-spec biodiesel when seeking an exemption of test results as part of an end-use compliance. Decades ago, REG developed processes to produce and deliver to the marketplace the highest quality biodiesel. As the industry leader, we are encouraged to know that our competitors have also stepped up to develop and deliver high-quality low-carbon bio-based diesel fuel including biodiesel, and that plays a disproportionate role in reducing transportation sources of greenhouse gas emissions. Evidence in this proposed rule demonstrates that access to high-quality biodiesel is prevalent and that higher blends of biodiesel are not expected to impede the performance of after treatment devices. Through the renewable fuel standard, the EPA has proposed growth in bio-based diesel volumes in 2022 and we believe that even more fuel may be delivered to the market this year and beyond. Blends of 20 percent biodiesel, or B20, should be the norm and we encourage engine manufacturers to work alongside fuel producers like Renewable Energy Group to support blends above B20. The diesel commercial trucks of the future can deliver cleaner air through the next-generation after treatment devices while delivering even greater climate benefits when operating using higher blends of low-carbon bio-based diesel fuels. Thank you very much for this opportunity to present our views and suggestions at this public hearing. As already noted, Renewable Energy Group will also be submitting written comments and we look forward to supporting the EPA as you continue your important mission to fight global warming and increase investment in renewable fuels while improving air quality and reducing emissions. [EPA-HQ-OAR-2019-0055-2867]

Organization: *State Soybean Associations*

In its Proposed Rule, EPA raises concerns about trace metals in biodiesel and their potential to adversely affect emissions control systems and engines. Its stated concern is that metals, such as sodium, potassium, calcium, and magnesium can enter the production of biodiesel and impact the diesel particulate filters or selective catalytic reduction catalyst. EPA has insufficient scientific data to back up this conclusion, however. EPA should not let this kind of unsubstantiated concern limit the use of biodiesel, given its proven utility in significantly reducing GHG emissions. [EPA-HQ-OAR-2019-0055-2035-A1, p.3]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EPA’s proposed procedures for in-use testing require that MY 2027 and later products comply with all in-use standards when operating on “any commercially available biodiesel fuel blend that meets the specifications for ASTM D975 or ASTM D7467.” (See §1036.415(c)(1).) There is a significant body of evidence accumulated over the last decade29 showing that fuel quality has a significant impact on emissions. Poor fuel quality, especially driven by the biodiesel chemistry, production processes, and distribution impacts, is prevalent in the U.S. compared to the rest of the leading markets (USMCA, EU, Japan). This is driven to a large extent by inadequate fuel quality standards as published by ASTM compared to other world-wide standards. Those inadequate standards and associated lack of regulatory oversight have led to vehicle downtime, and risks of elevated in-use emissions. Those risks will be even greater for engines and vehicles compliant with the proposed low-NOx emissions standards, where a single tank of poor-quality biodiesel fuel can permanently compromise the emission reduction efficacy of the entire aftertreatment system. The effect of this is shown in the CARB LED study. [EPA-HQ-OAR-2019-0055-1203-A1, p. 137]

29. CARB Low Emission Diesel Study (LED): Low Emission Diesel (LED) Study: Biodiesel and Renewable Diesel Emissions in Legacy and New Technology Diesel Engines - Final Report (ca.gov)

Furthermore, the recently published Fuels Institute's Diesel Fuel Quality Council's (DFQC) field fuel quality study30 revealed that over 50% of nozzle samples contained metals such as magnesium, calcium, and zinc, which are all elements poisonous to the aftertreatment system. While those metals values were within the ASTM standard, several manufacturers expressed concern that even at low levels, those metals could be impactful to aftertreatment deterioration at higher mileages. Those results, combined with the fact that 32% of the samples failed to meet the 20-hour oxidation stability threshold, raise serious concerns about the potential impacts of fuel quality going forward as new low-NOx requirements take effect. Finally, it is known that regular preventative tank maintenance can aid in minimizing unfavorable fuel properties such as high oxidation stability and high metal contamination. The DFQC field fuel quality study reported that less than 22% of tank sites reported performing routine tank maintenance. [EPA-HQ-OAR-2019-0055-1203-A1, p. 138]

30. Fuel Institute Diesel Fuel Sampling Study: An Evaluation of Diesel Fuel Sold and Consumed in the U.S. Market | Fuels Institute

Biodiesel also can degrade some gaskets and seals with prolonged exposure, particularly those made from natural or nitrile rubber. The lack of oxidation stability of biodiesel can put materials at risk of swelling, leaking, and/or failure. Fuel lines containing elements such as brass, bronze, copper, lead, tin, and zinc, may accelerate the oxidation process of biodiesel, thereby creating fuel insoluble compounds or gels and salts. [EPA-HQ-OAR-2019-0055-1203-A1, p. 138]

As acknowledged by EPA in the Draft RIA, metallic contamination in the aftertreatment due to fuel-borne contaminants has been shown in a variety of studies to degrade emissions control catalysts. "Brookshear et al. 2012 studied the impact of Na on heavy-duty diesel engine aftertreatment devices. In this accelerated aging study, they doped a B20 fuel to 5,000 ppm each of Na and S and aged to an equivalent 435,000 miles. They found impacts on SCR function if the SCR was positioned before the DPF." Due to the cold-start stringency proposed, leading concepts for system layouts, including EPA's Low-NOx Stage 3 demonstration system at SWRI, rely heavily on an SCR placed before the DPF. EPA further acknowledges these concerns, as follows: “Williams et al. 2013 studied the effect of Na, K and Ca on a 2011 LD 6.7L diesel engine aftertreatment. They doped their B20 fuel to 14 times the pseudo 1 ppm Na and Ca limit of a B20 fuel and accelerated aged the emission control systems out to 150,000 miles. The authors aged sets of production exhaust systems that included a DOC, SCR catalyst, and DPF. Four separate exhaust systems were aged, each with a different fuel: ULSD containing no measurable metals, B20 containing sodium, B20 containing potassium, and B20 containing calcium. Analysis of the aged catalysts included Federal Test Procedure emissions testing with the systems installed on a Ford F250 pickup, bench flow reactor testing of catalyst cores, and electron probe microanalysis (EPMA). The thermo-mechanical properties of the aged DPFs were also measured. [EPA-HQ-OAR-2019-0055-1203-A1, p. 138]

EPA further acknowledges these concerns, as follows: EPMA imaging of aged catalyst parts found that both the Na and K penetrated into the washcoat of the DOC and SCR catalysts, while Ca remained on the surface of the washcoat. Bench flow reactor experiments were used to measure the standard NOx conversion, NH3 storage, and NH3 oxidation for each of the aged SCR catalysts. Flow reactor results showed that the first inch of the SCR catalysts exposed to Na and K had reduced NOx conversion through a range of temperatures (Figure 1-8 and Figure 1-9) and also had reduced NH3 storage capacity. The SCR catalyst exposed to Ca had similar NOx conversion and NH3 storage performance compared to the catalyst aged with ULSD.” [EPA-HQ-OAR-2019-0055-1203-A1, pp. 138 - 139]

EPA has also referenced “A level of 1 mg/kg (1 part per million) of trace metal in the fuel result in an estimated accumulation of about 22 g of trace metal in diesel particulate filters per 100,000 miles (assuming a fuel economy of 15 mpg and 100% trapping efficiency).” Even at that low concentration, this equates to an additional 132 grams of DPF ash in a 600,000 mile full useful life. The additional ash accumulation caused by low levels of metals in the fuel will require more frequent DPF ash maintenance. [EPA-HQ-OAR-2019-0055-1203-A1, p. 139]

EPA suggests manufacturers can overcome this challenge by simply increasing the size of their emissions control catalysts, but fails to recognize that while a 5% conversion loss due to metallic contamination may have been acceptable with a 0.2 g/hp-hr standard, it is not acceptable with a 0.02 g/hp-hr standard, or even a 0.05 g/hp-hr standard. Increasing catalyst size also increases the thermal inertia of the system, which is counterproductive to the rapid catalyst light-off required by these regulations. Finally, increasing catalyst size adds additional cost to the product and requires additional installation space in the vehicle, potentially driving additional complexity around aftertreatment variants in vehicle applications. [EPA-HQ-OAR-2019-0055-1203-A1, p. 139]

In addition, metals are technically unregulated in ASTM D975 and ASTM D7467, which does not clearly translate to a design criteria. Since EPA’s data shows metallic contamination is low, EMA recommends EPA work with ASTM to adopt lower limits, in the range of 1ppm, for all metals, and particularly phosphorous, sodium and potassium, in all finished fuel blends. With regard to ASTM D6751, EMA strongly recommends a reduction to the phosphorous limit from 10ppm to something in the range of 1ppm. Individually, these contaminants at concentrations >1ppm can have irreversible impacts on aftertreatment elements. [EPA-HQ-OAR-2019-0055-1203-A1, p. 139]

Engine manufacturers develop products to meet a range of emissions, safety and performance requirements driven by customer demand and regulatory requirements. Manufacturers believe that the availability of biodiesel fuels presents a significant risk to compliance with emissions standards and to customers' satisfaction. Fleets expect a minimum level of performance and durability from the engine products they purchase, with total operating costs equal to or better than the products currently in the fleet. Significant changes to the engine and aftertreatment system, coupled with increased useful life requirements, make it particularly important to minimize the variables that can impact emissions compliance and customer downtime. Requiring that manufacturers allow operation (and testing) on any commercially available biodiesel blends up to B20 is not supportive of those important goals. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 139 - 140]

The expanded use of biodiesel poses a significant risk to the performance of low-NOx engine and aftertreatment technologies. While many manufacturers currently approve the use of up to B20, the impact of those fuels in widespread use is still unknown given the currently limited use of biodiesel nationwide. Customers are often unaware of the blend level of the fuel being dispensed when refueling. Despite the limited deployment of biodiesel and low-carbon alternative fuels, OEMs have seen increased incidences of wear and downtime associated with these fuels. Several manufacturers recommend reduced oil change intervals by up to 30% when using B20 or higher blends. In sum, the Agency should not eliminate the current provision allowing manufacturers to restrict operation and testing with B20. [EPA-HQ-OAR-2019-0055-1203-A1, p. 140]

ASTM specs for biodiesel stability are the lowest in the world. This causes oxidation byproducts and raises TAN in the fuel, which either form fuel system deposits, or cause corrosion within the fuel system. This makes the fuel unsuitable for use in any application where the equipment may sit for as little as a week. [EPA-HQ-OAR-2019-0055-1203-A1, p. 140]

The following are real-world examples of problems experienced by customers operating on fuels not meeting specification. These examples illustrate just how sensitive engines and aftertreatment systems are to these contaminants, justifying the need for tighter, well-enforced controls: Injector Deposits caused by carboxylate salts from water contamination: Customer complaint with nearly 100% failure rate at two facilities. Both locations had heavy amounts of water, sediment, and significant microbial growth in tank bottoms. One location had >10,000 ppm sodium content (limit <5 ppm). Fungible supply in biodiesel creates acid in the water layer. The presence of sodium and acid combined creates a reaction. [EPA-HQ-OAR-2019-0055-1203-A1, p. 140]

The following are real-world examples of problems experienced by customers operating on fuels not meeting specification. These examples illustrate just how sensitive engines and aftertreatment systems are to these contaminants, justifying the need for tighter, well-enforced controls: Injector Deposits caused by carboxylate salts from fungible supply: 3 different customers were having consistent injector failures where all customers were LTL operators and were located in the same area. Two customers fueled at different retail locations, while one customer had its own bulk tank. However, the fuel distributor for all 3 locations was the same fuel terminal. Analysis was nearly identical between all 3 customers – spectrums indicated that the deposit was most likely a carboxylate soap. [EPA-HQ-OAR-2019-0055-1203-A1, p. 140]

The following are real-world examples of problems experienced by customers operating on fuels not meeting specification. These examples illustrate just how sensitive engines and aftertreatment systems are to these contaminants, justifying the need for tighter, well-enforced controls: Plugged filters: All customer vehicles activated a “fuel filter plugged” diagnostic within 1 week. Fuel samples ranged from 16-22% biodiesel and all fuel samples failed ASTM D7467 (B6 to B20) standards with an oxidation stability in the range of 3-5 hours. TAN/TBN loss ranged from 0.16 to 0.25 mg KOH/g, all within D7467 limits, but extremely high compared to most fuel samples. All fuel filters showed media collapse and media discoloration once removed. Black gum was extracted from the fuel filter and was analyzed and determined to be consistent with byproducts from biodiesel oxidation. [EPA-HQ-OAR-2019-0055-1203-A1, p. 141]

It is clear from the foregoing that acids in the presence of metal can lead to deposits. Fuel system corrosion causes injector and pump failures from water and fuels with high TAN. Although increased acidity provides increased lubricity, the increase in TAN can lead to deposit formation on fuel injection system hardware. [EPA-HQ-OAR-2019-0055-1203-A1, p. 141]

Prior to implementing compliance requirements on any commercially available B20, manufactures would need to develop sensors that can detect the oxygen concentration or other markers that define the biodiesel fraction in conventional diesel. This will need to be correlated to service frequency requirements to prevent component failures due to loss of oil oxidation and loss of TBN. Given the new emphasis on variable oil life attributed to biodiesel content, manufacturers would also need to update their diagnostic, adaptive calibration and maintenance prognostics to account for variable biodiesel blends and the associated impact to tailpipe emissions. Finally, OEMs would need time to work with lube oil manufacturers and ASTM standards committees to develop oil formulations that are resistant to oxidation and degradation over time. [EPA-HQ-OAR-2019-0055-1203-A1, p .141]

In addition to the durability concerns discussed above, fuel characteristics have the potential to alter engine out-emissions, as has been reported in CARB’s Biodiesel Characterization and NOx Mitigation Study. Table 1 from that study (reproduced below) illustrates the significantly increased NOx emissions levels observed when compared to a reference B0 diesel fuel. [EPA-HQ-OAR-2019-0055-1203-A1, p. 141]

The foregoing data further confirm that the requirement to allow the use of any commercially available biodiesel blends will pose serious risks to manufacturers’ ability to comply with in-use emissions standards. EMA supports that EPA has proposed to permit manufacturers to use results from fuel sample testing to void in-use test results after-the-fact (see §1036.415(c)(5)), but it is very uncertain whether manufacturers will able to identify improper fuel usage records or otherwise determine the cause of a failed in-use compliance test that might be attributable to previous operation on poor-quality fuels. In the event of a test failure, manufacturers would be compelled to differentiate normal system wear, contamination, or deactivation from that attributed to the use of biodiesel and/or inadequate maintenance procedures appropriate to account for the use of biodiesel. The ability to identify the source of damage resulting from the use of biodiesel may be difficult or inconclusive in many cases. The serious and costly consequences for recall due to compromised in-use compliance could result in manufacturers being compelled to reduce maintenance intervals to mitigate the risk of damage from biodiesel fuels, even to the point of requiring aftertreatment replacement within the useful life period, significantly increasing the cost of vehicles compliant with the new standards. [EPA-HQ-OAR-2019-0055-1203-A1, p. 142]

It is important to reiterate that EPA indicated in the RIA that the impacts of biodiesel would not significantly increase emissions and could be addressed by increasing the catalyst size. However, that data is based on engines compliant to a 0.20 g/bhp-hr NOx standard rather than the proposed Option 1 or 2 standard, where a "small" increase of just 0.002 g/bhp-hr could render a product non-compliant. That risk is exacerbated by a 800,000 mile useful life requirement. [EPA-HQ-OAR-2019-0055-1203-A1, p. 142]

The Coordinating Research Council (not EPA) is evaluating the influence that diesel fuel variables, as wells as varieties of renewable diesel and biodiesel fuels, have on tailpipe NOx emissions from the Stage 3 low-NOx technology EPA is relying on in this rulemaking. That testing is scheduled to be completed in May or June, with follow-on data analysis thereafter. Additional testing to understand long-term effects of operation on biofuels has yet to be planned, but should be very informative to the setting of standards as well, given EPA's new requirements for compliance using "any commercially available" biodiesel fuel meeting the current inadequate ASTM specifications. EPA has formulated its proposal without any of those fuels-impacts data. [EPA-HQ-OAR-2019-0055-1203-A1, p. 172]

All of the critical research outlined above was not available or not completed in time to support the pending NPRM. Indeed, the vital research at issue is still in process, with much of it expected to be delivered just as the proposed rule is expected to "go final" in the fall, all to meet EPA's goal of having the new low-NOx standards take effect in 2027. Thus, there is considerable risk that these critical data will be unavailable when these largely infeasible standards are to be finalized. [EPA-HQ-OAR-2019-0055-1203-A1, p. 172.]

Accordingly, EMA recommends expanding the fuel requirements beyond the current ASTM standards to include the more stringent European biodiesel standards and the Top Tier requirements. This would apply to both feedstocks (B100) as well as finish stock. It is widely understood that after metals contamination, poor fuel oxidation stability is a key factor contributing to much of the biodiesel-based engine damage and the cascading downstream collateral damage impacts to aftertreatment. [EPA-HQ-OAR-2019-0055-1203-A1, p. 143]

Additionally, EMA recommends that the applicable regulations explicitly provide for a maximum biodiesel content of 20% nationwide. The emissions impacts from biodiesel increase significantly as blend percentages increases. [EPA-HQ-OAR-2019-0055-1203-A1, p. 143]

Finally, EMA recommends that EPA support updating ASTM D975 and D7467 to reduce the allowable concentrations of Calcium, Magnesium. Sodium, Potassium and Phosphorous. EMA stands ready to work with EPA and other stakeholders to determine appropriate limits for those properties, reducing them to levels in the range of 1ppm. These new fuel standards should be developed based on industry experience, experimental data, and supplier input, and should be enforceable at the pump. [EPA-HQ-OAR-2019-0055-1203-A1, p. 143]

In addition to these finished fuel specifications, EMA recommends improvements to the B100 feedstock specification as well, to help enable higher quality finished fuels with biodiesel content. The following B100 specifications and recommendations refer strictly to B100 as a blendstock and not as a finished product. [EPA-HQ-OAR-2019-0055-1203-A1, p. 143]

To summarize, EMA opposes the requirement that manufacturers must comply on any commercially available biofuel meeting current ASTM D975 or ASTM D7467 standards. Manufacturers should be permitted to continue to specify the maximum allowable biodiesel blend levels for their products, and vehicles operating on, or having operated on, fuels inconsistent with the manufacturers’ recommendations, should not be required to comply with the final standards. In addition, EPA should take action to assist in the development and enforcement of the improved biofuel specifications listed above before holding manufacturers liable for compliance when operating on such fuels. Only after improved fuel quality standards are developed, implemented, and enforced at the pump can the industry embrace the widespread deployment of alternative fuels, and promote their usage, so as to realize the rapid and significant reductions in GHG emissions they might offer. [EPA-HQ-OAR-2019-0055-1203-A1, p. 143]

Organization: *Valero Energy Corporation*

In the preamble to the NPRM and the Regulatory Impact Analysis, EPA raised concerns about the potential for trace metals (especially sodium, potassium, calcium and magnesium) in biodiesel to adversely affect the performance of engines and emission control systems, suggesting that trace metals can accumulate in and impact the effectiveness of diesel particulate filters or poison selective catalytic reduction (SCR) catalyst. The potential routes for metals introduction into the fuel mentioned by EPA include: presence of metals in vegetable oil seeds used to produce the biodiesel feedstock; introduction of metals from catalysts or filtration media; and introduction of metals from hard wash water. EPA believes it is possible for ASTM D6751 and ASTM D975-compliant biodiesels to have trace metals present at levels that could impact emission control systems, and EPA indicates that ASTM is evaluating a possible revision to the measurement method in D6751 to a method with a lower detection limit. [EPA-HQ-OAR-2019-0055-1328-A2, p.8]

Although we have no basis to agree or disagree with EPA's concern regarding biodiesel, Valero is confident that metals are not an issue with renewable diesel. Any metals introduced via vegetable oil or animal fat feedstocks are removed as part of the unique processing involved in making renewable diesel. We recognize that EPA does not propose any regulations to address this issue. If EPA were to consider addressing the issue, however, we urge EPA to recognize that renewable diesel is processed in a different manner than biodiesel and should be distinguished accordingly. [EPA-HQ-OAR-2019-0055-1328-A2, p.8]

Organization: *Volvo Group*

The Volvo Group appreciates the following EPA Biodiesel Quality comments. "…metals (e.g., Na, K, Ca, Mg) can enter the biodiesel production stream and can adversely affect emission control system performance if not sufficiently removed during the production." (87 FR at p. 17563.) [EPA-HQ-OAR-2019-0055-1324-A1, p. 6]

While off-specification blends may not be widespread, continued focus on specifications that protect emission reduction performance and component durability is needed. In support of this objective, the Volvo Group promotes endorsement of the following ASTM B100 specifications contaminant limits: Na+K+Ca+Mg 4 ppm, P 1 ppm. [EPA-HQ-OAR-2019-0055-1324-A1, p. 6]

EPA Summary and Response

Summary:

Regarding the use of biodiesel and the effect of contaminants from biodiesel, EMA, Daimler, and Navistar state that current ASTM standards for biodiesel are inadequate compared to other worldwide standards, and the use of even a small amount of poor-quality biodiesel could damage the aftertreatment system. These commenters further state that increasing the size of the aftertreatment system to compensate for use of biodiesel would be counterproductive, and introduce packaging, cost, and fuel economy concerns. Therefore, they recommend that the Agency should not eliminate the current provision allowing manufacturers to restrict operation and testing with B20. Daimler further recommends that EPA consider a uniform, nationwide biodiesel blending proposal (for example, B5 standard for all diesel fuel sold).

Daimler states that they have observed concerning levels of metallic contamination in fuel samples collected from fleets. EMA states that a field fuel quality study revealed that over 50% of nozzle samples contained metals such as magnesium, calcium, and zinc. Additionally, EMA cites several instances of real-world problems experienced by customers operating on biodiesel fuels not meeting specification.

EMA, Daimler, and Navistar recommend EPA mandate more stringent standards on biodiesel fuel, such as improving the current ASTM specifications to lower metal content, and/or adopting of both Top Tier and EU biodiesel standards in lieu of the ASTM D975, D7467 and D6751 standards. Volvo also recommends more stringent limitations on contaminants. Further, EMA and Daimler recommend setting a maximum biodiesel percentage of 20% nationwide. EMA and Daimler state that the impact on emissions increases significantly as biodiesel percentages are increased beyond 20%.

Furthermore, EMA and Daimler support EPA's proposal to permit manufacturers to use results from fuel sample testing to void in-use test results after-the-fact. However, EMA and Daimler comment that identifying a test failure due to the use of biodiesel would be difficult or inconclusive, as fuel quality and recordkeeping by fleets and retail stations are not the responsibility of the OEM. Daimler further recommends that a more supportable program would be where if a vehicle or HDIUT fleet were selected at start of mileage accumulation and a cooperative fuel sampling program put in place over the vehicle's lifetime.

EMA comments that they oppose the requirement that manufacturers must comply on any commercially available biofuel meeting current ASTM D975 or ASTM D7467 standards. They recommend that manufacturers should be permitted to specify the maximum allowable biodiesel percentage usable in their engines, and further state that manufacturers should not be required to comply using engines which have not been fueled to the stated specification.

However, CARB comments in support of the inclusion of all commercially available fuels, including fuels that contain biodiesel up to 20 percent, in off-cycle testing. The Renewable Energy Group comments that blends including 20 percent biodiesel should be the norm. API also agrees with EPA that there is no widespread off specification biodiesel blend stock or biodiesel blends in the marketplace. Clean Fuels comments that the most recent studies have shown that metals contamination in biodiesel is, on average, well below the standards set both in the United States and in Europe. MECA comments that results of a survey by researchers at NREL of biodiesel has shown metal content far below the current specification for the vast majority of samples collected. Both MECA and the Renewable Energy Group state that CARB also collected diesel and biodiesel samples, finding that phosphorus and metal contents of biodiesel were significantly lower than current ASTM limits. Additionally, the State Soybean Associations comments that there is insufficient evidence to conclude that metals can enter the production stream of biodiesel.

API also recommends that EPA consider the results of the SwRI study on the effect of biofuels on low NO_x emission control technologies before finalizing this rule.

MECA comments that sulfur is found in diesel fuels, and testing has shown some loss of aftertreatment performance due to the presence of sulfur from 435,000 miles to 800,000 miles. MECA also comments that metals found in lube oil can also cause deterioration in catalyst performance.

Multiple organizations, including Daimler, Neste, and Valero, support the use of renewable diesel. Valero comments that they are certain metal contamination is not an issue with renewable diesel.

Response:

In regard to water and acid content of the fuel; we do not have evidence that this is a widespread issue. In addition, engines are already equipped with fuel-water separators that mitigate the effects of water and inorganic acid by removing them prior to the fuel entering the fuel injection system. Based on this, we believe that we have adequately assessed the costs of this rule; our cost analysis is detailed in the preamble and RIA for the final rule.

The rest of EPA’s response to these comments is detailed in preamble Section III.C.4.ii.

11.5.5 PM emissions measurement

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

U.S. EPA requested comment on the need to measure PM emissions during in-use testing. CARB staff opposes eliminating PM emissions measurement during heavy duty in-use testing. PM emission measurement is critical to determine if an engine is emissions compliant and even more so now that the PM emission standard is lowered to 0.005 g/bhp-hr to ensure current wall flow DPF technology will be used. Unfortunately, CARB staff has discovered that manufacturers have been inappropriately screening their HDIUT vehicles. This includes but is not limited to rejecting engines based on visual inspections that identify excess PM on the exhaust tailpipe and replacing DPFs prior to in-use testing. These inappropriate screening practices were discussed by CARB staff at industry workshops. Since it is unclear how the historical engines in the HDIUT program were screened for PM testing, we believe it is necessary to continue PM testing. CARB staff strongly opposes the NPRM proposal to consider opacity testing for determining PM compliance. CARB staff believes that while opacity testing may well provide an indication of a failed DPF, it cannot, define PM emission compliance, especially with the proposed lower PM standard. Hence, CARB staff would not accept an opacity test method for determining compliance in lieu of current 1065 PM test requirements. [EPA-HQ-OAR-2019-0055-1186-A2, p.61]

Organization: *PACCAR, Inc (PACCAR)*

Proposed 1036.415(g) provides that '[y]ou may ask us to waive testing relative to one or more emission standards if you can show that field testing for such emissions is not necessary.' EPA must provide OEMs additional flexibilities. [EPA-HQ-OAR-2019-0055-1346-A1, p.55]

As a general matter, the proposed HDIUT testing needs to be streamlined to make the individual tests less burdensome because overall testing is expected to increase due to (i) more cases where 7 to 10 engines will need to be tested and (ii) possible separate engine families for California. PEMS testing requires skilled engineers and technicians who are willing and able to carry out challenging, physical work while traveling in harsh environments and expending long hours often during the night. These individuals are always very difficult – and currently nearly impossible – to find. [EPA-HQ-OAR-2019-0055-1346-A1, pp.55-56]

HDIUT testing also significantly disrupts OEM customers rendering recruiting participants extremely challenging. To sustain a base of customers that are willing to participate, and to make the proposed program potentially feasible, OEMs would need to drastically reduce installation time, vehicle space, and electrical power. On this issue, PACCAR incorporates EMA's Comments on this subject. See EMA Comments at 41. [EPA-HQ-OAR-2019-0055-1346-A1, p.56]

Organization: *Truck and Engine Manufacturers Association (EMA)*

In the Preamble to the NPRM, EPA requests comment on whether in-use testing for PM is still necessary. It is not, and should be eliminated. In fact, since the beginning of 2015 – more than seven years ago – EMA has been requesting that the Agency eliminate in-use testing for PM. EPA staff agreed with EMA on this matter in mid-2020, but have not taken the necessary steps to revise the relevant regulations. Now is the time to do that. [EPA-HQ-OAR-2019-0055-1203-A1, p. 44]

The background for this issue is important. The heavy-duty in-use testing (HDIUT) program, including for PM, resulted from the 2003 settlement of extensive NTE-related litigation (asserting that there were no sufficient test procedures for the then-new NTE standards). As part of that settlement, the parties (EMA, EPA, and CARB) negotiated a comprehensive outline of the NPRM for the HDIUT program, which included the following express provisions: The goal of this [HDIUT] program is to generate data on in-use emissions of heavy-duty on-highway diesel engines that can be used by EPA, CARB, and diesel engine manufacturers to ensure that emission standards are met throughout the useful life of 2007 and later model year heavy-duty on-highway diesel engines under conditions normally experienced in-use. The program is intended to monitor for NTE compliance and to help ensure overall compliance with emission standards. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 44 - 45]

The background for this issue is important. The heavy-duty in-use testing (HDIUT) program, including for PM, resulted from the 2003 settlement of extensive NTE-related litigation (asserting that there were no sufficient test procedures for the then-new NTE standards). As part of that settlement, the parties (EMA, EPA, and CARB) negotiated a comprehensive outline of the NPRM for the HDIUT program, which included the following express provisions: In-use NTE emissions testing will include total hydrocarbons (THC), carbon monoxide (CO), oxides of nitrogen (NOx), particulate matter (PM), and carbon dioxide (CO2) (and also O2)….Recognizing that experience may show that the effectiveness, durability and overall performance of new engine technologies and aftertreatment systems may demonstrate that in-use testing for certain pollutants may not be necessary, EPA/CARB will consider requests from the engine manufacturers to discontinue reporting and/or measurement of one or all engines based on test experience. [EPA-HQ-OAR-2019-0055-1203-A1, p. 45]

The follow-on final HDIUT rule was fully consistent with the parties' negotiated outline, and stated in relevant part as follows: All manufacturers will be regularly providing EPA with a significant quantity of data generated from engines used in regular service, which EPA will evaluate to ensure the engines comply with specified emissions requirements. The rule is a result of an agreement between EPA and the Engine Manufacturers Association. (70 FR at 34594.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 45]

The follow-on final HDIUT rule was fully consistent with the parties' negotiated outline, and stated in relevant part as follows: [HDIUT] is specifically intended to monitor compliance with the NTE exhaust emission standards and to help ensure that heavy-duty diesel engines will comply with all applicable emission standards (including those based on the FTP) throughout their useful lives. (70 FR at 34595.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 45]

The follow-on final HDIUT rule was fully consistent with the parties' negotiated outline, and stated in relevant part as follows: Recognizing that experience may show that the effectiveness, durability and overall performance of new engine technologies and exhaust aftertreatment systems may demonstrate that in-use testing for certain pollutants is unnecessary, we will consider requests from the engine manufacturers to discontinue reporting and/or measurement of one or more pollutants from some or all engines based on future test experience. (70 FR at 34610.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 45]

Test experience, which EMA catalogued and shared with the Agency starting in 2015, has conclusively demonstrated that the measurement and reporting of in-use PM emissions is both unnecessary and costly. Thus, EPA should honor its commitment to eliminate HDIUT for PM. More specifically, since 2006, the relevant test results from the HDIUT program have demonstrated that there have been no “failures” for PM emissions. While one failure was initially reported, that vehicle was subsequently found to have a cracked DPF due to misfuelling. Indeed, EPA has acknowledged that there have been no in-use testing failures for PM under the HDIUT program. At the same time, in-use testing for PM is expensive, and requires a separate PEMS, elaborate installation configurations and vehicle mountings, significant additional vehicle recruiting and set-up time, and significant additional de-installation and post-processing time. [EPA-HQ-OAR-2019-0055-1203-A1, p. 46]

The proposed reduction of the certification standard for PM (from 0.010 g/bhp-hr to 0.005 g/bhp-hr) does not alter the justifications for eliminating PM from the manufacturer-run HDIUT program. As EPA concedes, that reduced standard will not drive any new DPF technologies; it is simply intended to prevent hypothetical “backsliding.” Accordingly, no new risks of noncompliance are at issue. Moreover, eliminating manufacturers’ in-use testing for PM will also eliminate the Agency’s legitimate concerns of whether PM PEMS are up to the challenge of assessing in-use PM levels below 6 or 7 mg/bhp-hr. (See NPRM, 87 FR at 17468.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 46]

There is an additional technical reason supporting the elimination of in-use testing for PM. In-use PM compliance is already monitored by on-board PM sensors. The failure mode for a DPF is cracking, which is easily detected by a PM sensor. Thus, if the goal of the HDIUT program for PM is to monitor DPF performance in-use, that is already robustly built-in with today’s engines. Consequently, and as EPA staff has previously agreed, it is time to eliminate HDIUT testing for PM. There is no reasonable basis to do otherwise at this point. [EPA-HQ-OAR-2019-0055-1203-A1, p. 46]

It also is time to eliminate in-use testing for NMHC. The reasons for this are many and well-documented. First, there is a growing need to streamline HDIUT testing because the test burdens (the number of engine families and potentially the number of tests per family) continue to grow. Second, the HDIUT program is very disruptive to an OEM’s customers, which makes it extremely difficult to recruit willing fleet-owner participants A smaller footprint in terms of installation time, vehicle space, and electrical power is required to streamline HDIUT testing to maintain a sustainable base of willing customers needed to support this program. [EPA-HQ-OAR-2019-0055-1203-A1, p. 46]

This is not a trivial concern. Installation of PEMS often involves the removal of certain items that can include passenger seats, windowpanes, storage boxes, bedding and personal belongings, and other accessories and equipment belonging to the customer or driver. There is always risk of damage to a customer vehicle, and customers are often surprised by the intrusive nature of a PEMS installation and left questioning what they agreed to. When a PEMS test needs to be repeated, the altered configuration of the vehicle sometimes limits flexibility in terms of the next assigned task for the customer vehicle. It is not unusual for a customer to need to alter their activities and/or driver schedules to accommodate an OEM's need for extended in-use testing. The ancillary in-use testing of NMHC and PM adds significant risks that additional days of testing will be necessary due to an issue with an analyzer. In sum, in-use testing needs to be less invasive to be sustainable. [EPA-HQ-OAR-2019-0055-1203-A1, p. 46]

Third, a streamlined PEMS (i.e., gas PEMS, without FID or PM PEMS) is much lighter and has a much lower power requirement, such that it is feasible to power it with Li-ion batteries or 12 volt power from the chassis electrical system, or both, potentially eliminating the need for a gasoline-powered generator and its associated hazards, space requirements, and possible delays during inspection at a truck scale, which can adversely affect customers' operation. A streamlined PEMS's would reduce staffing pressure for executing PEMS tests, could be installed in a reasonable amount of time with minimal disruption to the customer vehicle, and would eliminate the risks of voiding a test or rescheduling a test trip due to a PM or FID analyzer issue. [EPA-HQ-OAR-2019-0055-1203-A1, p. 47]

Other more technical issues also warrant the elimination of in-use NMHC testing going forward: Diesel engines are inherently low emitters of NMHC, and there have been few, if any, failures of in-use tests for NMHC emissions since the inception of the HDIUT program. [EPA-HQ-OAR-2019-0055-1203-A1, p. 47]

Other more technical issues also warrant the elimination of in-use NMHC testing going forward: Hazards and associated HazMat handling protocols for the use of FID fuel (DOT special permit and HazMat shipper certification) is an unnecessary risk. Customers often express concern over the FID fuel, and recognize that it adds risk for major disruptions during an inspection at a weigh station. NMHC testing puts OEMs in the position of directly asking a customer to assume that risk. [EPA-HQ-OAR-2019-0055-1203-A1, p. 47]

Other more technical issues also warrant the elimination of in-use NMHC testing going forward: The supply of FID fuel is expensive and unreliable due to the continuing Helium shortage. [EPA-HQ-OAR-2019-0055-1203-A1, p. 47]

Other more technical issues also warrant the elimination of in-use NMHC testing going forward: The 181°C heated line and FID temperatures that are necessary to avoid HC hang-up to keep HC's in gaseous form drive high demand for power that is limited in a PEMS application. Long heated lines are often necessary due to constraints on the location of the PEMS, which draw even more power due to their length. [EPA-HQ-OAR-2019-0055-1203-A1, p. 47]

Other more technical issues also warrant the elimination of in-use NMHC testing going forward: OEM's are already incentivized to reduce NMHC to manage risks of thermal runaway of an aftertreatment system contaminated with HC. [EPA-HQ-OAR-2019-0055-1203-A1, p. 47]

Other more technical issues also warrant the elimination of in-use NMHC testing going forward: Actions necessary to control engine-out PM also reduce HC emissions (i.e., high injection pressure, droplet size, and distribution). Low engine-out PM is desired to minimize EGR cooler fouling and to reduce regen frequency to improve IRAF and fuel economy driving a co-benefit of HC reduction. [EPA-HQ-OAR-2019-0055-1203-A1, p. 47]

Other more technical issues also warrant the elimination of in-use NMHC testing going forward: The base architecture of diesel aftertreatment systems includes an NMHC-reducing DOC necessary to support combustion of the injected HC that, in turn, is needed to support DPF regen cycles. [EPA-HQ-OAR-2019-0055-1203-A1, p. 47]

Other more technical issues also warrant the elimination of in-use NMHC testing going forward: The base architecture of diesel aftertreatment systems includes an AMOX catalyst necessary to control ammonia slip, which can also reduce NMHC. [EPA-HQ-OAR-2019-0055-1203-A1, p. 47]

Other more technical issues also warrant the elimination of in-use NMHC testing going forward: NMHCs from diesel engines are composed of heavy long-chain HCs lacking the volatility needed to contribute to ozone formation.[EPA-HQ-OAR-2019-0055-1203-A1, p. 47]

Other more technical issues also warrant the elimination of in-use NMHC testing going forward: HC standards are to be lowered under the NPRM, but that is driven by goals for SI engines (EPA stated goal is to maintain the same numerical standard for CI and SI). There is no intent to force any new technology to control HCs from CI engines, and CI engine currently easily comply with the NMHC standard. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 47-48]

In sum, there is no need for further incentives to control NMHC emissions; there is no undeployed control technologies for NMHC; and no environmental need that justifies the continued burdensome measurement of NMHC with PEMS in the HDIUT program. Accordingly, just as for PM, EPA should eliminate the need to conduct in-use testing for NMHC. [EPA-HQ-OAR-2019-0055-1203-A1, p. 48]

EPA Summary and Response

Summary:

CARB opposes eliminating PM emissions measurement during heavy duty in-use testing. They comment that manufacturers have been inappropriately screening their HDIUT vehicles by rejecting engines based on visual inspections that identify excess PM on the exhaust tailpipe and replacing DPFs prior to in-use testing, and thus it is not clear in what way engines were historically screened for PM testing. CARB also opposes using opacity testing for determining PM compliance.

EMA comments that testing for PM emissions is unnecessary and costly. EMA states that since 2006, there have been no test failures for PM emissions, and that the reduction of the certification standard for PM will not introduce further risks of noncompliance. Additionally, they state that the failure mode for a DPF is cracking, which is easily caught by onboard PM sensors.

EMA also comments that testing for NMHC should be eliminated. They state that streamlining the PEMS unit would reduce cost and test burden and reduce the intrusion on the vehicle owner's time and space from installing the PEMS unit. They further comment that there have been few, if any, failures of in-use tests for NMHC emissions since the inception of the HDIUT program, and that there is no environmental need that justifies the continued burdensome measurement of NMHC with PEMS in the HDIUT program. PACCAR states that HDUIT testing needs to be less burdensome, and explicitly agrees with EMA's comments on streamlining testing.

Response:

EPA does not agree with the comment by CARB that removing the requirement for in-use off-cycle PM standards testing will lead manufacturers to stop using wall flow DPF technology to meet the PM standards. Wall flow DPF technology will still be needed to meet the standards at the time of certification, especially given the PM standard of 5 mg/hp-hr promulgated in this action. EPA also does not share CARB staff's concern that manufacturers have been inappropriately screening their HDIUT vehicles for PM related concerns. If a DPF is properly maintained there will be no visible soot on the tailpipe. If soot is found on the tailpipe, that is indicative of a DPF failure, typically due to cracking of the substrate that allows PM to slip between the catalyst channel walls. Measurement of PM from a failed trap due to cracking is not representative of the level at which a properly maintained and functioning system emits PM.

EPA has considered comments on elimination of requirements to measure PM and NMHC emissions; a discussion is included in preamble Section III.C.4.b.

11.5.6 Notification and data reporting

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

CARB staff supports the new requirement in 1036.430(c)(1) where notification is required after the testing of an engine is completed. This would aid in real time assessment of the test plan and provide updates sooner than the previous quarterly reporting requirements. [EPA-HQ-OAR-2019-0055-1186-A2, p.64]

Organization: *PACCAR, Inc (PACCAR)*

PACCAR respectfully request that EPA revise certain aspects of its proposed reporting requirements provisions. Proposed 1036.430(a)(3)(ix) would only authorize gaps in the 1 Hz test data file over the shift-day during analyzer zero and span verifications. This overlooks the fact that data gaps will exist when the engine is off. Any data transmitted by the engine ECU will stop when the key is off because a shut-off ECU is unable to send data. Therefore, EPA should add a 'key off' condition to the list in the Agency's proposed provision. [EPA-HQ-OAR-2019-0055-1346-A1, p.57]

EPA should also clarify the effect, if any, of potential data gaps. PACCAR respectfully submits that data gaps should not necessarily void a test, especially because occasionally an analyzer or measuring instrument will encounter a temporary issue. Proscribing any data gaps is unrealistic and overly burdensome – as long as the minimum window count is met, the test should be valid notwithstanding potential data gaps. EPA should revise its proposal accordingly. [EPA-HQ-OAR-2019-0055-1346-A1, pp.57-58]

PACCAR is also concerned with proposed 1036.430(a)(3)(ix)(O), which currently provides: 'Any parameter sensed or controlled to modulate the emission control system or fuel-injection timing.' As drafted, this provision is too broad and vague to provide regulatory certainty and enable compliance. EPA should therefore remove it. [EPA-HQ-OAR-2019-0055-1346-A1, p.58]

Organization: *Truck and Engine Manufacturers Association (EMA)*

In the reporting requirements of §1036.430(a)(3)(ix), EPA proposes to require that "gaps in the 1 Hz data file over the shift-day are only allowed during analyzer zero and span verifications." That is an impractical and unworkable requirement. First, the vehicle's CAN communications are interrupted whenever there is a key-off event. The PEMS may continue to record, but much of the required data provided by vehicle systems is not available during these engine-off events. Second, because PEMS are imperfect devices, it is currently difficult to complete a day of testing without at least one incident of data interruption. In some cases, toward the end of a test day, the FID may exhaust its fuel supply, terminating measurement capability. The provision as drafted is outside the test technician's control and should be eliminated in the final rule. [EPA-HQ-OAR-2019-0055-1203-A1, p. 92]

Another item of concern relates to EPA's proposed §1036.430(a)(3)(ix)(O), where it would be required, for each vehicle tested, that manufacturers provide 1 Hz data for "any parameter sensed or controlled to modulate the emissions control system or fuel injection timing." That requirement simply cannot be fulfilled. There are hundreds if not thousands of calculations performed in the ECU that contribute in some way to engine and aftertreatment control that would be subject to this requirement. SAE standards J1939 and J1979 would require updating to include this multitude of parameters, which, in reality would be an impossible task given that each manufacturer has its own set of control algorithms. The requirement is unworkable, and should be eliminated in the final rule. [EPA-HQ-OAR-2019-0055-1203-A1, p. 93]

EPA Summary and Response

Summary:

CARB supports the provision in §1036.430(c)(1) requiring notification after the testing of an engine is completed.

EMA and PACCAR comment that only allowing gaps in the 1 Hz data file over the shift day during analyzer zero and span verifications is unworkable. EMA and PACCAR state that data interruptions can occur during a key-off event, and PEMS units can also experience data interruptions; stating that both of these occurrences are unavoidable. EMA and PACCAR further state that the requirement that manufacturers provide 1 Hz data for "any parameter sensed or controlled to modulate the emissions control system or fuel injection timing" is also unworkable, as there are hundreds if not thousands of calculations performed which affect the emissions control system.

Response:

EPA agrees with EMA and PACCAR that gaps in the collection of emissions data in the 1 Hz data files when the engine is keyed off are unavoidable and is adding this as an allowed exclusion in the final 40 CFR 1036.430(a)(3)(ix). In response to this concern EPA is finalizing a new 40 CFR 1036.430(a)(4)(vi) that was not in the proposal, that covers summary information that must be included with the data submission and states "Describe the number and length of any data gaps in the 1 Hz data file, the reason for the gap(s), and the parameters affected." Requiring a summary report of these exclusions will limit the number of allowable exclusions and protect against manufacturers not including data that is unfavorable in the test and representing them as data gaps. In the windowing process, these gaps must be treated as exclusions and concatenated across as described in 40 CFR 1036.530.

Additionally, EPA agrees that the recording of ECU calculated parameters is unworkable and this was not the intention of what we proposed. The final requirement to provide 1 Hz data in 40 CFR 1036.430(a)(3)(ix)(O) applies only to parameters sensed or controlled and available on the Controller Area Network (CAN), and not parameters internal to the ECU. This requirement is no different than the current requirement for HDIUT NTE testing in 40 CFR part 86.1920(b)(4)(xii)(O). CAN signals that indicate changes to fuel injection timing or operational parameters of the emission control system are important to understand the operation of the engine in concurrence with what is being emitted from the engine.

11.6 PEMS and measurement accuracy margin (Preamble III.C.5.iii)

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

U.S. EPA requested comment on PEMS measurement uncertainty. CARB staff has significant concerns with U.S. EPA adding a PEMS accuracy margin for NOx in addition a certification standard multiplier for establishing the off-cycle standards. CARB staff views the use of both a multiplier and a separate PEMS accuracy margin to be redundant and unnecessary; having both a multiplier and accuracy margin would unnecessarily raise the off-cycle emissions threshold and allow excess emissions. The effects of applying multiple in-use margin is clearly listed in Table 6-1 above. Furthermore, U.S. EPA's impermissibly failed to consider the extent to its proposal will likely result in in-use emissions exceeding the off-cycle standards. State Farm, 463 U.S. at 43. [EPA-HQ-OAR-2019-0055-1186-A2, p.61]

CARB staff agrees with the JRC study estimated the uncertainty of PEMS measurements to be 10 percent. The PEMS accuracy evaluation conducted by JRC recommends the multiplier between the standard and the in-use threshold for the In-Service Conformity testing be reduced to the PEMS uncertainty (i.e., using a conformity factor of 1.10 multiplier to set the off-cycle standard). The U.S. EPA proposed off-cycle emission thresholds would be between 10 to 120 percent greater than the Omnibus thresholds. CARB staff believes the conformity factor in the 3B-MAW in the HD Low NOx rulemaking 129 and the multipliers in the off-cycle emission standards are already inclusive of the PEMS accuracy margin for NOx. The recommendations in the JRC report130 are to reduce their conformity factor to the estimated error rather than having an additive PEMS margin as proposed by U.S. EPA. CARB staff suggests not to have an additional PEMS accuracy margin of 10 percent of the off-cycle emissions standard to be applied when evaluating bin emissions. CARB staff also suggests that U.S. EPA review the latest PEMS measurement results from the Achates engine.131,132,133 [EPA-HQ-OAR-2019-0055-1186-A2, pp.61-62]

129 https://ww2.arb.ca.gov/rulemaking/2020/hdomnibuslownox

130 https://publications.jrc.ec.europa.eu/repository/bitstream/JRC124017/pems_uncertainty_2020_v10.pdf

131 Portable Emissions Measurement System (PEMS) Testing for the Achates Opposed Piston Low NOx Diesel Engine. https://calstart.org/event/heavy-duty-program-review-webinar/

132 https://achatespower.com/wp-content/uploads/2022/04/Achates-Power-In-Use-Emissions-Measurements.pdf

133 https://achatespower.com/wp-content/uploads/2022/04/Achates-Power-Heavy-Duty-Diesel-In-Use-Testing-Results.pdf

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

Daimler Truck supports an adequate Portable Emissions Measurement System (PEMS) measurement error allowance. [EPA-HQ-OAR-2019-0055-1168-A1, p.69]

Finally, Daimler Truck supports EPA’s proposal to include a margin for PEMS measurement error. While EPA references some initial studies on PEMS uncertainty on EPA’s candidate system, the Agency has not performed a broad study across a wide variety of test cycles and ambient conditions. It is well known that PEMS variability is heavily dependent on ambient conditions. We believe that EPA must perform a joint study with industry to determine an appropriate margin to apply. Manufacturers must have certainty that their systems will pass based on the merits of their actual emissions performance, and not be held liable for inaccurate measurements performed in the field. Moreover, we point the EPA to EMA’s extensive comments on this topic.90 We believe industry must participate in the testing to determine an adequate allowance. [EPA-HQ-OAR-2019-0055-1168-A1, p.69-70]

90 See EMA Proposed Rule Comments.

Organization: *General Motors LLC (GM)*

Real world emissions testing plays an important role in confirming that emissions systems are performing as designed in the field. Portable Emissions Measurement Systems (PEMS) are laboratory devices that may be temporarily installed on a vehicle to estimate emissions produced during real-world driving. The measurement capability of these systems to estimate emissions is less precise, accurate, and repeatable than dedicated lab facilities. Similarly, the test procedures, and binning of emissions results based on a wide range of conditions,8 produce significant variance in the estimate of emissions relative to proposed standards. EPA is considering standards, as measured in the laboratory, that reduce emissions rates to a small fraction of the current standard. As a result, the noise typically associated with data collected from PEMS is amplified relative to the size of the standard. EPA should carefully consider the precision, accuracy, and repeatability of measurements in PEMS devices when finalizing conformity factors. Low conformity factors in combination with standards with very small emissions increase the likelihood of misdiagnosing emissions performance when measured with PEMS. [EPA-HQ-OAR-2019-0055-1246-A1, p.4]

8 Idle, start-stop, highway driving, laden highway driving, etc.

GM recommends that, if PEMS must be used to verify compliance with very stringent criteria emissions standards, a larger conformity factor be specified to properly account for the capability of the PEMS device to accurately estimate emissions. [EPA-HQ-OAR-2019-0055-1246-A1, p.4]

Organization: *PACCAR, Inc (PACCAR)*

Proposed 1036.420 is flawed because a ten percent margin is much too small. In any event, PACCAR expects SwRI's ongoing work will support a much different PEMS accuracy margin and encourages EPA to use those findings to establish the margin. [EPA-HQ-OAR-2019-0055-1346-A1, p.56]

Organization: *Truck and Engine Manufacturers Association (EMA)*

In order to ensure the adoption of fully achievable and cost-effective HDOH low-NOx regulations, and notwithstanding our broader agreement, the Agency should revise the proposed standards in the following manner: The proposed in-use standards should be adjusted to account for the measurement variability and capabilities of portable emission measurement systems ("PEMS"), and to reflect the fact that the current OBD thresholds will not be able to screen-out potentially malfunctioning vehicles, as is done under the current in-use testing program. While EMA agrees with the Agency that the in-use standards should be reduced, the safeguards to ensure proper vehicle screening and to guard against "false" or otherwise unwarranted failures need to be retained. [EPA-HQ-OAR-2019-0055-1203-A1, p. 7]

EPA is proposing to address this issue by providing for a 10% measurement allowance (accuracy margin) based on an earlier European study that did not evaluate PEMS in the context of testing ultra-low-NOx engines in-use. (87 FR at p. 17477.) Nevertheless, on the basis of that one earlier study, EPA is proposing to reduce the current in-use accuracy allowance margin for NOx from

150 mg/bhp-hr to what amounts to 3 mg/bhp-hr with respect to the “Bin 3” standard – a 98% reduction. That is an unreasonable reduction. The accuracy of PEMS at low-NOx levels certainly has improved, but not by 98%. EPA should wait for the results from the pending PEMS Measurement Allowance Study at SwRI before proposing, in effect, to eliminate the in-use accuracy margin for NOx. [EPA-HQ-OAR-2019-0055-1203-A1, p. 11]

An additional component of SwRI’s work has included a technical assessment of the type of MAW-based approach on which EPA intends to build its 3B-MAW in-use compliance program. SwRI’s research and findings indicate that the necessary sensors and electronically-broadcast engine parameters may not be accurate or robust enough to implement EPA’s 3B-MAW-based approach as envisioned. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 81 - 82]

Specifically, SwRI has examined whether state-of-the-art NOx sensors are sufficiently accurate at low-NOx levels to support the proposed in-use regulations. As depicted in Figures 72 and 73 below from the SwRI Report, SwRI found that “substantial errors can be seen on the order of 10% to 20%, which errors grow larger at low overall NOx mass levels,” and that “NOx sensor data at present are not yet at the same level of accuracy as some of the other EMC broadcast measurements, such as exhaust flow.” (SwRI Report, ISOR Reference 191, p. 63.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 82]

In summing up its conclusions regarding CARB’s (and now, EPA’s) MAW-based approach, SwRI highlighted the facts that NOx sensors will “require considerable improvement in application and accuracy to support in-use compliance measurements at Low NOx levels,” and that “further investigation of the [in-use] metrics is needed, as well as to set a proper compliance threshold for whichever new metric is chosen.” (SwRI Report, ISOR Reference 191, p.88.) Accordingly, SwRI ended its report with the following recommendation: “More analysis needs to be performed before setting a final in-use measurement protocol, and the appropriate compliance thresholds [plural] for that protocol.” (SwRI Report, ISOR Reference 191, p. 89.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 83]

Following on that recommendation, and with funding from EMA and other stakeholders, SwRI has conducted additional research on the capabilities of current NOx-sensors to assess emissions at the ultra-low NOx values at issue. The results of that follow-on research are significant. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 83 - 84]

Perhaps just as significant as the concerns related to the 3B-MAW protocol, which concerns support the adoption of EMA’s alternative combined-bin approach, there are a number of concerns regarding whether the portable emissions measurement systems (PEMS) that will be used to implement and enforce the proposed in-use testing program are capable of measuring and “binning” NOx emissions at the near-zero levels that the low-NOx regulations would require. [EPA-HQ-OAR-2019-0055-1203-A1, p. 84]

Current PEMS may not be capable of measuring and sorting NOx emissions at levels below the Option 1 Bin 3 NOx standard of 0.030 g/bhp-hr level. To the contrary, the regulatory-capable NOx-detection and measurement range of current PEMS is at a level that can be equivalent to a significant percentage of the in-use NOx limits that EMA’s regulations envision, and that is before any in-use operational and environmental conditions and impacts are taken into account. [EPA-HQ-OAR-2019-0055-1203-A1, p. 84]

All stakeholders have recognized the critical importance of evaluating and quantifying the incremental low-NOx accuracy and variability of current PEMS. Accordingly, multiple stakeholders, including EPA, are collaborating on a PEMS Measurement Allowance (PEMS-MA) Evaluation Project at SwRI. Work under that program is still on-going, and an additional follow on PEMS-MA in-use validation program will be initiated soon. EPA will need to account for those measurement allowance results before finalizing this rule. [EPA-HQ-OAR-2019-0055-1203-A1, p. 84]

The need for a sufficient PEMS-related measurement allowance is well-established. The current PEMS measurement-accuracy adjustment factor was determined in 2008 through an extensive series of tightly controlled laboratory and in-vehicle tests designed specifically for the assessment of PEMS measurement accuracy and variability. EPA was an active participant in the development of that testing program, which was performed at SwRI.17 [EPA-HQ-OAR-2019-0055-1203-A1, p. 84]

> 17 See "Determination of PEMS Measurement Allowances for Gaseous Emissions Regulated Under the Heavy-Duty Engine In-Use Testing Program." SAE Paper, 2009-01-0938/0939/0940, SAE International Journal of Fuels and Lubricants (2009); EPA Report No. EPA 420-R-08-005 (Feb. 2008); EPA, Direct Final Rule, "In-Use Testing for Heavy-Duty Diesel Engines and Vehicles; Emission Measurement Accuracy Margins for Portable Emission Measurement Systems," (73 FR 13441-52, March 13, 2008).

To put this issue into perspective, today's NTE-based in-use NOx standard of 0.30 g/bhphr (0.45 when the authorized NOx measurement allowance of 0.15 g/bhp-hr is added on) involves measuring NOx concentrations on the order of 45 ppm. In comparison, the proposed medium/high load 3B-MAW "Bin 3" in-use Option 1 NOx standard of 0.030 g/bhp-hr would require measuring NOx concentrations of approximately 4 to 5 ppm, or closer to 3 ppm since manufacturers would need to design for some minimum level of compliance margin. Those single-digit ppm levels are not far removed from the "drift" of PEMS NOx measurements over an 8-hour period, before factoring in any of the actual in-use sources of PEMS' measurement inaccuracy and variability, such as signal noise, span errors, time-alignment, fuel and exhaust-flow estimates, interference from other emissions species in the exhaust stream, and varying environmental and ambient conditions. To be able to tolerate unavoidable NOx breakthroughs in the medium/high bin, the overall window result would basically have to be zero. Thus, 2 or 3 ppm of PEMS measurement error, on its own, could lead to a non-compliant in-use NOx result. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 84-85]

Significantly, the measurement "drift" that is permitted under the relevant federal and CARB specifications for emissions-measurement equipment (see 40 CFR 1065.550) would equate to a 0.0008 g/bhp-hr drift limit at the low NOx levels that EPA is targeting, a drift limit that would be difficult even for laboratory grade instruments to meet, let alone PEMS. [EPA-HQ-OAR-2019-0055-1203-A1, p. 85]

Given the foregoing, it is vitally important for EPA to fully account for the results of SwRI's current PEMS-assessment program before finalizing the in-use compliance elements of EPA's low-NOx regulations. EPA's proposal to provide for a 10% accuracy margin (see NPRM, p. 219) is simply not adequate nor sufficiently data-based. It would amount to a 0.003 g/bhp-hr NOx margin for Bin 3, as compared against the current NOx accuracy margin of 0.15 g/bhp-hr. EPA has not and cannot demonstrate that such a 98% reduction in the in-use accuracy margin for NOx is appropriate. [EPA-HQ-OAR-2019-0055-1203-A1, p. 85]

Such a massive regulatory undertaking, with cost implications many times over any prior rulemaking directed at the heavy-duty engine and vehicle industry, should be supported by extensive research and analysis to prove-out and justify the very considerable expenses and burdens that will fall upon manufacturers and the public. Unfortunately, that is not the case here. To the contrary, there are many underlying research activities that are still underway, some which likely will not be completed by the time the rule is finalized, let alone when it was proposed, and there are other major gaps in the overall research effort that will not be filled at all. [EPA-HQ-OAR-2019-0055-1203-A1, p. 171.]

The PEMS measurement variability study, involving extensive testing, modeling, analysis, and verification, is incomplete. SwRI anticipates completing that work, which also will be supported through on-road validation testing by UC Riverside (CE-CERT), by the end of August 2022, likely just weeks before EPA will be obliged to finalize this rulemaking according to the Agency's internal self-imposed schedule. [EPA-HQ-OAR-2019-0055-1203-A1, p. 171]

All of the critical research outlined above was not available or not completed in time to support the pending NPRM. Indeed, the vital research at issue is still in process, with much of it expected to be delivered just as the proposed rule is expected to "go final" in the fall, all to meet EPA's goal of having the new low-NOx standards take effect in 2027. Thus, there is considerable risk that these critical data will be unavailable when these largely infeasible standards are to be finalized. [EPA-HQ-OAR-2019-0055-1203-A1, p. 172.]

EPA Summary and Response

Summary:

CARB comments that they believe adding a PEMS accuracy margin within off-cycle standards is unnecessary, as the conformity factor used is already inclusive of the PEMS accuracy margin for NOx. In support, they cite a JRC study which recommends a conformity factor equal to the PEMS uncertainty, without an additional PEMS margin. Furthermore, CARB comments that EPA impermissibly failed to consider the extent to which its proposal will likely result in in-use emissions exceeding the off-cycle standards.

In contrast, Daimler, GM, and PACCAR all state that a PEMS accuracy margin is necessary, and that a 10% margin is too small. EMA agrees in their comments, and furthermore states that the testing cited by the EPA in establishing this margin was based on a study that did not evaluate PEMS in the context of testing ultra-low-NOx engines in-use. In support, EMA refers to a SWRI study finding that NOx sensors have substantial errors on the order of 10% to 20%. Both EMA and PACCAR encourage EPA to account for results in the on-going PEMS-assessment program by SWRI before finalizing the PEMS accuracy margin value. Daimler recommends that EPA perform a joint study with industry to determine an appropriate margin to apply across a wide variety of test cycles and ambient conditions.

Response:

EPA disagrees with CARB that a PEMS accuracy margin is unnecessary. The conformity factor and PEMS margin, although both raise the numeric value of the in-use standard, are applied for different reasons and ultimately arrive at the same stringency whether the accuracy margin is part of or separate from the off-cycle standards. The final conformity factor was set at a level that was feasible based on the emission performance of the Stage 3 engine. The PEMS accuracy margin was set to capture the incremental measurement uncertainty of PEMS relative to the laboratory. EPA acknowledges the cited JRC study, but believes that having a conformity factor independent of the PEMS margin is necessary to separate the measurement variability from the standard, especially in situations where the in-use engine is removed from the vehicle and tested on an engine dynamometer. In such situations, the accuracy margin would not be applied to the off-cycle standard because the engine is being testing in the laboratory.

The PEMS accuracy margin work at SWRI on the Stage 3 engine included testing the engine over five field cycles with three different commercially available PEMS. EPA's conclusion after assessing the results from this study, as described in Section III.C of the preamble, was that 0.4 g/hr (which is 4 percent of the Bin 1 standard), is more appropriate for Bin 1 and 5 mg/hp-hr (which is 8.6 percent of the Bin 2 standard), is more appropriate for Bin 2. Thus, the proposed 10 percent uncertainty margin is reduced in the final provision.

12 Emission credits and averaging, banking, and trading (ABT)

12.1 General ABT provisions for NOx emission standards

Comments by Organizations

Organization: *Alliance for Vehicle Efficiency (AVE)*

AVE recommends EPA conduct compliance modeling based on different credit and flexibility scenarios and avoid backsliding. [EPA-HQ-OAR-2019-0055-1280-A1, p. 6]

Before adopting new flexibilities and credits, AVE recommends EPA provide modeling scenarios that outline possible compliance strategies manufacturers might deploy to meet future standards. The modeling would allow suppliers to better estimate the need for various advanced technologies to meet the future standards and to plan accordingly. [EPA-HQ-OAR-2019-0055-1280-A1, p. 6]

Organization: *American Automotive Policy Council (AAPC)*

The EPA HD Engine notice of proposed rulemaking includes provisions for using credits to meet fleet requirements. Averaging Banking and Trading (ABT) credits are an important flexibility for manufacturers to meet stringent emissions standards. [EPA-HQ-OAR-2019-0055-1293-A1, p. 1]

Flexibilities to earn credits and to move credits between years and product applications are helpful for manufacturers. Quick changes to production and product plans often result in stranded capital and disruptions to the supply chain and manufacturing workforce. Depending on the product lineup and lifecycle position of their product portfolio, a manufacturer may not have the ability to respond to large changes in stringency immediately, with limited lead time. Alternatively, a manufacturer may be able to transition quickly in one part of its business, but not immediately in another. Manufacturers are more likely to be able to respond to stringent regulations with adjustments to their portfolios over time, and an ABT program with sufficient flexibilities can help manufacturers smoothly transition to stringent regulations. EPA should consider adding flexibilities to trade credits between certification classes, such as light-heavy and medium-heavy, for criteria emissions and GHG. [Also in Section 28. EPA-HQ-OAR-2019-0055-1293-A1, p. 1]

A reasonably constructed ABT program can help industry achieve air quality targets cost effectively, without undermining the air quality regulatory objective. Such a program can acknowledge that a ton of emissions is a ton of emissions, regardless of source, while still reducing the overall emissions to levels required to meet regulatory objectives. Similarly, a program with sufficient flexibilities to trade credits between certification classes reduces the likelihood that a manufacturer would need to develop two engines to address the different regulations for different regulatory classes, when one engine could meet customer requirements and deliver overall emissions reductions in line with program regulatory objectives and emissions reduction targets. [EPA-HQ-OAR-2019-0055-1293-A1, p. 2]

President Biden’s Executive Order on Strengthening American Leadership in Clean Cars and Trucks encourages the EPA administrator to consider the role zero-emission heavy-duty vehicles might have in reducing emissions from certain market segments,1 and an ABT program is a practical structure in a regulatory program aligned with this Presidential order. The ability to carry credits between years is a helpful flexibility for manufacturers, especially given the proposed rapid ramp in stringency. [EPA-HQ-OAR-2019-0055-1293-A1, p. 2]

1. Sec. 3. (b) https://www.whitehouse.gov/briefing-room/presidential-actions/2021/08/05/executive-order-on-strengthening-american-leadership-in-clean-cars-and-trucks/

EPA has proposed reductions in NOx and PM FTP emissions for gasoline spark-ignited emissions to the same level as diesel engines. In addition to the California Low NOx Regulation, the EPA also is proposing to reduce hydrocarbon (HC) emissions by 57-71% and Carbon Monoxide (CO) emissions by 58% versus the current standards. The proposed HC and CO emission standards are challenging and technology-forcing for spark-ignition engines, particularly when coupled with the new requirement to certify to a Supplemental Emissions Test

(SET) standard. Given the stringency of the new standards and test procedures, we believe that an averaging, banking, and trading (ABT) requirement should also apply for HC and CO emissions. Having an HC and CO ABT program will allow additional compliance flexibility as manufacturer engineer new solutions for these stringent standards. [This comment can also be found in section 3.2 of this comment summary.] [EPA-HQ-OAR-2019-0055-1293-A1, p. 3]

EPA should consider averaging, banking, and trading for other regulated criteria emissions, including HC, PM, CO, and N2O. Zero emissions vehicles should be allowed to participate in these programs as well, given their potential to reduce real world emissions. [EPA-HQ-OAR-2019-0055-1293-A1, p. 3]

Organization: *California Air Resources Board (CARB)*

On page 17550 of the NPRM, U.S. EPA asks for comments regarding the proposed revisions to the ABT program. [EPA-HQ-OAR-2019-0055-1186-A2, p.10]

CARB staff supports the elimination of the hydrocarbon (HC) and particulate matter (PM) pollutants from the ABT program. As indicated in the NPRM, modern day HD diesel and Otto-cycle engines can easily meet the emissions standards for HC and PM. Therefore, an ABT program for the HD sector is no longer needed and should be eliminated. [EPA-HQ-OAR-2019-0055-1186-A2, p.10]

On page 17550 of the NPRM, U.S. EPA asks for comments regarding the proposed revisions to the ABT program. [EPA-HQ-OAR-2019-0055-1186-A2, p.13]

CARB staff supports the proposal to discontinue the use of old credits that were generated almost a decade ago. It is obvious that these older credits generated before 2010 were not needed to transition to the 2010 standards. Allowing the use of these very old credits now and in the future would only unnecessarily delay emission reductions and prevent the timely transitioning to the new standards. [EPA-HQ-OAR-2019-0055-1186-A2, p.13]

The ABT program was developed to assist manufacturers in their product planning schedule to ease the transition to new stringent standards. As mentioned, these credits were generated with engine and aftertreatment system (EAS) technologies that do not meet the 2027 MY requirements. As such these older credits should not be available for use starting with the 2027 MY. [EPA-HQ-OAR-2019-0055-1186-A2, p.13]

Manufacturers seeking additional flexibility for meeting U.S. EPA’s 2027 MY standards should begin certifying to lower FEL now. In fact, because of California’s more stringent 2024 MY standards, manufacturers will generate new credits to help them meet U.S. EPA’s 2027 MY CTP standards. [EPA-HQ-OAR-2019-0055-1186-A2, p.13]

Organization: *CALSTART*

Double-counting should also not be allowed for combustion engines required under states’ adoption of the Heavy-Duty Omnibus. [EPA-HQ-OAR-2019-0055-1313-A1, p.5]

Organization: *Cummins Inc. (Cummins)*

An Averaging, Banking, and Trading (ABT) program that includes an appropriate balance of flexibilities and constraints, coupled with an appropriate engine FEL cap, are important and necessary elements for a successful EPA heavy-duty engine NOx emissions regulatory program. ABT encourages earlier implementation of new technologies, allows manufacturers flexibility in planning their investments and managing product costs, and can provide some amount of relief when a manufacturer encounters technical or lead-time constraints. Those attributes of ABT all help manufacturers deliver reliable and affordable products that meet the diverse range of heavy-duty applications and customer needs. Therefore, Cummins generally supports EPA's proposed ABT program because it provides additional environmental benefits, while providing some of the flexibility manufacturers need to address customer needs. However, because of the wide range of emerging zero and near-zero NOx emissions technologies, and the uncertainty of the rates at which those technologies will be adopted by the U.S. heavy-duty market, Cummins recommends that EPA finalizes a few ABT-related constraints to prevent unintended consequences that otherwise could be caused by the ABT program itself. [EPA-HQ-OAR-2019-0055-1325-A1, pp. 8 - 9]

A relatively unconstrained ABT program could lead to competitive disruptions between manufacturers, based on the mix of technologies different manufacturers are able to sell into various market subsegments. Specifically, if zero NOx emissions technologies sold in one market subsegment are used to bank significant NOx credits, those could be used to offer higher-emitting, lower-technology, lower cost engines in a different market subsegment, where another manufacturer is only able to offer lower emitting, higher-technology, higher-cost engines. That would disrupt the current competitively level playing field in that subsegment, and it would discourage the investment of manufacturers developing and customers purchasing lower-emitting engines. To prevent such a scenario, EPA should maintain its current NOx ABT averaging set constraints, which are based on the engine family primary intended service classes prescribed in Part 1036, namely: Spark-Ignition HDE and Light, Medium, and Heavy HDE CI engines. Additionally, EPA should maintain its constraints prohibiting the exchange of NOx credits between light-duty and heavy-duty classes and between chassis-dynamometer certified vehicles and engine-dynamometer certified engines. [EPA-HQ-OAR-2019-0055-1325-A1, p. 9]

To include powertrains that are neither SI nor CI internal combustion engine-based, EPA should prescribe how to align its vehicle-level primary intended service classes from EPA's Heavy-duty GHG Phase 2 regulations in Part 1037 with the appropriate engine-based NOx averaging set. [EPA-HQ-OAR-2019-0055-1325-A1, p. 9]

Furthermore, Cummins does not support EPA justifying the feasibility of a HC standard based on the projected availability of HC emissions credits. That approach to standard-setting could lead to competitive disruptions between manufacturers, based on the mix of technologies different manufacturers are able to sell into various market subsegments. [EPA-HQ-OAR-2019-0055-1325-A1, p. 6]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

Daimler Truck supports EPA's proposal to maintain a NOx credit ABT program, giving manufacturers latitude to manage their development schedules and investments. The ABT program helps manufacturers address compliance risks and maintain a complete portfolio while transitioning to UL NOx products and, ultimately, to ZEVs. It also allows for the balancing of business needs while simultaneously providing real NOx emission reduction benefits. [EPA-HQ-OAR-2019-0055-1168-A1, p.80]

The NOx ABT program should, however, optimally incentivize ZEV development and increased penetration. It should also recognize manufacturers' current investments in improved emissions performance and seek to allow manufacturers to spread their investments across a number of years. EPA's proposal lacks sufficient flexibility to be effective in attaining these important objectives. [EPA-HQ-OAR-2019-0055-1168-A1, p.80]

EPA proposes to make manufacturers' existing NOx credits valueless for the purpose of offsetting emissions from new engines in MY 2027 and later. This retroactive invalidation of earned credits is in bad faith: manufacturers have made improvements today to improve emissions, and accordingly, have certified their engines to lower-NOx FELs, yet the EPA proposes to strip away these credits. Engines certified to lower FELs today are providing real world NOx benefits and should be recognized accordingly. [EPA-HQ-OAR-2019-0055-1168-A1, p.85]

Daimler Truck understands EPA's concerns that these current engines are not certified to all of the test conditions of the proposed program. However, that does not change the fact that these engines are generating improved emissions today—improvements that manufacturers made, in part, because of the opportunity to generate credit. EPA also asserts, as basis for its proposal, that the Agency did not require NOx credits to demonstrate feasibility of the standards in the Proposed Rule. Daimler Truck has provided evidence that EPA has not demonstrated feasibility at all (see Section II.B.3 of these comments), and therefore credits will be necessary for manufacturers to meet the proposed standards. [EPA-HQ-OAR-2019-0055-1168-A1, p.85-86]

EPA's proposal to change the rules of the credit program this significantly threatens to discourage manufacturers from proactively improving emissions performance (and accepting additional in-use risk), since EPA may later decide to devalue those very improvements. EPA states in the proposal that it wishes to 'provide flexibility for manufacturers to spread out their investment and prioritize technology adoption in the applications that make the most sense for their businesses during the transition to meeting new standards.'108 Utilizing existing credits to accomplish this would improve manufacturer flexibility and is supported by real world emissions improvements. [EPA-HQ-OAR-2019-0055-1168-A1, p.86]

108 Id.

Daimler Truck recognizes that the EPA wishes to prevent decades-old credit windfalls from undercutting the effectiveness of the proposed program. Nevertheless, manufacturers are making improvements today that are rightly generating NOx credits and should be recognized accordingly. We recommend that EPA allow credits generated after the release of the Cleaner Trucks Initiative Advanced Notice of Proposed Rulemaking109 to be used in MY 2027+, as this is the benchmark date when manufacturers became aware of potential future increases in NOx stringency and the possibility of using NOx credits to manage the transition. [EPA-HQ-OAR-2019-0055-1168-A1, p.86]

109 EPA, Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine Standards; Advanced notice of proposed rulemaking, 85 Fed. Reg. at 3306 (Jan. 21, 2020).

Organization: *Ford Motor Company (Ford)*

The proposed HC and CO emission standards are challenging and technology-forcing for spark-ignition engines, particularly when coupled with the requirement to certify to a Supplemental Emissions Test (SET) standard. Given the stringency of the new standards and test procedures, we believe that an averaging, banking, and trading (ABT) requirement should apply for HC and CO emissions. Having an HC and CO ABT program will allow additional compliance flexibility as manufacturer engineer new solutions for these stringent standards. [EPA-HQ-OAR-2019-0055-1300-A1, pp. 3 - 4]

Organization: *General Motors LLC (GM)*

The ability to use ABT is an important tool for manufacturers, especially as the potential stringency ramps up in future model years. This allows OEMs to manage compliance over a longer time horizon, and across fuel types and averaging sets, in conjunction with the turnover of its portfolio and aligned with the preferences of its customers. [EPA-HQ-OAR-2019-0055-1246-A1, p.4]

Proposed restrictions to averaging, banking, and trading credits decrease a manufacturer's ability to respond to these stepped changes. [EPA-HQ-OAR-2019-0055-1246-A1, p.4]

Organization: *Maine Department of Environmental Protection (Department)*

Using the CARB Heavy-Duty Omnibus Regulation as a bellwether, the Department requests the following revisions to the federal proposal: [EPA-HQ-OAR-2019-0055-1288-A1, p.6]

- Averaging, banking, and trading. The Department fully supports EPA’s proposal to not allow averaging, banking, and trading for PM or hydrocarbons for model year 2027 and later engines. [EPA-HQ-OAR-2019-0055-1288-A1, p.7]
- Eliminating averaging, banking, and trading would maximize nationwide NOx reductions. If EPA retains these provisions, it should consider establishing a 0.05 grams NOx cap in 2027 that is consistent with that in the CARB Heavy-Duty Omnibus regulation in lieu of EPA’s proposed family emission limits (FEL) of 0.15 grams NOx in 2027 and 0.05 grams NOx in 2031. Manufacturers have already conducted engine development work to prepare for and comply with California 2024-2026 standards and if the CARB FEL caps are implemented federally, all states can benefit from this research

and development. [EPA-HQ-OAR-2019-0055-1288-A1,p.8] [Also appears in Section 13.2 of this document]

Organization: *Moving Forward Network (MFN)*

The total impact of the above crediting provisions is quite large, yet EPA has not completed any analysis of the environmental and/or public health impacts of these provisions. EPA has not required the necessary mechanisms to track the crediting provisions or guidance to prioritize environmental justice communities for the deployment of ZEV. If the agency had done a complete analysis, it would see clearly the deleterious effect such actions have on the efficacy of the program. [EPA-HQ-OAR-2019-0055-1277-A1, p. 49]

Below, we detail the harms posed by the agency's proposed flexibilities. In short, the proposed flexibilities are weak enough to virtually turn the 2027-2030 phase of the Option 1 standard from a 0.035 g NOx/bhp-hr standard, on paper, into a 0.05 g NOx/bhp-hr standard, in practice. These flexibilities under status quo deployment eliminates 12 percent of the benefits of the first step of the proposed Option 1—some of the more likely scenarios of electric vehicle adoption and/or the likely possibility that additional states adopt the Omnibus standards would only further erode the benefits of EPA's proposed program as a result of these unnecessary flexibilities. [EPA-HQ-OAR-2019-0055-1277-A1, p. 49]

In order to estimate the impacts of the program, we have primarily relied upon three key sources of data: 2022 heavy-duty engine certification data;182 engine production and installation data for 2019,183 the last year for which data is available which predates the temporary supply chain issues which have occurred as a result of the pandemic; and new vehicle registration data for 2019-2021,184 sorted by vehicle class, fuel, and state. [EPA-HQ-OAR-2019-0055-1277-A1, p. 50]

182. https://www.epa.gov/system/files/documents/2022-02/heavy-duty-gas-and-diesel-engines-2015-present.xlsx (updated February 2022)

183. https://wardsintelligence.informa.com/WI964489/North-America-Factory-Sales-December-2019

184. Atlas EV Hub, Medium- and Heavy-duty Vehicle Registrations Dashboard, which collects data from IHS Markit: https://www.atlasevhub.com/materials/medium-and-heavy-duty-vehicle-electrification/

While engine configurations are available in numerous horsepower configurations, they are generally certified under a single FEL, so we have reduced the number of engines to 34, covering the different fuels and engine classes the engine might be deployed.185 While the Wards data identifies engine manufacturers for a given gross-vehicle-weight rating (GVWR) class, it does not identify which of the engines manufactured by a given supplier is deployed to those vehicles, except in the case of Class 8 sales, where the data distinguishes between engines greater than or less than 10 liters in volume. Therefore, to assign these engines we have used our best technical judgment in assigning engines, including distinguishing between classes within a given engine class (e.g., LHDD encompasses both Class 4 and Class 5 vehicles) as well as additional data on engine configurations from manufacturers (for example, the engine manufacturers themselves or specific applications such as transit or school buses, where only a subset of engines might be deployed), or data from the Phase 1 greenhouse gas program.186 [EPA-HQ-OAR-2019-0055-1277-A1, p. 50]

185. For example, while Cummins' L9 engine is available in at least 9 different configurations, our analysis reduces this to 4 separate assigned engines, first to distinguish between L9 diesel and L9N compressed natural gas fuels, and then assigning each of those to both medium- and heavy-heavy-duty diesel engine classes (MHDD and HHDD, respectively).

186. https://www.epa.gov/compliance-and-fuel-economy-data/epa-heavy-duty-vehicle-and-engine-greenhouse-gas-emissions

Our analysis identifies three main buckets of credits: 1) engines certified below today's standards which will qualify for the transitional credit program; 2) engines certified to the Omnibus standards, which will qualify either for the transitional credit program or will, on average, achieve a standard below the federal requirements; and 3) zero-emission vehicles, which earn credits under the proposed provision for plug-in and fuel-cell electric vehicles. [EPA-HQ-OAR-2019-0055-1277-A1, p. 53]

While current certification procedures are not identical to the certification procedures required to qualify for the transitional credit program, as noted in Section IV.D.3 there is sufficient compliance margin such that these engines will almost certainly qualify for the program, and these credits are of such a large magnitude that it is obviously within the polluting industry's interest to take advantage of such a generous crediting program. Moreover, this is a conservative estimate of the likely availability of credits because this assumes no improved performance in the next two years of engines. Finally, for simplicity engines which would likely qualify for EPA's early credit program (and thus be able to use a credit multiplier) have been lumped into the transitional credit program only, and there has been no attempt to quantify the credits earned by those engines beginning in 2027, an additional conservative estimate. [EPA-HQ-OAR-2019-0055-1277-A1, p. 53]

For the Omnibus credits, it was assumed that all six states which have currently adopted ACT will move forward to adopt the Omnibus. To-date, three ACT states have done so (California, Oregon, and Massachusetts), representing 60 percent of the current ACT sales volume. Washington and New Jersey both have ongoing regulatory procedures to align with the Omnibus, and it is likely that New York, which just completed its ACT process less than six months ago, could follow.190 [EPA-HQ-OAR-2019-0055-1277-A1, p. 53]

> 190. Washington: https://ecology.wa.gov/Regulations-Permits/Laws-rules-rulemaking/Rulemaking/WAC173-423-400Jan18. New Jersey: https://www.nj.gov/dep/njpact/materials.html#NJPACT-co2trucks20200910-am. New York: https://www.dec.ny.gov/docs/air_pdf/adopted218.pdf.

Additionally, numerous other states could join the Omnibus program. Colorado is currently considering the program as part of its 2022 Clean Truck Strategy.191 Connecticut, which is not included in either ACT or Omnibus states, just passed a bill permitting the Commissioner of Energy and Environmental Protection to "implement the medium and heavy-duty motor vehicle standards of the state of California," which includes both ACT and Omnibus, signaling even more vehicles required to meet such standards.192 Moreover, there are numerous other advocacy efforts moving forward at the state level to adopt these stronger standards and additional complementary policies to cut freight pollution in light of federal inaction and the severity of the problem facing communities today. [EPA-HQ-OAR-2019-0055-1277-A1, p. 53]

> 191. https://freight.colorado.gov/sites/freight/files/documents/CleanTruckStrategy.pdf, p. 4, calls for "new trucks sold in the state to produce 90% less NOx emissions than current standards starting in 2027."
>
> 192. https://legiscan.com/CT/text/SB00004/id/2579528/Connecticut-2022-SB00004-Chaptered.pdf.

The determination of electric vehicle sales was described above. Because the proposal does not permit heavy-duty Otto-cycle (HDO) engines to receive credits, it was assumed consistent with the proposal that these credits would be allocated to the respective diesel engine class based on the GVWR of the according vehicle. Sales of HDO engines are dominated by Class 4-5 vehicles, so the majority of such generated credits (about 60 percent) applied toward LHDD engines. [EPA-HQ-OAR-2019-0055-1277-A1, p. 53]

To convert NOx certification levels into awarded credits, we've utilized the same procedure adopted by EPA in its MOVES modeling—for diesel engines, the work assumed over the FTP cycle is based on a linear function of the horsepower of the engine, where we've used the certified horsepower corresponding to the FEL; for gasoline engines, we've used a fixed value based on limited data.193 This is then combined with an assumed mileage factor for the FTP cycle (6.3 miles for gasoline vehicles, 6.5 miles for diesel) to yield an engines conformance factor. For reference, the average conformance factors for engine classes are: HDO, 3.07; LHDD, 3.50; MHDD, 3.90; and HHDD, 4.88. Because credits are not allowed to be traded between engine classes, however, there is little impact on any of the results stemming from the use of such estimates. [EPA-HQ-OAR-2019-0055-1277-A1, p. 54]

193. https://www.epa.gov/sites/default/files/2017-08/documents/03-heavy-duty-start-emission-rates-2017-06-07.pdf, slides 9 and 10.

The magnitude of these credit programs is quite large (Figure 10). This is, however, not surprising—the transition credit program awards credit compared to a 0.2 g/bhp-hr standard. HHDD engines see a large number of early credits related to the deployment of high-volume products like Detroit Diesel's latest DD13, which is certified to a 0.16 g/bhp-hr standard, as well as a small volume of CNG engines. HDO engines see a significant share of early credits due to the large volume of propane engines as well as the large share of gasoline engines certified below the 0.2 g/bhp-hr NOx standard. Very few LHDD and MHDD products are currently certified below today's standards so are not projected to earn a significant share of transitional credits; however, as indicated by Figure 2, there is plenty of room at the margins for that to change. [EPA-HQ-OAR-2019-0055-1277-A1, p. 54]

Under our analysis. over 325,000 metric tons of lifetime NOx emissions are credited through 2030, and nearly 450,000 metric tons through 2035. The majority of these credits stem from vehicles sold under state regulations that are stronger than the current federal program, representing a windfall credit for manufacturers that erodes the benefits of the proposed federal program. [EPA-HQ-OAR-2019-0055-1277-A1, pp. 54 - 55]

The majority of credits earned under our projections is granted for engines sold under the Omnibus standards, which are already required to achieve standards below the federal requirements in 2024 and beyond. For all but HHDD engines, these standards continue to be stronger than Option 1 in the 2027-2030 timeframe, yielding additional credits. [EPA-HQ-OAR-2019-0055-1277-A1, p. 55]

Owing to the nature of the banking and trading program, these credits have a significant impact on the emissions from the remaining vehicles in the fleet, especially in the early years of the program. Manufacturers have a range of ways in which they could utilize these credits, so it is impossible to capture every nuance in possible outcomes. Below, we consider two different ways to utilize those credits, as well as different limitations EPA could impose on the credit generation programs. [EPA-HQ-OAR-2019-0055-1277-A1, p. 55]

It should again be emphasized that we do not support the use of these credit programs, generally, as they undermine the real-world emissions reductions desperately needed in communities impacted by the freight sector. The analysis below is meant to be illustrative for EPA, emphasizing the need to consider the impacts of their proposed flexibilities in both their analysis of the feasibility of the standard and the degree to which they are upholding their legal requirements under the Clean Air Act. [EPA-HQ-OAR-2019-0055-1277-A1, p. 55]

The first way in which manufacturers could choose to deploy the credits earned under EPA's flexibilities would be to maximize the number of vehicles sold at the worst polluting level allowed under EPA's program. Such a deployment strategy is indicated in the panes of Figure 11 on the left side of the figure. Here it is assumed that manufacturers would sell as many engines with an FELFTP = 150 mg NOx/bhp-hr as possible in the 2027-2030 timeframe, and as many engines with an FELFTP = 50 mg NOx/bhp-hr in 2031 and beyond. [EPA-HQ-OAR-2019-0055-1277-A1, p. 55]

An alternative strategy would be to maximize the bare minimum improvements needed over the largest share of the fleet. As noted elsewhere in this document, the 50 mg NOx/bhp-hr FTP standard can be achieved with minimal changes in configuration and technology.194 Therefore, rather than target credit usage at a narrow selection of engines, a manufacturer may choose instead to minimize the improvements broadly over the entire volume of engines. This is represented by the panes of Figure 11 on the right. This FEL also represents the FEL for the Omnibus standards, and the required average FEL for Option 2. [EPA-HQ-OAR-2019-0055-1277-A1, pp. 55 - 56]

194. See https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hdomnibuslownox/appi.pdf pp. 18-21 for an analysis of the small changes needed based on data from Southwest Research Institute.

EPA's proposed credit program has the potential to substantially erode the benefits of stronger NOx tailpipe standards, delaying the deployment of cleaner trucks. As proposed, EPA's proposal would mean that 27 percent of all engines sold in 2027-2029 would be no better than today's engines under Option 1. Under Option 2, this number would be 32 percent, with at least 10 percent of engines never being required to improve compared to today's engines. While excluding vehicles sold in states adopting California's truck standards or excluding the proposed transitional credit program can help reduce the impacts of these credit provisions, only excluding them entirely can forestall their adverse impacts on the efficacy of the federal NOx program, and EPA must carefully consider these impacts under its requirements under the Clean Air Act before finalization. [EPA-HQ-OAR-2019-0055-1277-A1, pp. 56 - 57]

The graphs in Figure 11 show the marketshare of a given FEL as a share of engines in a given engine class. The top-most figure represents the proposed Option 1 program. As indicated by the left-hand graph, we see that in the 2027-2029 period, nearly one-quarter of MHDD and HHDD engines, more than one-third of HDO engines, and nearly half of all LHDD engines could be deployed with an FELFTP = 150 mg NOx/bhphr. EPA considers this FEL level "consistent with the average NOx emission levels achieved by recently certified CI engines," so this would mean that 27 percent of all engines sold in 2027-2029 would be no better than today's engines. [EPA-HQ-OAR-2019-0055-1277-A1, p. 57]

In the right-hand graph, credits for LHDD engines are sufficient as to require no improvement in those engines, thanks to the overwhelming share of zero-emission credits earned and the disproportionately small share of certified LHDD engines. However, three-quarters of all engines sold in the first step of Option 1 could be certified at the average level required under the weakest standard considered by EPA (Option 2). In fact, more than 15 percent of the fleet would never be required to improve beyond an FELFTP = 50 mg NOx/bhp-hr, even under the more stringent second step beginning in 2031. [EPA-HQ-OAR-2019-0055-1277-A1, p. 57]

The bottom-most figure shows how the weakest standard considered by EPA would further be weakened by the adoption of this credit program. Nearly a third of engines sold in 2027-2029 would be allowed not to improve from today's certification levels, and more than 10 percent of all engines sold would never be required to improve beyond those levels. [EPA-HQ-OAR-2019-0055-1277-A1, p. 57]

In total, at least 12 percent of the lifetime benefits of the first step of Option 1 (2027-2030) are expected to be given away under the credit provisions proposed. For the weaker Option 2 over this same timeframe, this increases to 17 percent of a program that is, as proposed, substantially less effective. [EPA-HQ-OAR-2019-0055-1277-A1, p. 57]

Given the harm caused by the proposed credit program, the best option for EPA is to simply eliminate all bonus crediting provisions—given the extensive lead-time and technical feasibility to reduce emissions from the freight sector, manufacturers do not need help transitioning to the levels of standards required by Option 1 or even the Omnibus. The so-called flexibilities provided are clearly detrimental to EPA's obligation to protect public health and welfare from pollution, the response most consistent with the agency's legal obligations under the Clean Air Act is to simply eliminate these provisions. [EPA-HQ-OAR-2019-0055-1277-A1, p. 57]

However, should EPA not take the more protective step of eliminating the proposed crediting provisions, there are measures that can be taken to improve the proposed credit program. [EPA-HQ-OAR-2019-0055-1277-A1, p. 57]

One clear issue is the windfall that results from the result of state regulatory programs that are more protective than the federal program. Elsewhere, we have noted that EPA should be factoring in the impacts that these state actions will have on the industry in assessing the feasibility of the program. However, if the agency does not adjust its stringency in response to these regulations, it must isolate the impact of those regulations. To do this, it can do as it has previously done in heavy-duty engine regulations and exclude engines certified to stronger state standards.195 The results of this are shown in the third graph of Figure 11. The result of this is to substantially reduce the impacts of the crediting program by excluding zero-emission vehicles driven by state adoption of the ACT, but it also excludes the impact of credits earned in 2027-2030 from engine classes other than HHDD resulting from Option 1 being weaker than the Omnibus rule. On net, this cuts the number of available credits by more than 50 percent. [EPA-HQ-OAR-2019-0055-1277-A1, pp. 57 - 58]

195. "It is worth clarifying that this phase-in excludes California complete heavy-duty vehicles, which are already required to be certified to the California emission standards. It also excludes vehicles sold in any state that has adopted California emission standards for complete heavy-duty vehicles. It would be inappropriate to allow manufacturers to ''double-count'' the vehicles by allowing them to count those vehicles both as part of their compliance with this phase-in and for compliance with California requirements. We would handle heavy-duty engines similarly if California were to adopt different emission standards than those being established by this rule." (66 FR 5043)

One additional obvious issue is the delay that the transitional credit program specifically causes. As noted above, three-quarters of engines sold under the first step of Option 1 could be certified to an FELFTP = 50 mg NOx/bhp-hr, the dirtiest engine allowed under the Omnibus and a level required, on average, beginning in 2024, a full seven years before the second step in the Option 1 program. This level of delay allowed under EPA's proposal flies in the face of what is needed in areas around the country to meet federal air quality standards, which is immediate action to reduce emissions from the freight sector.196 To reduce the amount of delayed action allowed under EPA's proposal, the agency should eliminate the transitional credit program. Eliminating the transitional credit program would cut credits available in the first step of the Option 1 program by nearly 80 percent. By reducing the credits available in this critical, initial part of the proposed regulation, EPA would increase the likelihood that manufacturers deploy the much needed cleaner trucks more quickly. However, in the long run, eliminating the transitional credit program alone would not mitigate the harm caused by the agency's credit program, which would permit at least 15 percent of heavyduty vehicles sold under the second phase of the proposed

Option 1 program to be certified to the dirtiest allowed FEL. [EPA-HQ-OAR-2019-0055-1277-A1, p. 58]

196. "[California's South Coast Air] Basin will be unable to achieve the ozone standards by the attainment dates of 2024 and 2032 without the additional emissions reductions from a revision of the existing on-road heavy-duty engine exhaust emission standards for NOx. A nationwide standard is also critical in assisting other states to achieve the more stringent 2015 NAAQS." Letter to EPA Administrator Gina McCarthy from The South Coast Air Quality Management District, et al., June 3, 2016. https://www.epa.gov/sites/default/files/2016-09/documents/petition_to_epa_ultra_low_nox_hd_trucks_and_engines.pdf. "The Ozone Transport Commission concluded in its 2020 Annual Report that, to address the persistent air quality issues in the tri-state area [of Connecticut, New Jersey, and New York], reducing NOx from heavy-duty diesel vehicles is of 'utmost importance.'" Letter to National Climate Advisor Gina McCarthy and EPA Administrator Michael Regan from the Attorneys General of Connecticut, New Jersey, and New York, November 23, 2021. https://portal.ct.gov/-/media/AG/Press_Releases/2021/NY-CT-NJ-Letter-REHeavy- Duty-Truck-NOx-Emission-Standards_112321.pdf.

In addition to the above changes to the program, we refer EPA to our comments on the zero-emission vehicle crediting program specifically (Section II.B). [EPA-HQ-OAR-2019-0055-1277-A1, p. 58]

Organization: *National Association of Clean Air Agencies (NACAA)*

NACAA does not support the inclusion of a NOx emission credit or Averaging, Banking and Trading (ABT) scheme. [EPA-HQ-OAR-2019-0055-1232-A1, p. 15]

EPA acknowledges in the NPRM that its proposed NOx standards are feasible without the use of credits. Even so, the agency proposes a NOx credit-generation scheme and ABT that would allow manufacturers to use credits generated from producing engines with emission levels below the standards to produce engines with emission levels above the standards. With areas all across the country seeking every possible ounce of NOx reduction in order to protect the health of those who live and work in their jurisdictions, including those in overburdened communities where neighborhood truck traffic is disproportionately high, the concept of turning additional NOx emission reductions beyond those required by the new standards into currency to be used to negate those reductions seems senseless. [EPA-HQ-OAR-2019-0055-1232-A1, p. 15]

This approach would also open the possibility of the federal program issuing to manufacturers large NOx credits against the current 200-mg/hp-hr federal standard for engines sold in Omnibus jurisdictions at the 50-mg standard. This would allow manufacturers to continue making dirtier engines at the expense of the emission reductions intended to occur from the states' Omnibus programs and would effectively float the standard higher, increasing emissions across engines in all states. [EPA-HQ-OAR-2019-0055-1232-A1, p. 15]

Although NACAA supports efforts to encourage and expand the deployment of ZEVs, we do not support efforts that come at the expense of NOx reductions in the rule. EPA should not include in the final rule provisions for generating NOx credits or an ABT program that will, in any way, deplete or negate important NOx emission reductions achieved through implementation of new emission standards, especially when the standards are feasible without the use of credits. [EPA-HQ-OAR-2019-0055-1232-A1, p. 15]

EPA should, however, finalize its proposal to end the ABT program for PM and hydrocarbons for MYs 2027 and later engines. [EPA-HQ-OAR-2019-0055-1232-A1, p. 15]

Organization: *Navistar, Inc. (Navistar)*

Navistar also wants to be very clear on another point. Some commenters on the proposed rule to date have asserted that diesel engine manufacturers may actually raise NOx emissions levels as a result of the AB&T credit structures in the proposed rule. The concern seems to be that the NOx credits from ZEVs will be sufficient to allow engine manufacturers to raise NOx emission levels even from their current levels. To be very clear: Navistar will not raise its NOx emission levels. The AB&T program will be used solely to balance the transition to the lower emission standards across engine families and model years and help keep costs in line. Navistar is in favor of a rule structure that makes it clear that backsliding on NOx emissions levels is prohibited. [EPA-HQ-OAR-2019-0055-1318-A1, p. 2]

In particular, we support: Providing a stable structure for NOx emissions credit generation and use to allow continued investments in clean diesel engines and development of ZEVs; [EPA-HQ-OAR-2019-0055-1318-A1, p. 3]

Organization: *Northeast States for Coordinated Air Use Management (NESCAUM)*

Should EPA instead promulgate Option 1, we urge the Agency to make the following changes to the proposed standards: We support EPA's proposal to not allow Averaging, Banking, and Trading (ABT) for PM or hydrocarbons for model year 2027 and later engines. EPA proposes to continue to allow ABT of NOx credits generated against applicable heavy-duty diesel engine NOx standards. As part of this proposal, manufacturers could certify battery electric and fuel cell vehicles to generate NOx emissions credits. NESCAUM does not support the inclusion of a NOx emission credit or ABT scheme. [EPA-HQ-OAR-2019-0055-1249-A1, p. 14]

EPA acknowledges in the NPRM that its proposed NOx standards are feasible without the use of credits.44 Even so, the agency proposes a NOx credit-generation scheme and ABT that would allow manufacturers to use credits generated from engines with emission levels below the standards to produce engines with emission levels above the standards.

Given the urgent need to reduce NOx emissions in the Northeast, we are opposed to heavy-duty engine NOx ABT. [EPA-HQ-OAR-2019-0055-1249-A1, p. 15]

Organization: *Oshkosh Corporation*

EPA requests comments on multiple aspects of the Proposed Rule related to the emission credit ABT programs for heavy duty trucks. Oshkosh generally supports the ABT provisions and views them as this as an important tool for incentivizing the introduction of EV and other advanced technologies. In past rulemakings, EPA has significantly limited the ability of manufacturers to carry over legacy credits for vocational trucks certified under the Phase 2 GHG custom chassis provisions. As a result, in the move from Phase 1 to Phase 2 GHG programs, Oshkosh's CO2 credit bank was effectively eliminated, thus constraining the Company's ability to use earned emission credits. The current rulemaking presents an opportunity to obtain a different result. To this end, Oshkosh is pleased to provide these comments regarding EPA's ABT proposals: [EPA-HQ-OAR-2019-0055-1226-A1, p. 5]

To provide further incentives for EV development, Oshkosh also requests that EPA ensure harmonization of NOx and CO2 credit programs for heavy-duty vehicles. In general, we request that EPA modify existing credit ABT programs to (1) allow credit transport across all heavy-duty engine/vehicle families; (2) allow a credit life of 10 years for credits generated by EV, FCEV and hybrid technologies; and (3) guard existing credit banks to enable carry over of legacy credits to future programs. [EPA-HQ-OAR-2019-0055-1226-A1, p. 6]

Organization: *Ozone Transport Commission (OTC) and Mid-Atlantic/Northeast Visibility Union (MANE-VU)*

Averaging Banking and Trading: The OTC supports EPA's proposal to not allow Averaging, Banking, and Trading (ABT) for PM or hydrocarbons for model year 2027 and later engines. However, EPA proposes to continue to allow ABT of NOx credits generated against applicable heavy-duty diesel engine NOx standards. As part of this proposal, manufacturers could certify battery electric and fuel cell vehicles to generate NOx emissions credits. The OTC does not support the inclusion of a NOx emission credit or ABT scheme. [EPA-HQ-OAR-2019-0055-1250-A1, p.16]

EPA acknowledges in the NPRM that its proposed NOx standards are feasible without the use of credits.40 Even so, the agency proposes a NOx credit-generation scheme and ABT that would allow manufacturers to use credits generated from engines with emission levels below the standards to produce engines with emission levels above the standards. [EPA-HQ-OAR-2019-0055-1250-A1, p.16]

40 87 Fed. Reg. 17414 (March 28, 2022), at 17550.

Further, with a NOx ABT program, higher NOx emitting engines could be driven in Overburdened Communities in the OTR, potentially exacerbating the adverse health effects from gasoline and diesel vehicle emissions. Given these concerns and the urgent need to reduce NOx emissions in the OTR, we are opposed to heavy-duty engine NOx ABT. [EPA-HQ-OAR-2019-0055-1250-A1, p.16]

Organization: *PACCAR, Inc (PACCAR)*

PACCAR agrees with the following EMA comments: However, because of the uncertainty associated with market adoption of zero and near-zero NOx emissions technologies, EMA recommends that EPA modify the proposal to include certain constraints to prevent unintended consequences from the ABT program. For example, a relatively unconstrained ABT program could lead to competitive imbalances among manufacturers, especially where product mix differences exist. More specifically, if zero-NOx emissions technologies sold in one market subsegment are used to bank significant NOx credits, those could 132 be used to offer higher-emitting, lower cost engines in a different market subsegment, competing against another manufacturer without credits and that, as a result, is only able to offer lower emitting, higher-cost engines. That would disrupt the current competitively level playing field in that subsegment of the market, and could discourage the purchase of lower-emitting engines. To prevent such an unintended outcome, EPA should maintain its current NOx ABT averaging set categories based on primary intended service classes (i.e., HDE SI, LHDE CI, MHD CI, and HHD CI). To include zero-emissions powertrains (that are neither spark-ignited nor compression-ignited internal combustion engine-based) in the ABT program, EPA should prescribe how to align its vehicle-level primary intended service classes from EPA's Heavy-Duty GHG Phase 2 regulations in 40 CFR Part 1037 with the appropriate engine-based NOx averaging set. [EPA-HQ-OAR-2019-0055-1346-A1, pp.35-36]

PACCAR generally supports EPA's proposed Subpart H Averaging, Banking, and Trading amendments, including those addressing NOx Family Emission Limit (FEL) credits and credit generation for Zero Emission Vehicles. However, EPA should amend 1036.745, which currently only addresses 'end-of-year CO2 credit deficits' to address NOx credit deficits as well. Although OEMs are increasingly adopting ZEV technology and business strategies, there continues to be significant uncertainty about the extent to which consumers will embrace and purchase ZEVs in substantial quantities, and whether there will be adequate nationwide charging infrastructure in place in the near future to accommodate ZEV fleets. See e.g., McKinsey & Company, Building the Electric-Vehicle Charging Infrastructure America Needs, (April 18, 2022) (estimating that the United States would need almost 20 times more EV chargers than it has now to achieve federal ZEV sale targets).2 For OEMs, the uncertainty surrounding ZEV purchases means uncertainty about credit generation, and the final end-of-year MY accounting does not take place until September 30 of the calendar year following the MY, which makes resolving NOx credit deficits within one MY following the deficit extremely difficult. In light of this uncertainty, OEMs need to have the same flexibility for NOx credit deficits that exists for CO2 credit deficits. This includes allowing OEMs to remedy NOx credit deficits 'with surplus credits within three model years.' 40 C.F.R. 1036.745(e). [EPA-HQ-OAR-2019-0055-1346-A1, pp.51-52]

2 Available at: https://www.mckinsey.com/industries/public-and-social-sector/ourinsights/building-the-electric-vehicle-charging-infrastructure-america-needs

Organization: *States of California, et al. (The States)*

In the Proposed Rule, EPA rightly recognizes the imperative to "ensure that NOx emission credits . . . do not compromise the environmental benefits expected from the proposal."89 The averaging, banking, and trading program (ABT) has an important but limited role in supporting the heavy-duty sector's transition to stricter standards, reducing compliance costs for manufacturers and operators, and incentivizing early adoption of advanced technologies. The States strongly support EPA's proposed measures to tailor the ABT program to this role, including (1) limiting credit life to at most five years, (2) replacing existing credit balances with transitional credits, and (3) lowering family emission limit (FEL) caps to below the 2007 heavy-duty standards.90 The States also generally support EPA's proposed early adoption incentives and the proposal to generate NOx credits from heavy-duty hybrid, battery, and fuel-cell electric vehicles (HD ZEVs).91 However, EPA should carefully calibrate ZEV-generated credits to ensure their environmental benefits are not offset by higher-emitting conventional engines. [EPA-HQ-OAR-2019-0055-1255-A1, pp. 20 - 21]

89. 87 Fed. Reg. at 17,555.

90. Id. at 17,552-54.

91. Id. at 17,554-62.

Organization: *Truck and Engine Manufacturers Association (EMA)*

A successful heavy-duty engine emissions regulation necessarily includes an Averaging, Banking and Trading ("ABT") program with the appropriate balance of flexibilities and constraints, coupled with an appropriate engine Family Emission Limit ("FEL") cap. Such an ABT program provides manufacturers with the needed flexibility to plan investments and manage product costs while also providing opportunities to overcome technical or lead-time challenges. Those attributes of ABT all help manufacturers deliver reliable and affordable products that meet the diverse range of heavy-duty applications and customer needs. [EPA-HQ-OAR-2019-0055-1203-A1, p. 134]

For these reasons, EMA generally supports EPA's proposed ABT program, which provides environmental benefits and the flexibility manufacturers require to address customer needs. However, because of the uncertainty associated with market adoption of zero and near-zero NOx emissions technologies, EMA recommends that EPA modify the proposal to include certain constraints to prevent unintended consequences from the ABT program. For example, a relatively unconstrained ABT program could lead to competitive imbalances among manufacturers, especially where product mix differences exist. More specifically, if zero-NOx emissions technologies sold in one market subsegment are used to bank significant NOx credits, those could be used to offer higher-emitting, lower-cost engines in a different market subsegment, competing against another manufacturer without credits and that, as a result, is only able to offer lower emitting, higher-cost engines. That would disrupt the current competitively level playing field in that subsegment of the market, and could discourage the purchase of lower-emitting engines. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 134 - 135]

To prevent such an unintended outcome, EPA should maintain its current NOx ABT averaging set categories based on primary intended service classes (i.e., HDE SI, LHDE CI, MHD CI, and HHD CI). To include zero-emissions powertrains (that are neither spark-ignited nor compression-ignited internal combustion engine-based) in the ABT program, EPA should prescribe how to align its vehicle-level primary intended service classes from EPA's Heavy-Duty GHG Phase 2 regulations in 40 CFR Part 1037 with the appropriate engine-based NOx averaging set. [EPA-HQ-OAR-2019-0055-1203-A1, p. 135]

Organization: *Tesla, Inc. (Tesla)*

First, Tesla supports and agrees with EPA reasoning that existing banked credits should be eliminated and not used to meet the proposed MY 2027 standards.135 [EPA-HQ-OAR-2019-0055-1219-A1, pp.15-16]

135 87 Fed. Reg. at 17533.

The unlimited lifetime of existing credits would allow the existing credit bank to erode to effectiveness of the standard and extension is unjustified given use of these credits would reward outdated technology in perpetuity. [EPA-HQ-OAR-2019-0055-1219-A1, pp.15-16]

EPA Summary and Response

Many of the summaries of comments on the proposed ABT program in the proposed rule, and EPA's responses to those comments, are included in Preamble Section IV.G. Immediately below, we briefly summarize and respond to additional comments on the proposed ABT program.

Summary of comments supporting and opposing the proposed general ABT provisions:

One commenter (MFN) stated that EPA has not conducted analyses on the environmental and/or public health impacts of the proposed credit flexibilities. The commenter conducted analysis suggesting that, under proposed Option 1, program benefits in 2027-2030 would be 12 percent lower than expected due to the proposed credit flexibilities; in the same timeframe, benefits from proposed Option 2 would be 17 percent lower. In the commenter's analysis the reductions in program benefits would come from credits generated by: 1) engines certified below today's standards which quality for the transitional credit program, 2) engines certified to the Omnibus standards which will qualify for the transitional program or on average achieve a standard below federal requirements, and 3) ZEVs. In the first category (transitional credit program) the commenter recognized that there would be different certification requirements for engines to qualify for the program, but states that they expect almost all engines to qualify for the program due to manufacturers having sufficient compliance margin. The commenter's analysis suggests that credits generated through 2030, as well as through 2045 are largely through engines sold to meet more stringent standards in state regulations. Three commenters stated that EPA should exclude engines certified to stronger state standards from generating federal credits, and that doing so would reduce the available credits by 50 percent. One commenter also urged EPA to eliminate the transitional credit program; their analysis suggested that doing so would decrease the credits available in 2027-2030 by 80 percent. Finally, one commenter stated that EPA should require mechanisms to track crediting provisions or issue guidance to prioritize ZEV deployment in environmental justice communities.

In addition to commenting on whether EPA should finalize a NO_X ABT program, commenters also provided input on several more specific topics, such as a flexibility for Credit NO_X Deficits. A commenter urged EPA to allow manufacturers to carry a deficit of NO_X emissions credits for three model years, which is currently allowed for CO_2 emissions credits. The commenter stated this flexibility is necessary because of uncertainty in ZEV adoption rates and, in turn, the volume of ZEV credits manufacturers would have in a given model year.

Finally, a commenter stated EPA should model the possible compliance strategies that manufacturers could take to meet future standards in order to provide suppliers with information for their product planning. Another commenter also stated that EPA should prescribe how to align its vehicle-level primary intended service classes from EPA's Heavy-duty GHG Phase 2 regulations in Part 1037 with the appropriate engine-based NO_X averaging set for powertrains that do not include an internal combustion engine.

<u>Response to comments supporting and opposing the proposed general ABT provisions</u>:

See preamble Section IV.G for EPA responses to several of the comment themes summarized above; additional responses on more specific aspects of comments are included immediately below in Section 12.1 of this document.

EPA appreciates the suggestion for guidance on prioritizing environmental justice communities for ZEV deployment; we may continue to evaluate and consider the suggestion in the future. Additional discussion on ZEVs, including our decision not to finalize an allowance for manufacturers to generate NO_X emissions credits from ZEVs in the final rule, is available in Section 12.6 of this document. Similarly, we appreciate the suggestion to develop a publicly available tracking system for emissions credits; we intend to consider this suggestion separate from this rulemaking. (See also Section 30 of this document and preamble Section XI for additional discussion on EPA's determinations that certain information is emission data or otherwise not entitled to confidential treatment.)

We did not propose or take comment on allowing manufacturers to carry a credit deficit for NO_X emissions credits, and we are not taking final action to allow such in this rule. Further, as just noted and discussed in Section 12.6 of this document and Section IV.G of the preamble, we are not including in the final action the proposal to allow manufacturers to generate NO_X emissions credits from ZEVs; thus, manufacturers' uncertainty in the volume of ZEV credits in a given model year, which the commenter pointed to as the main reason for needing the additional flexibility, is not applicable to the final NO_X ABT program. Similarly, since we are not including in the final action the proposal to allow manufacturers to generate NO_X emissions credits from ZEVs, we have not included a description on how to align vehicle-level primary intended service classes from EPA's Heavy-duty GHG Phase 2 regulations in Part 1037 with the appropriate engine-based NO_X averaging set for powertrains that do not include an internal combustion engine.

12.1.1 Additional comments on general ABT provisions

<u>**Comments by Organizations**</u>

Organization: *Allison Transmission, Inc. (Allison)*

- An alternative approach that EPA should consider is the extent to which state programs and other efforts, including new federal funding,2 could result in the retirement of pre-2010 vehicles and equipment. Programs that provide incentives to replace older equipment have been highly effective, as validated by EPA's own analysis3 and could be further integrated into EPA's analysis of resulting costs and benefits of its proposed program and alternatives. [EPA-HQ-OAR-2019-0055-1231-A1, p.5]

2 See Pub. L. 117-58, Sec. 71101, containing $5 billion in appropriated funds for "clean school buses.".

3 See, e.g., DERA Fourth Report to Congress, EPA Office of Transportation and Air Quality, July 2019

Organization: *Environmental Defense Fund (EDF)*

Finally, we encourage EPA to consider creation of a voluntary alternative compliance pathway that recognizes the significant investments manufacturers are making in ZEV technologies and affords a pathway to achieve even greater levels of emission reductions and ZEV deployment than would otherwise be incorporated in the standards. Such a pathway could pull forward reductions prior to 2027, given that many manufacturers are introducing ZEV technologies now and also planning for compliance with more protective NOx Omnibus requirements in 2024. It could also allow manufacturers to opt in to protective reductions post 2030, thereby providing manufacturers with added certainty as EPA is developing its Phase 3 program and also building strong momentum toward ensuring 100 percent of all new vehicles sold by 2035 are zero-emitting. Such a voluntary pathway could also be expressly multipollutant in nature, which, as we discuss above can help to accelerate ZEV deployment without sacrificing NOx or GHG emissions reductions from ICE vehicles. [EPA-HQ-OAR-2019-0055-1265-A1, p.26]

A voluntary pathway could also provide EPA an opportunity to create needed incentives for manufacturers of electric drivetrains, which will not be subject to compliance certification obligations under the proposed adjustment to the Phase 2 GHG vehicle standards. Indeed, EPA has adopted programs in past medium- and heavy-duty rules that have included similar mechanisms.114 [EPA-HQ-OAR-2019-0055-1265-A1, pp.26-27]

114 See, e.g., Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements, 66 Fed. Reg. 5002 (January, 18, 2001). See, e.g., Control of Air Pollution From New Motor Vehicles: Tier 2 Motor Vehicle Emissions Standards and Gasoline Sulfur Control Requirements, 65 Fed. Reg. 6698 (February 10, 2000).

Critically, however, such a voluntary program must achieve emissions benefits greater than would be achieved assuming manufacturer participation in the mandatory program. [EPA-HQ-OAR-2019-0055-1265-A1, p.27]

Organization: *Ford Motor Company (Ford)*

The Greenhouse Gas regulations do not currently allow trading of engine-based CO2 credits between averaging sets (e.g., between Light Heavy-Duty and Medium Heavy-Duty Diesel engines). This restriction is unnecessary and can drive costly investments for manufacturers who would otherwise be looking to invest in the advanced technology powertrains of the future (electric, fuel cell, etc.). A manufacturer with a single engine (which could be used to meet both the newly proposed NOx standards as well as the more stringent proposed GEM-based vehicle CO2 standards) could be forced to develop or purchase separate light-heavy-duty and medium-heavy-duty diesel engines simply to meet the "normalized to work" engine CO2 standards of both segments. This would not yield any additional GHG or NOx emission benefits. Ford recommends that EPA remove the restriction on trading of engine-based GHG credits between service classes or, at a minimum, allow trading in cases where engines and emission systems are substantially the same (e.g., displacement, combustion system design, emissions controls including aftertreatment chemistry and loading, etc.). This change would have no negative impact on fleet NOx or CO2 emissions and would enable manufacturers to more efficiently invest in the powertrains of the future. [EPA-HQ-OAR-2019-0055-1300-A1, p. 5]

Organization: *Lion Electric Co. USA Inc. (Lion)*

Lion strongly believes that incentive programs should benefit communities historically exposed to higher levels of air pollution. Lion suggests the EPA prioritize disproportionately impacted communities and disadvantaged business enterprises. These applicants often have fewer resources to supply a cash match and require extra support to start their fleet electrification process. Prioritizing these applicants will ensure a diverse range of applicants and geographic distribution of ZEVs. [EPA-HQ-OAR-2019-0055-1151-A2, p. 2]

Organization: *Natural Gas Vehicles for America (NGVAmerica)*

All clean options must be advanced to make a collective difference beginning today. We can't afford to pick the wrong solution or leave out available solutions. It is imperative that regulatory incentives not be used as a weapon to ensure market dominance for any one technology or company. It is abundantly clear that regulatory incentives influence today's market decisions. Our industry would not be where it is without the Renewable Fuel Standard and the low-carbon fuel standards adopted by several states. These programs have proven extremely valuable in encouraging the development, production, and use of a wide range of low-carbon fuels. It is also clear that regulatory incentives for electric vehicles have been disproportionately favorable to that technology (e.g., ignoring upstream emissions, providing sales multipliers, allowing credit trading from low-mileage vehicles to high-mileage vehicles, providing credits for fueling station capacity - not actual fuel use or emission reductions). [EPA-HQ-OAR-2019-0055-1330-A1, p.11]

Organization: *PACCAR, Inc (PACCAR)*

EMA Comments at 131-32. EPA should propose an initiative to encourage turning over outdated fleets. EPA should incentivize removing these high emission vehicles in an effort to accelerate the environmentally-beneficial newer Low NOx technologies. An analysis of vehicle registration data was conducted to explore the makeup of heavy-duty Class 8 vehicle on the road today. In this analysis, registration data updated in the first quarter of 2022 was evaluated to determine the number of trucks, by vehicle Model Year (engine Model Year is Vehicle MY-1) on the road today Vehicle registration data analysis shows that 41% of today's Class 8 vehicles on the road are pre-2010 MY vehicles. EPA should therefore revise proposed section 1036.705 (NOx credit generating and calculating emissions credit) to accelerate retiring these pre- 2010 vehicles. [EPA-HQ-OAR-2019-0055-1346-A1, p.36]

EPA should allow vehicle manufacturers to offer incentives to pre-MY 2010 vehicle owners in the form of vouchers that can be applied to the purchase of a new technology vehicle. In exchange for retiring a pre-MY 2010 vehicle, EPA should allow the manufacturer to bank NOx credits in the new federal NOx bank. [EPA-HQ-OAR-2019-0055-1346-A1, p.37]

An exploration of the NOx generation, using the NOx credit equation provided by EPA is used to illustrate the significance of this proposal. The NOx emission credit equation proposed by EPA is: [EPA-HQ-OAR-2019-0055-1346-A1, p.37]

This equation was used to explore the Mega gram of NOx emission (or displaced emission) from Zero Emission Vehicles and Current and Future CI diesel engines for a Class 8 HHDE. The lifetime emission was calculated by setting 'FEL' to zero. The lifetime NOx emission (for a CI diesel) or credit (for a ZEV) for an EPA MY2010-2026 powertrain is about 0.4 mega-grams. For the MY2027 and later vehicle certifying to a 0.05 NOx standard the lifetime emission of NOx is about 0.1 mega-grams of NOx. [EPA-HQ-OAR-2019-0055-1346-A1, p.37]

The analysis then explored the emission of NOx from a pre-2010 vehicles over approximately one year (assumed to be about 40,000 miles for illustration). The emissions from a Class 8 MYs 1996-2003 and a MYs 2003-2009 diesel engine over one year of operation was estimated to be 0.66 and 0.41 mega-grams of NOx, respectively. This example illustrates that these vehicles are emitting about four times the predicted lifetime emission of a proposed MY 2027 and later Low NOx diesel engine, every year. [EPA-HQ-OAR-2019-0055-1346-A1, p.38]

Therefore EPA should allow vehicle manufacturers to provide incentives to their customers to trade in their older vehicles for a new technology vehicle, and then OEMs should be allowed to bank NOx credits equivalent to one year of NOx emission from the older technology vehicle. OEMs would 'retire' the traded-in vehicle, meaning its engine would be seized or otherwise made permanently inoperable. This 'Credits for Clunkers' scenario would benefit both the Agency and manufacturers: EPA can realize accelerated real-world emission reductions and manufactures can use the displaced real-world NOx to ease the transition into the new Low NOx technology. Also, by taking only one year of credit, the benefit realized by the agency will be much greater than the credit given. Additionally, the new Low NOx technology trucks will also provide emissions control under low load operation, where the older technology vehicles are not as well controlled and produce much higher NOx emissions. [EPA-HQ-OAR-2019-0055-1346-A1, pp.38-39]

PACCAR summarizes below the major issues that EPA should take into account as it moves forward with this rulemaking: EPA should also allow vehicle manufacturers to provide incentives to their customers to trade in their older vehicles for new technology vehicles, after which manufacturers should be allowed to bank NOx credits proportional to one year of service for eliminating the trade-in vehicle from the population. [EPA-HQ-OAR-2019-0055-1346-A1, p.60]

EPA Summary and Response

Summary:

Several commenters provided additional perspectives on incentivizing additional emissions reductions, either through the proposed criteria pollutant ABT program, or alternative approaches through one or more specific technologies. One commenter (EDF) suggested a voluntary alternative compliance pathway to pull forward reductions prior to 2027. The commenter noted that many manufacturers are introducing ZEV technologies now and also planning for compliance with more protective NOx Omnibus requirements in 2024, but the commenter did not provide specific information on how the voluntary, alternative compliance pathway would work.

Two other commenters (Allison, PACCAR) suggested that EPA consider voluntary federal or state programs to encourage fleet turnover. One of these commenters (Allison) suggested that EPA could further integrate such programs into our cost and benefit analyses of the rule. The other commenter (PACCAR) provided an analysis of vehicle registration data that shows that 41% of today's Class 8 vehicles on the road are pre-2010 MY vehicles. The commenter stated that EPA should therefore revise proposed section 1036.705 (NOx credit generating and calculating emissions credit) to accelerate retiring these pre- 2010 vehicles, and the commenter provided a potential approach for allowing vehicle manufacturers to provide incentives to their customers to trade in their older vehicles for a new technology vehicle, which would in turn allow OEMs to bank NOx credits equivalent to one year of NOx emission from the older technology vehicle. Another commenter (Lion) stated generally that EPA should prioritize disproportionately impacted communities and disadvantaged business enterprises for incentive programs.

Another commenter (Ford) urged EPA to allow manufacturers to trade engine-based CO_2 credits between averaging sets, or at a minimum, allow trading in cases where engines and emission systems are substantially the same (e.g., displacement, combustion system design, emissions controls including aftertreatment chemistry and loading, etc.). The commenter claimed this change would have no negative impact on fleet NOx or CO_2 emissions and would enable manufacturers to more efficiently invest in the powertrains of the future.

Finally, one commenter (NGVAmerica) expressed concern that regulatory incentives for electric vehicles have been disproportionately favorable to that technology.

Response:

Related to the voluntary, alternative compliance pathway one commenter (EDF) presented, we agree with the importance of incentivizing manufacturers to pull forward emissions reducing technologies prior to MY 2027. As discussed in Section 12.4 of this document and Section IV.G of the preamble, we are finalizing a transitional credit program that we modified from the proposal after consideration of comments we received. We believe the Transitional Credit program we are finalizing will better incentivize manufacturers to participate in the transitional credit program, and therefore better achieve emissions reductions prior to MY 2027. While we believe the transitional credit program we are finalizing partially addresses the commenter's concern about pulling forward emissions reductions, we recognize that it is likely not the voluntary pathway for incentivizing electric drivetrains that the commenter suggests. We note that we are finalizing language that clarifies how heavy-duty ZEVs certify to criteria pollutants in 40 CFR 1037 (see Section 12.6 of this document and preamble Section III for details). We also note we are not finalizing the proposed allowance for manufacturers to generate NO_X emissions credits from ZEVs, as discussed in Section 12.6 of this document and preamble Section IV.G; our decision is based in part on ensuring that the final ABT program maintains the emissions reductions expected from the final standards, which is consistent with the commenter's stated interest in not sacrificing NO_X or GHG emissions from ICEs.

We also agree with the importance of encouraging fleet turnover, particularly for vehicles with engines that are compliant with pre-2010 emissions standards. In particular, we agree that state and other federal programs can result in the retirement of pre-2010 vehicles, and that some of these programs have been highly effective, and that some of these programs can be particularly impactful for disproportionally impacted communities.[32] Further, since we did not propose or ask for comment on incentive programs to allow vehicle manufacturers to generate NO_X emissions credits based on providing incentives to their customers to trade in their older vehicles for a new technology vehicle, we are not including such a program in the final rule.

Similarly, we did not propose or request comment on allowing heavy-duty vehicle manufacturers to trade engine-based CO_2 credits between averaging sets; this comment was outside the scope of the rule and we are not including such an approach in this final rule.

Finally, as just mentioned and discussed in Section 12.6 of this document and preamble Section IV.G, we are not finalizing the proposed allowance for manufacturers to generate NO_X emissions credits from zero-emissions vehicles; our rationale for that decision is detailed in preamble Section IV.G, but we anticipate the decision addresses the commenter's concern about this rule containing regulatory incentives favoring electric vehicle technologies. Further, as discussed in Section 3 of this document and preamble Section III, we are finalizing performance-based standards that do not specify a particular technology path for manufacturers to comply with the standards.

12.2 FEL Caps

[32] For example, the Bipartisan Infrastructure Law allows EPA to prioritize certain applicants in the Clean School Bus (CSB) Program, including school districts listed in the Small Area Income and Poverty Estimates (SAIPE) School district Estimates for 2020 as having 20% or more students living in poverty (EPA "2022 Clean School Bus Rebates – Prioritized School Districts" May 2022; available at https://www.epa.gov/system/files/documents/2022-05/2022-csb-rebates-prioritized-school-districts-2022-05.pdf, last accessed on August 29, 2022).

Comments by Organizations

Organization: *Alliance for Vehicle Efficiency (AVE)*

AVE supports additional modifications to Option 1 to provide the best opportunity for driving more rapid adoption of advanced engine and emission control technologies. These additional modifications include:

- Tightening the family emission limit (FEL) to 0.05 g/bhp-hr, down from the current proposal of 0.15 g/bhp-hr. [EPA-HQ-OAR-2019-0055-1280-A1, p. 3]

Organization: *California Air Resources Board (CARB)*

On page 17552 of the NPRM, U.S. EPA asks for comments regarding the proposed family emission limit (FEL) caps. [EPA-HQ-OAR-2019-0055-1186-A2, p.11]

CARB staff strongly encourages U.S. EPA to adopt an FEL cap lower than the 150 milligram per brake-horsepower hour (mg/bhp-hr) nitrogen oxides (NOx) FEL cap included in both Options 1 and 2. As described further below, an FEL cap of 150 mg/bhp-hr would allow engines only slightly cleaner than those being certified today (FEL of 160 mg/bhp-hr) to be produced until 2030. It should be noted that the current Omnibus regulation NOx FEL caps are specified as:

- 2024-2026 model years (MY): 100 mg/bhp-hr for all service classes
- 2027 and subsequent MYs: 50 mg/bhp-hr (light heavy-duty diesel (LHDD), medium heavy-duty diesel (MHDD)), 65 mg/bhp-hr (2027-2030 MY heavy heavy-duty diesel (HHDD)) and 70 mg/bhp-hr (2031 and subsequent MY HHDD) [EPA-HQ-OAR-2019-0055-1186-A2, p.11]

California's adopted HD Low NOx regulation (or Omnibus regulation) establishes a 50 mg/bhp-hr NOx emission standard in 2024 MY. Under U.S. EPA's proposed rule, manufacturers would have a four-year lead time to redesign their products to meet the future standards. It is not clear why a 150 mg/bhp-hr NOx FEL cap would be needed for 2027 through 2030 MY engines because manufacturers will be producing engines meeting California's 50 mg/bhp-hr up to three MYs ahead of CTP implementation. Such a high FEL cap would only lead to continued production of relatively high emitting legacy HD diesel engines using today's emission control technologies. For example, Detroit Diesel Corporation (DDC) has certified two HD diesel-fueled engine families (Appendix I) [Appendix I can be found at EPA-HQ-OAR-2019-0055-1186-A2, p.136-142] with California for the 2022 MY at an FEL of 160 mg/bhp-hr, just slightly above the FEL cap U.S. EPA is proposing for five years from now and that, under U.S. EPA's proposal, would continue until the 2030 MY. It is CARB staff's understanding that there are no major emission control technology changes associated with this new family emission limit. [EPA-HQ-OAR-2019-0055-1186-A2, p.11]

On page 17555 of the proposed rule, U.S. EPA asserts that 'specifically, our proposed NOx FEL caps would ensure significant emission reductions from all HD highway engines compared to today's products'. CARB staff agrees with the concept that the purpose of an FEL cap is to prevent the use of old, legacy technologies. However, setting a 150 mg/bhp-hr NOx FEL cap would not achieve that purpose. U.S. EPA has impermissibly ignored the aforementioned considerations and evidence, which undermine its rationale for this proposal, Genuine Parts Co. v. Env't Prot. Agency, 890 F.3d 304, 312 (D.C. Cir. 2018), failed to consider an important aspect of the proposal, namely, the extent to which the proposed FEL caps may adversely affect the projected emissions benefits of the Option 1 and Option 2 standards. Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co., (hereinafter State Farm), 463 U.S. 29, 43, (1983), and has not set forth a rational connection between the facts and its proposal. State Farm, 463 U.S. at 43. [EPA-HQ-OAR-2019-0055-1186-A2, pp.11-12]

As discussed further in section 3.a, CARB staff has serious concerns that CTP's proposed HD electric vehicle NOx credits with no sunset date and federal NOx credits generated by manufacturers complying with Omnibus standards will provide manufacturers with substantial amounts of credits. Thus, these credits would allow manufacturers to continue producing legacy engines with high NOx FEL caps nationally, causing serious erosion of the environmental benefits generated by the proposed rule. CARB staff strongly recommends that U.S. EPA adopt the same FEL caps outlined in the Omnibus regulation. [EPA-HQ-OAR-2019-0055-1186-A2, p.12]

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

And third, EPA's proposed FEL caps are unreasonably high. See Section D.2.c, infra. That failure exacerbates the effect of the Proposal's credit mechanism, and results in unacceptable emissions and health impacts. [EPA-HQ-OAR-2019-0055-1302-A1, p.53]

Option 1's proposed FEL cap for NOx is far too lenient because it fails to require the greatest degree of emissions reduction achievable by technologies that will be available by MY 2027. See 42 U.S.C. 7521(a)(3)(A)(i). Flouting Congress's direction to set technology-forcing standards, EPA instead proposes FEL caps that are based on the 'average NOx emission levels achieved by recently certified CI engines.' 87 Fed. Reg. at 17,522. But 'recently certified' engines were designed to comply with standards promulgated more than twenty years ago, and do not utilize the improved pollution-control technologies that will be available in MY 2027. See id. at 17,419 (noting emergence of new technologies). EPA's proposed FEL cap of 150 mg/hp-hr for MY 2027 is twice as high as the Omnibus's FEL cap of 100 mg/hp-hr for MY 2024–2026, and three times higher than the Omnibus's general NOx emission standard of 50 mg/hp-hr (which will take effect in MY 2024).240 87 Fed. Reg. at 17,552; Comments of CARB, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022. Given that manufacturers will already be required to implement technologies to achieve a 50 mg/hp-hr standard and a 100 mg/hp-hr FEL cap in several markets three years before EPA's rule takes effect, the proposed 150 mg/hp-hr cap lacks any technical justification. Commenters also support and incorporate by reference comments by MFN and CARB demonstrating the technological feasibility of (and the health and equity rationales for) a lower FEL cap. See Comments of (1) MFN and (2) CARB, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022. Establishing a lower FEL cap is technologically achievable and would better conform with the Clean Air Act's core pollution-minimizing mandate. [EPA-HQ-OAR-2019-0055-1302-A1, pp.58-59]

240 The Omnibus's FEL caps decrease to 50–70 mg/hp-hr in later model years, depending on service class. See Comments of CARB, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022.

Organization: *Colorado Energy Office, et al.*

We support NESCAUM's recommendations to limit flexibilities that could significantly reduce the emissions benefits of Option 1. For example, we recommend establishing stronger family emission limit (FEL) caps that are consistent with the FEL caps in the Low NOx Omnibus rule to avoid potential erosion of the effectiveness of the rule from the use of ZEV credits. [EPA-HQ-OAR-2019-0055-1297-A1, p.2]

Organization: *Cummins Inc. (Cummins)*

To further prevent unintended consequences, EPA should constrain the NOx FTP/SET FEL cap for MY 2027 and later to be no higher than 100 mg/hp-hr for all service classes. Depending on other details in the final rule, setting the FEL cap at some value between 50-100 mg/hp-hr may be more appropriate. Setting that lower FEL cap also will help to prevent the competitive problems described above. [EPA-HQ-OAR-2019-0055-1325-A1, p. 9]

Organization: *Maine Department of Environmental Protection (Department)*

Using the CARB Heavy-Duty Omnibus Regulation as a bellwether, the Department requests the following revisions to the federal proposal: [EPA-HQ-OAR-2019-0055-1288-A1, p.6]

- Eliminating averaging, banking, and trading would maximize nationwide NOx reductions. If EPA retains these provisions, it should consider establishing a 0.05 grams NOx cap in 2027 that is consistent with that in the CARB Heavy-Duty Omnibus regulation in lieu of EPA's proposed family emission limits (FEL) of 0.15 grams NOx in 2027 and 0.05 grams NOx in 2031. Manufacturers have already conducted engine development work to prepare for and comply with California 2024-2026 standards and if the CARB FEL caps are implemented federally, all states can benefit from this research and development. [EPA-HQ-OAR-2019-0055-1288-A1,p.8]

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

MEMA recommends that each HD manufacturer's fleet have a not to exceed limit (NTE limit) on individual vehicles by class to avoid very high emissions vehicles being permissible as part of the overall fleet. [EPA-HQ-OAR-2019-0055-1322-A1, p. 5]

Organization: Moving Forward Network (MFN)

To safeguard against potential underestimates of ZE truck sales under this approach, EPA must also significantly and progressively lower the FEL cap to ensure combustion engine families continue to utilize state-of-the-art technologies. [EPA-HQ-OAR-2019-0055-1277-A1, p. 20]

EPA's standards are defined as an average compliance value. This means that to the degree trucks are able to perform better than the average standard, a manufacturer can earn credits. These credits can then be used to offset vehicles that emit more of the harmful emissions than required by the average level of compliance. The only limit as to how dirty an individual truck can be is provided by the family emissions limit (FEL) cap. [EPA-HQ-OAR-2019-0055-1277-A1, p. 30]

For Option 1, EPA has proposed setting the FEL cap at 150 mg/bhp-hr NOx in 2027, a level "which is consistent with the average NOx emission levels achieved by recently certified CI engines."126 This means that at least through 2030, trucks can be certified to a level consistent with compliance with a standard promulgated three decades earlier. [EPA-HQ-OAR-2019-0055-1277-A1, p. 30]

126. 87 FR 17552.

Setting the FEL cap at a level consistent with today's technology falls well short of EPA's mandate under the Clean Air Act to set "standards which reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply."127 [EPA-HQ-OAR-2019-0055-1277-A1, p. 31]

127 42 U.S.C. § 7521(a)(3)(A).

SwRI's Stage 1 testing program showed that updates to engine calibration alone were able to reduce the tailpipe emissions of a modern diesel engine by 36 percent, to 0.09 g/bhp-hr.128 Simply by adding a heated catalyst, the system was able to reduce tailpipe NOx emissions below 0.05 g/bhp-hr, the Omnibus standard for 2024. These are minor changes to engine configurations, which is, in part, why they were used in the justification for the Omnibus standards in this timeframe.129 [EPA-HQ-OAR-2019-0055-1277-A1, p. 31]

The Omnibus standard will be enforced in a number of states by 2027, representing at least 9 percent of the total market, and likely more (see Section IV.D.5.c for further discussion). For three years, that standard will have been mandating an average requirement of 50 mg/bhp-hr, and in 2027 a maximum standard of 50 mg/bhp-hr. With such a substantial share of the market already required to achieve this standard or less, and a number of technological paths for manufacturers to achieve this standard, it is hard to argue on a technical basis that this should not be, at absolute worst, the upper level of emissions for all kinds of trucks. [EPA-HQ-OAR-2019-0055-1277-A1, p. 31]

EPA offers an historical precedent of setting the FEL at the previous standard level.130 However, this is not true for the rules currently on the books—the current HD diesel FEL cap is 0.5 g/bhp-hr NOx (2010+), whereas the previous average standard (2004-2006) was 2 g/bhp-hr.131 In citing the reason for not leaving the FEL at 2 g/bhp-hr and instead moving to the current 0.5 g/bhp-hr cap, EPA explicitly notes the 90 percent difference between the 0.2 and 2 g/bhp-hr NOx standards.132 [EPA-HQ-OAR-2019-0055-1277-A1, p. 31]

130. 87 FR 17552

131. The standard was either a combined 2.5 g/bhp-hr cap for NMHC+NOx, with a 0.5 limit on just NMHC, or a 2.4 g/bhp-hr cap on NMHC+NOx.

132 66 FR 5111

The situation the industry faces today is vastly different than in 2001. Whereas previously the new rules were predicated on unknown technologies, here there is much more certainty as to the capability of diesel powertrains to meet the requirements, with established technologies like variable-valve actuation, 48V hybridization, and evolutionary improvements in emissions controls. One similarity, however, is the tremendous disparity between the new average requirements and the old regulations. Here again EPA is expected to reduce emissions by 90 percent on the FTP cycle, and, as such, it is more important to worry about the disparity between different new trucks on the road and the capability of manufacturers to meet more stringent standards in the allocated timeframe. [EPA-HQ-OAR-2019-0055-1277-A1, p. 31]

It is clear based on available technology and the latest evidence that manufacturers are more than capable of meeting much stronger standards than have been on the books since 2010 (see Section III.B). This is precisely what the Omnibus program was meant to address, beginning 3 years prior to EPA's proposed rule. It is therefore appropriate that EPA align its FELs with the Omnibus program. These limits yield identical percentage improvements from the FELs and average standards from 2010 to 2027. [EPA-HQ-OAR-2019-0055-1277-A1, p. 31]

In 2027, EPA's FELs for LHDD and MHDD engines should be set no higher than 50 mg/bhp-hr, representing a 30 mg/bhp-hr shortfall from our recommended average standard, and a 90 percent reduction from the current FEL, consistent with the 90 percent reduction in the average standard. For HHDD engines, the gap should be identical (30 mg/bhp-hr), but the longer useful lifetime requires an additional margin, putting this limit at no more than 65 mg/bhp-hr. Should EPA set an intermediate lifetime limit on HHDD engines, its limits would be identical to the LHDD and MHDD engine requirements. [EPA-HQ-OAR-2019-0055-1277-A1, p. 32]

For 2031, the FELs appear to be aligned with the Omnibus rule. However, EPA should consider whether it is appropriate to allow in perpetuity a difference of 150 percent of FTP-cycle NOx emissions. Given the concerns about equity, and where the dirtiest trucks on the road inevitably end up (Section III.B.6.c), EPA should continue to tighten the FEL over time. [EPA-HQ-OAR-2019-0055-1277-A1, p. 32]

With respect to the 30 mg/bhp-hr value, it is important to note that it is not that 30 mg/bhp-hr is an appropriate gap, but that 50 mg/bhp-hr is a technically justified maximum, which so happens to have a difference of 30 mg/bhp-hr. The FEL is the level achieved by the worst-performing trucks. As technology continues to be improved and is broadly used across the entire fleet, the FEL should be reduced to reflect the fact that those worst vehicles can perform better than previously allowed, regardless of the value set by the average emissions standards. [EPA-HQ-OAR-2019-0055-1277-A1, p. 32]

Implicit in the existence of the FEL is EPA's belief that some trucks should be allowed to emit more pollution than others. However, 100 percent of today's heavy-duty diesel engines are certified to the required average standard (0.2 g/bhp-hr) or better. This indicates that there is no difference in technical capability across truck applications to meet today's standards. Therefore, FELs above the average technical capabilities of diesel engines should be considered a temporary, transitional option available only in the initial years of the standard, if at all. Given its mandate under the Clean Air Act and the wealth of evidence on the technological capability of diesel control technologies, not to mention the growing number of applications for zero-emissions vehicles, EPA should consider whether it is appropriate at all in the long run to maintain FELs that do not reflect the maximum technical capability to reduce emissions. [EPA-HQ-OAR-2019-0055-1277-A1, p. 32]

As noted above, the FEL cap (and by extension the averaging program) allows some trucks to pollute more than others. Unfortunately, those more polluting trucks are frequently in operation or operating conditions where they are likely to do the most damage–in communities already overburdened by pollution. For example, port drayage operations involve high volume freight flows, and freight operators use older trucks to limit the marginal costs, even in regions with targeted environmental policies meant to limit the use of older trucks.133 [EPA-HQ-OAR-2019-0055-1277-A1, p. 32]

> 133. See https://digitalcommons.law.ggu.edu/cgi/viewcontent.cgi?article=1150&context=gguelj and the references contained therein.

A recent study of real-world emissions control operations showed that under urban operating conditions, including goods movement and delivery with extended low-load conditions, diesel vehicles with modern emissions controls performed just 33 percent better on average than those without an SCR system,134 despite a required reduction of more than 90 percent on the federal test cycles. Other studies have shown similar conditions—while line-haul tractors may spend a significant share of time at highway speeds, the vocational operations most common in urban centers spend a lot more time at conditions where modern diesel controls are functioning suboptimally.135 [EPA-HQ-OAR-2019-0055-1277-A1, pp. 32 - 33]

> 134. McCaffery, C., et al. "Real-world NOx emissions from heavy-duty diesel, natural gas, and diesel hybrid electric vehicles of different vocations on California roadways," Science of the Total Environment 784 (2021), 147224. DOI: 10.1016/jscitotenv.2021.147224. https://doi.org/10.1016/j.scitotenv.2021.147224.

> 135. Boriboonsomsin, B., et al. "Real-world exhaust temperature profiles of on-road heavy-duty diesel vehicles equipped with selective catalytic reduction," Science of the Total Environment 634 (1 Sept 2018), 909-921. DOI: 10.1016/j.scitotenv.2018.03.362. https://doi.org/10.1016/j.scitotenv.2018.03.362.

EPA acknowledges this issue in its establishment of the low-load cycle (87 FR 17463). However, the flaws in the FELs on the FTP cycle are even further exacerbated on the LLC, which has even greater margins for compliance, virtually eliminating any possible potential gains this cycle could have for the worst performing vehicles: while the FELFTP is defined as 150 mg/bhp-hr for 2027-2030 diesel engines under Option 1, FELLLC is 150 / 35 × 90 = 385 mg/bhp-hr (87 FR 17551), a value that is worse than some 2017- 2019 diesel engines achieve today (87 FR 17470, Table III-12).136 [EPA-HQ-OAR-2019-0055-1277-A1, p. 33]

136. 150 mg/bhp-hr is the FEL_FTP limit; 35 mg/bhp-hr is the required standard on the FTP cycle; and 90 mg/bhp-hr is the required standard on the LLC cycle.

By setting its FEL as high as it has, EPA is proposing to allow in perpetuity vehicles that its own data show far exceed the levels of pollution allowed by current test procedures, in precisely the communities that are already overburdened by freight pollution. This is yet another example of how even EPA's most stringent proposed standard would prolong systemic environmental inequities in freight pollution and fall short of the Act's requirements. [EPA-HQ-OAR-2019-0055-1277-A1, p. 33]

Organization: *National Association of Clean Air Agencies (NACAA)*

EPA also seeks comment on a proposed Family Emission Limit (FEL) cap of 150 mg/hp-hr in 2027, which the agency says is consistent with the average NOx emission levels achieved by recently certified diesel engines. An FEL cap being achieved today is far too high for implementation more than four years from now and, at 150 mg, is inconsistent with the 50-mg/hp-hr standards applicable to engines that will be in production in 2026 to comply with the Omnibus. [EPA-HQ-OAR-2019-0055-1232-A1, p. 15]

Organization: *Northeast States for Coordinated Air Use Management (NESCAUM)*

We are especially concerned that EPA's proposed family emission limit (FEL) cap of 0.15 grams of NOx between 2027 and 2030 could cause significant erosion of the stringency of the heavy-duty engine NOx standards. [EPA-HQ-OAR-2019-0055-1249-A1, pp. 14 - 15]

Organization: *Ozone Transport Commission (OTC) and Mid-Atlantic/Northeast Visibility Union (MANE-VU)*

We are especially concerned that EPA's proposed family emission limit (FEL) cap of 0.15 grams of NOx between 2027 and 2030 could cause significant erosion of the stringency of the heavy-duty engine NOx standards. [EPA-HQ-OAR-2019-0055-1250-A1, p.16]

Organization: *PACCAR, Inc (PACCAR)*

To further prevent unintended consequences, EPA should reduce the FTP/RMC NOx FEL cap to be no higher than 0.100 g/bhp-hr for all service classes. Setting that lower FEL cap also will help to mitigate the competitive problems described above. [EPA-HQ-OAR-2019-0055-1346-A1, pp.35-36]

Organization: *States of California, et al. (The States)*

The States strongly support EPA's proposed measures to tailor the ABT program to this role, including (1) limiting credit life to at most five years, (2) replacing existing credit balances with transitional credits, and (3) lowering family emission limit (FEL) caps to below the 2007 heavy-duty standards.90 [EPA-HQ-OAR-2019-0055-1255-A1, pp. 20 - 21]

90. Id. at 17,552-54.

Organization: *Truck and Engine Manufacturers Association (EMA)*

To further prevent unintended consequences, EPA should reduce the FTP/RMC NOx FEL cap to be no higher than 0.100 g/bhp-hr for all service classes. Setting that lower FEL cap also will help to mitigate the competitive problems described above. [EPA-HQ-OAR-2019-0055-1203-A1, p. 135]

EPA Summary and Response

Many of the summaries of comments on the proposed FEL cap in the proposed rule, and EPA's responses to those comments, are included in Preamble Section IV.G. Immediately below, we briefly summarize and respond to additional comments on the proposed FEL cap.

Summary of comments on the FEL cap:

One commenter suggested that each manufacturer's fleet have a not to exceed limit (NTE limit) on individual vehicles by class to avoid very high emissions vehicles being permissible as part of the overall fleet.

One commenter stated that EPA should lower the FEL over time to reflect expected improvements in the maximum technical capability to reduce emissions. The commenter stated that the FEL cap allows some trucks to pollute more than others, and that more polluting trucks frequently operate in communities already overburdened by pollution (e.g., port drayage operations often use older trucks even in regions with polices meant to limit the use of older trucks). The commenter further stated that lowering the FEL over time would address concerns about equity given where the dirtiest trucks often end up, which is commonly in port drayage or urban operating conditions. The commenter provided data showing that trucks with modern emissions controls operating in urban driving conditions, including extended low-loads, performed only 33 percent better than trucks without an SCR system. They argued that the FEL for LLC is worse than some 2017-2019 diesel engines can achieve today and that finalizing the FEL caps as proposed would prolong systemic environmental inequities in freight pollution, and fall short of the Act's requirements.

Response to comments on the FEL cap:

EPA agrees with commenters that lower FEL caps than proposed are appropriate for the final rule. We believe the lower FEL caps in the final rule will ensure that the vast majority of engines make meaningful improvements from today's emissions levels, while also allowing manufacturers flexibility in their product plans.[33,34] We expect that this approach in the final rule will address the concern raised by one commenter regarding avoiding very high emissions vehicles as part of a manufacturer's overall fleet. Details on the FEL caps in the final rule, including EPA's analysis and rationale, are available in preamble Section IV.G.4.

As described in preamble Section IV.G.4, after further consideration, including consideration of comments, the FEL caps in the final rule will lower over time (i.e., progressively lowering the FEL cap to the level of the standards, as one commenter suggests). However, as proposed, we are not choosing to include an expiration date for the final ABT program. As discussed in Section IV.G.1, EPA continues to believe that an ABT program is an important flexibility for manufacturers to spread out their investment and prioritize technology adoption in the applications that make the most sense for their businesses during the transition to meeting new standards. In later years of the program when no changes in emission standards are involved, banking can provide manufacturers additional flexibility, provide assurance against any unforeseen emissions-related problems that may arise, and in general provide a means to encourage the development and introduction of new engine technology (see 55 FR 30585, July 26, 1990, for additional discussion on potential benefits of an ABT program). We note that the final FEL caps, particularly the FEL cap applicable to later years of the program, will require manufacturers to make meaningful improvements from the emissions control technologies used to meet the currently existing standards. Further, we note that credits banked prior to MY 2027 will expire as early as by MY 2030 and no later than by MY 2035 (depending on the extent to which engines used to generate credits meet the MY 2027 and later requirements, as explained in preamble Section IV.G.7); it is possible that at least some of the credits generated will not be used, particularly as the heavy-duty fleet continues to transition to ZEVs. Finally, as discussed in preamble Section IV.G, EPA is not finalizing the proposed allowance for manufacturers to generate NO_X emissions credits from ZEVs, and thus the growing number of ZEVs that the commenter points to is not a factor to consider in progressively lowering the FEL cap.

One commenter also stated that the FEL cap allows some trucks to pollute more than others and that more polluting trucks frequently operate in communities already overburdened by pollution (e.g., port drayage operations often use older trucks even in regions with policies meant to limit the use of older trucks). We acknowledge that an ABT program does inherently allow some engines to produce higher levels of emissions than other engines; however, the FEL cap constrains the extent to which engines can emit above the level of the standard and can be set to ensure that all engines improve. After further consideration, including consideration of comments from this commenter and others, we are finalizing lower FEL caps than proposed to

[33] As discussed in Section IV.G.9, we are finalizing an allowance for manufacturers to continue to produce a small number (5 percent of production volume) of engines that meet the current standards for a few model years (i.e., through MY 2029); thus, the vast majority, but not all new engines will need to include updated emissions control technologies compared to those used to meet today's standards until MY 2030 when all engines will need updated emissions control technologies to comply with the final standards. See Section IV.G.9 for details on our approach and rationale for including this allowance in the final rule. Except for this interim allowance, the FEL caps in the final rule are the maximum level to which manufacturers may certify an engine family while using NO_X emissions credits. In setting the FEL caps and requirements for this interim allowance, we considered concerns raised by commenters regarding the potential for high emissions from individual engines.

[34] We note that, as specified in 40 CFR 1036.101, each engine must meet the final standards unless participating in the voluntary ABT program. Under the current and final NO_X emissions standards, manufacturers must either certify that each of their engine families meets the numeric standards, or use NO_X emissions credits generated by engines certified to a numeric level below the standards

ensure that all engines improve at least 68% from today's standards in the early years of the program, and at least 75% in the later years of the program, compared to the 25% improvement that would have been required with the proposed FEL cap. The commenter argues that higher-emitting trucks are more likely to operate in communities that are already overburdened with pollution, such as port drayage operations; however, we have no data to suggest that engines certified to the FEL caps in the final rule would be more likely than other trucks to operate in these communities. While we agree that older trucks are more likely to operate in port drayage and other communities with environmental justice concerns, we do not have evidence that new trucks with an engine certified to 65 or 50 mg/hp-hr would be more likely than trucks with engines certified at 35 mg/hp-hr to operate in certain areas or operations. Further, by allowing manufacturers to participate in the NO_X ABT program in the final rule we are providing a flexibility for manufacturers to spread out their investments; as some commenters have noted, flexible program may help with fleet turnover as the new emission standards take effect (see Section 25 of this document for more discussion on fleet turnover). Fleet turnover would help replace older trucks, which emit at much higher levels than the FEL cap in the final rule, with newer trucks in port drayage and other communities impacted by freight operations. Finally, inherent in the ABT program is the requirement for manufacturers producing engines above the emissions standard to produce engines below the standard, or purchase credits from another manufacturer who has produced lower emitting engines. As a simplified example, the result is that any engine certified to a 50 mg/hp-hr FEL would need to be balanced by an engine certified to a 20 mg/hp-hr FEL. As the commenter points out, local or regional policies that limit the use of older, higher-emitting trucks could help to ensure that the lowest-emitting engines operate in communities overburdened by pollution. We also note that recent Federal funding may also help to encourage turnover of older, higher-emitting trucks.[35]

Finally, one commenter stated that the proposed FEL cap for the LLC is a value worse than what some 2017-2019 diesel engines can achieve today. After further consideration, including consideration of comments from this commenter and others, we are finalizing a lower LLC standard than proposed. As described in preamble Section III, the final LLC standard is based on the most recent EPA engine demonstration data, which includes emissions control technologies that are not widely used in current diesel engines (see Section 3 of this document and preamble Section III for additional details on the final LLC standard). As discussed in Section IV.G.2, manufacturers will base their final FEL_{FTP} for credit generation on their engine family's emission performance on the most challenging cycle. Thus, if a CI engine manufacturer demonstrates NO_X emissions on the FTP that is 25 percent lower than the standard but can only achieve 10 percent lower NO_X emissions for the low load cycle, the declared FEL_{FTP} would be based on that 10 percent improvement to ensure the proportional FEL_{LLC} would be met. We expect that the combination of the lower LLC standard and the lower FEL cap in the final rule address the concern the commenter raised about the FEL cap for the LLC.

12.3 Credit Life

[35] For example, see Sections 13403 (Qualified Clean Vehicles), 13404 (Alternative Fuel Refueling Property Credit), 60101 (Clean Heavy-Duty Vehicles), 60102 (Grants to Reduce Air Pollution at Ports), and 70002 (United States Postal Service Clean Fleets) of H. R. 5376,

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

On page 17553 of the NPRM, U.S. EPA asks for comments regarding the proposed five-year credit life. [EPA-HQ-OAR-2019-0055-1186-A2, p.12]

CARB staff supported the five-year greenhouse gas (GHG) emission credit life specified in 1036.740 (d) in the U.S. EPA Phase 1 GHG standards and aligned with them. CARB staff supports changes to also limit criteria emission credit life to five years. An unlimited credit life beyond five years would only serve to allow manufacturers to produce higher polluting engines when emission standards become more stringent many years from now, such as in the 2030 MY under the CTP proposal. For example, during development of the Omnibus regulation, CARB staff analyzed existing federal NOx credit banks and the credit accumulation practices of HD engine manufacturers for the 2007-2021 model year period and observed that several manufacturers had accumulated enough credits during the 2007-2009 MY period to be able to certify new 2024-2026 MY engine families at the proposed Omnibus regulation FEL caps. If CARB staff had not sunset the allowed use of these credits, it would have delayed needed emission reductions of the program. [EPA-HQ-OAR-2019-0055-1186-A2, p.12]

If manufacturers desire to have additional flexibility for meeting 2030 MY requirements, they would have the opportunity to certify lower FEL engine families up to five years prior to help transition to those standards. [EPA-HQ-OAR-2019-0055-1186-A2, p.12]

On page 17552 of the proposed rule, U.S. EPA asserts that the same credit life provisions for Carbon dioxide (CO2) emissions should also be applicable to NOx emissions. CARB staff strongly agrees with this assessment, which is in alignment with California's Omnibus regulation. [EPA-HQ-OAR-2019-0055-1186-A2, p.12]

"As specified in the proposed 40 CFR 1036.740(d), NOx emission credits generated for use in MY 2027 and later could be used for five model years after the year in which they are generated. … We request comment on our proposed five-year credit life." (87 FR 17552-3) [EPA-HQ-OAR-2019-0055-1277-A1, p. 49]

Organization: *Cummins Inc. (Cummins)*

With those averaging set and FEL cap constraints to protect against unintended consequences, Cummins supports unlimited NOx credit life, or at least credit life in-line with useful life, in lieu of EPA's proposed 5-year credit life. [EPA-HQ-OAR-2019-0055-1325-A1, p. 9]

Organization: *Moving Forward Network (MFN)*

"As specified in the proposed 40 CFR 1036.740(d), NOx emission credits generated for use in MY 2027 and later could be used for five model years after the year in which they are generated. … We request comment on our proposed five-year credit life." (87 FR 17552-3) [EPA-HQ-OAR-2019-0055-1277-A1, p. 49]

Three years, not five, is a reasonable timeframe to average out year-to-year variability and should therefore be an appropriate credit lifetime. EPA's three-year stability requirement under the Clean Air Act § 202(a)(3)(C) represents an industry standard pace of improvement to which manufacturers already adhere and plan against. Prior to EPA's elimination of credit lifetime, NOx and particulate emission credits had a three-year expiration (40 CFR § 86.091-14(f)(1) [2004]180). [EPA-HQ-OAR-2019-0055-1277-A1, p. 49]

180. This section of the CFR has since been amended, but an archival reference is available here: https://www.govinfo.gov/content/pkg/CFR-2004-title40-vol17/pdf/CFR-2004-title40-vol17-sec86-091-15.pdf.

Acknowledging the harm that the current indefinite credit system would cause were it allowed to persist, EPA has not justified its choice of five years, and a three-year lifetime is both more protective under the Clean Air Act and has previously been used by the agency. In fact, prior to its most recent elimination of a credit lifetime, EPA had proposed reintroducing the three-year lifetime after a temporary transition period but finalized an infinite credit lifetime based on a rationale it now rejects181— a return to the previous three-year lifetime for credits is thus the natural outcome of such action. [EPA-HQ-OAR-2019-0055-1277-A1, p. 49]

181. E.g., compare EPA-420-R-97-102, pp. 19-22 ("EPA believes that a limit on credit life would in this case to some degree stifle the development and introduction of new technology.") and 87 FR 17552-3 ("Manufacturers could continue to generate credits by adopting increasingly advanced technologies. … We believe a five-year credit life adequately covers a transition period for that option, while continuing to encourage technology development in later years.").

To appropriately limit the environmental harm caused by credit usage, EPA should reinstate the three-year (not five-) credit lifetime, if it is to have a banking and trading program at all. [EPA-HQ-OAR-2019-0055-1277-A1, p. 49]

Organization: *PACCAR, Inc (PACCAR)*

With those averaging set and FEL cap provisions in place to protect against unintended consequences, EMA recommends that EPA allow unlimited NOx credit life, in lieu of the Agency's proposed 5-year credit life. [EPA-HQ-OAR-2019-0055-1346-A1, pp.35-36]

Organization: *States of California, et al. (The States)*

The States strongly support EPA's proposed measures to tailor the ABT program to this role, including (1) limiting credit life to at most five years, (2) replacing existing credit balances with transitional credits, and (3) lowering family emission limit (FEL) caps to below the 2007 heavy-duty standards.90 [EPA-HQ-OAR-2019-0055-1255-A1, pp. 20 - 21]

90. Id. at 17,552-54.

Organization: *Truck and Engine Manufacturers Association (EMA)*

With those averaging set and FEL cap provisions in place to protect against unintended consequences, EMA recommends that EPA allow unlimited NOx credit life, in lieu of the Agency's proposed 5-year credit life. [EPA-HQ-OAR-2019-0055-1203-A1, p. 135]

EPA Summary and Response

A high-level summary of comments along with EPA responses to comments on credit life are available in preamble Section IV.G.

12.4 Transitional NOx credits

Comments by Organizations

Organization: *Alliance for Vehicle Efficiency (AVE)*

As of December 2020, approximately 50% of all commercial diesel trucks in operation, nationwide, were purchased after MY 2010 or later, while 50% of the heavy-duty trucks now on the roads continue to operate without the benefit of NOx and PM emissions control technologies. New heavy-duty trucks will be operational for decades. Incentives for compliant trucks, not just ZEVs, purchased prior to the MY 2027 will bring tremendous health benefits to at-risk communities and the nation. [EPA-HQ-OAR-2019-0055-1280-A1, p. 7]

Organization: *California Air Resources Board (CARB)*

On pages 17553-17554 of the NPRM, U.S. EPA asks for comments regarding the proposed transitional credits before 2027 model year. [EPA-HQ-OAR-2019-0055-1186-A2, p.13]

CARB staff recommends that the transitional credits for 2024 through 2026 MYs be subject to the following conditions:

• First, the five-year credit life should apply to these credits because these credits should be used to help manufacturers transition to the CTP 2027 MY standards that function within the proposed implementation schedule.

• Second, the 2024-2026 MY engines should be certified so that they are subject to all 2027 and subsequent model year requirements. This includes the low-load cycle, off-cycle standards, etc. Basically, there needs to be consistency between the way these credits are generated and the way they are used. [EPA-HQ-OAR-2019-0055-1186-A2, p.13]

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

EPA has proposed allowing various types of NOx credits to be used within its ABT program, with a credit lifespan of five years. 87 Fed. Reg. at 17,552–53. Under that proposal, 'transitional' credits, early adoption incentive credits, and BEV and FCEV credits could be generated as early as MY 2024. 87 Fed. Reg. at 17,552–57. EPA's Proposal does not adequately assess the impact of those pre-MY 2027 credit mechanisms on its emissions standards— especially given the gap between the EPA and Omnibus standards from MY 2024–26, and the extraordinarily large number of credits that could result from that gap. If EPA uses a single national credit bank, that credit surplus would threaten to drastically and unlawfully erode the emissions reductions achieved by the standards. See 42 U.S.C. 7521(a)(3)(A)(i). That potential erosion should be a central factor in EPA's decision whether to allow transitional credits, and (if it does allow them) how to limit those credits' use; EPA is consequently required to thoroughly address it before including transitional credits in its final rule. See Michigan v. EPA, 576 U.S. 743, 750 (2015) (to be lawful, agency decisions must rest on a consideration of all relevant factors). [EPA-HQ-OAR-2019-0055-1302-A1, p.61]

EPA's existing NOx standards that apply to MY 2024 through MY 2026 are much higher than the Omnibus standard—.2 g/hp-hr, rather than .05 g/hp-hr. Engines certified to the Omnibus standard in that time will, consequently, generate a very large quantity of credits against the federal standard (approximating .15 g/hp-hr per engine sold per year). California and other states adopting the Omnibus have a substantial market share; the credits generated prior to MY 2027 are therefore likely to be significant. Depending on the FEL cap incorporated into the final rule, whether the final rule allows BEVs and FCEVs to generate NOx credits, and manufacturers' decisions, the transitional credits generated between MY 2024–2026 could allow a large fraction of HHDEs to emit at the FEL cap even in MY 2030 and beyond. See Comments of MFN, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022. [EPA-HQ-OAR-2019-0055-1302-A1, pp.61-62]

That threat requires EPA to carefully assess the impact of the surplus credits generated by the gap between the pre-2027 EPA and Omnibus standards. Michigan, 576 U.S. at 750. And it further demands some adjustment to the Proposal's NOx crediting structure. EPA should adjust its standards to account for the effect of its transitional crediting program on manufacturers' actual compliance responsibility. In the alternative, EPA should eliminate or amend the transitional crediting mechanism (e.g., by establishing a separate credit bank for states adopting the Omnibus, and/or shortening the credit life of NOx credits to no more than three years) so as to ensure the 'greatest degree of emission reduction achievable' in the relevant model years. 42 U.S.C. 7521(a)(3)(A)(i). [EPA-HQ-OAR-2019-0055-1302-A1, p.62]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

EPA states that the intent of the credit program is, in part, 'to provide flexibility for manufacturers to spread out their investment and prioritize technology adoption in the applications that make the most sense for their businesses during the transition to meeting new standards.'107 Daimler Truck agrees with this approach and supports a credit program. New generation engines will require very significant investment across a variety of platforms. Manufacturers must be allowed to spread that cost over several years, determining which applications to prioritize. It is not possible for manufacturers to develop and release new engines across the entire breadth of their portfolios all at once. Manufacturers are limited on an annual basis in terms of investment dollars, but also in terms of resources—there are only so many engineers, test facilities, dynos, etc. available. [EPA-HQ-OAR-2019-0055-1168-A1, p.83]

107 Id. at 17,550.

To generate credits that could be applied in MY 2027 and later, manufacturers would have to certify to all of the test conditions of the proposed program starting in MY 2024. Given the infeasibility of manufacturers satisfying the proposed standards with one year's lead time, it will be virtually impossible to generate the proposed 'transitional' credits. In many cases, DF testing for MY 2024 engines has already started. It is not possible for manufacturers to adjust their engine development plans to meet new additional low load cycle and off-cycle test standards by MY 2024. As proposed, manufacturers would likely only be able to meet these new standards if by chance the engines they have already designed for MY 2024 happen to meet EPA's newly-proposed low load cycle and off-cycle standards. [EPA-HQ-OAR-2019-0055-1168-A1, p.86]

Compliance flexibilities such as credit ABT programs are arguably part of the whole package of program elements that constitute the emission 'standard' that EPA is proposing. In setting a new HD emission standard, the CAA requires EPA to provide at least four years lead time.110 For manufacturers that must rely on credits to meet the very stringent NOx standards that EPA is proposing for certain engine families, the ABT portion of the compliance program is a de facto standard that would have to be met in a period much shorter than the four years' lead time required under the Act. EPA's transitional credit proposal thus runs contrary to the spirit—and potentially the letter—of the CAA, which rightly recognizes that manufacturers require lead time to develop and validate new engine technologies. [EPA-HQ-OAR-2019-0055-1168-A1, p.86]

110 See 42 U.S.C. 7521(a)(3)(C).

More importantly, EPA's proposal serves to disincentivize the real world NOx improvements that could be (and are being) made for MY 2024+, unless manufacturers can design and validate their engines to meet the requirements of these newly proposed rules—which, as noted above, is virtually impossible in the time frame allowed. Under these circumstances, manufacturers have no regulatory incentive to make improvements that would otherwise go forward under their engine development programs. In other words, EPA's proposal would remove incentives for real world emissions improvements that could be made immediately—and thereby, if finalized, EPA's rule would actively discourage those improvements. [EPA-HQ-OAR-2019-0055-1168-A1, p.87]

Organization: *Moving Forward Network (MFN)*

There is no need to incentivize manufacturers to adopt the proposed test procedures earlier than required in MY 2027 because they are already required to adopt essentially identical test procedures beginning in 2024 under the Omnibus program. Moreover, any such transitional program will lead to a windfall of credits for manufacturers meeting the required state Omnibus standards, which are 75 percent lower in the 2024-2026 timeframe than the federal program. These credits will then be used to delay emissions reductions nationwide. [EPA-HQ-OAR-2019-0055-1277-A1, p. 46]

Model heavy-duty engines are all certified at or below the 0.2 g NOx/bhp-hr average FTP/SET requirements (blue bubbles). The sales-weighted average compliance margin for these engines is over 50 percent, with many achieving FTP test values far below the standard (green bubbles). The size of the bubble corresponds to sales volume estimates. Importantly, a high-volume product from a major manufacturer was just certified to a 0.16 FELFTP, which only bolsters concerns about windfall credits for today's engines delaying future progress. [EPA-HQ-OAR-2019-0055-1277-A1, p. 47]

In addition to the windfall credits from vehicles sold in states where the Omnibus standards are in place, manufacturers will likely be able to certify 2024-2026 engines to the new test procedures with little effort, and doing so will result in a substantial amount of credits owing to the current, weak average NOx standards. Every engine today is certified at or below the average required standard, with an average sales-weighted compliance margin of just over 50 percent between the FELFTP and the value from the certification test (Figure 8).179 This large compliance margin likely covers any difference owing to the new test procedures—the scalar provided for the 2027 FELLLC/FELFTP is 90/35 = 2.6, and the best-performing engines from 2017-2019 already achieved a scalar of 3.5, just a 25 percent difference, and well below the level of wiggle room provided by the current compliance margin. [EPA-HQ-OAR-2019-0055-1277-A1, p. 47]

We support EPA's proposal to exclude the current credit balances (87 FR 17553); however, the transitional credit program raises all the same concerns, and all the same risks. With only marginal improvements in performance owing to the new test procedures, it is far more critical that EPA push manufacturers to adopt new technology rather than meet new tests, and the best way to do this is to limit any flexibilities for manufacturers. The transitional credit program undermines efforts to reduce emissions in 2027 and beyond by rewarding the status quo. It should therefore be eliminated from the proposal in the final rule. [EPA-HQ-OAR-2019-0055-1277-A1, pp. 47 - 48]

While we oppose these credits, if EPA moves forward with this program, it must ensure that any credits are predicated on meeting all of the changes in program design changes adopted by EPA beginning in 2027 to improve the robustness of any test-cycle reductions in the real world. Critical to these changes is the elimination of the NTE program and the adoption of the moving-average-window approach to ensure that these newer trucks are seeing required reductions in real-world emissions on the road and the adoption of the low-load cycle, which better reflects the need to capture operations where today's vehicles fail miserably. If EPA moves forward with the credits they must ensure that reductions in medium- and heavyduty vehicle emissions occur within environmental justice communities by requiring the ZEVs are deployed in environmental justice communities. EPA must require that these vehicles are part of a publicly available tracking system to ensure adherence to the Rule. [EPA-HQ-OAR-2019-0055-1277-A1, p. 48]

We are absolutely opposed to credits for any engines that do not adhere to updated testing and compliance procedures that are at least as effective as those already met by the state Omnibus. [EPA-HQ-OAR-2019-0055-1277-A1, p. 48]

There should be absolutely no credits awarded for legacy engines nor legacy technologies. The difference is these engines cannot simply be captured in a conforming factor—it goes directly to the operation of the engine itself and the corresponding emissions controls. The current test procedures have not led to the reductions promised—there is absolutely no reason not to require that all certified engines moving forward are required to be certified under the updated procedure, directly assessing their emissions under the new protocol, without any conditional fudge factor that could be manipulated or gamed and would lead to a continuation of the inadequate compliance procedures to-date. [EPA-HQ-OAR-2019-0055-1277-A1, p. 48]

As is noted below, the impact that the credit program could have on future emissions requirements is substantial. This is particularly true in the years prior to 2027, when the difference between what is feasible and what is required is (at an absolute level) the greatest. While we oppose the generation of any credits in this time period, worse still is the possibility that any such credits could linger as late as 2031. If granting any such credits, EPA should propose a limit of no more than three years, as discussed below. [EPA-HQ-OAR-2019-0055-1277-A1, p. 48]

Organization: *Roush CleanTech (Roush)*

Roush supports the proposed use of transitional NOx emissions credits for 2024-26MY, and believes the proposed calculation method for credits and SET FEL's is reasonable. We cannot assess whether Roush will participate in this optional program or not, as we have not yet evaluated the impact on the SET requirements on our product design and customer acceptance, but we would expect to complete that analysis once the proposed rule is finalized. [EPA-HQ-OAR-2019-0055-1276-A1, p.2]

EPA Summary and Response

Many of the summaries of comments on transitional credits in the proposed rule, and EPA's responses to those comments, are included in Preamble Section IV.G.7. Immediately below, we briefly summarize and respond to additional comments on the proposed transitional credit program.

As part of their comments on the transitional credit program in the proposed rule, one commenter stated that EPA should require ZEV deployment in EJ communities and require the vehicles to be part of a publicly available tracking system. See Section 12.1 of this document for our response to the comment regarding ZEV deployment in EJ communities and a publicly available database for tracking emissions credits.

A commenter also stated that they oppose any allowance to use credits through MY 2031 if those credits are generated prior to MY 2027. Another commenter stated that the same five year credit life should apply to transitional credits as in the proposed ABT program. We have carefully considered appropriate credit life for the four transitional credit pathways and for the reasons we explained for each pathway in preamble Section IV.G.7, we have allowed the use of certain transitional credits through MY 2032 under two transitional credit pathways and through MY 2034 for one transitional credit pathway.

12.5 Early adoption incentives

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

On page 17555 of the NPRM, U.S. EPA asks for comments regarding the proposed early adoption incentives program. [EPA-HQ-OAR-2019-0055-1186-A2, p.14]

CARB staff recommends that the introduction of the early adoption incentives which would incentivize compliance with all future model year requirements be subject to the following conditions. CARB staff believes that most of the engines participating in this program would be designed to comply with California's Omnibus requirements. As such, CARB staff recommends that the term StdFTP in equation IV-2 (page 17555 of the NPRM) be redefined as the applicable current MY standard as specified in the Omnibus regulation. Doing so would match the amount of credits generated with what is calculated in the Omnibus regulation and avoids the generation of excess credits under the federal program. [EPA-HQ-OAR-2019-0055-1186-A2, p.14]

Excess credits could potentially be used to certify higher polluting engines in future model years, thereby eroding the environmental benefits of the CTP proposal. [EPA-HQ-OAR-2019-0055-1186-A2, p.14]

Organization: *Clean Energy (CE)*

We support the proposed structure of the early adoption credit multiplier which not only incentivizes early compliance for diesel engines but will also encourage the wider deployment of near-zero trucks. As proposed, zero-emission vehicles (ZEV) should remain ineligible for the early compliance credit multiplier since they already benefit significantly from state mandates and incentives as well as a plethora of federal incentives. Furthermore, incentives need to be focused on improving the emissions from internal combustion engines. ZEV incentives would be a distraction from the purpose of the rule and send a mixed message to engine manufactures. [EPA-HQ-OAR-2019-0055-1350-A1, p.4]

Organization: *Manufacturers of Emission Controls Association (MECA)*

MECA believes that incentivizing early introduction of technologies is an effective way of driving development of the cleanest technology ahead of regulations to deliver early emission reductions. We believe that staff's proposed use of NOx credit multipliers as phased-in by earliest year of introduction is appropriate and rewards manufacturers that have invested in the cleanest technology first with greater credits. Natural gas engines that are already emitting at the lowest 2027 limits will be able to generate these early compliance credits as investments are made to introduce diesel trucks that emit at these ultra-low NOx levels. [EPA-HQ-OAR-2019-0055-1320-A1, p.28]

Organization: *Moving Forward Network (MFN)*

EPA's generous early action credits must be removed as they unnecessarily dilute the emission standard while incentivizing a harmful, dead-end technology: natural gas vehicles. A strong fleet averaging system inherently incentivizes early action since earlier reductions can ease manufacturer compliance and provide flexibility, rendering early action credits redundant. Further, since natural gas vehicles, under the current inadequate testing and certification regimes, are falsely labeled as “low NOx” vehicles, early action credits functions as a carve out for these vehicles. [EPA-HQ-OAR-2019-0055-1277-A1, p. 44]

Organization: *Natural Gas Vehicles for America (NGVAmerica)*

NGVAmerica and its members submit the following recommendations for policies and programs that the EPA and other federal agencies can advance to encourage the use of cleaner trucks.

1. Support the early adopter NOx credits proposed by EPA to be included as part of the averaging, banking and trading program including the proposed sales multipliers for natural gas engines and vehicles and other technologies that certify to more demanding NOx levels ahead of schedule; [EPA-HQ-OAR-2019-0055-1330-A1, p.12]

Organization: *Southern Environmental Law Center (SELC)*

EPA’s proposed early incentive credit multipliers, however, should be scaled back or eliminated. [EPA-HQ-OAR-2019-0055-1247-A1, p.7]

Organization: *Tesla, Inc. (Tesla)*

Tesla supports early action crediting as it will hasten manufacturers’ pace of clean vehicle deployment. Early action NOx credits generated by BEVs will create an additional incentive for manufacturers to pull forward deployment of heavy-duty BEVs and accelerate the pace of fleet turnover to zero NOx vehicles.134 [EPA-HQ-OAR-2019-0055-1219-A1, p.15]

134 87 Fed. Reg. at 17556, fn. 681-2 (noting past Tesla comments).

While BEVs should play a central role in NOx compliance and credit markets, the various credit multipliers in the proposed crediting systems are unequitable toward electrification and will dampen actual near-term delivery of BEVs. Accordingly, the multipliers provided in the credit trading provisions should be eliminated. [EPA-HQ-OAR-2019-0055-1219-A1, p.15]

Second, regardless of technology eligibility, any multiplier for early adoption incentives should be eliminated.136 As proposed, the early adoption multipliers will provide the perverse incentive of a credit bonus encouraging new use of pollution emitting technologies.137 The multiplier will incentivize manufacturers to speed up deployment of improved but legacy, polluting technologies that will continue to load NOx emissions for years to come. Further, the multiplier will also create more credit accumulation and value for manufacturers that bring about a lesser emission reduction technology than BEVs. The early adoption multiplier should be eliminated. Tesla also agrees with the agency that providing credit multipliers can unnecessarily dampen actual deployment of the best emission control technologies and lead to a loss of emission reductions.138 This is true regardless of the technology to which a multiplier may be attached and is not applicable just to BEVs. [EPA-HQ-OAR-2019-0055-1219-A1, p.16]

136 87 Fed. Reg. at 17557.

137 87 Fed. Reg. at 17555.

138 87 Fed. Reg. at 17426.

For example, as proposed in MY 2024 thru and 2026 hybrid powertrains would generate two times as many credits as a BEV if deployed over the same period. Under this approach, the proposed regulation is asserting that hybrid powertrains are more valuable, in terms of NOx mitigation, than BEVs. Given BEV technology is available and provides greater emission reductions than other technologies, it simply does not make sense to favor hybrid technologies in the NOx rule over zero emission solutions. It is also consistent with the notion of technological neutrality. Accordingly, Tesla recommends eliminating the provisions in the regulation that provide credit multipliers for hybrid powertrains. [EPA-HQ-OAR-2019-0055-1219-A1, p.16]

As a general matter of policy development, in setting an emissions performance standard, such as the NOx rule, the regulation should be agnostic with respect to what technology is used to meet, and ideally outperform, the standard. Excluding or limiting ZEVs in the proposed regulation's crediting provisions would promote one set of solutions to reduce NOx, consisting of efficiency measures and post combustion emission controls, over better solutions, like BEVs that represent a more effective means of addressing the problem. [EPA-HQ-OAR-2019-0055-1219-A1, p.16]

Organization: *U.S. Chamber of Commerce*

EPA has often used various program elements to incentive early emissions reductions due to their ability to drive more estimated health benefits. Much as early investments help drive more retirement savings down the road, achieving earlier emissions reductions allows the time value of those health benefits to accrue over a longer period of time, thus providing more cumulative benefits. EPA has applied various incentives through its averaging, banking, and trading programs under both its mobile source and stationary source regulations. Early reduction credits, emissions reduction multipliers, and other incentives help businesses to take steps to reduce their emissions earlier. EPA does this recognizing that the benefits of earlier reductions, even if the standards are less stringent, will often outweigh potentially larger benefits achieved at a later date. [EPA-HQ-OAR-2019-0055-1245-A1, pp. 8 - 9]

Organization: *Western States Air Resources Council (WESTAR)*

Though, we caution EPA that the proposed early adoption credit program could undermine some of the benefits of the rule depending on the final design. If credits under the program can be generated from zero emission vehicles (ZEVs) that were already planned for production, those credits could allow more polluting conventional diesels to be manufactured. It is important that any credit system be crafted so that it does not incentivize the continued production of dirtier diesels when the technology exists to make them cleaner. Any benefits from this proposed rule to visibility in mandatory Class I federal areas will likely occur during the third and fourth regional haze planning periods, 2028- 2038 and 2038-2048, respectively. It is important to WESTAR that EPA be an active partner in making reasonable progress towards improving visibility in Class I areas. The final rule should reflect the choices and alternatives within the proposal that are technologically available to reduce the most emissions in the shortest period of time. [EPA-HQ-OAR-2019-0055-1230-A1, p.4]

EPA Summary and Response

See preamble Section IV.G for EPA's summary and response to comments on the proposed Early Adoption Incentives program.

12.6 NOx emission credits from electric vehicles

12.6.1 Proposal to Allow Electric Vehicles to Generate NOx Emission Credits

Comments by Organizations

Organization: *Advanced Engine Systems Institute (AESI)*

It is critical that zero emission trucks be excluded from generating NOx credits because they diminish the genuine NOx control reductions from internal combustion engines. [EPA-HQ-OAR-2019-0055-1281-A1, p. 2]

Organization: *Alliance for Vehicle Efficiency (AVE)*

AVE opposes the use of credits for battery electric vehicles (BEVs) or fuel cell electric vehicles (FCEVs) for low-NOx compliance. [EPA-HQ-OAR-2019-0055-1280-A1, p. 6]

As proposed, the credits being offered to manufacturers for BEVs, and FCEVs will undermine the goals of EPA's proposal to reduce NOx and other pollutants from heavy-duty engines. [EPA-HQ-OAR-2019-0055-1280-A1, p. 6]

Cost-effective technologies exist that will ensure enormous emission reductions from heavy-duty engines. To achieve the goal of improving engine emissions, compliance credits should be generated for compliance with a standard, not a technology. As proposed, manufacturers can over deploy BEVs or FCEVs at volumes higher than predicted, and easily backslide on engine improvements or emission control technology changes on ICE vehicles. For this reason, AVE recommends that EPA tighten the family emission limit (FEL) to 0.05 g/bhp-hr, down from the current proposal of 0.15 g/bhp-hr. Without a lower FEL cap, the opportunity for significant NOx reduction from new ICE trucks will be lost and the higher NOx levels will negatively impact at-risk communities for decades. [EPA-HQ-OAR-2019-0055-1280-A1, p. 6]

AVE also supports a sunset date of MY 2030 for all Heavy-Duty-ZEV NOx credits and adopt other protections such as tightening the family emission limit (FEL) to 0.05 g/bhp-hr, down from the current proposal of 0.15 g/bhp-hr. [EPA-HQ-OAR-2019-0055-1280-A1, p. 6]

Organization: *Allison Transmission, Inc. (Allison)*

In this regard, EPA's proposal to allow for generation of NOx credits by ZEVs, BEVs should not be finalized.68 While Allison generally favors incentives for development of new technologies, allowing vehicles with zero tailpipe emissions (albeit not zero CO2 emissions overall depending on the fueling source) does not provide an incentive for new technologies to reduce NOx in as much as it provides an additional incentive for the production of ZEVs. Thus, the credit is misaligned with the environmental gains it is seeking to address and unduly favors one technological approach over another. [EPA-HQ-OAR-2019-0055-1231-A1, pp.32-33]

68 86 Fed. Reg. at 17,557.

Organization: *American Automotive Policy Council (AAPC)*

It is appropriate for zero emissions vehicles to average into a fleet average on NOx standards, given the proposed step change in criteria emissions stringency. Zero emissions trucks are recognized as an important technology to meet air quality goals.2 President Biden encouraged the EPA Administrator to consider zero emissions vehicles when formulating emissions standards for 2027 and beyond. Accelerating the adoption and use of zero emissions technologies is widely accepted as a pathway for reducing GHG emissions by 50-52% from 2005 levels by 2030, which President Biden also ordered.3 Excluding zero emissions vehicles from an ABT program ignores real world NOx emissions reductions and subsequent air quality benefits that the use of these products can deliver. As a result, through unreasonable warranty and useful life requirements, there is a missed opportunity to incentivize and accelerate the adoption of zero emissions technologies. [EPA-HQ-OAR-2019-0055-1293-A1, p. 2]

2 "This requirement to shift to zero-emission trucks, along with the ongoing shift to electric cars, will help California meet its climate goals and federal air quality standards…" https://ww2.arb.ca.gov/news/california-takes-bold-step-reduce-truck-pollution

3 https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/

Some stakeholders have expressed concern that allowing zero emissions vehicles to generate ABT credits for criteria emissions would allow "backsliding", or higher criteria emissions on next generation internal combustion engines, and that backsliding may threaten the ability of the program to achieve air quality policy objectives. These concerns are unfounded. The EPA proposal includes a maximum threshold for NOx emissions for any engine, via the NOx Family Emission Limit (FEL). The EPA proposed FELs that are 25% or more below the current manufacturer average standard, which is enough to prevent backsliding. The proposed fleet standards for 2027MY+ are a fraction of the FELs, meaning that only a very small portion of a manufacturer's portfolio (including credit generating vehicles) could certify near the FEL value and still meet the overall fleet stringency. Maximum threshold caps, in combination with overall stringency requirements, are an effective policy mechanism to address concerns of backsliding and to still include zero emissions vehicles in an ABT program. [EPA-HQ-OAR-2019-0055-1293-A1, pp. 2 - 3]

Organization: *BorgWarner*

BorgWarner urges against the use of NOx credits for EV or fuel cell vehicles, as doing so could unintentionally dilute NOx-reducing technology in HD trucks. These credits could disincentivize manufacturers from investing in and developing the next generation of cleaner ICE trucks. A manufacturer could overachieve on the production of EV trucks and backslide on NOx-reducing technologies for ICE trucks. [EPA-HQ-OAR-2019-0055-1234-A1, p. 3]

We recommend EPA consider adopting a sunset date of 2030 MY for all HD-ZEV NOx credits and adopt other protections such as lower family emission limit (FEL) caps. Sunsetting these credits will help ensure manufacturers will adopt cost-effective and feasible technologies to reduce NOx emissions from combustion engines. [EPA-HQ-OAR-2019-0055-1234-A1, p. 4]

Organization: *California Air Resources Board (CARB)*

- CARB has concerns that the proposed NOx credit generation mechanism for battery electric vehicles and fuel-cell vehicles described in 40 CFR 1036.741 and 1037.616 would seriously erode the environmental benefits of the proposed rule. In developing these provisions, U.S. EPA staff has assumed an unrealistically small penetration of heavy-duty zero-emission technologies (1.5 percent heavy-duty zero-emission trucks in 2027 model year). CARB staff believes that U.S. EPA should incorporate a sunset date of 2026 model year for generation of these credits similar to the proposal in CARB's Omnibus regulation. [EPA-HQ-OAR-2019-0055-1186-A1, p.3]

On page 17558 of the NPRM, U.S. EPA asks for comments regarding the proposed NOx credit generation program for battery electric vehicles (BEV) and fuel-cell electric vehicles (FCEV). [EPA-HQ-OAR-2019-0055-1186-A2, p.14]

While CARB staff believes in incentivizing the early development and production of HD fuel-cell and battery electric vehicles, we oppose the proposed crediting mechanism without a sunset date for the program. CARB staff strongly recommends U.S. EPA include a sunset date of the 2026 MY for generation of NOx emission credits from electric vehicles. [EPA-HQ-OAR-2019-0055-1186-A2, p.14]

As stated in page 17556 of the proposed rule: 'Forecasting models and studies generally agree that Hybrid electric vehicle, BEV, and FCEV production volumes will grow, yet the predicted rate of growth ranges widely across various forecasts and partly depend[s] on the specific market segments and time periods being evaluated, study methodologies, as well as underlying assumptions'. For analysis, U.S. EPA used a 1.5 percent projected penetration rate for BEVs in 2027 model year (page 17458 of the proposed rule). CARB staff believes this projected penetration rate is an underestimate for the following reasons:

- There are more than 140 models1 of zero-emissions medium- and HD trucks and buses commercially available today with additional models expected to enter production this year. [EPA-HQ-OAR-2019-0055-1186-A2, p.15]

1 HVIP eligible vehicles. https://californiahvip.org/vehiclecatalog/

- The Advanced Clean Trucks (ACT) regulation2 will help place nearly 300,000 zero-emission vehicles (ZEV) on California roads by 2035. In addition, the ACT regulation has been adopted by five other states (Washington, Massachusetts, Oregon, New Jersey, New York). [EPA-HQ-OAR-2019-0055-1186-A2, p.15]

2 ACT regulation. https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks

- Multi-state action on heavy duty zero-emission policy and supporting activity is widespread. Seventeen states with the District of Columbia and supported by northerly neighbor Quebec are working under a memorandum of understanding3 (MOU) that commits to developing4 the multi-state action plan, currently in draft review,5 to identify barriers and propose solutions to support widespread electrification of medium and HD vehicles. [EPA-HQ-OAR-2019-0055-1186-A2, p.15]

3 Memorandum of understanding. https://www.nescaum.org/documents/mhdv-zev-mou-20220329.pdf/

4 Medium- and Heavy-Duty Zero-Emission Vehicles: Action Plan Development Process — NESCAUM https://www.nescaum.org/documents/medium-and-heavy-duty-zero-emission-vehicles-action-plan-development-process

5 https://www.nescaum.org/documents/announcement-mhd-zev-ap-public-draft.pdf

- Several Midwest states including Illinois, Indiana, Minnesota, Michigan, and Wisconsin have formed their own Regional Electric Vehicle Midwest MOU to promote HD ZEV infrastructure, manufacturing and other supportive policies.6 Other multi-state MOUs have been recently signed by states pursuing transportation applications of hydrogen as part of their joint proposals for federal Hydrogen Hub funding including Arkansas, Oklahoma and Louisiana‘s HALO Hub,7 Colorado, New Mexico, Utah and Wyoming’s Western Inter-States Hydrogen Hub,8 Ohio, Pennsylvania and West Virginia’s Northern Appalachian Industrial and Ohio Clean Hydrogen Hub Alliance,9 and the Connecticut, Massachusetts, New Jersey, and New York’s Regional Clean Hydrogen Hub.10 [EPA-HQ-OAR-2019-0055-1186-A2, pp.15-16]

6 https://www.michigan.gov/-/media/Project/Websites/leo/REV_Midwest_MOU_master.pdf?rev=6dd781b5a4eb4551b3b3a5b875d67fb9

7 https://ee.ok.gov/wp-content/uploads/2022/03/OK-LA-and-AR-Final-Hydrogen-RFI-Submittal-to-DOE-for-H2Hub-3-21-2022.pdf

8 https://energyoffice.colorado.gov/climate-energy/western-inter-states-hydrogen-hub

9 West Virginia Steps Toward Hydrogen Hub Despite Criticism (governing.com)

10 Governor Lamont Announces Connecticut Partners With New York, New Jersey, and Massachusetts To Develop Regional Clean Hydrogen Hub Proposal https://portal.ct.gov/Office-of-the-Governor/News/Press-Releases/2022/03-2022/Governor-Lamont-Announces-Connecticut-Partners-To-Develop-Regional-Clean-Hydrogen-Hub-Proposal

- Eight different major HD manufactures11 each have ZEVs that are commercially available in the class 8 semi-tractor category. [EPA-HQ-OAR-2019-0055-1186-A2, p.16]

11 HVIP eligible heavy-duty vehicles. https://californiahvip.org/vehicle-category/heavy-duty/

- Zero-emission Class 8 refuse vehicles are also available from at least six manufacturers in addition to more manufacturers supporting the smaller class refuse market.12 [EPA-HQ-OAR-2019-0055-1186-A2, p.16]

12 https://californiahvip.org/vehicle-category/refuse/

- Manufacturers continue to release subsequent generation class 8 ZEV models with increased performance and range.13,14 [EPA-HQ-OAR-2019-0055-1186-A2, p.16]

13 Volvo Trucks introduces second-generation VNR Electric with bigger battery, added range, and new configurations – Electrek https://electrek.co/2022/01/14/volvo-trucks-introduces-second-generation-vnr-electric-with-bigger-battery-added-range-and-new-configurations/

14 Manufacturers power up the EV marketplace | FleetOwner https://www.fleetowner.com/emissions-efficiency/electric-vehicles/article/21238869/manufacturers-power-up-the-ev-marketplace

- One analyst estimates that manufacturers are currently sitting on an order book of some 140,000 units for commercial battery electric trucks alone.15 [EPA-HQ-OAR-2019-0055-1186-A2, p.16]

15 https://www.ttnews.com/articles/high-diesel-prices-do-little-speed-adoption-alt-fuel-trucks

- Significant private investments are going into public HD charging infrastructure with Daimler leading a $650M project to install fast chargers on the East and West coasts as well as Texas.16 This follows their 'Electric Island' high power public charging station in Oregon.17 Truck stops are planning for electric charging including dedicated HD actions like the MegaWatt E-Truck stop in Bakersfield, CA,18 Travel Centers of America's eTA business unit,19 and more conventional DC fast charging forays that can accommodate lighter class commercial ZEVs.20,21 [EPA-HQ-OAR-2019-0055-1186-A2, pp.16-17]

16 Daimler Truck North America, NextEra Energy Resources and BlackRock Renewable Power Announce Plans To Accelerate Public Charging Infrastructure For Commercial Vehicles Across The U.S. - Daimler Truck Media Site https://media.daimlertruck.com/marsMediaSite/en/instance/ko.xhtml?oid=51874160

17 Daimler Trucks North America, Portland General Electric open first-of-its-kind heavy-duty electric truck charging site | Daimler https://northamerica.daimlertruck.com/PressDetail/daimler-trucks-north-america-portland-general-2021-04-21

18 Dedicated e-truck charging site coming up in California - electrive.com https://www.electrive.com/2021/05/10/dedicated-e-truck-charging-site-coming-up-in-california/

19 TravelCenters of America Announces eTA (ta-petro.com) https://www.ta-petro.com/newsroom/travelcenters-of-america-enhances-commitment--to-sustainability-and-alternative-energy

20 Electrify America Announces Collaboration with Love's Travel Stops (loves.com) https://www.loves.com/en/news/2020/august/electrify-america-announces-collaboration-with-loves-travel-stops

21 Electric Vehicle Charging Stations Coming to Truck Stops (govtech.com) https://www.govtech.com/transportation/electric-vehicle-charging-stations-coming-to-truck-stops.html

- Detroit diesel is pivoting to become the supplier of e-axles for Freightliner's trucks.22 [EPA-HQ-OAR-2019-0055-1186-A2, p.17]

22 https://www.greencarreports.com/news/1131231_detroit-diesel-is-going-electric-in-pivot-to-keep-powering-freightliner

- To address the upfront costs of HD ZEVs and their supporting infrastructure, more examples of innovative financing options are taking advantage of lower ZEV operating costs over time to better match existing budgeting practices for combustion vehicles. These include so-called Vehicle-as-a-Service and Charging-as-a-Service products are offered by manufacturers themselves23,24,25,26 or third parties.27,28,29 Traditional truck leasing companies like Ryder and Penske are already active in the ZEV space and bring their inclusive vehicle service models to ZEV introduction.30,31 These existing approaches offer the potential to substantially accelerate ZEV rollouts and market penetration by allowing broader access to the ZEV long term operational savings. [EPA-HQ-OAR-2019-0055-1186-A2, p.17]

23 https://stnonline.com/industry-releases/highland-electric-fleets-and-thomas-built-buses-sign-agreement-to-make-electric-school-buses-an-affordable-option-today/

24 Mack Launches Vehicle-as-a-Service Program for Battery Electric Vehicles | Mack Trucks

25 BYD, Levo Announce Collab to Deploy BEVs to U.S. Fleets - Green Fleet - Work Truck Online

26 Lion_PressRelease_Lion Capital Solutions.pdf (thelionelectric.com)

27 https://www.volvotrucks.com/en-en/news-stories/press-releases/2022/mar/volvo-trucks-sells-50-electric-trucks-to-truck-as-a-service-start-up.html

28 Zeem Solutions Launches First Electric Vehicle Transportation-As-A-Service Depot | Business Wire

29 ‘Charging As A Service’ For Electric Vehicles Growing As A Market Offering (forbes.com)

30 Fleets prepare for arrival of electric trucks in 2022 | Commercial Carrier Journal (ccjdigital.com)

31 Penske Electric Trucks and Vehicles - Penske Truck Leasing https://www.pensketruckleasing.com/full-service-leasing/leasing-services/electric-fleets/

- Ford, GM, and Rivian have new zero-emission pickup models that are commercially available for order. All three combined have already received over 300,000 orders on their respective pickup truck. This demonstrated demand is further underscored by a recent survey showing that 43 percent of current pickup owners expect to buy a ZEV pickup in the next decade.32 Although these pick-ups are class 3 vehicles, they are similar to Class 4 light HD vehicles and these powertrains will quickly transition to heavier class vocational vehicles. Ford has seen over 10,000 orders on their E-Transit vehicle as of January this year.33 Ford is also planning to nearly double production capacity for the second time of the all-electric F-150 Lightning pickup to 150,000 vehicles per year.34 GM has started deliveries of their BrightDrop vans35 and states 25,000 already on order.36 The United States Postal Service (USPS) has just placed an order for 10,019 BEVs Next Generation Delivery Vehicles37 and USPS Inspector General points out that 99 percent of the postal delivery routes are electrifiable today.38 [EPA-HQ-OAR-2019-0055-1186-A2, pp.17-18]

32 https://www.globenewswire.com/news-release/2022/02/03/2378575/0/en/CarGurus-Releases-Latest-Pickup-Truck-Sentiment-Study.html

33 Ford E-Transit Hits 10,000 US Orders, Including 1,100 From Walmart (insideevs.com) https://insideevs.com/news/563265/ford-etransit-10000-orders-usa/

34 Full Speed Ahead: Ford Planning to Nearly Double All-Electric F-150 Lightning Production to 150,000 Units Annually; First Wave of Reservation Holders Invited to Order | Ford Media Center

35 FedEx receives its first electric delivery vans from GM's BrightDrop - The Verge https://www.theverge.com/2021/12/17/22839470/fedex-gm-brightdrop-electric-delivery-van-ev600

36 High Demand For BrightDrop Electric Delivery Vans, Says CEO (gmauthority.com) gmauthority.com/blog/2022/04/high-demand-for-brightdrop-electric-delivery-vans-says-ceo/

37 https://www.prnewswire.com/news-releases/usps-places-order-for-50-000-next-generation-delivery-vehicles-10-019-to-be-electric-301509809.html

38 https://www.uspsoig.gov/sites/default/files/document-library-files/2022/RISC-WP-22-003.pdf

The aforementioned factors comprise an important aspect of the proposed crediting provision, because they are centrally relevant to the accuracy of U.S. EPA's assumption regarding projected numbers of HD ZEVs, and the likelihood that the projected NOx reductions from the CTP rule will be eroded because of ZEV NOx credits generation. U.S. EPA must therefore account for such factors in evaluating the impacts of NOx credits generated from electric vehicles. State Farm, 463 U.S. at 43. [EPA-HQ-OAR-2019-0055-1186-A2 p.18]

U.S. EPA should not permit NOx credit generation from electric vehicles to continue indefinitely. Such an allowance would allow these NOx credits to be used to certify higher polluting engines in future years, thereby eroding the overall environmental benefits of the CTP proposal. In order to assess the impacts of NOx credits from electric vehicles, CARB staff working on the Omnibus regulation performed an inventory analysis39 which showed significant losses of benefits from ZEV NOx credits if there is no sunset date for these credits. A summary of the results from that analysis is shown in Figure 3-1. As shown, having no sunset date would have reduced the overall benefits of the Omnibus regulation by 11 percent in 2050. [EPA-HQ-OAR-2019-0055-1186-A2 p.18]

39 Final Statement of Reasons for Rulemaking. Pages 196-203. https://ww2.arb.ca.gov/sites/default/files/barcu/board/rulemaking/hdomnibuslownox/fsor.pdf

CARB staff recommends that U.S. EPA perform a similar analysis using a penetration rate from one or more knowledgeable, independent sources40 for HD electric vehicles to quantify the potential losses of benefits in tons per year on nationwide basis. [EPA-HQ-OAR-2019-0055-1186-A2, p.19]

CARB staff asked International Council on Clean Transportation (ICCT) staff to perform a national emissions inventory analysis of CTP's Option 1 proposal based on a projected penetration rate of HD ZEVs, similar to that is estimated by ACT Research.40 As shown in Fig.

3-2, ICCT's analysis projects that about 14 percent of the projected benefits of U.S. EPA's Option 1 proposal would be lost due to manufacturers using HD ZEV NOx credits to certify engines to higher FELs. [EPA-HQ-OAR-2019-0055-1186-A2, p.19]

40 ACT: Third of Class 4-8 Vehicles to be Battery-Electric in 10 Years. https://www.truckinginfo.com/10144947/act-third-of-class-4-8-vehicles-to-be-battery-electric-in-10-years

Given the uncertainty in predicting the nationwide electric vehicle penetration rates and the strong possibility that HD ZEVs will soon make up a significant portion of new HD sales, CARB staff strongly recommends that U.S. EPA sunset the generation mechanism for the electric vehicle NOx credits in 2026 MY. This would almost fully align the opportunity manufacturers would have to generate ZEV NOx credits under Omnibus and CTP. To further align, U.S. EPA could allow ZEV NOx credits to begin with 2022 MY vehicles. This would further incentivize earlier uptake of these vehicles on a national level and would also align with the Biden administration goals of quickly transitioning to zero-emission technologies. [EPA-HQ-OAR-2019-0055-1186-A2, p.20]

CARB staff believes that the implementation of California's ACT, other states adopting ACT, and the fact that ZEVs are expected to become more cost effective than operating conventional combustion vehicles in the 2027 MY timeframe means that NOx credit incentives would lose their effectiveness and would only serve to delay needed NOx emission reductions from combustion vehicles. For some categories, ZEVs are already cheaper to operate today41 and this cost advantage is rapidly broadening to at least 42 percent of truck sales in 2030 according to a National Renewable Energy Laboratory (NREL) cost analysis42 while Lawrence Berkeley National Laboratory projects that even regional and long-haul ZEV trucks will be 50 percent cheaper to operate than diesel in 2030.43 [EPA-HQ-OAR-2019-0055-1186-A2, pp.20-21]

41 'ELECTRIC TRUCKS HAVE ARRIVED: The Use Case for Vans & Step Vans' https://www.nacfe.org/wp-content/uploads/edd-free-downloads-cache/Vans-and-Step-Vans-Report-Executive-Summary-FINAL.pdf

42 'Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis' https://www.nrel.gov/docs/fy22osti/82081.pdf

43 'Why Regional and Long-Haul Trucks are Primed for Electrification Now' https://eta-publications.lbl.gov/publications/why-regional-and-long-haul-trucks-are

In conclusion, U.S. EPA should re-analyze its estimates of the ZEVs market, craft the credit portions to deliver intended emissions benefits in a way that would be resilient to ZEV success, and include a sunset date of the 2026 MY for NOx emission credits from electric vehicles. If U.S. EPA adopts a sunset date that is later than the 2026 MY, then U.S. EPA needs to include provisions to limit ZEV NOx credits between 2026 and the adopted sunset date. A HD ZEV NOx credit backstop needs to be created to avoid the unanticipated consequence of HD ZEV credits undermining expected NOx reductions from HD combustion engines by allowing such engines to be certified to U.S. EPA's proposed high NOx FEL caps. CARB staff expects that this unintended detrimental impact will grow with time with the increase in sales of HD ZEVs, which will prevent progress reducing HDE emissions and have an especially detrimental impact on our most vulnerable communities. [EPA-HQ-OAR-2019-0055-1186-A2, p.21]

Organization: *CALSTART*

We also support a policy that gives vehicle manufacturers flexibility in meeting NOx emission targets through accelerated deployments of battery and fuel cell technologies. Crediting could be used to accelerate the deployment of zero-emission trucks before new NOx standards take effect in model year 2027. Credits could have higher value for earlier production, starting in model year 2024 for example, and phase down annually in advance of compliance dates, e.g., model years 2027 and 2031. [EPA-HQ-OAR-2019-0055-1313-A1, p.5]

EPA's credits for zero-emission trucks, however, should drive emission reductions and not erode intended reductions. Sales of zero-emission vehicles required under state policies, i.e., states' adoption of ACT, should not be credited and double-counted under the final rule. Double-counting should also not be allowed for combustion engines required under states' adoption of the Heavy-Duty Omnibus. The lifetimes of credits should be capped to ensure credits do not delay adoption of innovative combustion engine technology. Without the flexibility afforded by deployments of zero-emission vehicles, the policy should be backstopped with a 0.02 g NOx/bhp-hr standard for all engines no later than 2031. Engines allowed through zero-emission vehicle credits should emit no more than 0.05 g NOx/bhp-hr. [EPA-HQ-OAR-2019-0055-1313-A1, p.5]

To prevent the weakening of existing GHG standards and proposed NOx standards, the final rule should account for the number of zero-emission vehicles expected to be deployed from state policies and not allow double-counting of these vehicles. Credits for zero-emission vehicles in the Clean Trucks Plan should be awarded for deployments beyond those required from other polices, namely states' adoption of the ACT and Advanced Clean Fleets (ACF) standards. [EPA-HQ-OAR-2019-0055-1313-A1, p.11]

Credits for zero-emission trucks should not erode net criteria or GHG emission reductions from combustion engines and vehicles. [EPA-HQ-OAR-2019-0055-1313-A1, p.26]

Organization: *Clean Air Board of Central Pennsylvania*

We also ask that EPA eliminate Zero Emission Vehicle (ZEV) crediting towards NOx engine standard compliance. The ZEV crediting program should not be an offset mechanism that results in the production of higher emitting diesel engines. [EPA-HQ-OAR-2019-0055-1305-A1, p.1]

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

EPA must also modify its crediting proposals to ensure that 'transitional' credits and credits for battery electric vehicles (BEVs) and fuel cell electric vehicles (FCEVs) do not undermine the effectiveness of its criteria pollutant program. [EPA-HQ-OAR-2019-0055-1302-A1, p.8]

In a departure from its previous regulations, EPA has proposed to permit manufacturers to generate NOx emissions credits, from MY 2024 onwards, for BEVs and FCEVs. 87 Fed. Reg. at 17,556–57. Absent changes to the Proposal, those credits will substantially undermine the effectiveness of EPA's NOx standard. Commenters urge EPA to include BEV and FCEV technologies in its analysis of the appropriate NOx standard. See Section IV.B, supra. In the alternative, EPA should eliminate the provisions allowing BEVs and FCEVs to generate NOx credits, or at a minimum sunset the generation of those credits in MY 2026. [EPA-HQ-OAR-2019-0055-1302-A1, p.52]

EPA's proposed NOx emissions credits are intended to provide an incentive for adoption of zero-emission technologies and an 'opportunity for manufacturers to develop and refine transferable technologies to BECs and FCEVs (e.g., batteries, electric motors).' 87 Fed. Reg. at 17,556–57. EPA's Proposal would provide a one-for-one credit—that is, it does not include multipliers—because these technologies are relatively 'mature,' and in reliance on analyses indicating that 'BEV technologies will reach parity in the total cost of ownership with CI or SI engine technologies in most market segments by 2025 or earlier.' Id. at 17,561–62. Although the Proposal would allow manufacturers to generate credits from BEVs and FCEVs, EPA's underlying emissions standards do not consider '[hybrid electric vehicles (HEV)], BEV, or FCEV technologies,' based on EPA's conclusion that such technologies can achieve only limited penetration within the relevant model years. Id. at 17,458 (also requesting comment on whether EPA should instead include such technologies in its feasibility analyses for its NOx standards based on 'information showing higher BEV/FCEV market penetration in the MY 2027 or later timeframe'). [EPA-HQ-OAR-2019-0055-1302-A1, p.52]

As currently structured, the credit proposal would permit unnecessary and unlawful pollution. As EPA recognizes, NO X emissions credits create 'the potential for a greater portion of CI engines to emit up to the level of the FEL cap.' Id. at 17,560–61. Three elements of the Proposal sharply increase the likelihood and magnitude of those increased emissions. First, EPA has (as set forth in Section III, above) markedly underestimated HD ZEV market penetration in the relevant model years, even in a baseline scenario. See also 87 Fed. Reg. at 17,561–62 (recognizing that BEV technologies may reach cost parity in most market segments by 2025 or earlier). A more realistic estimate of baseline market penetration undermines EPA's rationale for providing NOx credits; there is no need to provide regulatory incentives for vehicles that will be built and sold based on their cost-competitiveness, to meet existing regulatory requirements, or to satisfy corporate or fleet commitments. And such an estimate suggests that the credits will erode the standards' effectiveness far more than the Proposal acknowledges, permitting a substantial number of vehicles to pollute at the FEL cap with concomitant adverse effects for surrounding communities.232 The result is a standard that, taken as a whole, fails to achieve the statute's requirement of the greatest achievable emissions reductions. 42 U.S.C. 7521(a)(3)(A)(i). [EPA-HQ-OAR-2019-0055-1302-A1, p.52]

232 See CARB, Final Statement of Reasons for Rulemaking Including Summary of Comments and Agency Responses 196–203 (Aug. 27, 2020), https://ww2.arb.ca.gov/sites/default/files/barcu/board/rulemaking/hdomnibuslownox/fsor.pdf (assessing impacts of credits on emissions reductions).

In the alternative, we ask EPA to eliminate the provisions of its rule allowing BEVs and FCEVs to generate NOx credits, see Section IV.E, infra (suggesting elimination of transitional credits), or at a minimum to 'sunset' the generation of BEV and FCEV NOx credits no later than MY 2026. EPA recognizes in its Proposal that once 'BEVs and FCEVs [have transitioned] into mainstream technologies in the heavy-duty market,' it would be appropriate to 'sunset, i.e., end, the generation and use of NOx emissions credits for BEVs and FCEVs.' 87 Fed. Reg. at 17,561. A more accurate projection of BEV and FCEV emergence indicates that the transition is occurring at a pace that warrants excluding those vehicles from the NOx credit program. See Section III, supra. If EPA does permit BEVs and FCEVs to generate NOx credits, the Agency should at least end the generation of credits well before MY 2027. Given the likelihood that BEVs and/or FCEVs will be cost-competitive in most applications by 2027, allowing credits beyond that point would needlessly dilute EPA's emissions standards. And if EPA retains non-ZEV transitional credits in its final rule, manufacturers will—even without BEV and FCEV credits—amass ample credits to retain any necessary flexibility in compliance with the standards. [EPA-HQ-OAR-2019-0055-1302-A1, p.53]

See Section IV.E, infra (describing glut of credits that will result from gap between federal and Omnibus standards during MY 2024–26). Commenters also agree that EPA should not adopt any emission credit multipliers, 87 Fed. Reg at 17,562 (requesting comments on whether emission credit multipliers should be included in the final rule). If EPA does permit the generation of NOx credits from BEVs and FCEVs, Commenters support EPA's proposed useful-life and warranty certification requirements for the generation of NOx credits from those vehicles, 87 Fed. Reg. at 17,553. We would also urge EPA to shorten the lifespan of any NOx credits generated by BEVs and FCEVs for the reasons explained in Section IV.E (discussing the effects of credit oversupply). [EPA-HQ-OAR-2019-0055-1302-A1, p.54]

Finally, EPA should in any event—but especially if it includes provisions for BEV and FCEV credits—make its FEL caps more stringent. See Section IV.D.2.c, infra. The inclusion of credits, as EPA acknowledges, increases the risk that a greater number of HDVs will pollute up to the level of the FEL cap. See also 87 Fed. Reg. at 17,552 ('The zero-tailpipe emissions performances of BEVs and FCEVs inherently provides the opportunity for manufacturers to generate more credits from these vehicles relative to conventional engines that produce between zero and the level [of] the standard.'). Ensuring that the FEL cap is appropriately stringent is, consequently, an especially critical component of any standard that includes credits. [EPA-HQ-OAR-2019-0055-1302-A1, p.54]

Organization: *Clean Energy Ventures et al.*

In the current Proposal, EPA is providing incentives that reward BEVs and FCEVs that are not available to other technologies or strategies that can achieve the same – or even greater – NOx or GHG emissions benefits when upstream and other indirect emissions are considered. Such an approach is likely to send market signals that will stifle innovation by companies that are developing non-BEV and non-FCEV decarbonization technologies, as well as reduce opportunities to increase the use of low-carbon, renewable, American-produced biofuels as part of the Clean Truck Plan's decarbonization strategy. [EPA-HQ-OAR-2019-0055-2339-A2, p.2]

Organization: *Coalition for Clean Air*

In addition, we are concerned that the Zero Emission Vehicle credits as proposed could inhibit reductions of diesel emissions. ZEVs should not be allowed to generate NOx credits, because those credits will be used to allow higher NOx emissions. [EPA-HQ-OAR-2019-0055-1139-A1, p.2]

Organization: *Consumer Reports (CR)*

In the rule, EPA is proposing to continue to use averaging, banking, and trading (ABT) of credits generated against heavy-duty engine criteria pollutant standards; provide incentives for early adoption of technologies to meet the standards; and allow manufacturers to generate NOx emission credits for hybrid electric (HEV), battery-electric (BEV), and fuel-cell-electric (FCEV) vehicles.52 While credits can be useful to encourage early adoption of technology, and to encourage adoption of low- or zero-emission technologies, they can also serve to disincentivize further improvements to internal combustion engine technology by allowing manufacturers to average out high-emitting internal-combustion engines (ICE) with ZEV and other credits.53 CR supports EPA's proposal to generate credits for early adoption of technologies prior to MY 2027. However, NOx credits from HEV, BEVs and FCEVs will ultimately limit the effectiveness of the proposed rule by generating too many credits. Manufacturers will be able to sell non-compliant polluting vehicles for many years and would lack incentive to adopt improved ICE technology. To prevent this outcome, EPA should not offer ZEV credits after 2027. Instead, EPA should set stringent standards that would drive adoption of the EPA HDV rule. However, if EPA ultimately decides to finalize the rule allowing ZEVs to generate NOx credits, EPA should not include any multipliers and should limit the use of NOx credits by sunsetting their use after five years or less, by limiting credit life to five years, and by lowering the family emission limit (FEL) cap. [EPA-HQ-OAR-2019-0055-1285-A1, pp.8-9]

52 87 F.R. 17426.

53 Sara Kelly and Ben Sharpe, Impacts of crediting zero-emission vehicles in the upcoming federal regulation for criteria pollutants from heavy-duty engines and vehicles, International Counsel on Clean Transportation, International Counsel on Clean Transportation, (January 2022). Available at: https://theicct.org/wp-content/uploads/2022/02/us-ze-hdvs-pollutant-credits-feb22.pdf.

Organization: *Daimler Truck North America LLC (DTNA)*

EPA should allow ZEVs to generate NOx credits, in recognition of their significant emission reduction benefits and the need to help manufacturers manage their investments. [EPA-HQ-OAR-2019-0055-1168-A1, p.80]

131 We request that EPA keep in mind its statutory directive to ensure that criteria pollutant emission standards for heavy-duty vehicles reflect the 'greatest degree of emission reduction achievable' through the application of technology that EPA determines will be available for the model year to which such standards apply, giving

'appropriate consideration to cost, energy, and safety factors associated with the application of such technology.' 42 U.S.C. §7521(a)(3)(A)(i). Compliance flexibilities such as the NOx credit program are essential to the achievability of the very stringent NOx standards that EPA has proposed, thus the considerations in CAA Section 202(a)(3)(A)(i) are relevant to appropriateness of the requirements that EPA has proposed for credit-generating ZEVs. [EPA-HQ-OAR-2019-0055-1168-A1, pp.117-118]

Organization: *Eaton Vehicle Group (Eaton)*

However, NOx emissions are in fact local in nature in terms of harmful effects and they are also a powertrain attribute, not a vehicle attribute. The entire NOx rule (both the existing 2020 regulations and the proposed in the NPRM) treat NOx as an engine attribute and regulate engine performance. Thus, it does not make sense to average an engine performance attribute (NOx tested on FTP, LLC etc.) with a vehicle attribute (zero emissions in the absence of an engine). NOx emissions averaging with such high variance could have negative and unpredictable effects:

1. It can artificially maintain high NOx emissions in industrial areas such as around ports, distribution centers and freight corridors, which raises environmental justice concerns.
2. It can move the NOx emissions from the communities with high electrical vehicle penetration to those that live around fossil fuel or natural gas energy plants, where real NOx emissions will be emitted.
3. It makes it difficult for planners to achieve ozone attainment as the actual NOx emissions in any particular area does not match the commercial vehicle activity in that area. Thus, our recommendation is to not average engine NOx emissions with zero-emissions vehicles. [EPA-HQ-OAR-2019-0055-1252-A1, p.7]

Agency Request / Topic: We are also interested in stakeholder input on our proposed requirements for manufacturers choosing to generate NOx emission credits from BEVs or FCEVs, as well as whether EPA should consider for this final rule, or other future rules, restrictions for NOx emission credits in the longer term (e.g., beyond MY 2031) (See Section IV.I for details). [EPA-HQ-OAR-2019-0055-1252-A1, p.9]

Eaton Comment Strategy / Materials: Due to the local effects of NOx emissions, we believe NOx standards should be achieved on 100% of diesel-powered vehicles to ensure clean air around highways, urban centers, underserved communities regardless of fleet-level BEV/FCEV sales. This ensures environmental justice and allows planners to put in place effective ozone attainment strategies. As explained, BEV in fact move NOx emissions to the power plant; thus averaging can in fact increase NOx emissions in other regions. [EPA-HQ-OAR-2019-0055-1252-A1, p.9]

Organization: *Environmental Defense Fund (EDF)*

As we discuss above, EPA should adopt multipollutant standards that consider the availability of ZEVs in establishing both NOx and greenhouse gas standards. EPA's proposal, however, does not consider ZEV technologies in setting NOx standards but does provide NOx credits for ZEVs in demonstrating compliance. In particular, NOx credits earned in MYs 2024-2026 can be carried over to MY 2027 and beyond if the credit earning vehicles meet the 'other' requirements (useful life, warranty, low load NOx standard, etc.), which would begin in MY 2027. As a result of this approach, instead of delivering additional air pollution benefits, ZEVs will instead significantly dilute the efficacy of the standard and allow for higher-polluting diesel vehicles to be sold. [EPA-HQ-OAR-2019-0055-1265-A1, p.22]

EDF analyzed the impacts of these crediting provisions, including the number of MY 2027 and later heavy-duty vehicles that could be certified to the maximum family emission level (FEL) under EPA's proposal, as well as the total tons of additional NOx emissions allowed by the BEV averaging. (See Attachment H for the full analysis). [EPA-HQ-OAR-2019-0055-1265-A1, p.23]

Our analysis used ERM BEV sales Scenario 2b (reflecting existing and reasonably foreseeable ACT adoption) to project baseline nationwide BEV sales likely to generate NOx credits. To calculate NOx credits earned by these BEVs, we used EPA's NOx credit calculation from the proposal, assuming a NOx standard of 200 mg/bhp-hr in MY 2024-2026 and EPA's Option 1 NOx standards of 35 mg/bhp-hr for MY 2027-2030 and 20 mg/bhp-hr for MYs 2031 and beyond. Applying the equation for NOx credits to the BEV sales, we estimated that the cumulative NOx credits earned by all BEVs through 2035 are 190,000 megagrams (metric tons). [EPA-HQ-OAR-2019-0055-1265-A1, p.23]

In order to put these levels of NOx credits in perspective, we calculated the number of vehicles that can be certified to the FEL cap and the increase in NOx emissions. We assumed manufacturers would use the credits to allow some of their heavy-duty vehicles to avoid as much of the increased stringency of the MY 2027 and MY 2031 NOx standards as possible. We assumed that manufacturers would utilize their credits within the same vehicle type and regulatory class in which they were earned to avoid proposed limitations on the transfer of credits between classes. We also assumed credits earned in MYs 2024-2026 would be banked for use in MYs 2027-2030. [EPA-HQ-OAR-2019-0055-1265-A1, p.23]

We calculated the number of vehicles that could be certified to the FEL cap of 115 mg/bhp-hr NOx and the percentage of national sales of vehicles in each category. By 2030, nearly 90 percent of school buses, 80 percent of transit buses, 35 percent of single unit trucks and a quarter of all tractors could be certified to a level of 115 mg/bhp-hr instead of meeting the proposed NOx standard of 35 mg/bhp-hr. And by 2035, nearly half of all school buses, 45 percent of Class 4-8 single unit trucks and a quarter of all tractors would still be emitting NOx at 115 mg/bhp-hr – nearly six times higher than the emissions standard of 20 mg/bhp-hr for 2031 and beyond. [EPA-HQ-OAR-2019-0055-1265-A1, p.23]

The ability to certify vehicles at the FEL cap instead of the 35 or 20 mg/bhp-hr level increases onroad NOx emissions until all of these vehicles are retired. We estimate the impact of certifying to the FEL caps using lifetime NOx emissions from EPA's MOVES3. The increase in lifetime NOx emissions from FEL cap certified engines (in metric tons) would be 174,000-213,000 metric tons through 2035. This increase is over 33 percent of the 559,000 ton reduction in NOx emissions that EPA projects for the Option 1 standards in 2045. Appendix G describes the results of this analysis and the methodology we used to conduct it in more detail. [EPA-HQ-OAR-2019-0055-1265-A1, p.23]

As these results demonstrate, EPA's proposal to allow ZEVs to generate NOx credits is damaging and would substantially erode the NOx benefits of the proposal. Accordingly, if EPA continues to establish NOx standards in a manner that does not consider ZEV technologies, EDF urges EPA to sunset the BEV and FCEV credits that are proposed at 87 Fed. Reg. 17561. However, if EPA retains these credits in any form, it is critically important that the agency not adopt any credit multipliers and that EPA substantially strengthen the FEL cap to help ensure remaining diesel vehicles are not able to certify to higher emission levels based on the availability of ZEV credits. [EPA-HQ-OAR-2019-0055-1265-A1, p.23]

Accordingly, if EPA continues to establish NOx standards in a manner that does not consider ZEV technologies, EDF urges EPA to sunset the BEV and FCEV credits that are proposed at 87 Fed. Reg. 17561. [EPA-HQ-OAR-2019-0055-1265-A1, p.23]

Organization: *Environmental Protection Network (EPN)*

Allowing EVs to generate NOx credits used by manufacturers of internal combustion (IC) engines is a major change in the HD program. The NOx standard currently applies to the manufacturers of IC engines that are used in HD vehicles. Unlike the program for light-duty vehicles, EVs in the HD sector are not included in the demonstration a manufacturer makes to show compliance with the NOx standard for IC engines. Manufacturers upgrade and improve their IC engines and use the resulting reduction in NOx emissions to demonstrate compliance with the HD engine standards. [EPA-HQ-OAR-2019-0055-1233-A1, p. 1]

EVs clearly reduce emissions of NOx, along with other pollutants such as particulate matter (PM) and GHGs. A critical reason to promote the transition to EVs is their tremendous potential to reduce harmful emissions from HD vehicles. The importance of promoting EVs as a critical multi-pollutant control strategy does not mean EVs should be used in a way that undercuts emission control from IC-powered vehicles. [EPA-HQ-OAR-2019-0055-1233-A1, p. 2]

Unfortunately, EPA's proposed allowance for EV NOx credits does just that. EPN believes it is highly likely that most, if not all, of the EVs used to generate NOx credits would be produced with or without the proposed NOx credits. The NOx credits would not appear to incentivize any real increase in production of EVs, given the current market transition already underway. Since the NOx reductions from these EVs would occur without the allowance for credits, allowing the credits produces no greater NOx reductions than would otherwise occur. However, allowing the credits will lead to greater NOx emissions from IC engines, especially diesel engines, than would occur without the credits. This means EPA's proposed Zero-Emission Vehicle (ZEV) NOx credits could cause a substantial increase in NOx emissions from IC engines compared to what could and should occur with no offsetting reductions. It runs counter to the core goal of achieving major reductions in NOx emissions, and EPA fails to justify the need to allow this increase in emissions. EPN opposes the proposed allowance for NOx credits from EVs. [EPA-HQ-OAR-2019-0055-1233-A1, p. 2]

If EPA decides to adopt some form of NOx credits for EVs, EPN recommends that EPA severely limit their allowance. For example, no credits should be allowed for MYs prior to MY 2027, the first year that more stringent NOx standards would apply. The amount of such early credits could be very large, based on the difference between zero emissions and the current NOx standard, which is approximately 10 times higher than the proposed standards. Allowing EVs to generate very large numbers of credits against the current standard would be a windfall that could seriously undercut the future, more stringent NOx standards. EPN recommends that at most, EPA allow any credits generated prior to MY 2027 to be based on the difference between zero and the level of the NOx standards that would apply in MYs 2027 and later. EPN also suggests that EPA not allow EVs to both show compliance with the revised GHG standards and generate NOx credits. A manufacturer should use EVs to either generate NOx credits or use the EV in its compliance demonstration for the revised GHG standards, but not both. This would mean the volume of EVs generating NOx credits are above and beyond those produced to meet the GHG standards. This would at least move in the direction of reducing the risk that NOx credits are from EVs that would have been produced in any case. [EPA-HQ-OAR-2019-0055-1233-A1, p. 2]

EPN is not suggesting these options because we believe they are a reasonable or appropriate approach, but only as options to reduce the adverse emissions impact if EPA decides to allow NOx credits for EVs. EPN believes that EPA would have to clearly and robustly justify the technological or other need to provide manufacturers with this relaxation in the stringency of the NOx standard. EPN feels that EPA should not lightly decide to allow NOx credits for EVs given the transition already occurring without the credits and the great need for NOx reductions. It would take a clear and strong case to justify any allowance for NOx credits for EVs, and EPA’s proposal fails to provide one. [EPA-HQ-OAR-2019-0055-1233-A1, p. 2]

Organization: *Ford Motor Company (Ford)*

We support the regulatory provisions to generate NOx credits from ZEVs. However, given the uncertainty in the heavy-duty commercial truck segment about the durability of ZEV high-voltage batteries and fuel cells, we recommend that partial NOx credits be available for ZEVs with a declared full useful life below the designated full-useful life of the particular engine service class. This regulatory flexibility is appropriate in light of the emissions reductions achieved and will be vital to ensuring broader deployment of heavy-duty ZEVs. [EPA-HQ-OAR-2019-0055-1300-A1, p. 4]

Organization: *General Motors LLC (GM)*

Battery electric vehicles (BEVs) and fuel cell vehicles (FCVs) will help GM achieve zero emissions. Including ZEVs in an averaging, banking, and trading program appropriately recognizes the role of zero emissions technologies in reducing real world emissions. [EPA-HQ-OAR-2019-0055-1246-A1, p.6]

Organization: *International Council on Clean Transportation (ICCT)*

EPA proposes to allow manufacturers to generate credits towards compliance with NOx engine standards through the sale of zero-emission powertrains. Our view is that allowing ZEVs to count toward the NOx standards will not increase ZEV adoption and will only reduce the NOx emission benefits of the rule for diesel engines. We view these credits as creating an inappropriate trade-off between public health and climate change. We also see a risk that these higher-emitting internal combustion engines could be concentrated in and around disadvantaged communities, undermining the administration's goal of addressing racial inequities. [EPA-HQ-OAR-2019-0055-1211-A1, p. 3]

RECOMMENDATION: We recommend EPA eliminate ZEV crediting towards compliance with NOx engine standards in 2027 and eliminate early generation credits. [EPA-HQ-OAR-2019-0055-1211-A1, p. 3]

ZEV crediting as currently proposed under EPA Option 1 will permit manufacturers to produce higher polluting diesel engines in return for greater ZEV sales. The implicit trade-off between climate and health implied in this regulatory design goes against international best practices for motor vehicle regulation first defined by the ICCT in 2001.21 We think such an incentive structure actually undermines progress towards NOx control, particularly during the proposed interim period between MY2027-2030. We explain below the basis for our recommendation to remove these credits. [EPA-HQ-OAR-2019-0055-1211-A1, p. 18]

> 21. The Energy Foundation (2001). Bellagio memorandum on motor vehicle policy: Principles for vehicles and fuels in response to global environmental and health imperatives. Bellagio, Italy, 19-21 June

The reason for our concern is the following: ZEV crediting has the potential to turn the NOx FEL cap, the maximum allowable emissions level to which a family of engines can be certified, into the de facto standard for diesel engines. Table 5 shows the percentage of diesel engines in the U.S. that could be certified at the FEL cap using only ZEV credits under EPA Option 1 for different ZEV uptake scenarios. Under likely state actions on ZEV deployment (MOU), 8% of diesel HDVs could be certified at the FEL cap using ZEV credits in 2031, and this share could increase to 11% by 2035 without further ZEV policies. Assuming accelerated ZEV uptake, the need to phase out ZEV crediting toward the NOx standards would be much greater: allowing ZEV crediting after 2031 could result in 76% (Alternative 1) to 85% (Alternative 3) of diesel HDVs being certified at the FEL cap in 2035 using ZEV credits alone. [EPA-HQ-OAR-2019-0055-1211-A1, p. 18]

Table 6 gives average zero-mile emission rates (ZMERs) under various scenarios. (See Attachment 1 - Appendix A for a description of scenarios.) ZEV crediting under EPA Option 1 could lead to ICE emission rates up to 4 times as high as no crediting in MY 2027-2030 and up to 2.25 times as high in 2031. Under scenarios of rapid ZEV uptake (Alt 1-3), ZEV crediting after 2031 could allow new diesel engines sold after 2031 to emit more than those sold prior to 2031, despite the tightening of certification limits. Strengthening EPA's Option 1 to match state HDV Omnibus requirements starting in 2027 would ensure that diesel engines entering the fleet emit 89% less NOx than those certified to current EPA 2010 standards. [EPA-HQ-OAR-2019-0055-1211-A1, p. 19]

We recommend EPA remove ZEV crediting towards compliance with NOx engine standards in MY2027. If EPA does not adopt this recommendation, we recommend EPA reduce the FEL cap for MY2027–2030 from 150 mg/bbhp-hr to 65 mg/bhp-hr, which would lead to a maximum average zero-mile emission rate of 23 in model years 2027-2030. [EPA-HQ-OAR-2019-0055-1211-A1, pp. 19 - 20]

Figure 8 illustrates the benefits of increased ZEV deployment on total NOx emissions from model year 2027- 2030 vehicles. Because of ZEV crediting, higher levels of ZEV deployment in these early years leads to fewer emissions benefits across the heavy-duty sector. Removing ZEV crediting from the proposal reverses this trend, ensuring that higher ZEV deployment leads to more benefits. [EPA-HQ-OAR-2019-0055-1211-A1, p. 20]

Organization: *Lion Electric Co. USA Inc. (Lion)*

To encourage OEMs to meet these standards, we strongly support providing opportunities for manufacturers to generate NOx emission credits, along with the use of credit multipliers, at least in the first few years of the proposed changes. This is an excellent way to encourage more OEMs to manufacture ZEVs, bringing the electric vehicle market closer to cost parity with ICE vehicles and accelerate long-term ZEV adoption. Lion believes that these credit allowances will boost ZEV production and adoption, and can always be revisited in future rulemaking once the market has advanced. [EPA-HQ-OAR-2019-0055-1151-A2, p. 2]

Organization: *Maine Department of Environmental Protection (Department)*

Using the CARB Heavy-Duty Omnibus Regulation as a bellwether, the Department requests the following revisions to the federal proposal: [EPA-HQ-OAR-2019-0055-1288-A1, p.6]

- Unfortunately, EPA is proposing to continue to allow averaging banking and trading of NOx credits generated against applicable heavy-duty diesel engine NOx standards. As part of this proposal, manufacturers could certify battery electric and fuel cell vehicles to generate NOx emissions credits and offset higher NOx emission rates, which could unintentionally erode the stringency of the heavy-duty NOx standards if heavy-duty ZEV sales exceed those assumed in the NPRM.18 [EPA-HQ-OAR-2019-0055-1288-A1, pp.7-8]

18 The EPA used data from 2016 (and earlier) in its heavy-duty ZEV forecasts, which significantly underestimate the market penetration of ZEV technology. Significant technical and policy developments have occurred since those studies were published, including reductions in battery cell and pack costs, improvements in range, and reductions in battery weight. In addition, the policy landscape has changed with the finalization of the CARB Advanced Clean Trucks (ACT) and Advanced Clean Fleets regulations and the adoption of ACT in five Clean Air Act Section 177 states.

Organization: *Manufacturers of Emission Controls Association (MECA)*

MECA is concerned with the credit mechanisms proposed for zero-emission trucks for both NOx and GHGs. First, we recommend a reduction in the FEL cap down to 0.05 g/bhp-hr at 435,000 miles that scales with FUL, which harmonizes with CARB’s Omnibus. A higher FEL cap, such as the proposed 0.15 g/bhp-hr, would result in a loss in NOx emissions benefits that could disproportionately impact disadvantaged communities. Second, we support the exclusion of ZEVs from earning NOx credits. CARB originally proposed to allow ZEVs to earn NOx credits until MY 2030. However, after analyzing the impacts and considering the high anticipated uptake of electric vehicles over the next decade, CARB revised its proposal and will end ZEV NOx credits in MY 2026. MECA calculated that CARB's original proposal would lead to 12,000 higher emitting diesel trucks with service lifetimes of 10-15 years that could be sold in California alone, generating an additional 523 tons of NOx over their useful lives. [EPA-HQ-OAR-2019-0055-1320-A1, p.28]

We believe that the NOx inventory impact from direct NOx credit averaging and banking is a conservative estimate because ZEV NOx credits fail to take into account the upstream NOx emissions from the electrical grid that will be used to charge electric trucks. Lifecycle emissions analysis is becoming the established methodology for understanding the upstream and downstream impacts of the transportation sector and can be used to predict the overall environmental impact of policy decisions. [EPA-HQ-OAR-2019-0055-1320-A1, p.28]

To illustrate the relative NOx inventory contribution of battery electric trucks compared to their near-zero combustion counterparts, we relied on U.S. EPA's eGrid average annual NOx emission values for in-state electricity production. We took into account renewable energy targets (e.g., California has renewable energy targets of 44% in 2024 to 60% in 2030) and manufacturer claimed electric efficiencies from marketing materials. In our conservative approach, transmission and charging losses were not included, nor were smart charging strategies. Furthermore, fuel economy values of 7 mpg were approximated for Class 8 trucks using U.S. DOE and industry publications for diesel vehicles, even though these are lower than required by HD Phase 2 GHG regulations. Upstream fuel related NOx emissions from refining of 20% were also added. [EPA-HQ-OAR-2019-0055-1320-A1, pp.28-29]

On a gram-per-mile basis, a MY 2027 and later class 8 low NOx diesel truck will emit approximately 0.1 g/mile at full useful life. The grid emissions from the same weight class battery electric truck will lead to upstream emissions of 0.25 g/mile in 2024 and 0.18 g/mile in 2030 as the grid continues to incorporate higher percentages of renewable sources of energy. This analysis is not meant to suggest that one truck technology is cleaner than another since only NOx emissions were considered. It simply illustrates that crediting battery electric trucks as zero NOx in the ABT program is not warranted. Since EPA's Clean Trucks Rule starts in MY 2027, we encourage the agency to follow CARB and remove the ability for ZEV to generate NOx credits. [EPA-HQ-OAR-2019-0055-1320-A1, p.29]

EPA staff should reconsider the generous credit provisions with respect to NOx credits and ZEV credit multipliers in light of the numerous OEM announcements of market introductions of EV trucks. Furthermore, stringent CO2 standards being adopted in other global markets, such as Europe, will drive electric truck technology in the US into the market. All of these factors should be considered when revising the Phase 2 vehicle GHG limits and credit considerations. An underestimation of the EV penetration in light of generous credits could significantly increase emissions of NOx and CO2 from combustion powered trucks. Our industry is prepared to do its part and deliver cost-effective and durable advanced emission control and efficiency technologies to the heavy-duty sector to assist in simultaneously achieving lower GHG and NOx emissions, while also meeting other criterial pollutant standards. [EPA-HQ-OAR-2019-0055-1320-A1, p.34]

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

MEMA encourages EPA to not issue NOx credits for battery electric vehicles or fuel cell electric vehicles to avoid unintended backsliding and lowering of technology deployment on internal combustion engine heavy-duty vehicles. [EPA-HQ-OAR-2019-0055-1322-A1, p. 4]

Organization: *Moving Forward Network (MFN)*

Given the myriad risks posed by EPA's proposed averaging scheme, if EPA refuses to adopt more stringent standards that reflect the feasibility of achieving significant emissions reductions through the application of ZE truck technologies, EPA must remove ZEV credits from the NOx compliance calculations. The current proposal fails to properly account for the on-going transition to ZEVs and the feasibility of ZEVs as NOx reduction technology, while allowing ZEV to undermine an already weak combustion engine standard. Consequently, the combustion engine standard will weaken over time as more ZEV are sold due to state policies and market economics. EPA cannot defend the inclusion of these credits with either Option 1 or Option 2 as meeting the requirements of the Act. Unless EPA intends to accelerate ZEV adoption, ZEV credits must be excluded from the NOx compliance calculation. [EPA-HQ-OAR-2019-0055-1277-A1, p. 21]

As noted in Section II, zero-emission trucks are projected to reach a much greater degree of market penetration than EPA's projections. However, the best way of driving the adoption of these vehicles is to require their sale. [EPA-HQ-OAR-2019-0055-1277-A1, p. 46]

By crediting the sale of these zero-emission solutions without considering them when setting the average requirements, EPA has created a perverse situation where the sale of a zero-emission truck results in the sale of a dirtier diesel vehicle. This is untenable for the communities suffering from freight pollution, particularly when the dirtiest vehicles on the road are likely to end up in those overburdened communities.178 [EPA-HQ-OAR-2019-0055-1277-A1, p. 46]

> 178. See Chernova 2018 (https://digitalcommons.law.ggu.edu/cgi/viewcontent.cgi?article=1150&context=gguelj) and references contained therein.

EPA's best option is to consider and drive the sale of these vehicles separately, as outlined in Section II.A. If EPA insists on retaining zero-emission trucks in a vehicle NOx standard, EPA must lower the NOx standard to reflect the greatest degree of emission reductions achievable across the entire truck fleet based on the feasibility of widespread transition to zero-emission trucks, as outlined in Section II.B. [EPA-HQ-OAR-2019-0055-1277-A1, p. 46]

ZEV credits from Omnibus states were considered in the 2024-2026 timeframe under the Omnibus average stringency, since manufacturers can earn ZEV credits toward their requirements in that timeframe. However, nationwide sales in the 2024-2026 period still yield

ZEV credits. As zero-emission trucks approach even just an 11 percent marketshare in 2030, credits from these vehicles surpass 13,000 metric tons—by 2035, at a projected share of just 17 percent this is doubled to 26,000 owing to increased FUL as well as marketshare. [EPA-HQ-OAR-2019-0055-1277-A1, p. 55]

Organization: *National Association of Clean Water Agencies (NACWA)*

NACWA supports EPA's efforts to incentivize zero emissions vehicle (ZEV) and near-zero emission vehicle (NZEV) development while reducing nitrogen oxides (NOx), particulate matter, and greenhouse gas emissions. This is important for publicly owned treatment works (POTWs) that are major stationary sources and located in nonattainment air basins, since these utilities may face significant penalties. POTWs have no option to reduce or stop their operations – they must operate continuously to provide reliable wastewater treatment and protect public health and the environment. [EPA-HQ-OAR-2019-0055-1343-A1, p.1]

Organization: *Northeast States for Coordinated Air Use Management (NESCAUM)*

In particular, if heavy-duty ZEV sales exceed the sales projections that EPA assumed in the NPRM, substantial heavy-duty engine NOx credits would be available in the ABT program. The projections for heavy-duty ZEV sales in the NPRM relied on data from 2016 or earlier and significant technical and policy developments have occurred since those studies were published. Examples are reductions in battery cell and pack costs, improvements in range, and reductions in battery weight. In addition, the policy landscape has changed with the finalization of the CARB Advanced Clean Trucks (ACT) and Advanced Clean Fleets regulations and the adoption of ACT in five Clean Air Act Section 177 states. [EPA-HQ-OAR-2019-0055-1249-A1, pp. 14 - 15]

44. 87 Fed. Reg. 17414 (March 28, 2022), at 17550.

Organization: *Oshkosh Corporation*

Oshkosh supports EPA's proposal to allow all heavy-duty EVs (including BEVs and FCEVs) to generate NOx credits. See Proposed Rule, 87 Fed. Reg. at 17,556. EPA requests comment on its proposed approach to limit the use of NOx emission credits generated from BEVs or FCEVs to the averaging sets in which they are generated. Id. at 17,558. In response to this request, Oshkosh submits that EPA should encourage maximum penetration of heavy-duty EVs by adopting an approach that would allow BEV-generated credits to be used in any heavy-duty engine or vehicle family. Not only would this approach provide crucial incentives for heavy-duty EV production at an important stage of market and technological development, but the approach is warranted given the high bar that EPA proposes to set through new testing, useful life, warranty, and durability requirements for credit generating BEVs and FCEVs. [EPA-HQ-OAR-2019-0055-1226-A1, p. 5]

To provide further incentives for EV development, Oshkosh also requests that EPA ensure harmonization of NOx and CO2 credit programs for heavy-duty vehicles. In general, we request that EPA modify existing credit ABT programs to (1) allow credit transport across all heavy-duty engine/vehicle families; (2) allow a credit life of 10 years for credits generated by EV, FCEV and hybrid technologies; and (3) guard existing credit banks to enable carry over of legacy credits to future programs. [EPA-HQ-OAR-2019-0055-1226-A1, p. 6]

Organization: *Ozone Transport Commission (OTC) and Mid-Atlantic/Northeast Visibility Union (MANE-VU)*

In addition, if heavy-duty ZEV sales exceed EPA's projections, substantial heavy-duty engine NOx credits would be available in the ABT program. The projections for heavy-duty ZEV sales in the NPRM rely on data from 2016 or earlier. Significant technical and policy developments have occurred since those studies were published. Because of this, we believe heavy-duty ZEV sales will be significantly greater than the 1.5 percent of heavy-duty vehicle sales in 2027 and subsequent model years that EPA assumed. [EPA-HQ-OAR-2019-0055-1250-A1, p.16]

40 87 Fed. Reg. 17414 (March 28, 2022), at 17550.

Organization: *PACCAR, Inc (PACCAR)*

PACCAR supports EPA's initiative to offer NOx credits to incentivize ZEV adoption. See proposed 1037.616 (NOx credits for electric vehicles and fuel cell vehicles). Promulgating a NOx ABT program provides manufacturers with the needed flexibility to plan investments and manage product costs, while also providing time to overcome technical or lead-time challenges. Although we support starting the NOx credit bank for ZEVs and early credit in MY 2024, we do not support using NOx credits from earlier technology engines (i.e., pre-MY 2024) because EPA should further incentivize producing new low NOx and ZEV technologies. PACCAR also supports establishing a NOx FEL cap to avoid backsliding if ZEVs proliferate, and a reasonable NOx cap would support manufacturers' technological investments and provide manufacturers additional product planning flexibility to meet the NOx standard, while allowing them to focus research and development engineering resources toward future products. [EPA-HQ-OAR-2019-0055-1346-A1, p.35]

PACCAR summarizes below the major issues that EPA should take into account as it moves forward with this rulemaking: PACCAR supports EPA's initiative to allow NOx credit generation from ZEVs. [EPA-HQ-OAR-2019-0055-1346-A1, p.60]

Organization: *Rivian Automotive, LLC (Rivian)*

Because of the important and growing role of ZEV technology in reducing NOx emissions, Rivian generally supports EPA's proposal to allow ZEVs to earn credits toward NOx standard compliance. Even if the agency finds that the standards are feasible using conventional engine technologies alone, recognizing the development and sale of zero-emission trucks and buses on a one-for-one basis with their emissions abatement is valuable for accelerating the growth of the MHD ZEV industry to the point of economical and profitable scale. To the extent that concerns arise about the potential for backsliding on individual conventional engine performance due to the salutary effects of including ZEVs in the averaging set, Rivian encourages EPA to explore a more stringent emissions standard that expressly accounts for ZEV technology in its development. Rivian supports ZEVs earning NOx credits that recognize the zero tailpipe emissions. [EPA-HQ-OAR-2019-0055-1229-A1, p.4]

Organization: *Southern Environmental Law Center (SELC)*

Moreover, to advance these goals, the credit systems used in the nitrogen oxides (NOx) and GHG emissions standards must be properly tailored to ensure the regulations result in cleaner internal combustion engines and meaningful deployment of ZEV technology beyond the forecasted baseline. [EPA-HQ-OAR-2019-0055-1247-A1, pp.1-2]

EPA notes that proposed Option 1 is feasible without the use of credits.41 Yet the agency proposes to maintain the averaging, banking, and trading of credits and early adoption incentives to offer compliance flexibility for manufacturers. If these flexibilities are retained, it is critical that they do not unnecessarily dilute the effectiveness of the standards. Getting ZEVs on the road should be a priority, but efforts to incentivize their deployment cannot erode improvements intended for the internal combustion engines that will be sold during the period of the proposed rule. [EPA-HQ-OAR-2019-0055-1247-A1, p.7]

41 Id. at 17550.

For this reason, EPA should reconsider whether NOx emissions credits should be provided for ZEVs at all.42 If ZEVs are permitted to offset NOx emissions from other vehicles in manufacturers' fleets, manufacturers will be able to continue to sell highly polluting internal combustion vehicles that contribute to the significant public health and environmental impacts in communities. This is especially true given the fact that ZEV technology is not currently included in baseline compliance modeling due to EPA's artificially low ZEV market penetration projection discussed above. If EPA maintains the use of NOx credits, we support the agency's efforts to minimize backsliding of emissions reductions from internal combustion engine vehicles through credit restrictions and caps. EPA's proposed early incentive credit multipliers, however, should be scaled back or eliminated. [EPA-HQ-OAR-2019-0055-1247-A1, p.7]

42 Additionally, the elimination of ZEV credits would better align the standards with the Omnibus Regulation, which phases out ZEV credits after model year 2026. Id. at 17557.

EPA should also adjust the NOx and CO2 emissions credit systems to ensure that these compliance flexibilities do not unnecessarily dilute the stringency of the standards. [This comment can also be found in section 28.2 of this comment summary.] [EPA-HQ-OAR-2019-0055-1247-A1, p.8]

Organization: *South Coast Air Quality Management District*

Further, South Coast AQMD supports rapid deployment of HD ZEVs, but opposes NOx crediting for ZEV beyond MY 2026. A recent report issued by the International Council on Clean Transportation, which echoes information found in the Omnibus Final Statement of Reasons, analyzed the emissions impact from ZEV NOx credits and concluded that overly generous NOx crediting for ZEVs is less likely to incentivize additional ZEV deployment but rather would lead to a small NOx dis-benefit from engines with higher NOx emissions.44 [EPA-HQ-OAR-2019-0055-1201-A1, p.11]

44 International Council on Clean Transportation (ICCT), Impacts of Crediting Zero-Emission Vehicles in the Upcoming Federal Regulation for Criteria Pollutants from Heavy-Duty Engines and Vehicles (January 2022), available at https://theicct.org/wp-content/uploads/2022/02/us-ze-hdvs-pollutant-credits-feb22.pdf, pgs. 7-8; FSOR at 197.

We also support not permitting HD ZEV credits to be transferred to other vehicle weight classes. This might permit manufacturers to opt to produce lighter weight class ZEVs (Class 4-6) and use the credits to sell higher emitting HD diesel engine families which could result in further delay of the development and deployment of low NOx technologies. [EPA-HQ-OAR-2019-0055-1201-A1, p.11]

Organization: *States of California, et al. (The States)*

The States are enthusiastic about the significant potential of HD ZEVs to reduce NOx emissions and fully support rewarding early market entry of HD ZEVs. But conventional heavy-duty diesel engines and HD ZEVs will coexist on roads for a significant transition period.92 Thus, stringent federal emission limits must continue to control conventional engines' emissions effectively even as the market share of HD ZEVs grows. While the States support the generation of NOx credits from HD ZEVs, EPA should carefully calibrate this feature so that NOx standards for conventional diesel engines remain binding. In particular, the States urge EPA to:

- Limit the credit life to at most five years
- Sunset the generation of NOx credits from HD ZEVs in model year 2026
- Set FEL caps to match those in California's Omnibus Rule93 [EPA-HQ-OAR-2019-0055-1255-A1, p. 21]

92. The most recent projections by the National Renewable Energy Lab (NREL) for HD ZEV adoption, modeling only economic factors, show 42 percent adoption by 2030, but greater than 99 percent adoption only after 2035 (for light- to medium-duty trucks), 2046 (for medium-duty trucks), and 2042 (for heavy-duty trucks). C. Ledna et al., NREL, Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis, at 2, 20-22, 25 (Mar. 2022), https://doi.org/10.2172/1854583, attached as Exhibit 9 ("NREL Cost Analysis").

93. See 87 Fed. Reg. at 17,552 (discussing FEL caps in Omnibus Rule); 17,561 (discussing five-year credit life and sunset of credit generation).

First, because credits are best used to facilitate the transition to current, more effective NOx control technologies, a limited credit life commensurate with this transition period is appropriate. A five-year credit life, or even a shorter life such as three years, ensures credits are available to ease the transition to model year 2027 and later standards and reward early adoption of the most current NOx aftertreatment systems and HD ZEVs, without reducing or delaying widespread implementation of the standards in later years. Second, as EPA discusses, battery-electric trucks are expected to reach cost parity with conventional engines between 2025 and 2030.94 Sunsetting HD ZEV credit generation in model year 2026 would therefore incentivize early adoption and simultaneously prevent excess credit generation once market factors start to make them unnecessary. Third, lowering FEL caps prevents a surplus of credits from undermining the stringency of the proposed standards. [EPA-HQ-OAR-2019-0055-1255-A1, pp. 21 - 22]

94. Id. at 17,562.

The above limits on the ABT program ensure that early adoption of HD ZEVs remains attractive for manufacturers and operators, without compromising the environmental benefits expected under the proposed standards. Notably, States and the federal government alike already undertake numerous other incentives for HD ZEVs that are both more meaningful and less environmentally costly, including initiatives to deploy charging infrastructure for HD ZEVs, alternative fuel corridors, purchase rebate programs, and government fleet electrification.95 These initiatives enhance the market conditions that are projected to make HD ZEVs more attractive purchases than conventional trucks within the next decade.96 [EPA-HQ-OAR-2019-0055-1255-A1, p. 22]

95. Meyer & Dallmann, Air quality and health impacts of diesel truck emissions, supra note 13, at pp. iii, 16-17; Or. Dept. of Transp., Climate Action Plan 2021-26, at pp. 17-18 (Jul. 2021), attached as Exhibit 10; Gov. Jay Inslee, Policy Brief: Responding to the climate crisis and building Washington's clean energy future, at 6-8 (Dec. 2021), attached as Exhibit 11.

96. Id.; see also Jane Culkin & Dana Lowell, MJ Bradley & Assoc., Medium- & Heavy-Duty Vehicles: Market structure, Environmental Impact, and EV Readiness, at pp. 23-24 (Jul. 2021) (projecting cost parity for 76 percent of medium- and heavy-duty fleet by 2025-30), attached as Exhibit 12; D. Hall & N. Lutsey, International Council on Clean Transportation, Estimating the Infrastructure Needs and Costs for the Launch of Zero-Emission Trucks, at pp. 20-23, 25 (Aug. 2019) (predicting cost advantage for most HD ZEVs by 2030), EPA-HQ-OAR-2019-0055-0148.

Organization: *Tesla, Inc. (Tesla)*

In 2021, Tesla generated almost $1.5 billion in revenue selling zero-emission regulatory credits to other manufacturers.133 Proceeds from such sales go towards building new factories to produce BEVs – including in the heavy-duty sector - that will continue to displace ICE vehicles and their tailpipe emissions. For the U.S. to meet its decarbonization goals and to mitigate the public health and welfare impacts from climate change and criteria air pollutant emissions, EPA's proposal should allow heavy duty BEVs to generate NOx credits and be amended to meet increasingly more stringent regulatory requirements that support medium and heavy-duty manufacturers rapidly scaling up delivery of high-quality BEVs. [EPA-HQ-OAR-2019-0055-1219-A1, p.15]

133 Tesla, SEC Form 10-K (Jan. 26, 2022) at 37.

In Tesla's view, agency proposals that would prevent or reduce the role of BEVs in compliance are misguided, as heavy-duty BEVs represent the best NOx mitigation strategy, and should be recognized as such through the crediting provisions. NOx credits generated by BEVs under the NOx rule can also help further deploy BEVs by creating additional value that can be passed onto prospective buyers in the form of lower prices. While it is common practice today for internal combustion engine vehicle manufacturers to purchase regulatory credits from other companies (such as Tesla) to offset their total CO2 and other emissions, Tesla recognizes that in the long-term it is not a sustainable strategy. Accordingly, providing NOx crediting should be time limited to provide some near-term compliance flexibility while supporting much more stringent regulations and a full transition to BEV technology. [EPA-HQ-OAR-2019-0055-1219-A1, p.15]

Finally, Tesla supports sunsetting the use of NOx credits generated by ZEVs beyond MY 2031.139 This sunset provision would ensure that many of the credits generated in the program will have only a limited timeframe within which they can be generated, traded, and used to offset emissions deficits. As BEV penetration will grow rapidly Tesla supports a sunset date that will prevent overall emissions backsliding and ensure complete electrification of the medium- and heavy-duty sectors. [EPA-HQ-OAR-2019-0055-1219-A1, p.16]

139 87 Fed. Reg. at 17561

Organization: *Toyota Motor North America, Inc. (Toyota)*

Toyota appreciates EPA's concerns of credits impeding deployment of cleaner technologies on certain classes of vehicles. However, we think limiting the use of NOx emission credits generated from BEV or FCEV to the class, or "primary intended service," to which they were generated is unnecessarily inflexible. We believe credits should be transferrable across vehicle classes, with appropriate adjustments to account for differences in annual mileage and other factors to ensure emission tons-equivalence. This would allow flexibility to heavy HD vehicles as cleaner, longer-range technologies in the HD space are introduced to the fleet. Additionally, it would encourage HD vehicle OEMs to use BEV and FCEV powertrains when feasible across the classes that can be electrified more rapidly, leading to lower emissions overall. [EPA-HQ-OAR-2019-0055-1224-A1, p.2]

Organization: *Truck and Engine Manufacturers Association (EMA)*

As discussed above, ZEVs are beginning to emerge in the medium- and heavy-duty trucking industry, yet many significant challenges remain for manufacturers, fleets, utilities, governments, and other stakeholders before we can point to the beginning of a broad-based transition of the industry to ZEVs. While aspirations are quite high right now, a great deal of work remains before trucking fleets will be willing to make the significant and long-term investments needed to begin transitioning to ZEVs in a meaningful way. At this time, most medium- and heavyduty ZEVs in service are prototypes or demonstration units that are a long way from providing trucking businesses with the competitive total cost of ownership that they need to justify beginning the process of converting to ZEVs. [EPA-HQ-OAR-2019-0055-1203-A1, p. 109]

The NPRM proposes to reduce the barriers to ZEV adoption by allowing BEVs and FCEVs to generate NOx credits beginning in model year 2024. EMA endorses that strategy as a way not only to incentivize ZEVs, but also to provide manufacturers additional product planning flexibility to meet the NOx standard. [EPA-HQ-OAR-2019-0055-1203-A1, p. 109]

Organization: *Valero Energy Corporation*

The current HD engine and vehicle regulations do not allow electric HD vehicles to generate NOx or particulate matter ('PM') emission credits.7 Ignoring upstream emissions associated with electricity generation based on the rationale that these emissions are subject to regulation at the source of generation, EPA now proposes to allow BEVs and FCEVs to generate tailpipe NOx emission credits. [EPA-HQ-OAR-2019-0055-1328-A2, p.6]

7 40 CFR 86.016-1(d)(4)

EPA does not describe how allowing EVs to generate NOx emission credits for the first time is consistent with its statutory authority. [EPA-HQ-OAR-2019-0055-1328-A2, p.6]

Organization: *Westport Fuels Systems (WFS)*

As policymakers create frameworks to both encourage and support the deployment of new technologies, RNG and Hydrogen ICEs should be given equal footing to Fuel Cell Electric Trucks and battery electric trucks. [This comment can also be found in section 3.10 of this comment summary.] [EPA-HQ-OAR-2019-0055-1278-A1, p.1]

Organization: *Wisconsin Department of Natural Resources (WDNR)*

Incentivizing accelerated adoption of heavy-duty ZEV’s will have a positive impact on air quality; however, it is also important to ensure that combustion engines, which will remain a significant portion of the heavy-duty vehicle fleet for many years, are also required to reduce emissions. EPA’s NOx credit trading program in the proposal allows NOx credits generated by ZEVs to be traded with those generated by combustion engines with no backstop. If the market share of ZEVs accelerates more quickly than EPA estimates in this proposal, it is possible that high emitting internal combustion engines will continue to be produced without stringent emission controls. EPA should adopt a reasonable sunset date for NOx credits to ensure internal combustion engines are required to include technically feasible emission controls. [EPA-HQ-OAR-2019-0055-1162-A1, pp. 3 - 4]

Organization: *Zero Emission Transportation Association (ZETA)*

ZETA supports EPA’s proposal to allow manufacturers to earn credits for achieving lower NOx emissions than EPA sets as the standard via HDEV deployment. Because HDEVs do not have tailpipe emissions and therefore do not emit NOx or any other tailpipe pollution, it stands to reason that HDEVs should be counted as vehicles that emit 0 grams of NOx per mile. HDEVs are the best available technological mechanism for mitigating NOx emissions, and

manufacturers should receive credits for increasing their production share of HDEVs. [EPA-HQ-OAR-2019-0055-1283-A1, p.8]

We appreciate the arguments that giving credits for HDEV deployments could obscure the true NOx emissions of HDVs with tailpipes and, therefore, 'dilute' the standard. **We contend that EPA should mitigate this problem by both increasing the baseline MY2027 NOx standard and increasing its ratcheting process through MY2030.** [EPA-HQ-OAR-2019-0055-1283-A1, p.8]

<u>**EPA Summary and Response**</u>

As described in preamble Section IV.G, we are not finalizing the proposed allowance for manufacturers to generate NO_X emissions credits from heavy-duty zero emissions vehicles (ZEVs). Numerous commenters provided feedback on EPA's proposal to allow manufacturers to generate NO_X emissions credits from ZEVs. The majority of commenters oppose allowing manufacturers to generate NO_X emissions credits from ZEVs. Several additional commenters oppose ZEV NO_X emissions credits unless there were restrictions on the credits (e.g., shorter credit life, sunsetting credit generation in 2026). Other commenters support allowing manufacturers to generate NO_X emissions credits from electric vehicles. Arguments from each of these commenter groups are summarized immediately below. Further below in this Section 12.6, we discuss EPA's response to those comments, which includes our rationale for our approach to ZEVs NO_X credits in the final rule.

<u>Summary of Comments Opposing **NO_X emissions credits for ZEVs:**</u>

Commenters opposing NO_X emissions credits for ZEVs present several lines of argument, including the potential environmental impacts of NO_X emissions credits for ZEVs, impacts on improvements in conventional engine technologies, impacts on ZEVs and other technologies, and legal authority. Each of these topic areas is discussed further immediately below in this Section 12.6.1. Stakeholders opposing NO_X emissions credits from ZEVs were generally environmental or state organizations, or suppliers of heavy-duty engine and vehicle components.

Environmental Impacts and Legal Authority

Commenters state that NO_X emissions credits for ZEVs would diminish the environmental benefits expected from the rule. Some of these commenters argued that the credits would result in standards that fail to "achieve the statute's requirement for the greatest emissions reductions achievable." One commenter further stated that EPA did not describe how allowing manufacturers to generate NO_X emissions credits from ZEVs is consistent with its statutory authority.

Commenters stated that EPA underestimated ZEV adoption rates, and that higher ZEV adoption rates would result in larger impacts on the expected emissions reductions than EPA estimated in the proposal. One commenter provided an extensive list of references to information suggesting higher ZEV adoption rates would be likely (e.g., number of models available today, number of state regulatory and non-regulatory actions). Several of these commenters provided analyses showing the potential emissions impacts of higher ZEV adoption rates than assumed in EPA's proposal analysis; commenters used different metrics (e.g., tons of NO_X reduced in 2045, emission rates of internal combustion engines, increase in tons of NO_X emitted) but results consistently showed substantial impacts on the emissions reductions expected from the proposed rule due to higher ZEV adoption rates, leading to greater magnitudes of NO_X emissions credits than projected in the proposal. Other commenters also argued that EPA should consider emissions of criteria pollutants that occur upstream of the vehicle (e.g., from power plants providing electricity to ZEVs). One commenter estimated gram-per-mile NO_X emissions rates of a MY2027 diesel-fueled truck compared to a BEV when accounting for upstream emissions; results of their analysis suggested a diesel truck meeting MY 2027 and later requirements could produce slightly lower g/mile NO_X in 2030 than a battery-electric truck from same weight class. The commenter stated that the analysis is not intended to suggest that one truck technology is cleaner than another since only NOx emissions were considered, but rather that NO_X credits for ZEVs is not warranted.

Numerous commenters also stated that the higher NO_X emissions resulting from ZEV NO_X emissions credits would lead to higher emissions in some communities (e.g., those located near power plants) than others (e.g., those with higher numbers of ZEVs), which could result in disproportionate impacts in disadvantaged communities already overburdened with pollution. Commenters argue that EPA has not justified the need to allow the increased emissions that would result from allowing ZEVs to generate NO_X emissions credits. At least one commenter further argues that the credits do not support NO_X emissions reductions, and thus are misaligned with the environmental goals of the rule.

Impacts on ICE improvements

Commenters further state that the credits would result in a lack of improvement in conventional engine technologies. Commenters argue that cost-effective technologies exist to reduce emissions from heavy-duty engines and that the standards should be achieved with conventionally-fueled vehicles.

Impacts on ZEVs and other technologies

Several commenters argue that ZEVs will be cost-competitive with internal combustion engine technologies in the 2025 timeframe and thus emissions credits are not needed as incentives. Commenters state that ZEVs already planned for production would be used to generate NO_X emissions credits, and thus the credits would not incentivize additional ZEV production. Rather, commenters argue, the credits would only serve to allow higher emissions from internal combustion engines. At least one commenter noted that other State and federal actions are providing more meaningful and less environmentally costly HD ZEV incentives (e.g., deploying charging infrastructure, purchase rebate programs). Some commenters further argue that the allowing ZEVs to generate NO_X emissions credits favors one technological approach over another; commenters state that the credits would stifle innovation and use of non-ZEV decarbonization technologies.

Restrictions on NOx Emissions Credits for ZEVs

Many commenters provided input on the types of restrictions that would be necessary, in their view, if EPA were to allow manufacturers to generate NO_X emissions credits from ZEVs. First, several commenters stated that EPA should include ZEVs when setting the level of the numeric standard. Other commenters urged EPA not to allow ZEVs sold to meet state policies such as the California Advanced Clean Trucks (ACT) rule, to generate federal NO_X emissions credits. Many of these commenters urged EPA not to allow ZEVs to generate NO_X emissions credits beyond 2026; other commenters suggested different sunset dates for ZEV NO_X emissions credits (e.g., 2030). In contrast, one commenter stated that EPA should only allow ZEVs to generate NO_X emissions credits starting in 2027 in order to avoid large credit values that would result from the current standard and zero; the commenter stated if EPA allowed ZEVs to generate NO_X emissions credits prior to 2027, then the value of the credits should be calculated based on the difference between zero and the 2027 and later standards.

Numerous commenters also stated that the Family Emission Limit (FEL) cap should be lower than proposed; several commenters suggested a FEL cap of 0.05 g/hp-hr, which would be consistent with the CARB Omnibus program NO_X emissions standard for MYs 2024 – 2026. Some commenters supported EPA's proposed credit life of five years, while others urged EPA to shorten the credit life for ZEVs to three years based on data suggesting that BEVs will reach cost parity with internal combustion engines in the 2025 to 2030 timeframe. At least one commenter supported EPA's proposed restriction not to allow ZEV NO_X credits to be transferred between vehicle weight classes; however, another commenter, who supports allowing ZEVs to generate credits, argued ZEV NO_X credits should be allowed to be used in any vehicle weight class as a way to incentivize ZEV production. Finally, one commenter urged EPA to only allow ZEVs to generate NO_X or GHG credits, not both; the commenter stated this approach would only credit ZEVs produced beyond the volume of ZEVs needed to show compliance with revised GHG standards.

Summary of Comments Supporting **NO_X emissions credits for ZEVs**:

In contrast, several commenters support allowing manufacturers to generate these credits. Many of these commenters are heavy-duty engine and vehicle manufacturers. These comments are summarized immediately below as they relate to: 1) environmental impacts, 2) impacts on ICE improvements, and 3) Impacts on ZEVs and other technologies.

Environmental Impacts

Some commenters state that it is appropriate for EPA to allow manufacturers to generate NO_X emissions credits from ZEVs because doing so recognizes the zero-emissions tailpipe performance of the technologies, and because these technologies help meet emissions reductions and air quality goals. One commenter stated that incentivizing ZEVs and near-zero emissions vehicles is important for stationary sources that must operate in nonattainment areas.

Impacts on ICE improvements

Several commenters stated that concerns about NO_X emissions credits from ZEVs resulting in higher emissions from internal combustion engines were not warranted because FEL caps would prevent ICE backsliding. One commenter noted that the difference between MY2027 and later standards and the proposed FEL would mean only a small fraction of manufacturers' fleets could certify near the FEL cap. Other commenters argued that the FEL cap combined with a stringent standard would prevent backsliding of internal combustion engines. One commenter agreed with commenters opposing ZEV emissions credits and stated that EPA could address concerns about backsliding by considering ZEVs when setting the NO_X emissions standards. Finally, one commenter argued that compliance flexibilities such as the NO_X credit program would be essential to the achievability of the standards.

Impacts on ZEVs and other technologies

Some commenters further argue that NO_X emissions credits for ZEVs would allow manufacturers to manage investments across different products and ultimately result in increased ZEV deployment. One commenter noted that using credits to incentivize ZEV production is warranted based on the proposed requirements for ZEVs (e.g., testing, useful life, warranty). Another commenter stated that EPA should allow ZEVs to generate NO_X emissions credits in this final rule, and then could revisit that decision in a later rulemaking. One commenter stated that allowing a credit life of 10 years for ZEV credits would further incentivize EV development. Finally, one commenter stated that President Biden encouraged the EPA Administrator to consider ZEVs when setting emissions standards for 2027 and later.

In Section 12.6.1 of this document, we discuss our responses to the comments summarized in this Section and our decision not to finalize at this time the allowance for manufacturers to generate NO_X emissions credits from heavy-duty ZEVs. See Sections 12.6.2 through 12.6.6 of this document for additional details on comments received and EPA responses to comments on the proposal to allow manufacturers to generate NO_X emissions credits from and ZEVs, including: emission credit multipliers for ZEV credits, vehicle certification for ZEVs, testing requirements for ZEVs generating NO_X emissions credits, and useful life and warranty requirements for ZEVs generating NO_X emissions credits.

Response to Comments and Rationale for Approach to ZEV Credits in Final Rule:

As discussed in preamble Section IV.G, we are not finalizing the proposed allowance for manufacturers to generate NO_X emissions credits from heavy-duty ZEVs. In this Section 12.6 of this document, we provide additional discussion of the three considerations on which we based our decision not to finalize the allowance for manufacturers to generate NO_X emissions credits from ZEVs.

First, the standards in the final rule are technology forcing, yet achievable for MY2027 and later engines without the flexibility for manufacturers to generate NO_X emissions credits from ZEVs. CAA section 202(a)(3)(A) requires EPA to set emission standards for NOx, PM, HC, and CO that reflect the greatest degree of emission reduction achievable through the application of technology that the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology. As described in preamble Section III, after further consideration, including consideration of public comments, we are finalizing standards that our assessment and data show are feasible in the MY 2027 timeframe. We therefore disagree with the commenter who stated that compliance flexibilities such as the ability for manufactures to generate NO_X emissions credits from ZEVs would be essential to the achievability of the proposed standards. Nevertheless, as described in preamble Section IV.G, the ABT program in the final rule balances providing manufacturers with flexibility in their product planning and encouraging the early introduction of emissions control technologies with maintaining the expected emissions reductions from the program. We expect that the final standards, including the final ABT program, will result in meaningful emissions reductions in all communities, including in disadvantaged communities already overburdened with pollution.

Second, since the final standards are not based on projected utilization of ZEV technology, and given that we believe there will be increased penetration of ZEVs in the HD fleet by MY 2027 and later, we are concerned that allowing NO_X emissions credits from ZEVs would result in fewer emissions reductions than intended from this rule. We therefore generally agree with commenters who provided analyses suggesting that rapid growth in ZEV penetration rates could result in NO_X credits from ZEVs impacting the emissions reductions expected from the final standards. This is particularly true in light of other, recent Federal programs that may result in additional HD ZEVs leading up to and following MY 2027.[36] Thus, while we agree with some commenters that ZEV technologies can provide zero-emissions tailpipe performance, and accordingly proposed an allowance to generate NOx credits from ZEVs as compliance flexibility, we have determined that the potential for the flexibility to reduce the expected emissions reductions from the rule outweighs the potential benefits of additional flexibility to meet the standards.[37]

Third, we continue to believe that testing requirements to ensure battery and fuel cell performance over the useful life of a ZEV are important to ensure the zero-emissions tailpipe performance for which they are generating NO_X credits; however, after further consideration, including consideration of public comments, we also believe it may be appropriate to take additional time to work through specific test procedures and other specifications for ZEV battery and fuel cell performance over the useful life period of the ZEV. These three considerations, including the relationship between the second and third considerations, supports our decision not to allow manufacturers to generate NO_X emissions credits from ZEVs in this final action (see Sections 12.6.4 and 12.6.5 of this document for additional detail on comments and EPA responses to comments on the proposed ZEV testing and useful life and warranty requirements).[38]

We note that one commenter stated that EPA had not described how our proposal to allow EVs to generate NO_X emission credits is consistent with our statutory authority. While we are choosing not to finalize at this time the proposed allowance for manufacturers to generate NO_X emissions credits from ZEVs, doing so would be consistent with our statutory authority.

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[36] For example, the recently passed Inflation Reduction Act (IRA) has many incentives for promoting zero-emission vehicles, see Sections 13403 (Qualified Clean Vehicles), 13404 (Alternative Fuel Refueling Property Credit), 60101 (Clean Heavy-Duty Vehicles), 60102 (Grants to Reduce Air Pollution at Ports), and 70002 (United States Postal Service Clean Fleets) of H. R. 5376.

[37] One commenter suggested that EPA could ensure only ZEVs produced beyond the volumes required to meet GHG standards would generate NOx emissions credits by allowing ZEVs to generate NOx or GHG credits, but not both. EPA did not propose or ask for comment on this approach and since we are not allowing NOx ZEV credits we are not including this approach in the final rule. We also note that if we were to include an approach that allowed ZEVs to generate NO_X or GHG credits but not both, then that approach may lessen the potential concerns of the second consideration, but it would not fully address the three considerations on which we based our decision not to allow NOx ZEV credits.

[38] We note that our approach for ZEV NO_X credits differs from our approach to hybrid engines and hybrid powertrains in the final rule. While the first consideration discussed in this response is the same for any emission control technology that can comply with the final standards, the second consideration is more pronounced for ZEVs than for hybrids given the greater number of potential credits that could be generated by ZEVs. This difference is then compounded by the third consideration for ZEVs, whereas our approach for hybrid engines and hybrid powertrains relies on an accurate test procedure for quantifying NO_X emissions (see preamble Section III.A for details). The uncertainty in appropriate test procedures to validate the NO_X emission credits generated for ZEVs combined with additional uncertainty in the potential for allowing ZEV NO_X emissions credits to result in fewer emissions reductions than intended from this rule, leads us to finalize a different approach for ZEVs than hybrids at this time.

Finally, as noted at the start of this Section 12.6, many commenters provided input on the types of restrictions that would be necessary, in their view, if EPA were to allow manufacturers to generate NO_X emissions credits from ZEVs. Since we are not allowing NO_X ZEV credits, we are not including the suggested restrictions in the final rule.

12.6.2 Multipliers for NOx Emissions Credits Generated by Electric Vehicles

Comments by Organizations

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

Commenters also agree that EPA should not adopt any emission credit multipliers, 87 Fed. Reg at 17,562 (requesting comments on whether emission credit multipliers should be included in the final rule). [EPA-HQ-OAR-2019-0055-1302-A1, p.54]

Organization: *California Air Resources Board (CARB)*

On page 17562 of the NPRM, U.S. EPA asks for comments regarding the applicability of NOx credit multipliers for BEVs and FCEVs. [EPA-HQ-OAR-2019-0055-1186-A2, p.21]

CARB staff supports U.S. EPA’s position for not allowing credit multipliers for electric vehicles. It should be noted that these vehicles are currently unable to generate any NOx credits. The proposed rule introduces a new incentive to this market segment by allowing these vehicles to accrue credits. Addition of multipliers would lead to double counting of these credits and would be detrimental to the overall program benefits. [EPA-HQ-OAR-2019-0055-1186-A2, p.21]

CARB staff also agrees with U.S. EPA that the current state of technology development and implementation of electric vehicles, while still relatively nascent compared to combustion engines, are mature enough not to warrant emission credit multipliers. It should also be noted that in addition to California, the ACT regulation has also been adopted by five other states (Washington, Massachusetts, Oregon, New Jersey, New York). [EPA-HQ-OAR-2019-0055-1186-A2, p.21]

Organization: *Daimler Truck North America LLC (DTNA)*

As noted above in Section II.A, incentivizing ZEV market penetration should be a guiding principle for EPA in this and all other Agency rulemakings related to vehicle emission standard-setting. While EPA correctly determines in the Proposed Rule that ZEVs should generate NOx credits, the Agency does not go far enough to incentivize them in its proposal. A simple analysis shows that ZEVs contribute to the NOx inventory reductions and can balance out NOx emissions from higher-emitting diesel vehicles. Offering credit multipliers for ZEVs would only serve to enhance production incentivizes for these vehicles, which in turn would increase their emission reduction benefits. [EPA-HQ-OAR-2019-0055-1168-A1, pp.80-81]

EPA notes that in developing the proposal, it considered whether to provide NOx credit multipliers for ZEVs, but ultimately decided against it ‘due to the potential emission impacts of the use of credit multipliers.'105 Paradoxically, however, EPA does propose to apply credit multipliers (and accordingly, enhance incentives) for early adoption of new low-NOx diesel engines.106 In this manner, EPA proposes to incentivize low-NOx diesel vehicles, which do emit NOx, over ZEVs, which do not emit NOx. [EPA-HQ-OAR-2019-0055-1168-A1, p.81]

105 Proposed Rule, 87 Fed. Reg. at 17,557.

106 See id. at 17,554.

EPA's logic on credit incentives should be applied consistently; ZEVs are a nascent technology, and EPA should seek to spur ZEV adoption wherever possible. Increased ZEV adoption today has a carry-on effect far greater than its direct effect to the NOx inventory implies, as widespread ZEV adoption will drive increased market acceptance. This increased demand will enable further manufacturer investment and new technologies, and it will drive demand for ZEV infrastructure, which, in turn, enables further ZEV penetration later on. [EPA-HQ-OAR-2019-0055-1168-A1, p.81]

We recommend that EPA apply emission credit multipliers for ZEVs of at least 2.0; since the Agency proposes to grant this credit to low-emission diesels that meet the MY 2031 emissions standards early. ZEVs, by comparison, are even cleaner than diesel engines that meet the proposed MY 2031 emission standards, and should be entitled to at least as much credit: [EPA-HQ-OAR-2019-0055-1168-A1, p.81]

EPA requests comments on whether the Agency should limit ZEV emission credits to particular vehicle classes or categories. Daimler Truck believes that all ZEVs are equally deserving of incentive programs, as penetration rates are not guaranteed for any class. However, if EPA must limit NOx multiplier eligibility to any particular category, we believe that ZEVs that replace heavy-heavy duty conventional vehicles are the least likely to have significant adoption rates of mature technology without proper incentives. EPA could thus limit these credits to Class 6-8 trucks and tractors. [EPA-HQ-OAR-2019-0055-1168-A1, p. 81]

Organization: *Environmental Defense Fund (EDF)*

However, if EPA retains these credits in any form, it is critically important that the agency not adopt any credit multipliers and that EPA substantially strengthen the FEL cap to help ensure remaining diesel vehicles are not able to certify to higher emission levels based on the availability of ZEV credits. [EPA-HQ-OAR-2019-0055-1265-A1, p.23]

Organization: *Fuel Cell and Hydrogen Energy Association (FCHEA)*

The hydrogen and fuel cell industry supports the proposal to provide early adopter incentives, as well as credit multipliers for longer-range FCEVs able to travel 300 miles between fuelings and ability to fuel in less than twenty minutes. This would provide greater incentive for adoption of these zero-emission technologies. [EPA-HQ-OAR-2019-0055-1187-A2, p. 2]

Organization: *Lion Electric Co. USA Inc. (Lion)*

To encourage OEMs to meet these standards, we strongly support providing opportunities for manufacturers to generate NOx emission credits, along with the use of credit multipliers, at least in the first few years of the proposed changes. This is an excellent way to encourage more OEMs to manufacture ZEVs, bringing the electric vehicle market closer to cost parity with ICE vehicles and accelerate long-term ZEV adoption. Lion believes that these credit allowances will boost ZEV production and adoption, and can always be revisited in future rulemaking once the market has advanced. [EPA-HQ-OAR-2019-0055-1151-A2, p. 2]

We disagree with the proposal to "provide a multiplier for longer-range BEVs" as many of the market segments that most need ZEVs have the lowest range needs. This accounts for school buses, refuse trucks, and delivery trucks, which may not travel long distances, but have multiple stops in neighborhoods and communities that may already be overburdened by air pollution. Also, while Lion does not oppose the generation of credits for hybrid vehicles, we encourage the EPA to offer higher credits to manufacturers of all-electric vehicles. [EPA-HQ-OAR-2019-0055-1151-A2, p. 2]

Organization: *Natural Gas Vehicles for America (NGVAmerica)*

NGVAmerica and its members submit the following recommendations for policies and programs that the EPA and other federal agencies can advance to encourage the use of cleaner trucks.

2) Adopt the regulatory safeguards EPA has proposed with respect to electric vehicle credits since electric vehicles are already heavily subsidized and benefit from recently adopted sales mandates in California and other states; this includes support for the safeguards proposed for the use of credits to limit emissions from engines and vehicles that rely on credits for compliance, and the decision not to extend sale credit multipliers to electric vehicles; [EPA-HQ-OAR-2019-0055-1330-A1, pp.12-13]

Organization: *Rivian Automotive, LLC (Rivian)*

At the same time, consistent with our position in GHG programs, Rivian opposes ZEV credit multipliers in the criteria emissions program and finds EPA's initial proposal in this regard appropriate. Generally, multipliers are intended to encourage the development and use of advanced technologies that otherwise face substantial barriers to market entry and proliferation. While EPA offers certain narrow HD segments as examples of where this might still be the case, Rivian believes that industry has amply demonstrated its ability to develop and commercialize advanced technology vehicles in all classes.11 Rivian supports NOx credits commensurate with zero tailpipe emissions but not credit multipliers. [EPA-HQ-OAR-2019-0055-1229-A1, p.4]

> 11 Baha Al-Alawi, Owen MacDonnell, Ross McLane, and Kevin Walkowicz, CALSTART, Zeroing in On Zero-Emission Trucks: The Advanced Technology Truck Index: A U.S. ZET Inventory Report (January 2022), available at www.calstart.org/zeroing-in-on-zero-emission-trucks/.

Organization: Zero Emission Transportation Association (ZETA)

EPA should not issue multipliers for these NOx credits. As more HDEVs become available, auto manufacturers will no longer need external incentives baked into these emissions standards to build more HDEVs. Manufacturers should be encouraged to maximize their HDEV production; credit multipliers would have the adverse effect of encouraging manufacturers to produce a limited number of HDEVs in order to inequitably write off the emissions of their most polluting vehicles. Multipliers would undermine the intention of this rulemaking. Once HDEVs make up the majority of the market, these credits should be removed to more stringently regulate the emissions of remaining fossil fuel-powered vehicles. Similarly, EPA should eliminate all credit multipliers for vehicles in the current draft. We are agnostic to the mechanism for removing these credits. [EPA-HQ-OAR-2019-0055-1283-A1, pp.8-9]

EPA Summary and Response

Summary:

A subset of commenters opposing the proposal to allow manufacturers to generate NO_X emissions credits from ZEVs also stated that they opposed providing emissions credits multipliers for ZEV emissions credits. Commenters stated that multipliers would lead to double counting of the credits and would be detrimental to the program benefits. Commenters further stated that ZEV technologies are mature enough that they do not need multipliers; this rationale is consistent with one commenter who supported the proposal to allow manufacturers to generate NO_X emissions credits from ZEVs but opposed credit multipliers. Another commenter stated that the multipliers would encourage manufacturers to produce a limited number of ZEVs.

In contrast, a subset of commenters support emissions credit multipliers for ZEVs emissions credits; these commenters are a subset of those who supported the proposal to allow manufacturers to generate NO_X emissions credits from ZEVs. One commenter stated that EPA should apply emissions credit multipliers of at least 2.0 to incentivize ZEVs and provide level playing field with low-emissions diesel products that meet MY 2031 standards early; the commenter noted that, if needed, EPA could restrict multipliers to Class 6-8 trucks and tractors. Another commenter stated that EPA should incentivize adoption of FCEVs by providing multipliers for FCEVs with a range of 300 miles and ability to fuel in less than 20 minutes.

Response:

As discussed in Section 12.6.1, EPA is not finalizing the proposed allowance for manufacturers to generate NO_X emissions credits from ZEVs. Since we are not allowing NO_X emissions credits from ZEVs, we are also not allowing emissions credits multipliers for ZEV emissions credits. As described in preamble Section IV.G, we are also not finalizing the proposed Early Adoption Incentive Program, and in turn we are not including emissions credit multipliers in the final program. Rather, we are finalizing a revised version of the transitional credit program under the ABT program that provides four pathways to generate straight NO_X emissions credits (i.e., no credit multipliers) that are valued based on the extent to which the engines generating credits comply with the requirements we are finalizing for MY 2027 and later (e.g., credits discounted at a rate of 40% for engines meeting a lower numeric standard but none of the other MY 2027 and later requirements) (see Section 12.4 of this document and preamble Section IV.G.7 for more details).

12.6.3 Vehicle Certification for ZEVs

Comments by Organizations

Organization: *Allison Transmission, Inc. (Allison)*

EPA has proposed that HEVs, BEVs and FCEVs be allowed to generate NOx emission credits starting in MY 2024.57 In doing so, EPA is proposing to allow vehicle manufacturers to generate the credits using certification pathways that have already been established pursuant to the Phase 2 rule. Given existing CARB rules in this area concerning powertrain certification, however, it is probable that EPA will receive comments advocating broader use of powertrain certification method and/or targeted use in vehicle categories that EPA believes will move more rapidly towards electrification. Again, Allison's view is that EPA should explore and utilize simpler methods for certification. Allison comments regarding the generation of NOx emission credits are contained below in Section XVII. [EPA-HQ-OAR-2019-0055-1231-A1, pp.27-28]

57 Id. at 17,556-7.

Organization: *Cummins Inc. (Cummins)*

EPA proposes to allow vehicle manufacturers, rather than powertrain manufacturers, to generate NOx credits from battery electric vehicles (BEV) and fuel cell electric vehicles (FCEV). EPA proposed this approach "because the vehicle certification pathway is already utilized for certifying BEV and FCEV to GHG standards, and thus would require fewer resources to implement and carryout for both manufacturers and EPA's certification program" (87 FR 17557). However, it is unclear how the resources and burden are reduced with EPA's proposed approach. The default procedures in §1037.552 and §1037.554 for determining inputs for calculating ZEV NOx credits and for determining initial useable battery energy (UBE) for a BEV or initial fuel cell voltage (FCV) for a FCEV are powertrain tests. It is unclear how a zero emission powertrain manufacturer would experience more burden in completing a test of their own powertrain compared to a vehicle manufacturer completing a test of a powertrain which may or may not be their own. [EPA-HQ-OAR-2019-0055-1325-A1, p. 10]

As proposed, a zero emission powertrain manufacturer such as Cummins who does not manufacture vehicles would be prevented from generating ZEV credits of their own. Since EPA's rule sets new NOx standards and other requirements for engine (powertrain) certification applicable to the engine (powertrain) manufacturer, it is more appropriate for zero emission credits brought into the engine program to be earned by the zero emission powertrain manufacturer, rather than the zero emission vehicle manufacturer. This change would provide consistency with NOx and greenhouse gas credit ownership in existing engine regulations, continue to foster a level playing field among manufacturers, and provide incentive for powertrain manufacturers, including vertically-integrated manufacturers who manufacture both the powertrain and the vehicle, to invest in and develop zero emission powertrain technology. If

EPA chooses to finalize provisions that allow the generation of ZEV NOx credits, those credits should belong to the zero emission powertrain manufacturer. Note too that CARB recently finalized MY 2024 regulations that prescribe that ZEV NOx credits are generated by the certifying powertrain manufacturer. [EPA-HQ-OAR-2019-0055-1325-A1, p. 10]

Organization: *Daimler Truck North America LLC (DTNA)*

Daimler Truck supports EPA's proposal that such NOx credits should accrue to the vehicle manufacturer. While CARB grants NOx credits from ZEVs to the manufacturer of the 'Zero Emissions Powertrain,' Daimler Truck has argued that the concept of a 'powertrain manufacturer' does not apply well to ZEVs. For example, Daimler Truck currently manufactures ZEVs whose 'powertrains' have one manufacturer for the battery, another manufacturer for the electric motor, and many other manufacturers for other components that CARB considers part of the 'zero emissions powertrain.' Ultimately, Daimler Truck is responsible for the system integration, validation of the system, and service and warranty of the vehicle, and the Company is the face of the ZEV experience to the customer. Therefore, the Company believes it is appropriate for the credits generated to accrue to the vehicle manufacturer. Most importantly, it is Daimler Truck that must take on the financial obligation of making the ZEV attractive for customers to buy, and is therefore the only organization in the production chain that needs to be incentivized to market these products. Suppliers are incentivized to develop and market the components because vehicle manufacturers will buy them. [EPA-HQ-OAR-2019-0055-1168-A1, p.80]

Any rule that EPA adopts to set ZEV certification standards should:

1. Minimize added cost and manufacturer uncertainty for ZEVs, which will serve only to slow their adoption.

2. Seek opportunities to incentivize ZEV adoption wherever possible by allowing judicious use of credits, etc.

3. Ensure a level playing field for manufacturers regardless of their NOx credit status, to avoid creating a splintered market with two tiers of products.

4. Limit useful life, warranty, and durability standards to those in the vehicle GHG standards in 40 CFR 1037 today.

5. Base useful life, warranty, and durability requirements on total system energy throughput to recognize non-motive forms of operation that age ZEVs.

6. Set clear requirements for useful life, a concept which does not neatly apply to ZEVs. ZEVs will emit zero emissions forever, so EPA must directly identify what requirements manufacturers are certifying their products to for the defined useful life period.

7. Study the effect of infrastructure and charging, especially high charge-rate systems, on ZEV durability and longevity, and account for it during standard setting.

8. Develop test procedures in concert with OEMs to ensure repeatability, practicality, and effectiveness; if EPA must test battery capacity, it should be done at the battery pack or fuel cell level, and not at the vehicle or powertrain level, which is expensive and impractical, and does not provide additional information about the battery or fuel cell. DTNA recommends the Static Capacity Test (Constant Current Method)' set forth in Society of Automotive Engineers (SAE) J1798, 'Recommended Practice for Performance Rating of Electric Vehicle Battery Modules.'

9. Avoid adding unnecessary requirements that do not serve EPA's mission to reduce emissions. EPA requests comments on various aspects of potential standards for ZEVs, including diagnostic requirements from CARB's Zero Emission's Powertrain procedure, communication requirements, proposed signals manufacturers would need to make available, and more. None of these requirements have any effect on emissions, and serve only to add development cost and burden to manufacturers, delaying ZEV introduction and increasing prices.

10. Ensure that manufacturers have adequate lead-time to develop systems, and the market can develop organically, by delaying new standards for ZEVs to at least MY 2031. [EPA-HQ-OAR-2019-0055-1168-A1, pp.124-125]

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

MEMA encourages EPA to not issue NOx credits for battery electric vehicles or fuel cell electric vehicles to avoid unintended backsliding and lowering of technology deployment on internal combustion engine heavy-duty vehicles. In addition, NOx credits have traditionally only gone to engine certifiers. Opening this up to additional parties could result in a fundamental change to the NOx credit program with significant unintended consequences. Not many companies make both batteries and internal combustion engines to be able to transfer credits within one company. This generates more questions than answers and may open the door to backsliding. [EPA-HQ-OAR-2019-0055-1322-A1, p. 8]

Organization: *Toyota Motor North America, Inc. (Toyota)*

We request that the EPA allow manufacturers of HD ZEV powertrains (such as HD-BEV and HD-FCEV) to generate credits, rather than only allowing credit generation by vehicle manufacturers. Toyota appreciates the ability of vehicle manufacturers to generate NOx credits from ZEV HD vehicles and believes this is an important incentive for wider adoption of ZEV technologies that lead to emissions benefits. However, development of ZEV powertrain technologies for HD vehicles requires significant investments and risks. Allowing powertrain manufacturers to generate credits would be a powerful incentive to encourage more widespread investment from manufacturers in the development of ZEV technologies. We suggest EPA establish a credit allowance for the ZEV powertrain manufacturers to generate credits for the powertrain. The powertrain credits would be a portion of the total credits the vehicle generates, split between the vehicle and powertrain manufacturers. [EPA-HQ-OAR-2019-0055-1224-A1, p.2]

EPA Summary and Response

Summary:

Several commenters provided perspectives on EPA's proposal for manufacturers to certify ZEVs through a vehicle certification pathway, and therefore generate vehicle credits when choosing to participate in the NOx ABT program with ZEVs. One commenter opposes the proposal and urged EPA to allow powertrain manufacturers, not vehicle manufacturers, to generate NO_X emissions credits from ZEVs; this commenter stated that vehicle certification would prohibit powertrain manufacturers who do not manufacturer vehicles from generating ZEV credits on their own. Another commenter supported EPA's proposal and argued vehicle manufacturers were the more appropriate owner of ZEV NO_X emissions credits because the vehicle manufacturer is responsible for integrating and validating systems from multiple component manufacturers (e.g., battery, electric motor). Another commenter stated that EPA should allow both vehicle and powertrain manufacturers to own credits from ZEVs, with the powertrain manufacturer owning a portion of the vehicle credits. The remaining two commenters did not clearly support or oppose the proposed vehicle certification approach; one commenter urged EPA to simplify the process without providing specific suggestions, and the other commenter stated that allowing parties other than engine manufacturers to generate NOx credits could lead to backsliding and uncertainty since not many companies make both batteries and internal combustion engines to transfer credits within one company.

Response:

As discussed in Section 12.6.1 of this document, and Section IV.G of the preamble, EPA is not finalizing the proposed allowance for manufacturers to generate NO_X emissions credits from ZEVs. However, as proposed, we are finalizing requirements for ZEVs to certify to criteria pollutant standards under 40 CFR 1037. We are finalizing the vehicle certification pathway as proposed, which allows manufacturers to use the same compliance pathway for certifying ZEVs to both criteria and GHG standards. We believe this approach also minimizes added costs for manufacturers and provides manufacturers with certainty on a criteria pollutant certification pathway for ZEVs, which address additional factors that one commenter raised. EPA agrees with the commenter who stated that the vehicle manufacturer is responsible for system integration and validation, as well as vehicle service and warranty; therefore, we continue to believe the vehicle certification pathway is the most appropriate.

The remaining considerations that the commenters provide pertain to ownership of ZEV NO_X emissions credits and the proposed requirements for ZEVs that generate NO_X emissions credits, which are not at issue in this rule as finalized.

12.6.4 Testing Requirements for Electric Vehicles Generating NOx Emissions Credits

Comments by Organizations

Organization: *Alliance for Automotive Innovation (Auto Innovators)*

40 C.F.R. 1037.552 Multicycle powertrain test for battery electric vehicles.

We request that the requirement to measure DC energy during AC recharge be removed from the test procedure requirements. DC energy measured during the AC recharge is not required for the test result calculations and introduces additional test burden to laboratories. AC recharge energy is measured upstream of the charger and includes any charger losses. Measurement of DC energy during AC recharge may require modification of charge monitoring systems and additional intrusive current sensor(s) on the vehicle/powertrain if the recharge cable is separate from the drive cables. [EPA-HQ-OAR-2019-0055-1303-A1, pp.4-5]

Subsection (c)

Auto Innovators proposes that 'Charge the powertrain for the duration of the soak period measuring the DC recharge energy, EDCRC , and do not end the soak period prior to reaching full charge' be revised to 'Charge the powertrain for the duration of the soak period and do not end the soak period prior to reaching full charge.' [EPA-HQ-OAR-2019-0055-1303-A1, p.5]

Subsection (f)(ii)

Regarding the statement 'Immediately apply the brake and decelerate the powertrain to a stop within 15 seconds once the test termination criteria have been met[,]' Auto Innovators suggests that EPA consider increasing the time requirement for HD vehicles from 15 seconds to 20 or 30 seconds. Decelerating high mass vehicles from 55 mi/hr to 0 mi/hr in 15 seconds can be challenging given the lower coefficient of friction on a dynamometer. [EPA-HQ-OAR-2019-0055-1303-A1, p.5]

Subsection (g)

Auto Innovators proposes that 'Place the powertrain on-charge within 3 hours of completing the MCT and charge the battery to full capacity to measure the total AC recharge energy, EACRC, and DC recharge current per hour, CRC' be revised to 'Place the powertrain on-charge within 3 hours of completing the MCT and charge the battery to full capacity to measure the total AC recharge energy and EACRC.' [EPA-HQ-OAR-2019-0055-1303-A1, p.5]

Auto Innovators recommends that EPA remove section (g)(6) referring to Charge Recovery. Charge recovery verification is not typically an issue for BEV vehicles. Significant issues with charge recovery can be detected from the AC recharge energy. [EPA-HQ-OAR-2019-0055-1303-A1, p.5]

Organization: *California Air Resources Board (CARB)*

CARB staff recommends that U.S. EPA modify the greenhouse gas emission model to include the ability to calculate work performed by electric motors. Such an approach would establish an industry-wide, standardized procedure for calculating the electric vehicle credits. [EPA-HQ-OAR-2019-0055-1186-A2, p.22]

The HD electric vehicle market is quite diverse and includes small volume manufacturers and large, vertically integrated manufacturers. Given such a landscape, establishing a simple tool to standardize the calculations could lead to the establishment of a level playing field for estimating electric vehicle credits. [EPA-HQ-OAR-2019-0055-1186-A2, p.22]

In response to U.S. EPA's request for comment on the proposed approach to BEV and FCEV powertrain testing, CARB staff supports U.S. EPA's proposal to require manufacturers to measure work produced as well as usable battery energy and fuel-cell voltage for BEV and FCEV powertrains, respectively, via the multicycle test (MCT) because it better reflects real-world operation compared to other common battery and fuel-cell test methodologies (e.g., bench testing). Requiring such testing would provide reliable information about a powertrain's work capabilities when new as well as a verifiable baseline value for either usable battery energy or fuel-cell voltage, as applicable, to facilitate the implementation of the proposed durability requirements for BEVs and FCEVs. Furthermore, because of the value of the information provided by this testing to potential purchasers of BEVs and FCEVs, CARB staff recommends that all BEV and FCEV powertrains, regardless of whether or not they generate NOx emission credit, be subject to the same testing requirements. [This comment can also be found in sections 15.1 and 15.2 of this comment summary.] [EPA-HQ-OAR-2019-0055-1186-A2, p.22]

However, CARB staff recommends that in later model years, manufacturers be required, as part of the durability demonstration, to age/cycle the batteries and/or fuel cells to simulate real-world operation prior to performing the MCT. In addition, CARB staff recommends that the durability of BEV and FCEV powertrains be demonstrated through the same process, regardless of whether these vehicles generate NOx credits. Durable BEVs and FCEVs will be needed to provide a viable secondary market. A robust secondary market is necessary to ensure success of these new technologies because many fleets only operate new vehicles for a few years and rely on vehicle asset residual value in the secondary market to fund future new vehicle purchase. Also, some fleets only buy reliable second market vehicles to reduce upfront costs and so BEVs and FCEVs success requires them to be reliable through their useful lives. This aspect is critically important because purchasers of used vehicles tend to be small businesses and owner-operators who often reside in historically underserved communities. CARB staff believes the success of the secondary market will depend on transparency to understand the status of a used vehicle and its battery health or fuel stack voltage performance when purchasing these vehicles. [EPA-HQ-OAR-2019-0055-1186-A2, p.23]

Organization: *Cummins Inc. (Cummins)*

Cummins manufactures a broad range of technologies for on-highway vehicles – from internal combustion engines to hybrids to zero emission powertrains. We strive to provide durable and reliable products to our customers who rely on them for their livelihood. In principle, we support durability testing for zero emission powertrains, along with appropriate useful life and warranty requirements that are on par with requirements for other types of powertrains. Those requirements are important to ensure acceptance by customers, so that adoption increases, and to provide a level-playing field for manufacturers of competing technologies. However, just as with conventional powertrains, any test procedures for durability demonstration should not create undue cost or a lengthy test burden for the manufacturer. Similarly, useful life and warranty requirements should not be so extreme as to significantly increase the cost of the zero emission powertrains further and inhibit their adoption. EPA should work with manufacturers to strike the right balance in the final rule. [EPA-HQ-OAR-2019-0055-1325-A1, p. 10]

1036.510(d)-(e)

When the CD mode is covered in EV and the charge sustaining mode has one FTP/SET cycle, the GHG emission will be elevated based on the current calculation approach. Cummins suggests running more than one CS cycle to account for cold warm operations:
• The current method defined in NPRM can be used to calculate GHG emission in CD mode.
• The first cycle in CS mode should be treated as cold cycle and the next cycle as warm. Calculate composite CS mode emission using 1/7 and 6/7 weighting factors for cold and warm cycles.
• Then apply UF based calculation to get the combined CO2. [EPA-HQ-OAR-2019-0055-1325-A1, p. 25]

Organization: *Daimler Truck North America LLC (DTNA)*

EPA's proposed method for calculating ZEV NOx credits is overly onerous and not practical. [EPA-HQ-OAR-2019-0055-1168-A1, p.82]

Under the Proposed Rule, manufacturers would calculate vehicle emission credits using a powertrain test cycle that measures work produced over a defined duty-cycle test, and either useable battery energy for battery-electric vehicles (BEVs) or fuel cell voltage for fuel cell electric vehicles (FCEVs). EPA proposes to use the measured work to define the number of credits a ZEV would generate. [EPA-HQ-OAR-2019-0055-1168-A1, p.82]

EPA has not, however, considered the feasibility of performing such a test for all electric vehicle configurations. Issues related to the technical feasibility of this test are elaborated in Section VI of these comments, but in short, each powertrain configuration will require approximately 40 hours of chassis-dyno testing to complete this test procedure. [EPA-HQ-OAR-2019-0055-1168-A1, p.82]

Since EPA envisions this testing will be performed on a powertrain level, it is not clear how many configurations a manufacturer must test—but the work produced over the defined duty-cycle test will vary based on number of factors not related to the NOx emissions emitted by these vehicles (which is, of course, zero). These factors include, among others:

- Axle ratio of the drivetrain
- Vehicle transmission characteristics
- Control strategies and driver-selectable options
- Battery capacity, configuration, controls
- Power rating of the powertrain
- Power consuming accessories [EPA-HQ-OAR-2019-0055-1168-A1, p.82]

As EPA does not specify how powertrains should be categorized for this testing, we assume that EPA expects manufacturers to run this test for each configuration that could result in a different cycle power measurement. [EPA-HQ-OAR-2019-0055-1168-A1, p.82]

Each of these factors will have an effect on the measured cycle power, and therefore manufacturers could be expected to test many configurations. Even with a reasonable categorization strategy—per vehicle family as defined in Part 1037, for example—manufacturers could be required to demonstrate many configurations at great expense, and vehicle families already contain several different ZEV architectures today. [EPA-HQ-OAR-2019-0055-1168-A1, pp.82-83]

Ultimately, this test intends to measure how much NOx credit a vehicle should generate— but by definition, a ZEV generates no NOx at all. The amount of work that a powertrain outputs on a cycle test is not indicative of the NOx savings that vehicle will accrue over its life, and it is not reasonable to assume that the vehicle it replaces would output the same amount of work. Diesel engine credits are not affected, today, by the axle ratio, gearing, shift strategies, or control strategies of the vehicles they are installed in; nor is the work done by those engines reduced by the losses in their associated powertrains. By extension, ZEV NOx credits should not be affected by these factors either. This is very significant expense and an impractical amount of testing with no tangible benefit. [EPA-HQ-OAR-2019-0055-1168-A1, p.83]

Lastly, this is a new test procedure that EPA proposes – manufacturers have little experience performing the testing, few accessible test cell facilities that can perform the test, and no time with which to develop these capabilities. It is impractical to expect manufacturers to certify new products, with which we have little experience, to a new test cycle, with which we have no experience, and to complete that testing in less than one year from the time the rule is finalized. [EPA-HQ-OAR-2019-0055-1168-A1, p.83]

Daimler Truck recommends that EPA assign a specific NOx credit value for each ZEV, based on vehicle weight class. Credits could be assigned without cycle work testing, since the amount of NOx the vehicle will emit is known (it is zero), and the amount of NOx the vehicle will offset cannot be determined from this testing. [EPA-HQ-OAR-2019-0055-1168-A1, p.83]

EPA could set the credits so that a Class 8 ZEV would offset the typical NOx credits consumed by a typical conventional Class 8 vehicle. EPA could similarly categorize credits for Class 6-7 vehicles, and other categories that the EPA could reasonably bin together. Such an approach would drastically reduce manufacturers' test burdens, EPA's certification review load, and credit-related unpredictability and risk—all without any trade-offs in emission reductions. [EPA-HQ-OAR-2019-0055-1168-A1, p.83]

While the Proposed Rule contains new test standards for both battery electric vehicles and hydrogen fuel cells in this rule, before finalizing its proposal EPA must work with manufacturers and testing experts to determine practical testing procedures that make sense. [EPA-HQ-OAR-2019-0055-1168-A1, p.121]

Daimler Truck has analyzed EPA's proposed Multicycle Test (MCT) from proposed 40 C.F.R. 1037.552 and believes it is not a practical or reasonable test for the following reasons:

- EPA's test procedure takes approximately 40 hours of testing to complete, per configuration
- EPA's test procedure will not be able to be completed as envisioned by some configurations (particularly with high power ratings relative to their battery size) since the vehicles will be left with <10% of their battery capacity after the second HDTC/LLC/SET test sequence. In fact, it is likely the test will only be able to be completed by vehicles with the largest battery capacities relative to their power outputs.
- EPA's abrupt speed/grade/load changes in the HDTC/LLC/SET test sequence are unsafe— the high torque and instant torque capability of ZEVs cause extreme stresses to the dyno couplings and test equipment. This is a real safety risk and could damage the powertrain, the dyno, or any couplings in the system.
- Truck control strategies (such as low-power derates) might cause the test to end earlier than battery capacity alone would dictate.
- EPA's test procedure would require production high-voltage cabling to be removed, since shielded high voltage cables cannot be adequately measured with current probes. This will mean that to perform EPA's proposed testing, manufacturers will have to modify the high voltage cabling in a potentially unsafe manner.
- Very few test facilities in the U.S. are even capable of performing the test EPA proposes, as complete powertrain testing that meets EPA's testing requirements has not typically been used by manufacturers to any great degree. Manufacturers will have to build up this test equipment and the expertise needed to use it.
- EPA's test procedure requires ambient temperatures to be maintained throughout the cycle, but most existing powertrain test facilities may not be conditioned with enough capability to hold temperature throughout the entire test. [EPA-HQ-OAR-2019-0055-1168-A1, p.121]

Daimler Truck would be happy to review its analysis of the MCT in a confidential setting, but firmly believes that the EPA must develop any test procedure with adequate input from manufacturers and test facilities before incorporating it into the federal regulations. [EPA-HQ-OAR-2019-0055-1168-A1, p.122]

Additionally, as discussed in Section III of these comments, EPA's test procedure represents an inappropriate burden for manufacturers. Since EPA envisions this testing will be performed on a powertrain level, it is not clear how many powertrain configurations a manufacturer must test, but the test results will vary based on number of factors not related to the energy capacity or durability of the powertrain. These factors include, among many others:

- Axle ratio of the drivetrain
- Vehicle transmission characteristics
- Control strategies and driver-selectable options
- Battery capacity, configuration, controls
- Power rating of the powertrain
- Power-consuming accessories [EPA-HQ-OAR-2019-0055-1168-A1, p.122]

Since EPA does not specify how powertrains should be categorized for this testing, we assume that the Agency expects manufacturers to run this test for each configuration that could result in a different outcome; therefore manufacturers could be expected to test many configurations. Even employing a reasonable categorization strategy—per vehicle family as defined in Part 1037, for example—manufacturers could be required to demonstrate many configurations at great expense, particularly given that today's typical vehicle families already contain several different ZEV architectures.136 [EPA-HQ-OAR-2019-0055-1168-A1, p.122]

> 136 This increased expense and the attendant compliance burden should be weighed heavily in OMB's review and decision whether to approve the information collection components of the Proposed Rule, in accordance with the Paperwork Reduction Act. Each test takes about 40 hours to run (per vehicle). Given the many configurations that manufacturers may have to test, it is difficult to approximate exactly how much cost and how many personnel hours would be involved, but Daimler Truck expects that the burden would be significant.

Ultimately, EPA's proposed test is intended to measure how much capacity is available in the battery pack. It is unclear why factors outside of the battery should be part of the test. While the drive motor, accessories, control strategies, etc. might change the rate at which power is consumed from the battery, they have no effect on the total amount of energy stored in the battery pack (and by extension, the total amount of energy expended during the MCT, since the test ends when the battery is depleted). The proposed test will need to be repeated many times—one for each configuration that affects the test—with no significant additional information to be gained about the capacity of the battery pack. [EPA-HQ-OAR-2019-0055-1168-A1, p.122]

Daimler Truck recommends that EPA consider a battery-only test to determine battery capacity. Such a test reduces the number of configurations a manufacturer must test, and provides detailed information about the capacity of the battery in a useable, repeatable manner. The industry already uses such a test for this purpose—the 'Static Capacity Test (Constant Current Method)' set forth in Society of Automotive Engineers (SAE) J1798, 'Recommended Practice for Performance Rating of Electric Vehicle Battery Modules,' which is incorporated by reference in CARB's 'California Standards and Test Procedures for New 2021 and Subsequent Model Heavy- Duty Zero Emission Powertrains.' [EPA-HQ-OAR-2019-0055-1168-A1, p.122]

Organization: *General Motors LLC (GM)*

EPA proposes to incorporate by reference regulations and test procedures in many cases that are unclear, duplicative, or are not yet final. [EPA-HQ-OAR-2019-0055-1246-A1, p.5]

In " § 1037.102 Exhaust emission standards for NOx, HC, PM, and CO", EPA proposes that, for battery electric vehicles to qualify for averaging, banking, and trading programs, "Useable battery energy must remain at or above 70 percent throughout the useful life." with the Initial capacity determined by "§ 1037.552 Multicycle powertrain test for battery electric vehicles." These proposed test procedures are new, and duplicative with and distinct from United Nations and CARB proposals to estimate and regulate battery capacity over the useful life of the vehicle.

None of the procedures are yet finalized with final regulations. [EPA-HQ-OAR-2019-0055-1246-A1, p.6]

Incorporating standards by reference that are not finalized, unclear, or duplicative adds uncertainty to what is expected in a finalized regulation, and often increases the burden to industry to comply with standards. GM encourages EPA to not incorporate by reference regulations and test procedures that are unclear, potentially duplicative, or not finalized. [EPA-HQ-OAR-2019-0055-1246-A1, p.6] [[This comment can also be found in section 7.5 of the comment summary]]

Organization: *Truck and Engine Manufacturers Association (EMA)*

However, the NPRM also proposes to impose on credit-generating ZEVs a suite of excessively complex, burdensome, and expensive certification, durability, useful life, and warranty requirements. In that regard, the NPRM includes entirely new certification and compliance requirements that, as written, appear to be impossible to implement. Even if a manufacturer could meet all the proposed regulatory requirements, the certified ZEV would be so expensive that no fleet would be willing to invest in it. The proposed requirements are likely to end up creating two distinct classes of medium- and heavy-duty ZEVs. Credit-generating ZEVs would be burdened with excessive certification, durability, useful life, and warranty provisions, making them commercially non-viable. Conversely, manufacturers would be free to customize non-credit generating ZEVs to meet their customers' needs most efficiently. That unlevel competitive playing field would splinter and hamstring the nascent medium- and heavy-duty ZEV market, rather than promote ZEV sales. [EPA-HQ-OAR-2019-0055-1203-A1, p. 109]

EPA has developed the proposed new ZEV certification, durability, useful life, and warranty provisions without any consultation with the manufacturers that are expected to implement them. History has shown that such unilateral development of complex vehicle certification procedures rarely leads to implementable and successful regulatory requirements. Although it is unfortunate that industry would be starting with the unilateral proposal included in the NPRM, we request that EPA commit to collaborating with manufacturers to identify a workable path forward for the certification and compliance requirements for credit-generating ZEVs. Considering the limited time before a final rule, and the complexity and novelty of ZEV certification and compliance requirements, we believe an interim approach may be the only realistic path forward. An interim solution could be fashioned to meet EPA's needs while not burdening ZEVs with excessive costs and regulatory requirements. If we can identify an appropriate interim approach, a long-term solution could then be developed as part of the Phase 3 GHG rulemaking. That rulemaking is a more appropriate forum for the in-depth data analyses and technical discussions needed to establish workable and effective long-term ZEV certification and compliance requirements. [EPA-HQ-OAR-2019-0055-1203-A1, p. 109]

In medium- and heavy-duty applications, BEVs and FCVs can be used in emissions reducing applications that do not accumulate mileage. For instance, a vehicle may be used as a source of electricity in remote applications, or at a job site, replacing a generator and powering jobsite equipment. A zero-emission vehicle may be used to temporarily power a building, replacing a generator. In advanced applications, a vehicle or a fleet of vehicles may be used to supplement electricity grid services, such as through load-leveling. These example applications have the potential to create societal value using advanced transportation technologies to reduce emissions traditionally associated with other sectors. NESCAUM19, Union of Concerned Scientists (UCS)20, Environmental Defense Fund (EDF)21, International Council on Clean Transportation (ICCT)22, Rocky Mountain Institute (RMI)23, Sierra Club24, the State of California, and the United States Department of Energy25 have all recognized the potential value from zero-emissions vehicles, and especially from medium-duty and-heavy duty zero emissions vehicles, through their deployment in innovative applications. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 135 - 136]

19. “Providing V2G services benefits school districts and utility ratepayers by generating revenue that improves the economics of fleet electrification while reducing electricity distribution system costs for ratepayers.” (page 15-16, pages 31-35), Multi-State Medium- and Heavy-duty Zero-Emission Vehicle Action Plan. https://www.nescaum.org/documents/mhd-zev-action-plan-public-draft-03-10-2022.pdf/

20. “Flexible loads and V2G can provide many of the same benefits as dedicated storage, such as enabling increased market penetration by renewables.” (page 4), Charging Smart. https://www.ucsusa.org/sites/default/files/attach/2017/05/Charging-Smart-executive-summary.pdf

21. EDF supported research through the NC Clean Energy Technology Center (NCCETC) in coordination with Roanoke Electric Cooperative (REC) to demonstrate vehicle-to-grid smart chargers. “Preliminary findings from a demonstration of two-way, vehicle-to-grid (V2G) technology in North Carolina show the economic potential for using bidirectional charging technologies to feed energy stored in electric vehicle batteries back to charging sites, especially when the grid is experiencing high demand.”, NC Cooperative Demonstration of Vehicle-to-Grid Smart Charger Shows Economic Value. https://nccleantech.ncsu.edu/2021/09/21/nc-cooperative-demonstration-of-vehicleto-grid-smart-charger-shows-economic-value/

22. “EVs could potentially benefit the grid through additional services that help utilities manage load. For example, an EV that is plugged in all day could be used to store excess electricity during off-peak hours; he utility could later withdraw that electricity from the EV battery to supply peak load, avoiding some inefficient cycling of generators.” ICCT recommends that policy makers “Create or amend rules to allow participation by EVs in electricity markets, so EVs can provide and be compensated for ancillary services.” (pages 3-4), Electric Vehicle Grid Integration in the U.S., Europe, and China. https://theicct.org/wp-content/uploads/2021/06/ICCT_Briefing_EVgrid_integration_20130923.pdf

23. “Actions on the demand side, such as improved energy efficiency (and appliance efficiency), demand response, community scale RE and battery storage systems, vehicle-grid systems, etc. can benefit the system by smoothening peak loads, mitigating grid power shortfalls, and sustaining critical services during power outages.” (page 19)

Powering Through: A Climate Resilient Future. https://rmi.org/insight/powering-through-a-climate-resilient-future/

24. “Vehicle-to-grid (V2G) technology allows EVs to absorb electricity from the grid when it’s plentiful, and then provide electricity back to the grid when – and where – it’s needed most. Heavy-duty electric vehicle fleets are particularly attractive energy resources.” Electric Vehicles are Indispensable for California’s Climate Resiliency, Even During a Power Outage. https://www.sierraclub.org/articles/2020/09/electric-vehicles-are-indispensable-forcalifornias-climate-resiliency-even-during

25. “The current availability of plug-in electric vehicles (PEVs), and their projected penetration of the private transportation market in the coming years, introduces the possibility of feeding the energy stored in the vehicle batteries back to the electric grid.” (page 1), Vehicle-to-Grid (V2G) Power Flow Regulations and Building Codes Review by the AVTA. https://www.energy.gov/sites/prod/files/2014/02/f8/v2g_power_flow_rpt.pdf

CARB, EPA, and the United Nations are all proposing regulations requiring manufacturers to report on or meet battery durability, UL, and warranty requirements, as measured by different test and certification procedures. Those multiple requirements are duplicative, and burdensome, and possibly counter-productive to accelerating the deployment of zero-emissions vehicles, and the realization of the attendant emissions reductions. CARB is proposing to regulate battery durability through Advanced Clean Cars II26; EPA has proposed new test procedures for energy storage devices in this NPRM27; and the United Nations Economic Commission for Europe has finalized a Global Technical Requirement (UN GTR) for light-duty vehicle battery durability28 (Heavy-Duty in-vehicle battery durability development was started in 2022). EPA should work with those regulating bodies to coalesce around a single harmonized standard. The UN GTR process has incorporated feedback from manufacturers, more so than the CARB or EPA rulemakings. The Society of Automotive Engineers J1979 and J1939 standards may be excellent references as the topic matures as well. Complying with multiple regulations, having different requirements and test procedures, has the potential to slow manufacturers’ ability to bring zero emissions vehicles into the market and could prevent the realization of economies of scale. As with any emerging market, regulations can have unintended consequences. For example, mileage based warranties and ULs could preclude zero-emission vehicles from participating in innovative applications, such as electricity grid services. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 136 - 137]

26. Advanced Clean Cars 2, Proposed Regulation Order. https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2022/accii/appa8.pdf

27. § 1037.552 Multicycle powertrain test for battery electric vehicles. (Pages 310 – 319.) https://www.epa.gov/system/files/documents/2022-03/hd2027-nprm-reg-redline-memo-2020-02.pdf

28. Final Light-Duty UN GTR #22 for In-Vehicle Battery Durability. https://unece.org/transport/documents/2022/04/standards/un-gtr-no22-vehicle-battery-durability-electrified-vehicles

EPA Summary and Response

Summary:

Several commenters provided perspectives on EPA's proposed testing requirements for ZEVs that manufacturers were choosing to generate NO_X emissions credits from. One commenter (CARB) suggested that EPA modify GEM to calculate work performed by electric motors; the commenter stated that doing so would allow a standardized approach to calculate credits and create a level playing field for manufacturers to calculate NO_X emissions credits. One commenter (CARB) supports proposed approach to use the multicycle test (MCT) to measure work produced since it better reflects real-world operation compared to other test methods (e.g., battery bench testing). The commenter recommends that EPA require the same testing for all ZEVs, regardless of whether or not they generate NOx emissions credits because the information would be valuable. They further recommend that in later program years EPA require manufacturers to age the batteries or fuel cells prior to conducting MCT, and again that, the same requirement should apply to all ZEVs regardless of if they generate NOx emissions credits. The commenter asserted that testing information is critical to support durability and transparency on the state of battery or fuel cell stack performance when purchasing vehicles in the secondary market, and noted that secondary market users can often be those who live in underserved communities. Finally, the commenter stated that test procedures should not create undue costs or lengthy test burden for manufacturers.

One commenter (DTNA) opposing the proposed test requirements stated that EPA hasn't considered the feasibility of performing MCT for all electric vehicle configurations. They noted that each powertrain configuration will require approximately 40 hours of chassis-dyno testing based on their evaluation and stated that the considerable test burden should be considered relevant to Paperwork Reduction Act. They further stated that it is unclear how many configurations would need to be tested and that the work produced will vary based on factors unrelated to NOx emissions (e.g., axle ratio of drivetrain, battery capacity). They also noted that diesel credits are not affected by factors that impact work produced by ZEV powertrain. They further stated that manufacturers don't have experience with the test procedure, and it is impracticable for them to complete the testing in less than one year from when rule is finalized. The commenter (DTNA) recommends that EPA assign a specific NOx credit value for each ZEV based on vehicle weight class with no testing required (e.g., set Class 8 ZEV credits equal to typical NOx credits consumed by Class 8 vehicle). The commenter provided a list of specific concerns with the test procedure (e.g., some vehicles would be unable to complete the test due to insufficient battery energy) and suggested EPA consider a battery-only test to determine battery capacity; they noted that industry is already using SAE J1798.

Other commenters opposing the proposed test procedures state that the test procedures are new and duplicative with and distinct from UN and CARB proposals to estimate and regulate battery capacity over useful life of a vehicle. Commenters stated that incorporating standards by reference that are not finalized, unclear, or duplicative adds uncertainty regarding what to expect in the final rule and can increase industry burden to comply with standards. Commenters encouraged EPA not to incorporate by reference regulations and test procedures that are unclear, potentially duplicative, or not finalized. Commenters stated that mileage-based useful life and warranty requirements could discourage the use of HD ZEVs in applications that don't accumulate mileage, such as supplying energy back to the grid. Finally, commenters stated that EPA should work with other entities such as the United Nations, CARB, and SAE to develop a harmonized test procedure(s) and set of requirements.

<u>Response</u>:

Since we are not finalizing the proposed allowance for manufacturers to generate NOx emissions credits from ZEVs (see Section 12.6.1 of this document and preamble Section IV.G), we are also not finalizing the testing requirements we proposed for ZEVs to generate NOx emissions credits.

We recognize that one commenter urged EPA to require the same durability demonstration process for all ZEVs, regardless of whether they generate NOx emissions credits; however, we did not propose that the testing and performance requirements for battery and fuel cells over the useful life would apply to all ZEVs and thus are not finalizing such an approach at this time. We note that the final requirements result in consistent requirements for manufacturers certifying ZEVs to criteria and GHG emissions standards. We intend to continue to consider the perspectives included in this comment and the other comments in this Section 12.6.4 when developing future rulemakings relevant to heavy-duty ZEVs.

12.6.5 Useful Life and Warranty Requirements for Electric Vehicles Generating NOx Emissions Credits

<u>Comments by Organizations</u>

Organization: *American Automotive Policy Council (AAPC)*

Given the early stage of commercialization of zero emissions vehicles in medium- and heavy-duty applications, it is appropriate for EPA to collect battery data as the market develops prior to regulating a useful life. EPA should consider exempting ZEVs from useful life requirements in the 2027-2030 timeframe until more real-world battery data is available to inform rulemaking. When EPA does choose to regulate the useful life of ZEVs, EPA should reconsider the restrictive definition of useful life that has been proposed. EPA "mileage or years" based useful life standards should be updated to include, "mileage or year or hours or kWh delivered" to better consider ZEV emissions reducing applications. For instance, hours could accumulate any time the battery is productively discharging. The "kWh delivered" metric would consider wear and tear batteries frequently discharged at high rates and provide some incentive to install packs with larger capacity. Alternatively, the "kWh delivered" metric could be normalized to initial battery pack capacity to effectively sum discharge cycles, without biasing the regulation away from smaller capacity battery packs in affordable applications. EPA should consider harmonizing the "hours or kWh delivered" metrics between classes (for instance light-heavy, and medium-heavy) to ease certification burdens. BEVs and FCVs are technologies that can reduce criteria emissions and GHG emissions; including ZEVs in an ABT program appropriately recognizes how these vehicles can contribute to meeting ambitious air quality goals. [EPA-HQ-OAR-2019-0055-1293-A1, p. 3]

Additionally, we recommend including a provision that partial NOx credits be available for Zero-Emission Vehicles with a declared full useful life below the designated full-useful of the particular engine service class. EPA should consider updates to the Warranty and Useful Life requirements for the final rule to recognize innovative applications for battery electric vehicles (BEVs) and fuel cell vehicles (FCVs). For instance, BEVs and FCVs may be used in emissions reducing applications that do not accumulate mileage. Identical BEV and FCV powertrains may be installed in different vehicle classes and would therefore be subject to different, conflicting warranty and useful life requirements. With some simple changes that align the Warranty and Useful Life requirements, EPA could increase the likelihood that zero emissions vehicles will qualify for NOx ABT without precluding innovative applications. Including zero emissions vehicles in the NOx ABT program appropriately recognizes the potential of these vehicles to reduce emissions and improve air quality. [EPA-HQ-OAR-2019-0055-1293-A1, pp. 3 - 4]

In medium- and heavy-duty applications, BEVs and FCVs add significant new use capabilities that will be used in emissions reducing applications that do not accumulate mileage. For instance, a vehicle can be used as a source of electricity in remote applications, or at a job site, replacing a generator and powering jobsite equipment. The vehicle could be used to power a building for a time, replacing a generator. In advanced applications, the vehicle, or a fleet of vehicles may be used for electricity grid services, such as load leveling. These example applications have the potential to create societal value and use transportation technology to reduce stationary emissions traditionally associated with other sectors. NESCAUM,4 Union of Concerned Scientists (UCS),5 Environmental Defense Fund (EDF),6 International Council on Clean Transportation (ICCT),7 Rocky Mountain Institute (RMI),8 Sierra Club,9 the State of California, and the United States Department of Energy10 have all recognized the potential value zero emissions vehicles, and especially medium duty and heavy-duty zero emissions vehicles, to be used in innovative applications. The referenced U.S. Department of Energy report correctly states that, “V2G adds uncertainty related to battery life and capacity”, which is particularly relevant for useful life requirements measured in mileage or years, as EPA proposes. In innovative zero emissions vehicle applications, battery packs may accumulate cycles unrelated to mileage, and the EPA should consider this when finalizing standards for useful life and warranty. Considering age of the equipment, in years, is also insufficient. Battery cycles, and wear and tear for innovative applications may be unrelated to mileage or years. [EPA-HQ-OAR-2019-0055-1293-A1, pp. 4 - 5]

4 “Providing V2G services benefits school districts and utility ratepayers by generating revenue that improves the economics of fleet electrification while reducing electricity distribution system costs for ratepayers.” (page 15-16, pages 31-35), Multi-State Medium- and Heavy-duty Zero-Emission Vehicle Action Plan. https://www.nescaum.org/documents/mhd-zev-action-plan-public-draft-03-10-2022.pdf/

5 “Flexible loads and V2G can provide many of the same benefits as dedicated storage, such as enabling increased market penetration by renewables.” (page 4), Charging Smart. https://www.ucsusa.org/sites/default/files/attach/2017/05/Charging-Smart-executive-summary.pdf

6 EDF supported research through the NC Clean Energy Technology Center (NCCETC) in coordination with Roanoke Electric Cooperative (REC) to demonstrate vehicle-to-grid smart chargers. “Preliminary findings from a demonstration of two-way, vehicle-to-grid

(V2G) technology in North Carolina show the economic potential for using bidirectional charging technologies to feed energy stored in electric vehicle batteries back to charging sites, especially when the grid is experiencing high demand.", NC Cooperative Demonstration of Vehicle-to-Grid Smart Charger Shows Economic Value. https://nccleantech.ncsu.edu/2021/09/21/nc-cooperative-demonstration-of-vehicle-to-grid-smart-charger-shows-economic-value/

7 "EVs could potentially benefit the grid through additional services that help utilities manage load. For example, an EV that is plugged in all day could be used to store excess electricity during off-peak hours; the utility could later withdraw that electricity from the EV battery to supply peak load, avoiding some inefficient cycling of generators." ICCT recommends that policy makers "Create or amend rules to allow participation by EVs in electricity markets, so EVs can provide and be compensated for ancillary services." (pages 3-4), Electric Vehicle Grid Integration in the U.S., Europe, and China. https://theicct.org/wp-content/uploads/2021/06/ICCT_Briefing_EV-grid_integration_20130923.pdf

8 "Actions on the demand side, such as improved energy efficiency (and appliance efficiency), demand response, community scale RE and battery storage systems, vehicle-grid systems, etc. can benefit the system by smoothening peak loads, mitigating grid power shortfalls, and sustaining critical services during power outages." (page 19) Powering Through: A Climate Resilient Future. https://rmi.org/insight/powering-through-a-climate-resilient-future/

9 "Vehicle-to-grid (V2G) technology allows EVs to absorb electricity from the grid when it's plentiful, and then provide electricity back to the grid when – and where – it's needed most. Heavy-duty electric vehicle fleets are particularly attractive energy resources." Electric Vehicles are Indispensable for California's Climate Resiliency, Even During a Power Outage. https://www.sierraclub.org/articles/2020/09/electric-vehicles-are-indispensable-for-californias-climate-resiliency-even-during

10 "The current availability of plug-in electric vehicles (PEVs), and their projected penetration of the private transportation market in the coming years, introduces the possibility of feeding the energy stored in the vehicle batteries back to the electric grid." (page 1), Vehicle-to-Grid (V2G) Power Flow Regulations and Building Codes Review by the AVTA. https://www.energy.gov/sites/prod/files/2014/02/f8/v2g_power_flow_rpt.pdf

The EPA proposal includes warranty and useful life requirements that vary by regulatory class, and this unnecessarily complicates certification, especially for zero emissions vehicles. For instance, the proposed mileage requirement for useful life of medium heavy- duty is nearly 1.5 times that of light heavy-duty, in 2027-2030. Ideally, requirements would be similar for similarly equipped powertrains, or similarly capable vehicles. The additional weight of batteries on zero emissions vehicles often increases curb weight, and subsequently gross vehicle weight rating (GVWR). As a result, zero emissions vehicles with high-capacity batteries, designed for lighter applications, may be subject to warranty and useful life regulations that historically were tailored for internal combustion engine vehicles with higher capabilities and uses. [EPA-HQ-OAR-2019-0055-1293-A1, p. 5]

The California Air Resources Board (CARB), EPA, and the United Nations are all proposing regulations requiring manufacturers to report on or meet battery durability, useful life, and warranty requirements, as measured by different test and certification procedures. Knowing that OEMs are ultimately responsible for customer satisfaction, these requirements are duplicative and burdensome, and possibly counter-productive to accelerating the adoption of zero emissions vehicles, and their emissions reductions. Durability and warranty requirements for ICE vehicles have developed over many years, but the knowledge of how ZEV technology works in numerous heavy-duty use cases requires further analysis and more time to mature. CARB is proposing to regulate battery durability through Advanced Clean Cars II,11 EPA has proposed new test procedures for energy storage devices in this notice,12 and United Nations Economic Commission for Europe has finalized Global Technical Requirement (UN GTR) for light-duty vehicle battery durability13(Heavy-Duty in-vehicle battery durability development started in 202214). EPA should work with these regulating bodies to form one national standard for the U.S. The UN GTR incorporates significantly more feedback from manufacturers than the current drafts of other proposals. Society of Automotive Engineers J1979 and J1939 standards may be excellent references as the topic matures, as well. Many different regulations, with different requirements and test procedures, has the potential to slow manufacturers' ability to bring zero emissions vehicles to market and reduce economies of scale. As with any emerging market, regulations may have unintended consequences; for instance, a mileage based standard alone may preclude participation in innovative zero emissions vehicles applications, like supplying electricity grid services. [EPA-HQ-OAR-2019-0055-1293-A1, pp. 5 - 6]

11 Advanced Clean Cars 2, Proposed Regulation Order. https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2022/accii/appa8.pdf

12 § 1037.552 Multicycle powertrain test for battery electric vehicles. (page 310 – 319) https://www.epa.gov/system/files/documents/2022-03/hd2027-nprm-reg-redline-memo-2020-02.pdf

13 Final Light-Duty UN GTR #22 for In-Vehicle Battery Durability. https://unece.org/transport/documents/2022/04/standards/un-gtr-no22-vehicle-battery-durability-electrified-vehicles

14 (EVE) Latest EVE #54 Meeting including Heavy-Duty UN GTR development on battery durability. https://wiki.unece.org/display/trans/EVE+54th+Session

Organization: *California Air Resources Board (CARB)*

CARB staff supports U.S. EPA's proposal to require manufacturers of BEVs and FCEVs that choose to generate NOx credits certify their configurations to the same useful life (UL) requirements as conventional engines and powertrains. This would provide assurance to owners and operators that BEVs and FCEVs are designed to be as durable as their conventional vehicle counterparts. Such requirements would ensure that real-world emission reductions resulting from the use of BEVs and FCEVs are realized and would align with the level of NOx emission credits generated. Additionally, CARB staff agrees with U.S. EPA's proposal to use a phased in approach for earlier model years to allow adequate time for BEV and FCEV manufacturers to transition to these more stringent requirements. [EPA-HQ-OAR-2019-0055-1186-A2, pp.22-23]

In response to U.S. EPA's request for comment on the proposed approach for warranty requirements applicable to BEVs or FCEVs that generate NOx emission credits, CARB staff supports U.S. EPA's proposal to subject said BEVs and FCEVs to the warranty periods corresponding to an engine-based primary intended service class, as specified in the proposed 1037.120(b). [EPA-HQ-OAR-2019-0055-1186-A2, p.23]

CARB staff appreciates U.S. EPA's acknowledgement of the work to develop the Zero-Emission Powertrain (ZEP) certification procedure for medium and HD vehicles. In response to U.S. EPA's request for comments on the proposed approach that only batteries and fuel cells in BEVs and FCEVs, respectively, are covered under warranty for manufacturers choosing to generate NOx emission credits, CARB staff recommends that covered components include, at minimum, not only the battery or fuel cell, but all powertrain components. In ZEP Certification,44,45,46 a ZEP includes (as applicable) the electric traction motor, system controller, generator, on-board charger, battery management system, thermal management systems, energy storage system (batteries, capacitors, and flywheels), inverter, fuel-cell stack, and the interface at which electrical power is converted to (or from) tractive mechanical power. System design and component selection are both critical in ensuring the function of a ZEP, and inappropriate design or components could cause catastrophic failure along the driveline. Therefore, CARB staff does not believe that the current proposal would adequately protect purchasers from the potential problems that could occur in BEVs and FCEVs. [EPA-HQ-OAR-2019-0055-1186-A2, pp.23-24]

44 https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/zepcert/fsoraddendum.pdf

45 https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/zepcert/fsor.pdf

46 https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/zepcert/isor.pdf

Additionally, the proposed warranties for battery and fuel-cell powered HD vehicles are already being offered by several companies commercially,47,48,49 and the performance of some of the early fuel cell buses deployed in transit operations in California are exceeding 30,000 hours of operation. [EPA-HQ-OAR-2019-0055-1186-A2, p.24]

47 https://www.masstransitmag.com/home/press-release/12058920/byd-motors-llc-byd-announces-12-year-battery-warranty

48 https://legistarweb-production.s3.amazonaws.com/uploads/attachment/pdf/261695/Battery_System_Warranty_E2_V3.pdf

49 https://www.transit.dot.gov/sites/fta.dot.gov/files/2020-07/FTA_Report_No._0169%20%28002%29.pdf

CARB staff is providing several references50,51,52,53 to similar efforts under the Advanced Clean Cars II rule making development proposals to require robust warranties, service information, and recycling labels for light-duty vehicles. [This comment can also be found in section 5.3 of this comment summary.] [EPA-HQ-OAR-2019-0055-1186-A2, p. 25]

50 https://ww2.arb.ca.gov/sites/default/files/2021-10/accII_october_2021_workshop_presentation_ac.pdf

51 https://ww2.arb.ca.gov/sites/default/files/2021-12/draft%20zev%20battery%20label%201962.6%20posted.pdf

52 https://ww2.arb.ca.gov/sites/default/files/2021-12/draft%20zev%20warranty%201962.8.pdf

53 https://ww2.arb.ca.gov/sites/default/files/2021-12/draft%20service%20information%201969.pdf

Organization: *Cummins Inc. (Cummins)*

Durability, useful life, and warranty are especially important in the context of ABT. EPA proposes to allow the generation of ZEV NOx credits that can be used by diesel engines to comply with the engine NOx standards and to require ZEV to meet the same useful life requirements as diesel engines. This parity in useful life is needed to ensure that the ZEV is fully offsetting the higher emissions of the credit-using diesel engine. EPA further proposes to require that UBE and FCV must remain at least 70% and 80%, respectively, throughout UL. Alternatively, EPA should consider allowing manufacturers to calculate ZEV credits based on reduced UL periods if the UBE and FCV minimums can't be met for the full UL. [EPA-HQ-OAR-2019-0055-1325-A1, pp. 10 - 11]

Organization: *Daimler Truck North America LLC (DTNA)*

EPA has not adequately demonstrated feasibility of their proposed ZEV durability standards, especially in the timelines EPA proposes. We believe that it is impossible for manufacturers to validate and certify their vehicles to durability standards for MY 2024, when such certification would need to start less than one year from now. Any ZEV requirements that increase uncertainty, cost, or risk will serve to dis-incentivize their production and adoption, which is the opposite of EPA's intention. Requiring different standards for ZEVs that generate NOx credit, as compared to those that do not, could create a splintered ZEV market, with two tiers of ZEVs at different price points, creating an unlevel playing field and confusing or misleading customers—ultimately dissuading further adoption of ZEVs. Each of these issues is discussed in more detail in Section VI of these comments. [EPA-HQ-OAR-2019-0055-1168-A1, pp.81-82]

Further, the emissions benefits of ZEVs—and the knock-on effects of incentivizing ZEVs now—outweighs the small risk that ZEVs will not offset as much NOx as their credits enable. The same risk exists for clean diesels, which may not generate as much credit as predicted (particularly if they are not used as much as their statutory useful lives imply, or are damaged in an accident or otherwise removed from service). The public benefit is best served by an aggressive and dramatic shift towards ZEVs as soon as possible. We urge EPA not to slow the adoption of ZEVs with unnecessary requirements tied to the generation of NOx credits. [EPA-HQ-OAR-2019-0055-1168-A1, p. 82]

EPA proposes useful life and durability requirements for credit-generating HD ZEVs far in excess of what the Agency has demonstrated to be feasible.131 The only materials that EPA presents in support of feasibility are several press articles claiming 'transit buses show BEVs are capable of operating more than 10 million miles and over 30 years of normal service,' and that the Department of Energy has set a durability *target* for HD FCEVs as part of DOE-sponsored research program to develop a one-off demonstrator vehicles.132 The sources do not adequately support the Agency's claims that its proposed ZEV useful life and durability requirements are feasible for the following reasons:

1. The articles that EPA cites are not controlled studies. Rather, EPA provides a collection of press releases from manufacturers and magazine articles, which are intended to sell vehicles.

2. The cited articles only focus on city buses, which are prime candidates for electrification in light of their controlled and predictable charging practices. These vehicles should be expected to have better durability than other ZEV applications, since their loads are light, their total energy throughput is small in comparison to Class 8 vehicles, and they will not be exposed to aging factors like high charge rates.

3. The cited articles mostly focus on the length of the warranty: 12 years in these cases. However, since they are press pieces, they are presented in brief and do not focus on the limitations of the warrantees. Many warrantees expressly limit the number of cycles or the total energy throughput the battery is guaranteed for, and these limits are often not in line with EPA's proposals. The articles do not even provide a mileage limit— which, in any case, would not translate from city buses to other ZEV applications that target much higher mileage.

4. One of EPA's cited articles even explicitly states that the battery will need to be replaced at mid-life, specifically because it will not meet durability targets.133 As the most expensive component of a ZEV, the cost of a battery pack must be accounted for in the purchase price of the ZEV if a replacement is required.

5. The DOE target that EPA cites is a development target for the Super Truck 3 program. This program is intended to research the feasibility and develop demonstrator vehicles. While the value of government investment in ZEV research cannot be understated, a research program target should not be assumed as evidence of feasibility for production vehicles. In addition, no products have been completed or demonstrated to meet the targets of Super Truck 3 to date; it is an in-progress research program, but EPA uses it to justify a requirement which will take effect in MY2024. [EPA-HQ-OAR-2019-0055-1168-A1, pp.117-118]

131 We request that EPA keep in mind its statutory directive to ensure that criteria pollutant emission standards for heavy-duty vehicles reflect the 'greatest degree of emission reduction achievable' through the application of technology that EPA

determines will be available for the model year to which such standards apply, giving 'appropriate consideration to cost, energy, and safety factors associated with the application of such technology.' 42 U.S.C. §7521(a)(3)(A)(i). Compliance flexibilities such as the NOx credit program are essential to the achievability of the very stringent NOx standards that EPA has proposed, thus the considerations in CAA Section 202(a)(3)(A)(i) are relevant to appropriateness of the requirements that EPA has proposed for credit-generating ZEVs.

132 See Proposed Rule, 87 Fed. Reg. at 17,502.

133 See id. (citing 'Idaho's YRT to add Proterra battery-electric buses, charging infrastructure,' Metro Magazine, (Oct. 25, 2019) ('The performance warranty also includes a requirement for Proterra to install new batteries on the buses at mid-life to help ensure the batteries always have plenty of energy to meet their route needs and hedge against future replacement battery costs.')).

EPA's own sources in fact support the *in*feasibility of the Agency's proposals. City bus manufacturers are offering warrantees, which are limited in terms of cycles, energy throughput, or mileage—and even in these cases, may require battery pack replacements. It can be inferred that other applications may struggle even more with EPA's proposed requirements, with higher loads, greater energy throughput, large accessory loads, and potential exposure to higher charge rates. [EPA-HQ-OAR-2019-0055-1168-A1, p.118]

The ZEV market is still developing, and factors will emerge bearing on feasibility that EPA has not considered during its assessment. For example, high-speed charging (megawatt charging or more) will almost certainly become a market necessity, which will enable further penetration of ZEVs, but will likely have some effect on battery life that manufacturers cannot predict at the time of certification. Similarly, the state of hydrogen infrastructure and the quality and purity of the supplied hydrogen could affect fuel cells in ways that are not well understood today. [EPA-HQ-OAR-2019-0055-1168-A1, p.118]

Additionally, EPA's proposal does not consider the widespread adoption of Vehicle-to- Grid operations (which Daimler Truck has already successfully deployed today) or for auxiliary power draws in the form of so-called 'ePTO' applications. Both of these technologies could draw as much or more power from the vehicle as driving will, but EPA's proposals do not account for them in their calculation of useful life. Any useful life requirement should be based on total energy throughput, which accurately represents the work done by the powertrain over its life. [EPA-HQ-OAR-2019-0055-1168-A1, pp.118-119]

Daimler Truck's experience as one of the leaders in ZEV deployment suggests that ZEV equipment specifications for battery and fuel cells may not match EPA's proposed useful life targets for credit-generating ZEVs. The Company will share further relevant technical details on the state of development of BEVs and FCEVs with the EPA in a confidential setting. [EPA-HQ-OAR-2019-0055-1168-A1, p.119]

Finally, it would be impossible for manufacturers to validate products to the useful life values that EPA proposes, especially in the timeframe EPA proposes. Traditional diesel vehicles are operated twenty-four hours a day, for years ahead of production, to ensure their performance over EPA's useful life targets. ZEVs cannot be operated as aggressively, since they need downtime for charging. Using Daimler Truck's most aggressive validation programs, it takes about twice as long to validate a ZEV to full useful life than it does for a conventional vehicle. It would take more than 4 years to even accumulate the mileage necessary to validate a single truck to EPA's proposed useful life, given the charging requirements. EPA proposes its requirements would take effect as early as MY 2024; products for that year have already been developed and validated, and there is about one year between now and when certification efforts begin for those products. Thus, certifying these products to the proposed useful life values in the timeframe given is not practical or reasonable. [EPA-HQ-OAR-2019-0055-1168-A1, p.119]

All of these factors must be considered by EPA when it determines whether or not its proposed durability and useful life requirements for NOx credit-generating ZEVs are in fact feasible. [EPA-HQ-OAR-2019-0055-1168-A1, p.119]

Our customers are aware that ZEV products are ideal for some applications, but not appropriate for others. In their current forms, ZEVs are not well-suited for long-haul, sleeper applications that have extremely high energy usage, high mileage, and little downtime. Daimler Truck works with its customers to determine appropriate applications for their needs, and customers' expectations regarding range, durability, and longevity are well-defined before they invest in the technology. Typical use cases involve regional pick-up and delivery, short-haul tractors, trucks, school buses, walk-in-vans, and other applications that generally accumulate fewer miles over their life. However, EPA is proposing to set 'one size fits all' useful life and durability targets for manufacturers to generate NOx emission credits from these vehicles, on the assumption that there will be adequate ZEV replacements for *all* types of diesel vehicles on the road today. This assumption fails to account for the wide variety of applications and duty cycles that customers demand. [EPA-HQ-OAR-2019-0055-1168-A1, p.119]

It is likely true that an average ZEV will accumulate fewer miles over its life than a diesel-powered, long-haul truck. EPA argues that therefore it might not be appropriate for it to generate the same number of NOx credits. EPA makes no attempt, however, to rationalize the same inconsistency in the diesel market today—namely, that a manufacturer may generate NOx credits for producing a HD engine used in a short-haul vehicle, and use them to meet emissions compliance obligations for a HD engine that powers a long-haul vehicle. [EPA-HQ-OAR-2019-0055-1168-A1, pp.119-120]

Customers will adopt ZEVs in the applications that make business and technical sense for them. In these applications, ZEVs will replace trucks that would have been conventionally diesel powered—and therefore, these vehicles deserve to generate NOx credit because their adoption will lead to actual NOx emissions reductions. Even if a ZEV is not destined to be used in the most extreme applications that its diesel counterpart would be, it is still being used as a replacement for a diesel-powered vehicle, and this should be reflected in the crediting provisions of EPA's regulatory program. [EPA-HQ-OAR-2019-0055-1168-A1, p.120]

Instead, EPA proposes to impose durability targets that would make ZEVs capable of meeting the durability of the longest-lived, highest mileage diesels in order to generate NOx emission credits; this will necessarily add cost. EPA admits as much in the Proposed Rule, explicitly recommending approaches for meeting battery and fuel cell durability requirements that would add significant cost to these vehicles: 'For instance, manufacturers could choose to design the battery or fuel cell in their product to have a larger capacity at the start of the vehicle life and limit the extent to which the initial capacity is available for use […] Alternatively, a manufacturer could choose to include battery or fuel cell maintenance or replacement as part of critical emission-scheduled maintenance.'134 [EPA-HQ-OAR-2019-0055-1168-A1, p.120]

134 Proposed Rule, 87 Fed. Reg. at 17,559.

In other words, EPA's proposal would amount to a requirement that manufacturers:

1. Install a larger battery or fuel cell;

2. Limit the capability of the vehicle by restricting its available energy; and/or

3. Replace the battery or fuel cell during its useful life. [EPA-HQ-OAR-2019-0055-1168-A1, p.120]

Each of these actions would necessarily add very significant cost, or reduce the effectiveness of the vehicle at a given cost point. EPA's proposal is geared towards guaranteeing capability that fleets might not need, by adding very significant cost or reducing product capability. This serves to undermine the principles of variability in use and customer needs discussed above, and will directly reduce the adoption of ZEVs in the market place. [EPA-HQ-OAR-2019-0055-1168-A1, p.120]

Regarding EPA's request for comment on whether manufacturers should be required to pay for battery / fuel cell replacement,135 ultimately, that cost will be passed on to the customer, either as a maintenance replacement that they pay for, or an up front cost reflected in the purchase cost of the vehicle. If manufacturers are obligated to take on liability for replacements, this will add further uncertainty and risk, making manufacturers less likely to aggressively pursue new technologies and increase ZEV penetration. [EPA-HQ-OAR-2019-0055-1168-A1, p.120]

135 See id. at 17,560.

Ultimately, manufacturers want to build products that customers want to buy. EPA's proposal threatens to disrupt the supply-demand dynamics of the ZEV marketplace by effectively impeding manufacturers' ability to design and build products with the capacity, range, and durability that fleets demand. EPA's proposal, if finalized, would mandate the optimum product that manufacturers must produce to the detriment of customers' ability to choose. The likely outcome would be to dampen the ZEV market and impose significant and unnecessary costs, serving to slow ZEV adoption. [EPA-HQ-OAR-2019-0055-1168-A1, pp.120-121]

EPA states its belief that the proposed battery and fuel cell durability requirements for BEVs and FCEVs would ‘help to ensure consistency in product quality as these technologies become increasingly available in larger portions of the heavy-duty fleet.’137 As noted above, manufacturers are sufficiently motivated to ensure product quality. Manufacturers want to sell the products that fleets want to buy—and with ZEVs, fleet motivations are already well-aligned with environmental benefits. The requirements of the Proposed Rule would only serve to stifle market forces, add cost, and ultimately slow adoption of these technologies. [EPA-HQ-OAR-2019-0055-1168-A1, p.123]

137 Id. at 17,559.

EPA’s proposed requirements for generating NOx credits would in fact undermine the notion of consistency in the ZEV market by specifically creating two different ‘classes’ of ZEVs. ZEVs that are produced to generate NOx credits will be subject to much stricter requirements for longer periods of time, while non-credit-producing ZEVs will be subject to no durability requirements, and be held to much shorter useful life and warranty periods. This will create two tiers of ZEVs:

- Credit-producing ZEVs with long, expensive warranty periods, long certified useful lives, and (as discussed above) oversized batteries which are intentionally capacity-limited
- Non-credit-producing ZEVs with shorter warrantees, shorter useful life periods, and much more freedom and flexibility regarding their power source—and no EPA-guaranteed durability. [EPA-HQ-OAR-2019-0055-1168-A1, p.123]

This will necessarily lead to market confusion and uncertainty. Fleets will not be aware or, nor be interested in, the certification strategies that manufacturers used to generate credits or not, but they will know that they can buy cheaper products, or more expensive, less-flexible products. [EPA-HQ-OAR-2019-0055-1168-A1, p.123]

Not only will this lead to inconsistency in the marketplace for ZEVs, it will create an uneven playing field for manufacturers. Manufacturers that produce a significant legacy portfolio of conventionally-powered vehicles will need to generate NOx credits—since, as we have demonstrated, EPA’s proposed diesel regulations are not feasible. Smaller manufacturers, who can afford to sell only ZEVs in targeted markets where ZEVs are most likely to be successful, will not face such challenges and will offer ZEVs without these expensive EPA requirements. [EPA-HQ-OAR-2019-0055-1168-A1, p.123]

The upshot will be that manufacturers who are best positioned to develop the long-term solutions for difficult ZEV applications will be forced to significantly reduce sales in markets that are not technically ripe for ZEV adoption. Meanwhile, smaller ZEV-only manufacturers will have an advantage in ZEV-ripe applications, since they won’t be burdened by onerous EPA requirements for longevity, warranty, and useful life. The market impacts of such a situation are dramatic. EPA will not realize its goals of consistent product quality, and may disrupt the entire market as no legacy products will be available. Such an uneven approach, which gives so much advantage to non-traditional OEMs, cannot be tolerated. While Daimler Truck is aggressively pursuing a

ZEV future, we cannot do so competing against companies playing by different rules. EPA must assure a level playing field. [EPA-HQ-OAR-2019-0055-1168-A1, pp.123-124]

Daimler Truck has also investigated EPA's proposed test procedure for hydrogen fuel cells and discussed this proposed test with our fuel cell suppliers, and find similar concerns with the proposed test procedures. EPA's test procedures must be developed in concert with truck, battery, and fuel cell manufacturers to adequately capture the degradation modes of these vehicles. [EPA-HQ-OAR-2019-0055-1168-A1, p.123]

Organization: *Ford Motor Company (Ford)*

However, given the uncertainty in the heavy-duty commercial truck segment about the durability of ZEV high-voltage batteries and fuel cells, we recommend that partial NOx credits be available for ZEVs with a declared full useful life below the designated full-useful life of the particular engine service class. This regulatory flexibility is appropriate in light of the emissions reductions achieved and will be vital to ensuring broader deployment of heavy-duty ZEVs. [EPA-HQ-OAR-2019-0055-1300-A1, p. 4]

Organization: *General Motors LLC (GM)*

In medium- and heavy-duty applications, BEVs and FCVs may be used in emissions reducing applications that do not accumulate mileage, such as providing electricity to a job site. [EPA-HQ-OAR-2019-0055-1246-A1, p.6]

GM encourages EPA to exempt ZEVs from the useful life requirement to participate in the ABT program, or to reform the useful life metrics to better account for innovative emissions reducing applications of ZEVs. [EPA-HQ-OAR-2019-0055-1246-A1, p.6]

Organization: *Navistar, Inc. (Navistar)*

A well-structured credit system is critical to providing compliance flexibility for manufacturers, and can be accomplished without sacrificing emission reductions or causing backsliding. In the proposed rule, EPA is seeking to impose battery life requirements in order for NOx credits to issue. Specifically, for vehicles generating NOx credits, EPA would require that for electric vehicles ("EVs") useable battery energy must remain at or above 70 percent throughout the useful life, and for fuel cell vehicles ("FCVs") fuel cell voltage must remain at or above 80 percent throughout the useful life as a requirement of the NOx emission credit calculation. 87 Fed. Reg. at 17814. These remaining useful life percentages are based on the engine useful life warranty requirements in 40 CFR §§ 1037.102 and .120. EPA should not use the engine useful life requirements as the basis for battery and fuel cell durability requirements. The modes of operation of batteries and fuel cells are much different from engines. For example, batteries and fuel cells will likely be used as back-up power or for peak shaving. These modes of operation are unique to EVs and FCVs, and the durability of batteries and fuel cells should not be subjected to the same requirements as engines for purposes of generating NOx credits. Indeed, EPA has acknowledged that EV and FCV technologies "are in relatively nascent periods of development." 87 Fed. Reg. at 17559. Navistar urges EPA to adopt lower percentages than 70 and 80 percent, respectively, for the required percentage of battery energy and fuel cell voltage remaining at the end of the useful life period in order to generate NOx credits. [EPA-HQ-OAR-2019-0055-1318-A1, p. 5]

Organization: *NC Commerce*

We are also concerned about the proposed rules attempts to add new certification, warranty, and useful life requirements to zero-emission vehicles. This will add cost to ZEV and delay their deployment to the business community. Nearly half (49 percent) of U.S. commercial trucks are now powered by the newest generation, near-zero emissions diesel technology. It is imperative we do not impede continued progress on this front. [EPA-HQ-OAR-2019-0055-1434]

Organization: *North Carolina Assembly House of Representatives, John Faircloth*

We are also concerned about the proposed rules attempts to add new certification, warranty and useful life requirements to zero emission vehicles. This will add cost to ZEV and delay their deployment. [EPA-HQ-OAR-2019-0055-2446, p. 1]

Organization: *Tesla, Inc. (Tesla)*

Under EPA's proposal, to participate in the NOx trading provisions, manufacturers face an eligibility threshold whereby manufacturers must attest that their vehicles retain 70% useable battery energy (UBE) for a useful life of 10 years and/or 435,000 miles (and greater after MY 2027), whichever comes first.140 For reasons elaborated below, the durability requirements should be removed or substantially amended. [EPA-HQ-OAR-2019-0055-1219-A1, p.16]

140 87 Fed. Reg. at 17557-17559.

Tesla shares EPA's interest in building BEV customer assurance and increasing BEV adoption. Indeed, Tesla maintains overwhelming customer satisfaction with all its vehicles.141 As drafted, the durability requirements, however, provide no NOx emission reduction benefit, encourage a lack of customer transparency, and will harm electric vehicle uptake by imposing substantial new costs by inviting designs with hidden battery capacity. EPA should eliminate the threshold and defer any such requirement until at least the Phase 3 GHG regulations when manufacturers have adequately acquired data from the deployed BEV fleets. [EPA-HQ-OAR-2019-0055-1219-A1, p.17]

141 J.D. Power, Making Electric Vehicle Leap of Faith is Highly Satisfactory to New Owners, J.D. Power Finds (Jan . 27, 2022) (Tesla Model 3 and Model Y rank highest); Consumer Reports, The Most and Least Liked Car Brands: Rankings based on Consumer Reports' owner satisfaction survey (Feb. 1, 2022) ('This year Tesla again tops our brand-level satisfaction ranking.')

First, as a threshold to participation the durability requirement provides no additional emissions benefit. Under potential BEV inclusion in the NOx program, a heavy-duty vehicle would be able to generate early action credits from MY 2024-27 and post-MY 2027 program credits through

MY 2031. Manufacturers have only a short credit generation window and are incentivized to ensure a good initial customer experience. Indeed, the entire seven-year crediting period is far shorter than a proposed BEV useful life period. In other words, when manufacturers cease to able to generate credits the first deployed BEVs in the program will still not have reached useful life and data as to durability performance will still be sparse. Furthermore, whatever the retained UBE in any of these vehicles after 10 years/435,000 miles these deployed heavy-duty BEVs will still have emitted no NOx over their useful life. [EPA-HQ-OAR-2019-0055-1219-A1, p.17]

Second, Tesla is not aware of evidence from any OEM that heavy duty BEV battery packs can maintain the proposed 70% UBE retention over 10 years for all customer use cases. In the heavy-duty space, BEVs will borrow directly from light-duty battery chemistry (unlike moving from a gas light duty vehicle to a heavy- duty diesel). On the light-duty side, few Tesla vehicles (or any EVs) have been on the road for 10 years (Tesla's oldest Model S vehicles are just reaching such an age) and/or 435,000 miles. Furthermore, the heavy-duty cycling use case is substantially more aggressive than the light duty use case (more throughput/day, more fast charging, etc.). Allowing greater BEV deployment now via NOx program participation without requiring a durability pre-requisite would empower manufacturers to begin to deploy BEVs without regulatory risk, accumulate significant durability data, and as noted above, do so without any direct NOx emission implications. [EPA-HQ-OAR-2019-0055-1219-A1, p.17]

Third, EPA suggests that manufacturers can overcome the durability threshold by either creating larger batteries with hidden capacity that can slowly be accessed142 or by declaring a lower UBE during testing and certification than is present.143 Encouraging either of these approached is fundamentally flawed. BEV customers, just like other heavy-duty customers, will have guarantees of performance from the manufacturer. In adding new product specifications, the agency is just adding cost for more performance than what the customer/company wanted in the vehicle. Further, compelling oversized battery packs will also significantly and unnecessarily raise BEV prices and dampen deployment of the best NOx reduction technology currently available. In addition to cost and range, the hidden capacity approach negatively impacts other product performance metrics (such as range recovered during a fast-charging event), which may be more important for the heavy-duty application than battery lifetime. To that end, hiding capacity does not actually change much about the battery itself. All it does it take away utility, and further NOx emission reductions, at the beginning of life to give customers a manufactured sense of stability. Allowing full access to the battery (with reliable energy estimation) allows for maximum utility of deployed products over the entire life - something that is fundamental to the Tesla customer experience and should be present in good public policy. [EPA-HQ-OAR-2019-0055-1219-A1, p.17]

142 87 Fed. Reg. at 17559.

143 Id. at fn. 695 (allowing manufacturer to declare UBE lower than measured value in order account for degradation over useful life.).

Organization: *Toyota Motor North America, Inc. (Toyota)*

Growing the market for HD ZEV is crucial as these emerging technologies, particularly FCEVs, have promising uses in long distance transportation. However, further study is needed to determine the long-term performance of these powertrains under the new operating conditions they will encounter in heavy-duty service. Toyota supports EPA's incorporation of UNECE durability requirements of 70% usable battery energy (UBE) for BEV and 80% for fuel cell voltage (FCV) for FCEV. However, Toyota disagrees with the proposal to align BEV and FCEV useful life periods with those for an engine-based service class to generate NOx emission credits. BEV and FCEV powertrain durability is impacted by multiple factors, including duty cycles. Variations in duty cycles are likely to result in variations in ZEV powertrain performance and longevity. [EPA-HQ-OAR-2019-0055-1224-A1, p.2]

We request EPA specify a limited set of duty cycles and/or vehicle use cases, such as drayage, long haul, regional haul, local delivery, etc., and establish an appropriate durability requirement for each duty cycle to generate credits. Additionally, while early data from ZEV HD applications show good durability, and we expect future trends to be similar, the technology is still evolving. Therefore, we propose EPA begin with a lower durability requirement for the various duty cycles and reassess in three to five years' time. This will allow both EPA and manufacturers to collect data on the appropriate durability for ZEV powertrains as the technology evolves and improves. [EPA-HQ-OAR-2019-0055-1224-A1, p.2]

Toyota also finds EPA's potential requirement to provide maintenance free-of-charge as part of emission-related maintenance to be extremely burdensome. As EPA has stated, the battery or fuel cell is guaranteed to be one of the highest-cost components as part of a BEV/FCEV. Powertrain manufacturers and HD OEMs have contractual agreements and warranty coverage [EPA-HQ-OAR-2019-0055-1224-A1, p.3] which includes certain parts, performance standards, and maintenance arrangements. This proposal exceeds those agreements and would be extremely costly. [EPA-HQ-OAR-2019-0055-1224-A1, p.2]

Organization: *Volvo Group*

EPA should not apply useful life and emissions warranty requirements to ZEVs
The Volvo Group supports the EMA comments regarding useful life and warranty requirements for ZEVs generating NOx credits ("11. The Proposed Certification and Compliance Provisions Would be a Barrier to the Adoption of Medium- and Heavy-Duty ZEVs", EMA comments, pg. 106). Further, we are opposed to any application of useful life or emissions warranty to zero-emission vehicles. [EPA-HQ-OAR-2019-0055-1324-A1, p. 8]

Battery and fuel cell durability is highly dependent on loading of the power source, depth of discharge, operation, and environmental factors. Thus, warranty and durability will be highly variable and may change dependent on a specific application, or even from customer to customer within an application, based on average load, daily mileage, terrain, climate, etc. As a result, a standardized determination of durability is not feasible. [EPA-HQ-OAR-2019-0055-1324-A1, p. 8]

Additionally, the Volvo Group does not have sufficient in-use data to determine what battery or fuel cell state of health (SOH) is achievable at the current 435,000-mile useful life, let alone at the increased 600,000- and 800,000-mile proposed values. Nor do we expect to have this data available for approximately five to eight years. [EPA-HQ-OAR-2019-0055-1324-A1, p. 8]

As a result, we urge EPA not to apply useful life criteria to zero-emission vehicles. Barring EPA's acceptance of this request, EPA must work with manufacturers to evaluate actual in-use durability achievements prior to setting any level of useful life or required emissions warranty. [EPA-HQ-OAR-2019-0055-1324-A1, p. 9]

EPA Summary and Response

Summary:

Several commenters provided perspectives on the proposed useful and warranty periods, as well as the proposed requirements for battery and fuel cell performance over the useful life period (referred to as "durability requirements" in the proposal). [39] Commenters supporting the proposed requirements stated that the proposal would provide assurance to owners and operators that ZEVs are designed to be as durable as conventional vehicles, as well as ensure real-world emissions reductions. They further stated that durable ZEVs are necessary to ensure success of the technologies and support robust secondary market since some fleets only buy second market vehicles. Commenters suggested that EPA require the same durability demonstration process for all ZEVs, regardless of whether they generate NOx emissions credits, and, in later years of program, require manufacturers to age/cycle the batteries and/or fuel cells prior to conducting the proposed multicycle test procedure. One commenter supports EPA adopting the UNCE percentages for remaining battery useable energy and fuel cell voltage, as proposed, but would like EPA to start with lower requirements and reassess in three to five years. Other commenters who didn't specifically support or oppose the proposed requirements suggested simply that EPA adopt percentages lower than the proposed 70 and 80 for remaining battery useable energy and fuel cell voltage, respectively. Commenters also stated that EPA should not use engine useful life periods as the basis for battery or fuel cell useful life since ZEVs are used in different applications than conventionally fueled vehicles (e.g., supplying power to the grid) and therefore shouldn't be held to the same requirements as engines for the proposes of generating credits.

Some commenters opposing the proposed useful life and warranty requirements stated that they are unreasonable. They further argued that EPA should not apply useful life and warranty requirements to ZEVs, while other commenters suggested that EPA allow partial NOx credits for useful life less than what's required for particular engine service class. Commenters urged EPA to consider ZEV applications that do not accumulate mileage when setting useful life requirements. They noted that the same ZEV powertrain may be used in different vehicle classes,

[39] We proposed that manufacturers who choose to generate NO_X emission credits from BEVs or FCEVs would certify to the emission standards, useful life values, and warranty periods of an engine-based primary intended service class, as specified in proposed 40 CFR 1037.102(b). We further proposed that manufacturers choosing to generate NO_X emissions credits from ZEVs would be required to meet battery or fuel cell performance requirements over the useful life of the vehicle, where throughout useful life, useable battery energy (UBE) would remain at 70 percent or greater and fuel cell voltage (FCV) would remain at 80 percent or greater of the initial value of a BEV or FCEV, respectively, that was used to generate NO_X emissions credits.

and therefore subject to different useful life and warranty requirements. Commenters were generally concerned with the variety of duty-cycles that HD ZEVs could be used in and how those different duty-cycles would impact battery and fuel cell durability, or performance over the useful life period. Commenters opposing the proposed requirements for battery and fuel cell performance over useful life further argued that the requirements do not provide NO_x emission reduction benefit and could encourage a lack of customer transparency. They also stated that the proposed requirements could result in larger batteries or hidden battery capacity, these and other commenters expressed concerns about the proposed requirements adding costs to ZEVs, which they stated would then decrease ZEV purchases. They noted that based on the variety of use cases in heavy-duty industry, manufacturers prioritize different characteristics (e.g., ability to charge quickly vs. longer range driving) and customers should have full access to the battery with reliable energy estimation. Commenters also argued that there is insufficient data available to set performance requirements for battery useable energy and fuel cell voltage, and therefore EPA should allow manufacturers to deploy HD ZEVs without regulatory requirements to acquire durability data. Finally, commenters stated that EPA's proposal for manufacturers to provide battery or fuel cell maintenance free of charge as part of emissions-related maintenance is overly burdensome and would be extremely costly because it would exceed current contracts and warranty coverage between powertrain manufacturers and vehicle manufacturers.

<u>Response</u>:

As discussed in Section 12.6.1, EPA is not finalizing the proposed allowance for manufacturers to generate NO_X emissions credits from ZEVs. Since we are not allowing NO_X emissions credits from ZEVs, we are also not finalizing the proposed useful life and warranty periods, or the proposed durability requirements for battery and fuel cells to meet certain performance requirements over the useful life, for ZEVs used to generate NO_X emissions credits.

We recognize that one commenter urged EPA to require the same durability demonstration process for all ZEVs, regardless of whether they generate NO_x emissions credits; however, we did not propose that the testing and performance requirements for battery and fuel cells over the useful life would apply to all ZEVs and thus are not finalizing such an approach at this time. We note that the final requirements provide consistent requirements for manufacturers certifying ZEVs to criteria and GHG emissions standards. We intend to continue to consider the perspectives included in this comment and the other comments in this Section 12.6.5 when developing future rulemakings relevant to heavy-duty ZEVs.

12.7 Production volume allowance

<u>Comments by Organizations</u>

Organization: *Alliance for Vehicle Efficiency (AVE)*

In the Proposal, EPA discusses "Other Flexibilities Under Consideration" 12 Here, EPA is considering providing additional flexibilities that will allow for the production of engines with much higher in-use emissions through the year 2032. These flexibilities would allow over 5% of heavy-duty trucks to emit NO_x and PM at levels 10 times higher than what Option 1 proposes to take effect in 2031. This flexibility will unnecessarily subject the public, particularly those in high-risk areas, to additional decades of high NOx emissions and related adverse health effects. AVE asks EPA to reconsider the offering of these flexibilities. [EPA-HQ-OAR-2019-0055-1280-A1, p. 6]

12. Federal Register / Vol. 87, No. 59 / Monday, March 28, 2022, at 17563

Organization: *Allison Transmission, Inc. (Allison)*

As proposed, beginning with MY 2027, more stringent GHG and NOx standards would apply for all heavy-duty vehicle OEMs. Limited exceptions apply, but most heavy-duty vehicles are addressed in this rulemaking.65 EPA, however, indicates that they will consider flexibility for engine manufacturers to certify up to 5 percent of their total production volume to pre-MY 2027 standards where the vehicles involved would be low-volume specialty vocational vehicles such as fire trucks.66 [EPA-HQ-OAR-2019-0055-1231-A1, p.31]

65 Proposed 40 C.F.R. §1036.5.

66 87 Fed. Reg. at 17,565.

- In addition to such flexibility, EPA should consider additional means to ease regulatory burdens for smaller OEMs. For example, the CARB Advanced Clean Trucks Low Volume Exemption allows small OEMs with fewer than 500 average annual vehicle sales in the state over the past three model to be able to generate ZEV credits, but vehicle sales do not generate the accompanying ZEV deficits.67

67 13 CCR §§1963- 1963.5(c). See also Definitions 21(e).

- CARB also allowed for exemptions within the Heavy-Duty Omnibus Rule for certain vocations such as for transit agencies, motorcoach, refuse and heavy-haul given the need for specialized capabilities, along with lower volumes. EPA should consider allowing for similar, specialized exemptions or extensions in the context of this rulemaking for applications which will require additional time to cost-effectively control emissions.[EPA-HQ-OAR-2019-0055-1231-A1, p.31]

Organization: *California Air Resources Board (CARB)*

- CARB opposes the provisions for ‘Other flexibilities under consideration’ and ‘Production volume allowance for model years 2027 through 2029’ as described in pages 17563 through 17565 of the Federal Register. [EPA-HQ-OAR-2019-0055-1186-A1, p.2]

U.S. EPA is seeking comments on considering providing additional flexibilities that would allow manufacturers to certify up to 5 percent of their total production volume of 2027 through 2029 MY medium and heavy HDEs to the current federal pre-MY 2027 engine provisions. [EPA-HQ-OAR-2019-0055-1186-A2, p.56]

Again, CARB staff opposes U.S. EPA finalizing a flexibility that would allow engine manufacturers to certify up to 5 percent of their production volume in a given MY in MY 2027 through 2029 medium and heavy HDEs to the current federal standards for the MY. The justification provided for considering this flexibility is to provide engine and vehicle manufacturers additional lead time to redesign low sales volume products to accommodate the technologies needed to meet the proposed more stringent engine emission standards. CARB staff does not agree with the justification provided by U.S. EPA. CARB staff believes there is enough lead time between now and 2027 to develop the technologies and overcome any packaging challenges. Since HDEs last for many years before they are scrapped, these flexibilities together with the other flexibilities mentioned above could result in significant emissions impacts for many years to follow creating extreme difficulty for California and other impacted states to achieve air quality goals. If U.S. EPA decides to move forward with this flexibility, and with the described restrictions, then CARB staff recommends that those engines emissions should be offset with ABT emission credits to protect our vulnerable impacted communities. [EPA-HQ-OAR-2019-0055-1186-A2, p.56]

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

EPA has requested comment on exempting a portion of engines from compliance with its updated emissions standards by allowing them to instead comply with pre-MY 2027 requirements through MY 2029. Id. at 17,565. That exemption is unnecessary, and EPA should not adopt it. The Proposal states that EPA is considering an allowance for up to 5% of a manufacturer's production volume within the Medium HDE or HHDE families that manufacturers show would be used in low volume, specialty vocational vehicles. Id. The purported reason for such an allowance would be to provide 'lead time and flexibility to redesign' those vehicles. Id. EPA's Proposal provides more than adequate lead time to meet requirements in MY 2027. See Comments of CARB, to be filed in Docket EPA-HQ-OAR-2019- 0055 on May 16, 2022. And to the extent that some vehicles present unique design difficulties, manufacturers can and should generate cleaner engines to compensate for those few nonconforming engines through the standards' ABT provisions. See Section IV.E, supra (noting likely excess of credits). But if EPA does adopt an exemption, it should identify the specific vocational categories for which redesigns will be infeasible, and limit any exemption to those categories alone. [EPA-HQ-OAR-2019-0055-1302-A1, p.63]

Organization: *Cummins Inc. (Cummins)*

Cummins also recommends a low-volume legacy engine flexibility for the most challenging applications. EPA requested comment on a 5% annual sales flexibility to address specialty vehicle applications. Specifically, Cummins recommends EPA's suggested 5% annual sales cap for current NOx level engines. Cummins recommends further constraining this flexibility to the following engines and vehicles: ≥525 hp engine family sales into any vehicle application or any engine sales that are directed for installation in the following Part 1037 vehicle categories: heavy-haul tractors and custom chassis motor homes, concrete mixers, and emergency vehicles. All those engine and vehicle categories have clear EPA definitions, and most have very low average annual vehicle miles traveled. Therefore, a 5% of sales cap would be enforceable and constrained and would lead to a much lower percentage of additional emissions inventory. [EPA-HQ-OAR-2019-0055-1325-A1, p. 9]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

The credit program that EPA proposes is not, however, sufficiently flexible to allow manufacturers to spread their investments and their limited development resources adequately. Under EPA's proposal (and in concert with EPA's other proposals), regardless of a manufacturer's credit balance, they will be required to implement, in MY 2027:

- Emissions systems with a maximum family emission limit (FEL) cap of 0.15 g/hp-hr NOx. o It should be assumed most engines today, regardless of their certification values, could not be certified with an FEL cap of 0.15 g/hp-hr NOx, or manufacturers would do so to generate credit under the existing programs.
- New closed crankcase ventilation systems.
    - This will require, in some cases, dramatic and expensive redesign efforts, up to and including changes to the casting of the engine blocks
- New OBD and inducement requirements.
    - This will require significant software development, and may include changes to vehicle to display signals that EPA envisions.
- New useful life requirements.
    - This could require the redesign of critical emissions relevant components for greater longevity.
- New standards for criteria pollutants besides NOx.
- Many other requirements that could require development beyond the proposed low-NOx standards. [EPA-HQ-OAR-2019-0055-1168-A1, p.84]

So while manufacturers may use NOx credits to reduce the NOx FELs that they must certify to in later model years, they are still required to engage in expensive and time-consuming engine development programs to meet all of the other, non-NOx requirements. In fact, developing new engines that meet all of the above standards—and then, some years later, developing again to further reduce NOx—is very likely to be more expensive than a single development step without any NOx credits. In effect, such an approach creates an 'extra step,' which Daimler Truck believes is not cost effective or beneficial to the manufacturers or the environment. [EPA-HQ-OAR-2019-0055-1168-A1, p.84]

What manufacturers need is a program that will enable them to carry over some of their existing MY 2026 engines and vehicles entirely into MY 2027 and beyond, at least for a few years. This is necessary so that manufacturers can adequately manage their investments, and prioritize technology adoption in the applications that make the most sense—during the transition to new UL NOx technologies, but more importantly, during the transition to ZEVs. [EPA-HQ-OAR-2019-0055-1168-A1, p.84]

For example, manufacturers may decide that certain classes are ripe for ZEV adoption: school buses, walk-in vans, etc. A manufacturer may wish to subsidize small volumes of existing diesel engines using NOx credits to support these applications with the intention to never develop a next-generation UL NOx engine for these applications, but rather, to ramp up ZEV penetration in these applications and obviate the need for diesels in these categories altogether. EPA's proposal does not allow this approach, since manufacturers would be required to develop new engines, with new reduced emissions, new closed-crankcase architectures, longer useful life periods, etc. Under EPA's proposal, manufacturers would be required to engage in a significant, expensive development program regardless of their NOx credit positions. This is money that could be better spent on enabling those ZEV platforms. [EPA-HQ-OAR-2019-0055-1168-A1, pp.84-85]

Similarly, EPA's proposal prevents manufacturers from delaying engine development programs for the purposes of spreading development costs, and managing their human and capital resources. If a manufacturer wished to delay development for a high-horsepower, low-volume, vocational application to manage this R&D investment wisely, he may have sufficient NOx credits to do so, but EPA's other rules prevent such a strategy. [EPA-HQ-OAR-2019-0055-1168-A1, p.85]

Effectively, EPA's proposed NOx credit strategy only serves to manage risk associated with very low NOx levels. It does not allow a manufacturer to adequately manage its investment, or to prioritize technology adoption—since manufacturers will have to engage in costly development and validation for all platforms for MY2027. [EPA-HQ-OAR-2019-0055-1168-A1, p.85]

EPA should consider alternate credit program options that can be used to truly manage investment and to prioritize appropriate applications by allowing manufacturers to leverage credits to stage development programs. CARB has developed similar (although overly complicated) provisions in its Omnibus rule by providing a certification path for so called 'legacy engines,' and additionally by providing an alternative certification path for emergency vehicles and for low-volume high horsepower engines. [EPA-HQ-OAR-2019-0055-1168-A1, p.85]

To enable manufacturer flexibility, EPA must delay the implementation of the other standards in the Proposed Rule for engines that are certified using NOx credits, at least for a transitional period. Delaying such standards to MY 2031 for engines that use NOx credits would be a reasonable compromise and would allow manufacturers to plan to transition all of their products to UL NOx in a manageable and affordable fashion, or, where possible, transition some of them straight to ZEVs. [EPA-HQ-OAR-2019-0055-1168-A1, p.85]

Organization: *Moving Forward Network (MFN)*

The current program has not resulted in the emissions reductions originally promised, owing in large part to shortcomings in the certification procedures on the books today. These are detailed extensively in the NPRM in the agency's justifications for the low-load cycle, increases in warranty and useful life, and updates to the off-cycle program, and more. [EPA-HQ-OAR-2019-0055-1277-A1, p. 33]

As detailed in the section on credit provisions (Section IV.D), particularly the transitional credit program, there is no need for additional flexibility for the dirty diesel engines held to today's weak standards. In fact, there is already far too much flexibility in the proposal which undermines the standards and will eat away at the proposed reductions in damaging NOx emissions this rule is purported to target. [EPA-HQ-OAR-2019-0055-1277-A1, p. 33]

It is abhorrent that EPA would consider further weakening the rule by giving credits to legacy engines certified to 20-year-old standards. Furthermore, the engines found in these vehicles are generally produced by the same large-volume manufacturers that are found in the highest mileage vehicles, Class 8 tractors. In fact, the largest engine manufacturer, Cummins, boasts of one of the identified applications that "more firefighting and EMS professionals depend on Cummins than any other diesel engine."137 [EPA-HQ-OAR-2019-0055-1277-A1, pp. 33 - 34]

137. https://www.cummins.com/engine-applications/fire-and-emergency

The proposed 5 percent exemption is patently absurd—from Cummins alone, such a target could mean that over 10,000 vehicles could be exempted from the proposed standards. Factor in Detroit Diesel and Ford engines, two other high-volume vocational engine manufacturers, and that would mean 20,000 vehicles in 2027-2029 could be exempted at standards that emit nearly 6 times more NOx emissions on the FTP cycle than the already-weak proposed Option 1, a number that is larger when you consider the differences in off-cycle certification and other protections which strengthen real-world emissions reductions compared to the current program. [EPA-HQ-OAR-2019-0055-1277-A1, p. 34]

The proposed exemption is so large that these vehicles could easily represent 20-25 percent of the total NOx emissions from 2027-2029 vehicles. This proposal is as though EPA were creating a loophole comparable to the glider vehicle provisions it limited in the Phase 2 regulations. Moreover, because these vehicles are certified to a different crediting process, whose credits are not eligible to be transferred according to the proposal (87 FR 17553), it is not even clear that these vehicles will be credited against a manufacturer's annual average requirements, which means those emissions will not be made up for in gains elsewhere. At least if such engines were credited against EPA's already too-high FELs, there would be some attempt at recovering those lost emissions! [EPA-HQ-OAR-2019-0055-1277-A1, p. 34]

Finally, 100 percent of diesel engines certified since 2019 have been certified at or below the current average requirement. There is no indication that manufacturers need the added flexibility provided, and the Omnibus standards in effect in 15 percent of the market for new vehicles already require engines below the current standard. This argument is further detailed in Section III.B.6.1 above, in the technical justification opposing a high FEL. [EPA-HQ-OAR-2019-0055-1277-A1, p. 34]

Even under the limited low-volume constraints supposed by EPA, it is possible to achieve a standard much reduced from the current levels, and EPA should eliminate any exemption to such reductions in its finalization of the rule, particularly those that would further the unprotective standards currently on the books. [EPA-HQ-OAR-2019-0055-1277-A1, p. 34]

Organization: *National Association of Clean Air Agencies (NACAA)*

NACAA does not support the inclusion of manufacturer production volume allowances for specialty vocational products or any other engine categories.[EPA-HQ-OAR-2019-0055-1232-A1, p. 14]

Another flexibility on which EPA seeks comment is production volume allowances for MY 2027 through 2029 medium HD engines and heavy HD engines. Based on EPA's description of this option manufacturers would be allowed to continue to certify up to 5 percent of their total production volume of medium and heavy HD diesel engines in each of MYs 2027 through 2029 to "pre-MY 2027 engine provisions"; that is, these engines would be exempt from the new emission standards and allowed to continue to comply with the 21-year-old 200-mg NOx standard. [EPA-HQ-OAR-2019-0055-1232-A1, p. 14]

EPA says this exemption from the new emission standards for the first three MYs "may" be necessary to allow manufacturers lead time and flexibility to redesign some low sales volume specialty vocational products to accommodate the technologies needed to meet the new emission standards. EPA offers as its only example fire trucks, for which, the agency contends, not being subject to the new emission standards during the first three MYs would be "appropriate" because of potential challenges to engine, chassis and body manufacturers of packaging new emission controls. [EPA-HQ-OAR-2019-0055-1232-A1, p. 14]

Not only is this flexibility unwarranted, it would undermine the effectiveness of the rule to reduce emissions and protect public health. Allowing 5 percent of a manufacturers' total production volume of HD engines to meet a 200-mg/hp-hr NOx standard means that one in every 20 engines would be allowed to emit NOx at a level that is an order of magnitude higher than the standard NACAA recommends for MYs 2027-2029, with excess emissions of 180 mg/hp-hr, and to do so with no requirement for mitigating the increased emissions. The result would be an inventory increase of up to 45 percent for each applicable model year's production from a manufacturer with products in a single useful life and power rating category. However the excess NOx inventory could be even greater if a manufacturer elects to satisfy the 95 percent of production with low-rated power and short-useful-life engines while using the 5-percent allowance for engines with a much longer useful life and higher rated power output (such as the large engines that are typically used in EPA's own example). Useful life can vary by a factor of three or four and power rating by a factor of two or three, depending on the details of the engine models involved, but could multiply the excess NOx inventory beyond the 45-percent simplest case above. [EPA-HQ-OAR-2019-0055-1232-A1, p. 14]

The agency also asks whether an exemption from the new emission standards for an interim period should be "limited to specific vocational vehicle regulatory subcategories and the engines used in them" or allowed for others as well. [EPA-HQ-OAR-2019-0055-1232-A1, p. 14]

The only fair evaluation of the emissions impact of this "flexibility" is one based on the assumption that manufacturers will use their full 5-percent allowance and apply the allowance to an engine mix of the largest, longest-lived engines. Assuming actual sales will be less than the allowed 5 percent would be highly imprudent and imperil the NOx reduction program. [EPA-HQ-OAR-2019-0055-1232-A1, p. 14]

EPA should not exempt any engines from complying with the adopted new emission standards for any amount of time and, therefore, should not adopt a production volume allowance option. [EPA-HQ-OAR-2019-0055-1232-A1, p. 15]

Organization: *PACCAR, Inc (PACCAR)*

PACCAR supports the following EMA comment: EPA has also requested comment on a 5% annual sales flexibility to address specialty vehicle applications. In that regard, EMA recommends a low-volume ‘legacy engine’ flexibility provision that a manufacturer could utilize for the most challenging applications. Specifically, EMA recommends that the final rule provide that a manufacturer may sell US 10-compliant engines in volumes up to 5% of their total annual sales volume in the same primary intended service class for a period of 3 years. EMA recommends further limiting this flexibility provision to include only engines that have low annual average miles traveled, thereby minimizing the emissions inventory consequences of this flexibility allowance. This can be achieved by allowing legacy engine sales only from the following engine and vehicle applications:

1) ≥525 hp engine family sales into any vehicle application [PACCAR respectfully submits that this lower threshold should be 510 hp]; and

2) any engine sales that are directed for installation in the following 40 CFR Part 1037 vehicle categories: heavy-haul tractors, custom chassis motor homes, concrete mixers, and emergency vehicles. All those engine and vehicle categories have very low average annual vehicle miles traveled. EMA supports EPA’s proposal to allow for limited sales of previous-Tier engines according to the limitations as described. [EPA-HQ-OAR-2019-0055-1346-A1, p.39]

EMA Comments at 132. PACCAR also proposes to add the following provision to those above:

3) Low Volume highly specialized vocational applications that will not support the installation of these Low NOx systems due to severe packaging constraints. These applications are to be reviewed and approved by EPA on a case by case basis.’ This would protect manufacturers from unforeseen issues that might arise with very specialized products. [EPA-HQ-OAR-2019-0055-1346-A1, p.39]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EPA also has requested comment on a 5% annual sales flexibility to address specialty vehicle applications. In that regard, EMA recommends a low-volume “legacy engine” flexibility provision that a manufacturer could utilize for the most challenging applications. Specifically, EMA recommends that the final rule provide that a manufacturer may sell US10-compliant engines in volumes up to 5% of their total annual sales volume in the same primary intended service class for a period of 3 years. EMA recommends further limiting this flexibility provision to include only engines that have low annual average miles traveled, thereby minimizing the emissions inventory consequences of this flexibility allowance. This can be achieved by allowing legacy engine sales only from the following engine and vehicle applications: 1) ≥525 hp engine family sales into any vehicle application; and 2) any engine sales that are directed for installation in the following 40 CFR Part 1037 vehicle categories: heavy-haul tractors, custom chassis motor homes, concrete mixers, and emergency vehicles. All of those engine and vehicle categories have very low average annual vehicle miles traveled. EMA also supports EPA's proposal to allow for limited sales of previous-Tier engines according to the limitations as described. [EPA-HQ-OAR-2019-0055-1203-A1, p. 135]

Organization: *Volvo Group*

The Volvo Group appreciates the following EPA specialty vocational comments and requests that EPA consider a specialty vehicle definition that considers applications where aftertreatment is mounted off the frame rails. "We are considering a flexibility allowing engine manufacturers, for model years 2027 through 2029 only, to certify up to 5 percent of their total production volume of heavy-duty highway compression-ignition (CI) engines in a given model year to the current, pre-MY 2027 engine provisions of 40 CFR part 86, subpart A. The allowance we are considering would be limited to Medium HDE (Heavy Duty Engine) or Heavy HDE engine families that manufacturers show would be used in low volume, specialty vocational vehicles." (87 FR at p. 17563.) [EPA-HQ-OAR-2019-0055-1324-A1, p. 6]

Organization: *Wisconsin Department of Natural Resources (WDNR)*

In addition to the technical program elements included in Options 1 and 2 of the proposal, EPA is taking comment on several "other flexibilities under consideration", including production volume allowances. As described in the proposed rule, this provision would allow engine manufacturers, for model years 2027 through 2029 only, to certify up to 5 percent of their total production volume at pre-MY 2027 engine standards. [EPA-HQ-OAR-2019-0055-1162-A1, p. 4]

EPA should not finalize the production volume allowance described in this proposal without further justification. Finalizing this provision would allow manufacturers to produce engines that emit significantly more NOx (as much as five times more) for MY's 2027 through 2029, greatly reducing the benefits of the proposed standards. These provisions are intended to allow manufacturers time to understand and address in-use deterioration of engines; however, due to the importance of the NOx emission reductions from this rulemaking, EPA should work with manufactures to ensure these issues are analyzed and addressed prior to the implementation of this rule in MY 2027 wherever possible. If EPA intends to finalize any volume allowance provision, it must provide strong technical justification for each engine category subject to the provision. [EPA-HQ-OAR-2019-0055-1162-A1, p. 4]

EPA Summary and Response

See preamble Section IV.G for EPA's summary and response to comments on the request for comment on a potential flexibility to allow engine manufacturers, for model years 2027 through 2029 only, to certify up to 5 percent of their total production volume of heavy-duty highway CI engines in a given model year to the currently existing, pre-MY 2027 engine provisions of 40 CFR part 86, subpart A.

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16 General engine and vehicle testing provisions under 40 CFR parts 1065 and 1066

16.1 Measuring catalyst temperature for vanadium-based SCR systems

Comments by Organizations

Organization: *Cummins Inc. (Cummins)*

EPA is proposing to codify EPA Guidance CD-16-09 “Certification of Diesel Engines Equipped with Vanadium-Based SCR Catalyst” by adding requirements to the standard-setting parts for on- and off-highway engines to prevent vanadium sublimation and to protect the catalyst from high temperatures. The proposal also adds a procedure for identifying the sublimation threshold temperature, specified in §§1065.1113 through 1065.1121. Cummins supports the intent of those proposed additions, but we recommend the following improvements. [EPA-HQ-OAR-2019-0055-1325-A1, p. 18]

First, it is possible for vanadium-based catalyst wash-coat materials to mechanically shear from the substrate and result in a false-positive detection of sublimated vanadium, when in fact it was only physically transported in the solid phase within the experimental setup. Cummins recommends that the test procedures should be modified to either prevent such a false-positive detection, or EPA should allow for such false-positive results to be voided if physical transport of solid phase vanadium is known to have occurred. To minimize shear stress differences between different lab-to-lab experimental setups, EPA should restrict the allowable sample length to be 2 – 3 inches, instead of EPA’s proposed 1 – 3 inches. At a constant space velocity, restricting the sample length to 2 – 3 inches decreases the shear stress differences by a factor of two, versus EPA’s proposed 1 – 3 inch specification. Cummins supports EPA’s prescribed test procedure space velocity of 35 k/h, but Cummins recommends that the detection limit unit of measure should be a gaseous sample volume normalized concentration, in μg/m3, not a solid sample mass normalized concentration (e.g., pg/g) that includes the mass of the recovered alumina, a portion of the ground quartz tube and the quartz wool. Combining the constant space velocity requirement with Cummins' recommended μg/m3 limit of detection unit of measure unambiguously specifies the procedure and detection limit. In contrast, the total mass-based approach could lead to false negatives if the denominator is sufficiently large, due to a large fraction of the mass merely being part of the experimental setup. [EPA-HQ-OAR-2019-0055-1325-A1, p. 18]

Cummins also requests the addition of an option in Part 1065 for manufacturers to request EPA approval of alternative vanadium sublimation test procedures that involve a system-level test with the complete aftertreatment system and potentially involve higher exhaust temperatures to demonstrate durability and feasibility under representative conditions. We request EPA clarification on whether §1065.10(c)(1) already clearly provides that option, or whether it would be more appropriate for EPA to specify that alternative test procedures may be approved by EPA in advance, in the chapeau paragraph of §1065.1113. [EPA-HQ-OAR-2019-0055-1325-A1, p. 18]

Organization: *Navistar, Inc. (Navistar)*

In particular, we support: EPA's continued support of innovation and flexibility regarding the potential use of different catalysts in SCR processes, including vanadium-based SCR catalysts; [EPA-HQ-OAR-2019-0055-1318-A1, p. 3]

In the proposed rule, EPA is proposing to codify the vanadium SCR requirements currently included in EPA's 2016 guidance (CD 1609). The 2016 guidance clarified EPA's expectations for manufacturers using vanadium-based SCR catalysts and summarized EPA's recommendations on steps manufacturers could take to protect against excessive loss of vanadium from these SCR systems. Navistar supports EPA's proposal to codify the 2016 guidance as regulatory requirements for using vanadium-based SCR catalysts. 87 Fed. Reg. at 17626. [EPA-HQ-OAR-2019-0055-1318-A1, p. 5]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EPA is proposing to codify the Vanadium SCR requirements currently included in Guidance CD 1609. The proposed provisions of §§ 1065.1113 through 1065.1121 are reflective of that long-standing guidance, and provide reasonable requirements related to the determination of sublimation temperatures for the catalyst formulations proposed for certification. Manufacturers would be required to demonstrate that exhaust gas temperatures would not exceed the critical threshold temperatures, and that the system has the capability to detect upstream failures that might lead to high exhaust temperature. [EPA-HQ-OAR-2019-0055-1203-A1, p. 118]

EMA supports the proposed Vanadium SCR provisions, as applicable to HDOH, non-road and other market sectors. Those catalysts have been shown to be effective for NOx reduction and may be a key part of OEM strategies to comply with stringent tailpipe emissions requirements. The proposal provides clear methodologies to validate and certify a highly effective SCR catalyst. That said, EMA requests the addition of a provision in Part 1065 that would allow manufacturers to request EPA approval for alternative test procedures. For example, a manufacturer could propose a system-level test with the complete aftertreatment assembly, and potentially include higher exhaust temperatures to demonstrate representative durability and feasibility. [EPA-HQ-OAR-2019-0055-1203-A1, p. 118]

EPA Summary and Response

Three commenters provided perspectives on the proposed requirements to prevent vanadium sublimation and to protect the catalyst from high temperatures, as well as the proposed procedure to identify the sublimation threshold temperature for vanadium catalysts. Commenters were supportive of the proposed requirements, but two commenters suggested some adjustments for EPA to consider.

Specifically, one commenter suggested that EPA modify the measurement procedure to prevent detection of vanadium-based catalyst wash-coat materials that are physically transported in the solid phase within the experimental setup, or allow for results to be voided if physical transport of solid phase vanadium is known to have occurred. The commenter further stated that EPA should restrict the allowable sample length to be 2 – 3 inches, instead of 1 – 3 inches as proposed; the commenter stated that doing so would minimize sheer stress differences between lab environments. The commenter also stated that the detection limit unit of measure should be a gaseous sample volume normalized concentration, in μg/m3, not a solid sample mass normalized concentration (e.g., pg/g); they stated that the total mass-based approach could lead to false negatives if the denominator is sufficiently large. Finally, two commenters asked EPA to clarify whether the proposal allows manufacturers to request EPA approval of alternative vanadium sublimation test procedures.

EPA agrees with commenters that the proposed requirements for vanadium-based SCR catalysts provide important clarity for manufacturers who wish to use this type of SCR catalyst. We agree that physical transport of solid phase vanadium should be discarded from test results as it is likely that any solid vanadium present in the capture bed is a result of the test method. While the loss of vanadium catalyst could result in environmental concerns whether it is due to physical transport of solid phase or sublimated, any solid vanadium present as a result of the 1065 test procedure is very likely due to the test method itself. We do note, however, this means that when EPA is evaluating an ambient air sample of vanadium (e.g., near a construction site where V-SCR catalysts could be in use), we would collect all inhalable vanadium and consider it relevant for human health evaluation, regardless of size or indication of whether it was sublimated or abraded from the catalyst surface. EPA agrees that a 2- to 3-inch sample may help minimize shear stress differences between lab-to-lab environments; however, loss of sample due to abrasion or sheer stress is already accounted for in the procedure by measuring titanium in 40 CFR 1065.1115(f). The presence of titanium would be an indication of solid vanadium loss. The vanadium correction then takes into account the vanadium-to-titanium ratio of the catalyst. We are also aware that many labs have been testing 1-inch samples for many years and have built up a database of sample and blank test results based on this sample size. While we understand the possibility of loss of sample from the core due to sheer stress, we have not received concerns regarding this from other labs carrying out this testing as abrasion is already accounted for as described above. Therefore, we are not revising the length from what was proposed in the final test procedure. EPA agrees that the detection limit unit of measure should be a gaseous sample volume normalized concentration, rather than solid mass volume, as this will address concerns with the variable impact of dilution effect based on sample size. We are finalizing a recommended method detection limit of 15 μg/m^3 based on a target mass-based method detection limit of 2 ppm, a 60 g capture bed mass, a 0.0129 L (1" long x 1" diameter core) catalyst volume, an SV of 35,000, and an 18-hour test duration. We also agree that the units in EPA guidance document CD-16-09 have been inaccurate and that the units should be in μg instead of pg to reflect a detection limit of ppm. As described in preamble Section XII, we have clarified that manufacturers can request EPA approval of alternative vanadium sublimation test procedures as described in existing 40 CFR 1065.10(c)(7) for test procedures in part 1065. Therefore, no clarification in 40 CFR 1065.1113 is needed.

16.2 Real-time PM corrections based on gravimetric PM filter measurement

Comments by Organizations

Organization: *Alliance for Automotive Innovation (Auto Innovators)*

40 C.F.R.1065.190 PM-stabilization and weighing environments for gravimetric analysis.

We support these proposed changes remove the recommendation to measure the static change of the filter. This test is not typically performed and also not required. [EPA-HQ-OAR-2019-0055-1303-A1, p.5]

EPA Summary and Response

Thank you for your comment.

16.3 NIST-traceability

Comments by Organizations

Organization: *Alliance for Automotive Innovation (Auto Innovators)*

40 C.F.R.1065.301 Overview and general provisions.

Auto Innovators also supports the proposed changes to this section as they appear to be in line with revisions previously requested by Auto Innovators. [EPA-HQ-OAR-2019-0055-1303-A1, p.5]

EPA Summary and Response

Thank you for your comment.

16.4 Engine mapping

Comments by Organizations

Organization: *Truck and Engine Manufacturers Association (EMA)*

Numerous revisions are proposed for GEM modeling in Part 1037. GEM powertrain mapping is an incredibly complex process. To improve the understanding for all, the Agency should provide step-by-step flow charts of the powertrain mapping procedure for ICE, PHEV, and BEV powertrains. Flowcharts would greatly clarify the process, reducing confusion, avoiding wasteful errors, and saving time for both manufactures and the Agency. Similarly, we support the added regulatory flexibility to test hybrid and plug-in hybrid vehicles on either an engine dynamometer or a powertrain dynamometer. [EPA-HQ-OAR-2019-0055-1203-A1, p. 116]

One additional recommendation concerns the engine mapping procedures under §1065.510(b)(5)(ii). The preamble reads: Specifically, our proposed update to 40 CFR 1065.510(b)(5)(ii) would require manufacturers to disable any electronic controls that they report to EPA as an auxiliary emission control device (AECD) that would impact peak torque during the engine mapping procedure. Yet, in proposed §1065.510(b)(5)(ii), there is no such revision. EPA should correct this omission in the final rule. [EPA-HQ-OAR-2019-0055-1203-A1, p. 116]

EPA Summary and Response

EPA agrees with the commentor that the addition of a flow chart to 40 CFR 1037.550 will be useful, but not a necessity at this time, thus we will propose a flow chart in a future rulemaking. Regarding the requirement to disable any electronic controls reported as AECDs that would impact peak torque during the engine mapping procedure, the preamble inadvertently cited the wrong paragraph in 1065.510. This update was added to proposed 40 CFR 1065.510(a), not proposed 40 CFR 1065.510(b)(5)(ii) and is included in the final rule.

16.5 Miscellaneous engine testing amendments

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

CARB staff supports the proposal to add requirements of zero and span verification frequency, and range, zero, and span verification and following actions for 'PEMS gas analyzers used to determine bin emission values' in 1065.935(d)(4)(ii) and 1065.935(g)(5), respectively. However, CARB staff strongly recommends U.S. EPA to add language requiring email notification to the agencies (U.S. EPA and CARB) prior to any retests due to range, zero, and/or span invalidation, so that CARB and U.S. EPA staff know about the retest, including the reasons for the retest. With that notification, U.S. EPA and CARB staff can decide to ask for data of the invalidated test and the retest in a timely manner. Otherwise, we would not see any data of the invalidated test, which are not needed to be submitted unless U.S. EPA or CARB staff asks, and would only have the retest results when they submit their in-use testing report and data for their assigned engine families, which could be more than a year before U.S. EPA or CARB staff would even know about it as it should be described that a retest had to be done in the comment field of the report as in 1036.430, Reporting requirements. In addition, regarding zero- and span-drift verification in 1065.935(g)(5)(iii), CARB staff recommends U.S. EPA to clarify the consequences when PEMS gas analyzers (used to determine bin emission values) do not meet zero- and/or span-drift criteria. CARB staff assumes all the test data would be considered invalid while drift criteria are not met, but it is not clearly stated in paragraph 1065.935(g)(5)(iii). [EPA-HQ-OAR-2019-0055-1186-A2, pp.129-130]

Organization: *Cummins Inc. (Cummins)*

1065.935(g)(4)(ii)

Invalidation criteria should be as follows: Invalidate any data that does not meet the drift criterion in § 1065.550. For HC, invalidate any data if the difference the difference between the uncorrected and the corrected brake-specific HC emission values are not within ±10 % of the uncorrected results or the applicable standard, whichever is greater. [EPA-HQ-OAR-2019-0055-1325-A1, p.24]

1065.935(g)(5)(ii)

Invalidation criteria should be as follows: For HC, invalidate data if the difference between the uncorrected and the corrected brake-specific HC emission values are not within ±10 % of the uncorrected results or the applicable standard, whichever is greater. [EPA-HQ-OAR-2019-0055-1325-A1, p.24]

Organization: *Outdoor Power Equipment Institute (OPEI)*

Section 1065.650 – Emission calculations OPEI is seeking clarification, if the new parts will also affect the sub calculations before reaching the reporting value. Additionally, if a reporting value is negative will it be set to zero? (E.g. this can happen during the THC correction on CH_4 – Sub calculation.) [EPA-HQ-OAR-2019-0055-1205-A1, p.4]

EPA Summary and Response

40 CFR 1065.935

One commentor supports the proposal to add requirements of zero and span verification frequency, and range, zero, and span verification and following actions for 'PEMS gas analyzers used to determine bin emission values' in 1065.935(d)(4)(ii) and 1065.935(g)(5), respectively. EPA thanks you for your comment.

One commentor strongly recommends EPA add language requiring email notification to the agencies (EPA and CARB) prior to any retests due to range, zero, and/or span invalidation, so that CARB and EPA staff know about the retest, including the reasons for the retest. EPA does not agree with the commentor. Tests are occasionally voided due to equipment issues and EPA does not need the manufacturer to notify EPA of a voided test prior to receiving the data from the “official” in-use test; EPA receiving information about the voided tests at the same time as receiving the “official” in-use test data is sufficient.

One commentor recommends EPA to clarify in 40 CFR 1065.935(g)(5)(iii) the consequences when PEMS gas analyzers (used to determine bin emission values) do not meet zero- and/or span-drift criteria. The commentor assumes all the test data would be considered invalid while drift criteria are not met. EPA agrees with the commentor and has revised 40 CFR 1065.935(g)(5)(iii) to invalidate data for the entire shift-day if any of the NOx analyzer drift limits in paragraphs 1065.935(g)(5)(iii)(A) and (B) are exceeded. This intent was implied in the changes proposed to 40 CFR 1065.935(g)(5)(iii) and the revision for the final rule makes this clear.

1065.935(g)(4)(ii)

One commentor stated that the invalidation criteria should be “…**not** within ±10 % of the uncorrected results or the applicable standard, whichever is greater.” EPA agrees with the commentor as the intent is to invalidate the data where the difference between the corrected and uncorrected result is greater than 10 %. Therefore, we have added “not” to 40 CFR 1065.935(g)(4)(ii).

1065.935(g)(5)(ii)

One commentor stated that the invalidation criteria should be “…**not** within ±10 % of the uncorrected results or the applicable standard, whichever is greater.” EPA agrees with the commentor as the intent is to invalidate the data where the difference between the corrected and uncorrected result is greater than 10 %. Therefore, we have added “not” to 40 CFR 1065.935(g)(5)(ii).

40 CFR 1065.650(a)

One commentor requested clarification on if the new sentences added to paragraph (a) of 1065.650 will affect the sub calculated value prior to calculating the reporting value. EPA would note that negative values resulting from sub calculations should never be set to zero unless specified elsewhere in 40 CFR part 1065 or the standard setting parts. The additional language added to paragraph (a) of 40 CFR 1065.650(a) makes it clear that negative values should be carried forward until the final emission calculation, with the exception of the chemical balance where values may need to be set to zero to obtain convergence. 40 CFR 1065.650(g) then make it clear that any negative mass or mass rates should be set to zero for calculating brake-specific emissions, but should be left negative for drift validation.

One commentor asked: If a reporting value is negative, will it be set to zero? (e.g., this can happen during the THC correction on CH_4 – Sub calculation). EPA is not clear on exactly what the commentor’s example is intending to cover. In regards to a reporting value for compliance with an emission standard, this is governed by 40 CFR 1065.650(g) where it states “If a measured mass (or mass rate) is negative, set it to zero for calculating composite brake-specific emissions, but leave it unchanged for drift validation.”

16.6 Other comments on general engine and vehicle testing provisions under 40 CFR parts 1065 and 1066

Comments by Organizations

Organization: *National Propane Gas Association (NPGA) and Propane Education & Research Council (PERC)*

We suggest the following modifications to the Proposed Option 1:

- 4. **Fuel Quality Changes to Propane**: We urge the agency to modify the butanes standard for propane as detailed at Part 1065.720.12 Table 1 includes a butanes standard at a maximum value of 0.05 m3/m3 as per ASTM D2163.13 We ask that the maximum value for butanes is revised to 0.1 m3/m3. There are multiple advantages presented with a modified butanes maximum. First, it slightly lowers the vapor pressure for propane, which makes it more conducive to direct liquid injection. Additionally, butane has a lower light off temperature and therefore this will further aid in mitigating Carbon Monoxide (CO) and Hydrocarbon (HC) emissions from propane vehicles. [EPA-HQ-OAR-2019-0055-1263-A1, p.3]

12 40 C.F.R. 1065.720(a) (2022); see also supra note 1, at 17867.

13 40 C.F.R. 1065.720(a) (2022).

EPA Summary and Response

EPA disagrees with NPGA and PERC. We did not propose a change to the butane value in 40 CFR 1065.720. While the commentor states that there are multiple advantages to increasing the maximum butane limit on the certification fuel, NPGA and PERC did not provide any data on what effect this change would have on the stringency of the emission standards other than stating it would help lower CO and HC emissions. Further, they did not provide any data showing what the typical butane values are of “in-use” fuels and how these values compare to the current certification fuel butane content and their requesting new butane maximum. If the intent of their change is to help reduce CO and HC, then the change in certification fuels also needs to translate to real world butane values at the pump to ensure real world emission reductions.

Organization: *Outdoor Power Equipment Institute (OPEI)*

Section 1065.720 – Liquefied petroleum gas Today’s Section 1065.720 is named ‘Liquefied petroleum gas’. With the Amendment package, it is intended to rename the section to ‘Data requirements’. Section 1065.695 is currently also named ‘Data requirements’. OPEI believes the renaming of Section 1065.720 may be an oversight (same as 1065.695) and recommends no change to Section 1065.720 title – ‘Liquefied petroleum gas’. [EPA-HQ-OAR-2019-0055-1205-A1, p.4]

EPA Summary and Response

EPA agrees with the commentor. We did not intend to propose to change the title of section 1065.720 to "Data Requirements". This was a publication error in the proposed rule amendatory text and we are not finalizing a change to the title in the final rule. Section 1065.720 will continue to be titled "Liquefied petroleum gas."

17 Rulemaking process, analysis, and legal requirements

17.1 Rulemaking Procedures for Small Businesses

Comments by Organizations

Organization: *American Truck Dealers (ATD)*

Importantly, the COVID-19 pandemic and related supply-chain shortages, inflation, and strong freight volumes have resulted in high new and used CMV prices for now and the foreseeable future.11 Given that the majority of ATD members are small businesses and that almost all (98%) of U.S. fleet owners are small businesses, current and foreseeable market conditions are especially concerning. Thus, when evaluating the potentially dramatic market impacts of its NOx proposal, it is incumbent upon EPA to fully evaluate potential impacts on small business dealerships and their small business customers. [EPA-HQ-OAR-2019-0055-1321-A1, p. 4]

11. Equipment Radar, New & Used Medium & Heavy-Duty Truck Prices Will Likely Continue Rising Amid Components Shortages (Sept.2021); Fleet Equipment, Commercial Vehicle Industry Faces An 'Everything' Shortage (Dec. 2021).

Organization: *American Trucking Associations (ATA)*

ATA has established 12 fleet Guiding Principles that should be considered in the development of HD2027 including:

• Impacts on the 97% of trucking companies classified as small business must be considered. [EPA-HQ-OAR-2019-0055-1326-A1, p. 5]

Organization: *National Association of Chemical Distributors (NACD)*

Moreover, it can be reasonably inferred that the EPA's estimated economic impact underestimates how the rule will affect small businesses. … Also, while the proposed rule did not predict a significant impact on a substantial number of small entities, this analysis only considered ***manufacturers*** of heavy-duty vehicles to be affected. There are a wide range of other entities, a substantial number of them small businesses, that will also be impacted. Nearly all stakeholders in the supply chain use heavy-duty trucks to deliver their products to their customers, be it from ports, rail yards, warehouses, or intermodal transportation facilities. The

EPA's economic analysis in its final rule should reflect the entire universe of affected entities so the full economic impact of this regulation can be appreciated. [EPA-HQ-OAR-2019-0055-1279-A1, p. 2]

Organization: *Owner-Operator Independent Drivers Association (OOIDA)*

Furthermore, OOIDA disagrees with EPA's certification that this action will not have a significant economic impact on a substantial number of small business entities under the Regulatory Flexibility Act. [EPA-HQ-OAR-2019-0055-1266-A1, p.2]

As currently proposed, both option 1 and option 2 introduced in the NPRM fail to provide adequate production timelines to ensure vehicle affordability for motor carriers or other truck buyers. During an EPA Virtual Public Hearing on the NPRM held in April, the Truck and Engine Manufacturers Association stated, "EPA's proposed rule is not technologically feasible, cost-effective or customer acceptable."2 This and other initial responses from heavy-duty truck manufacturers indicate that EPA has not learned from previous rulemakings and that this proposal will undoubtedly lead to higher costs for truckers. [EPA-HQ-OAR-2019-0055-1266-A1, p.3]

2 https://www.epa.gov/system/files/documents/2022-04/hd-2027-stds-public-hearing-transcript-2022-04-12-day1.pdf

In recent years, the trucking industry has been subjected to numerous federal and state regulations relating to environmental emissions. Some of these standards were necessary and have been helpful in reducing NOx vehicle emissions by as much as 98%. However, many were short-sighted and have been difficult to implement, especially for smaller motor carriers. The influx of regulations has contributed to higher costs for new trucks with the average price increasing almost 49 percent since 2001.3 Meanwhile, the cost of used trucks has remained relatively the same. In some cases, these dramatic cost increases can limit the environmental benefits of the regulations by forcing truckers to maintain older vehicles longer than they otherwise would or compelling truckers to purchase used vehicles. On average, OOIDA members have stated that emissions and environmental equipment represented approximately $5,700 of their annual maintenance costs.4 53 percent of OOIDA members indicated they did not get a return on investment for installing and using environmental/emissions technologies such as exhaust gas recirculation (EGR) / selective catalytic reduction (SCR) systems and diesel particulate filters (DPF).5 For small carriers operating on the slimmest of margins, these costs can be a major deterrent to purchasing newer, cleaner trucks. [EPA-HQ-OAR-2019-0055-1266-A1, pp.3-4]

3 Owner-Operator Member Profile Survey 2020, OOIDA Foundation (2020).

4 Ibid.

5 Ibid.

Small-business truckers also remember EPA's track record from previous emissions rulemakings. Dating back to the 1970's, the agency has a history of well-intentioned attempts at reducing air pollutants and increasing fuel efficiency. However, the unrealistic expectations of engine manufacturers' capabilities, the underestimation of costs, the failure to anticipate risk aversion from buyers, and a lack of understanding about the trucking industry have undermined the environmental goals of the agency as well as intensified the mistrust of the agency.6 In order to avoid similar results, the NOx proposal must be amended to achieve the desired reduction in emissions. [EPA-HQ-OAR-2019-0055-1266-A1, p.4]

6 EPA's Myopic Cost Benefit Analysis, OOIDA Foundation (2014).

Any final rulemaking must better prioritize affordability for owner-operators drivers who will be required to purchase and install new equipment. This rulemaking must ensure that drivers and carriers who are investing in new vehicles are getting a fair deal and will not be constantly sidelined from their profession due to costly and repeated breakdowns. OOIDA members have encountered various problems with emissions systems which have had a dramatic impact on their business. These challenges include expensive visits to dealers, lost productivity, poor efficiency, and towing costs that can quickly escalate into the tens of thousands of dollars. For small carriers, hefty maintenance expenses coupled with the loss of income resulting from downed trucks, can severely jeopardize their ability to remain viable. [EPA-HQ-OAR-2019-0055-1266-A1, p.4]

For these reasons, EPA must conduct a more comprehensive RFA analysis that addresses the impact the Rule would have upon small-business vehicle purchasers, including OOIDA members, whom EPA has acknowledged are integral stakeholders in this rulemaking proceeding. [EPA-HQ-OAR-2019-0055-1266-A1, p.5]

While EPA has included a Regulatory Flexibility Act certification in the NPRM (id. at 17640), it has only addressed the impact the Rule would have on certain small-business manufacturers. The certification did not address the impact the Rule would have on small-business truckers or owner-operators such as OOIDA's members. Therefore, OOIDA requests that the EPA comply with the Regulatory Flexibility Act, 5 U.S.C. 601-611, by alleviating the detrimental impact the Rule will have on OOIDA's small-business independent owner-operators. [EPA-HQ-OAR-2019-0055-1266-A1, p.8]

The Regulatory Flexibility Act (RFA), 5 U.S.C. § 601, et seq. (1980), requires an agency issuing a final rule to either conduct "an analysis of the rule's impact on small businesses," Nat'l Tel. Co-op. Ass'n v. F.C.C., 563 F.3d 536, 538 (D.C. Cir. 2009), or to "certify" that there will be "no impact for those small businesses that are subject to the regulation," Cement Kiln Recycling Coal. v. E.P.A., 255 F.3d 855, 869 (D.C. Cir. 2001) (internal quotation marks omitted). See 5 U.S.C. § 605. [EPA-HQ-OAR-2019-0055-1266-A1, p.8]

In addition to, and separate and apart from, EPA's obligation to consider costs of compliance under the Clean Air Act, EPA is required to consider the impact of regulations to small businesses under the RFA. Here, EPA has published an RFA certification in the NPRM, but the certification only referenced the impact on "heavy-duty alternative fuel engine converters, heavy- duty electric vehicle manufacturers, a heavy-duty conventional vehicle manufacturer, and heavy-duty secondary vehicle manufacturers." Id. at 17640. EPA should conduct a complete RFA analysis and certification with respect to OOIDA owner-operators whom EPA has forthrightly acknowledged to be integral stakeholders in this rulemaking proceeding. [EPA-HQ-OAR-2019-0055-1266-A1, p.9]

OOIDA's members meet the definition of small businesses under the RFA. The RFA defines "small entities" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction," as defined in the RFA. 5 U.S.C. § 601(6). Section 601(3), "Definitions" provides:
(3) the term "small business" has the same meaning as the term "small business concern" under section 3 of the Small Business Act, unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register; [EPA-HQ-OAR-2019-0055-1266-A1, p.9]

Section 3 of the Small Business Act states that such a concern is "one which is independently owned and operated and which is not dominant in its field of operation." 15 U.S.C. § 632(a)(1). [EPA-HQ-OAR-2019-0055-1266-A1, pp.9-10]

It should be noted that EPA has separately defined small businesses as follows: A small business is a person, corporation, partnership, or other entity that employs 100 or less individuals (across all facilities and operations owned by the small business). Small Business Compliance Policy, 65 Fed. Reg. No.70 at 19632 (EPA April 11, 2000). [EPA-HQ-OAR-2019-0055-1266-A1, p.10]

OOIDA members readily satisfy each of the foregoing "small business" definitions for purposes of the RFA. A majority of OOIDA's 150,000 members are small trucking businesses with one to five trucks that are "independently owned and operated and which [are] not dominant in [their] field of operation." [EPA-HQ-OAR-2019-0055-1266-A1, p.10]

Again, the Regulatory Flexibility Act certification only addressed small-business manufacturers. However, EPA has separately recognized OOIDA's importance as a stakeholder in this proceeding in responding to OOIDA's prior ANPRM comments as follows:

- EPA received comments from trade organizations representing very large trucking fleets (e.g., the American Trucking Associations, ''ATA''), small fleets (e.g., National Association of Small Trucking Companies, ''NASTC''), and owner operators (e.g., Owner-Operator Independent Drivers Association, ''OOIDA''), as well as from independent commenters, indicating that serviceability issues are one of the top concerns when operating trucks with advanced emission control systems. See NPRM at 17514.
- OOIDA commented that their members have encountered various problems with emissions systems which have had a dramatic impact on their businesses including expensive visits to dealers, lost productivity, poor efficiency, and towing costs. See NPRM at 17514.

- We are keenly aware of significant discontent expressed by owners concerning their experiences with emission systems on engines compliant with EPA 2010 standards. … OOIDA commented that some of its members have experienced emission technology failures that caused their engines to quickly derate, placing truckers and other motorists in unsafe situations. See NPRM at 17515.
- In response to the ANPRM, EPA received numerous comments on difficulties associated with repairs of emission control systems. … OOIDA commented that according to a 2018 survey, 73 percent of their members perform repairs and maintenance on their own trucks. OOIDA added that being able to diagnose problems and repair equipment outside of dealerships is important for owner-operators and allows them to save time, avoid downtime, and reduce operating costs; however, they believe that restrictions built into existing trucks are preventing this practice. OOIDA supported an emphasis on serviceability improvements so that professional drivers can independently identify and repair problems with their engines and after treatment as much as possible. See NPRM at 17515.
- Commenters stated that, despite their continued diligence to use high-quality DEF, they have repeated experiences with inducements resulting in very onerous costs. Some commenters noted they were subject to the most severe restrictions multiple times per year even though DEF tanks were properly filled. OOIDA commented that inducement related costs can severely jeopardize owner-operators' ability to stay in business, citing costs that included towing and lost income from downtime in addition to diagnosis and repair. See NPRM at 17538-39. [EPA-HQ-OAR-2019-0055-1266-A1, pp.10-11]

While OOIDA appreciates that EPA has acknowledged its concerns in the NPRM, the response is simply insufficient in alleviating the detrimental impact the Rule will have on OOIDA's small-business truck owner-operators. [EPA-HQ-OAR-2019-0055-1266-A1, p.11]

Based on the foregoing, OOIDA requests that EPA comply with the Regulatory Flexibility Act including, but not limited to, the following requirement in 5 U.S.C.A. § 604 (a)(6):

(a) *** Each final regulatory flexibility analysis shall contain—

***

(6) a description of the steps the agency has taken to minimize the significant economic impact on small entities consistent with the stated objectives of applicable statutes, including a statement of the factual, policy, and legal reasons for selecting the alternative adopted in the final rule and why each one of the other significant alternatives to the rule considered by the agency which affect the impact on small entities was rejected;

Id. [EPA-HQ-OAR-2019-0055-1266-A1, p.11]

The Regulatory Flexibility Act analysis required under this rule related to small-business truck owners and purchasers would include an examination of:

- the costs of the proposed equipment (and installation where required) to truck owners; ï,· the new costs of ongoing maintenance of the proposed equipment,
- the reduction in truck efficiency caused by the proposed equipment,
- the predictable costs of new equipment unreliability caused by more frequent breakdowns, costly towing to the locations qualified to do such repairs, lengthy shop time (due to mechanics' unfamiliarity with new equipment and the wait for scarce parts delivery) and the loss of business and productivity each day the truck is in the shop, and
- the cost of equipment failures on the highway that create the opportunity for collisions and damage to roads and property. [EPA-HQ-OAR-2019-0055-1266-A1, p.12]

The analysis must also consider the regulatory options that may reduce the economic burden of the new equipment:

- the requirement that purchasers of the new equipment are given the ability to diagnose problems with and maintenance needs of equipment,
- the provision of adequate manuals, diagrams, instructions, troubleshooting guides and QR codes for truck owners to be able to repair the new equipment, and
- the requirement for adequate warranties to protect small businesses from the cost of repairs (labor and parts) of new equipment. [EPA-HQ-OAR-2019-0055-1266-A1, p.12]

The economic analysis of these and other issues is critical for EPA to perform an adequate Regulatory Flexibility Act analysis to determine how EPA may be able to achieve its goals in a way that reduces the burdens on small-business truck owners to the greatest extent possible. [EPA-HQ-OAR-2019-0055-1266-A1, p.12]

EPA Summary and Response

Summary:

The four comments reproduced above, from ATD, ATA, NACD, and OOIDA, each of which represent the owners and/or operators of regulated equipment (trucks), note that most (97%, according to ATA) owner/operators are small companies that should be included in EPA's Regulatory Flexibility Act analysis for this rule. ATA referred to the recent COVID-19 pandemic and several other economic factors as contributing to higher commercial motor vehicle prices, and noted those higher prices are especially concerning for small businesses. NACD also noted that many other small entities in the supply chain will be impacted, and they should also be considered. OOIDA commented that EPA's recognition of the concerns of owner/operators in the NPRM is insufficient, and EPA must consider the economic burden on these entities in the RFA analysis. The commenter stated that this would include the costs to truck owners of the equipment itself, its maintenance, any reduction in efficiency and reliability, and equipment failures including costs of collisions and damage to roads and property. The commenter stated that, pursuant to the RFA, EPA must also consider regulatory options to reduce those burdens including giving the purchasers the ability to diagnose maintenance and repair issues, adequate manuals to be able to repair those issues, and adequate warranties to protect small businesses from the cost of repairs.

Response:

Our assessment of small business impacts prepared to support EPA's certification that the rule will not have a significant economic impact on a substantial number of small entities was appropriately limited to small entities that would be regulated under the proposed rulemaking (i.e., engine and vehicle manufacturers). Other than those entities discussed in the final RIA Chapter 11, the rule does not impose any requirements on small businesses (for example, small trucking firms are not regulated entities under the final rule's requirements). The impacts on small businesses to which the commenters refer would not be effects of the rule on regulated entities, and thus are not impacts that we are required to analyze. See *Cement Kiln Recycling Coal. v. EPA*, 255 F.3d 855, 869 (D.C. Cir. 2001) (noting that "this court has consistently rejected the contention that the RFA applies to small businesses indirectly affected by the regulation of other entities" and citing cases), *Mid-Tex Elec. Coop. v. FERC*, 773 F.2d 327, 342-43 (D.C. Cir. 1985) ("An agency may properly certify that no regulatory flexibility analysis is necessary when it determines that the rule will not have a significant economic impact on a substantial number of small entities that are subject to the requirements of the rule. . . . Congress did not intend to require that every agency consider every indirect effect that any regulation might have on small businesses in any stratum of the national economy."); see also *Coalition for Responsible Regulation v. EPA*, 684 F. 3d 102, 129 (D.C. Cir. 2012).

Even though EPA is not required to include owner/operators in our Regulatory Flexibility Act analysis since they are not regulated entities under the rule, the Agency considered concerns from owner/operators in developing both our proposed program, as noted by OOIDA, and this final rule. As explained in the final rule preamble, including Sections IV and V, we expect that all truck owner/operators will benefit from several provisions being adopted in this rule, including longer useful life, longer warranty periods, and improved serviceability. These provisions are expected to lead to improved engine durability, reduced repair costs, and more consistent maintenance over the life of the engines. Our technology demonstration shows that the final standards can be achieved without a reduction in truck efficiency (see RIA chapter 3). Further, manufacturers have the option of meeting the standards using technologies that differ from our demonstrated technology package and that may have less costs than the technology pathway we anticipated. Overall, the final regulations being adopted in this rule will be helpful toward ensuring that new MY 2027 and later HD trucks purchased and used by all owner/operators, including small owner/operators, will perform more reliably while reducing their emission impacts on human health and the environment. As noted in our response to the American Farm Bureau in section 18.9 of this Response to Comments document, we hope, as everyone does that the current economic conditions – inflation, the pandemic, etc. – and any associated impact on businesses, including small businesses, are alleviated by the time the new standards are being implemented.

17.2 Request for Extension of Comment Period

Comments by Organizations

Organization: *American Bus Association (ABA) (1070 and 1308)*

As a preliminary matter, EPA has not provided sufficient time for the public or stakeholder community to review the Proposal. As ABA is small organization, it has limited resources and this is especially true in the wake of the COVID-19 pandemic. In March 2020 and throughout the period, nearly a quarter of the motorcoach businesses in operation closed, with industry revenue losses exceeding $8.4 billion in 2020 alone (https://home.treasury.gov/news/press-releases/jy0395). In turn, as the industry representative, ABA has also suffered economic losses and downsized to fit the needs of the industry it serves. ABA's abilities to review the highly complex, technical and lengthy Proposal are severely constrained, particularly given the short amount of time provided for the comment period. Because ABA lacks both in-house technical expertise and the capacity to obtain such assistance in a short time span, it has placed the motorcoach industry at a distinct disadvantage in responding to the Proposal. This benefits neither EPA or the motorcoach industry in terms of meeting the goal to better control air pollution from heavy duty vehicles. [EPA-HQ-OAR-2019-0055-1308-A1,pp.1-2]

On behalf of the motorcoach industry, ABA, along with many other stakeholders, petitioned EPA for a reasonable extension of time to appropriately review the Proposal, as done on prior occasions with similarly complex rulemakings (EPA–HQ–OAR–2014–082, Sept. 2015; 80 FR 53756). Considering the Notice is 475 pages in length, including various complex tables and formulas, along with a docket of additional supplemental materials ranging in the thousands of pages, it is unrealistic for small stakeholders to properly review and prepare comments in response to the Agency's proposed action. The EPA's grant of a 3-day extension, particularly after being forced to extend the public hearing schedule and conduct additional outreach/briefings, appears misguided, in terms of providing sufficient opportunity for public participation in a significant rulemaking. Proposed rules of this size and scope require, and the public is generally afforded, a minimum of 60 to 120 days to review and formulate comments. It is unfortunate EPA is limiting the process for a rulemaking proposal of this scope as it will result in costly, unintended consequences that will diminish anticipated benefits and hinder future cooperation between the public and private sectors. [EPA-HQ-OAR-2019-0055-1308-A1, p.2]

We do appreciate the letter sent to ABA from Principal Deputy Assistant Administrator Joseph Goffman regarding our request for an extension of time for the comment period and explaining the Agency's position in denying the request for additional time. We do find it hard to understand how the Agency could consider an issuance of the pre-publication version of the proposal as part of the review timetable, when it is well known that those pre-publication versions can change (and in this case did change, as additional dates were added to the announced public hearing), and in this specific case between March 15 and May 4, nearly 450 new supplementary materials were added to the docket. That is a tremendous amount of material to review, consider and digest in addition to the lengthy proposal. As stated in the response letter, it is very clear that the EPA is committed to their timeline in getting a final rule out before the end of the year, and very few suggestions for modifications to this rule proposal will be evaluated or considered very seriously. [EPA-HQ-OAR-2019-0055-1308-A1, p.2]

Nonetheless, in the interest of ensuring EPA is aware of the interest, and to the best of our abilities, the concerns of the motorcoach industry in relation to this rulemaking, ABA submits the following comments for the record. Please be advised, however, ABA will file supplementary comments, as appropriate, as we continue to work through the Proposal.[EPA-HQ-OAR-2019-0055-1308-A1, p.2]

The EPA is moving far too quickly with this technically complex rulemaking and ABA again requests the agency extend its comment period deadline to allow for necessary and appropriate input. [EPA-HQ-OAR-2019-0055-1308-A1, p.12]

On behalf of the American Bus Association (ABA), I petition the US Environmental Protection Agency (EPA) to request a 60-day extension of time for filing comments on the notice published in the Federal Register on March 28, entitled Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards [EPA–HQ–OAR–2019–005] (Notice). Currently, the comment period is set to close on May 16, 2022. [EPA-HQ-OAR-2019-0055-1070-A1, p.1]

ABA's request for a 60-day extension is based on the following: 1) the length and complexity of responding to the proposed rule; 2) the need to review and obtain technical assistance as part of the review; and 3) the hinderance of limited public outreach and engagement. The ABA requests this action to ensure the public has a fair opportunity to provide meaningful comment. As precedent, we note an extension was requested and granted for the similarly complex Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles - Phase 2 proposed rule in 2015 (EPA–HQ–OAR–2014–082, Sept. 2015; 80 FR 53756). [EPA-HQ-OAR-2019-0055-1070-A1, p.1]

The Notice, as published in the Federal Register, is over 450 pages long and the docket, which continues to expand, includes a number of supplementary documents. In order to fairly analyze and address the Notice and the supplementary material, even just the materials added to the docket between March 15 and the present, totaling thousands of pages, more time is needed. As of today, there are at least 445 documents in the docket related to this proceeding, which requires review and analysis, if not even just a cursory review – this equates to thousands of pages. Although there may be some nonrelevant or unrelated supplementary materials within the whole, there is insufficient time to even make this distinction and to focus only on the relevant material necessary to prepare comments. [EPA-HQ-OAR-2019-0055-1070-A1, p.1]

Further, much of the Notice and supplementary materials are of a highly technical nature, requiring technical expertise and resources to interpret, understand and assess. These type of resources are not readily available to small industries such as the motorcoach industry, particularly in the wake of the unprecedented economic fallout from the COVID-19 pandemic. Additionally, as referenced and relied upon by EPA in this rulemaking proceeding, the California Air Resources Board (CARB) recently completed a similar rulemaking effort. Based on the close nexus between these two respective proceedings, we need additional time to review the materials and supporting documentation from the CARB proceeding. [EPA-HQ-OAR-2019-0055-1070-A1, p.2]

It is unreasonable for a federal agency to expect businesses affected, both directly and indirectly, by a sweeping, complex rule to be in a position of providing thoughtful and accurate comments within this short of a time period, particularly if these businesses have not been included in prior discussions. In fact, based on an initial cursory review of the Notice, it appears EPA only minimally considered motorcoaches, if at all, in this proceeding. Significant rulemakings such as this, involving a high level of complexity, depth and length, and affecting such a broad swath of operating industries, at a minimum provide a 120-day comment period. Even if the original proposed period was only 60 days, it is not unusual or unreasonable for agencies to grant extensions well beyond the original proposal. [EPA-HQ-OAR-2019-0055-1070-A1, p.2]

The motorcoach industry is a relatively small industry, in terms of the entire surface transportation sector. However, motorcoach vehicles use the same engines used by the commercial property-carrying industry. The motorcoach industry is not subsidized on any significant scale by the Federal Government. Of the approximately 1800 motorcoach companies currently in operation in the U.S. following the COVID pandemic, over 90% are small fleets or operating 10 vehicles or less. The pandemic hit the industry considerably hard, and its effects continue to plague the industry. More than 40% of the operating companies went out of business and vehicle development and sales came to a complete standstill. Recovery to pre-COVID levels is not projected to until late 2023, or longer. While various public transportation modes (e.g., Amtrak, transit and aviation) received significant federal support to sustain their operations through the pandemic, this is not the case for the motorcoach industry. The industry is currently struggling to recover, and resources are in short supply. As a result, the industry is at a distinct disadvantage to participate in this rulemaking, as access to resources to assist in reviewing the complex rule proposal is limited. [EPA-HQ-OAR-2019-0055-1070-A1, p.2]

Further, motorcoach manufacturers are in one of the best positions to provide technical assistance to the motorcoach industry in evaluating this rulemaking and identifying the unique operational impacts on motorcoach operations. Yet, these equipment manufacturers are a step removed from engine manufacturers, who design and produce engines universally for trucks, buses and other heavy-duty diesel vehicles. Based on the size of the motorcoach industry, in comparison to the truck industry, the motorcoach manufacturers do not have the same amount of contact, bearing or input into the engine manufacturing process. However, there is only a limited number of motorcoach manufacturers, and they also are struggling with resources in the wake of the pandemic. The motorcoach industry needs more time to obtain their assistance on this proceeding. [EPA-HQ-OAR-2019-0055-1070-A1, p.2]

The preamble of the proposal includes numerous statements regarding the close working relationship of EPA and CARB in developing this proposal. However, there is little mention of EPA's interaction with stakeholders beyond the public hearing. The public hearing, which occurred after the publication of the Notice, limited EPA's ability to engage and provide a proper briefing to the public on a very complex rule. This in turn resulted in a hearing where, with very little time to prepare, speakers scrambled to read the lengthy, complex proposal and had even less time to understand it and develop thoughtful feedback for the hearing. [EPA-HQ-OAR-2019-0055-1070-A1, p.3]

Although there may very well be a limited number of stakeholders better versed and more engaged with EPA, who were in a better position to participate, this is not the case for a vast majority of the stakeholders will be affected by this proceeding. It is unclear what efforts EPA engaged in to ensure stakeholders, including not only the engine manufacturers, but all those who use and rely on these engines, were provided sufficient time to digest the complex Notice in advance of a public hearing. It is only at this late breaking stage of this comment period that EPA is now undertaking outreach in the nature of a briefing to these constituencies, many of whom are small industries like the motorcoach industry. There should be better and broader outreach and recognition that the stakeholder community for this rulemaking goes far beyond engine manufacturers. [EPA-HQ-OAR-2019-0055-1070-A1, p.3]

Further, it appears EPA has not given much consideration, if at all, to the motorcoach or coach bus industry. In the fact sheet posted to the website related to this rulemaking, motorcoaches do not even appear in the graph categorizing mobile source GHG, unless being swept up in descriptions like “other transportation sources”. The Notice, as currently written, mentions trucks over 300 times, whereas coach bus or motorcoach are mentioned less than 10 times, in terms of the NOx standards. Even worse, there is no recognition of the positive environmental benefits that motorcoach operations provide in removing cars from the road, serving socially and economically disadvantaged communities, reducing congestion, and conveying essential as well as emergency services. One plausible outcome of this reading is to deduce the Notice or parts of it do not apply to bus operations, which also illustrates the need for time to dive deep enough into the proposal to make the appropriate connections. Also, although we do appreciate the outreach efforts at this late stage, many stakeholders are not prepared or are ill-equipped to participate meaningfully in the comment period now due to the abbreviated time frame of the comment period. While these stakeholders could provide meaningful input to assist EPA in reaching its goals, because of the short comment period they instead risk the imposition of significant, costly requirements that will end up impeding their business operations. This is not the intended outcome of the Administrative Procedures Act (APA) for significant rulemakings. If EPA wishes this rulemaking to be successful in meeting its goals, it will provide more time and opportunity for all stakeholders to be fully apprised and knowledgeable of this federal action and provide sufficient opportunity to provide meaningful input. [EPA-HQ-OAR-2019-0055-1070-A1, p.3]

For these reasons, ABA urges EPA to extend the comment period deadline, for at least 60 days. The Notice repeatedly notes that it is EPA’s goal to “work with stakeholders,” therefore we urge the agency to provide sufficient time, and conduct and engage in broad stakeholder outreach, to accommodate the needs of all affected stakeholders and particularly smaller businesses. It is not simply engine manufacturers who will bear the burden of the changes proposed in the Notice, and this should be taken into consideration by EPA. [EPA-HQ-OAR-2019-0055-1070-A1, pp.3-4]

Organization: *Coach USA, Inc. (Coach USA)*

The relatively short comment period allowed for the EPA’s massive (475-page) and technically-complex proposed rules was grossly insufficient to allow Coach USA to adequately analyze all of the implications of the proposed rules on its business and its customers. [EPA-HQ-OAR-2019-0055-1307-A1, p. 3]

Organization: *Navistar, Inc. (Navistar)*

As an initial matter, the 49-day public comment period, which currently ends on May 16, 2022, does not provide sufficient time to stakeholders to meaningfully evaluate the regulatory intricacies to provide comprehensive comments on the proposed rule. We respectfully urge EPA to extend the public comment period on this important rulemaking, in which EPA's actions will have profound ramifications on the future development of the next generation of low-NOx heavy-duty engines and vehicles, and zero-emission commercial trucks. [EPA-HQ-OAR-2019-0055-1318-A1, p. 1]

Organization: *New Flyer of America Inc. (New Flyer) and Motor Coach Industries, Ltd. (MCI)*

To allow for complete review of the detailed rule, and in order to fully understand what impact the new standards would have on our suppliers, New Flyer / MCI requests for the EPA to extend the NPRM comment period by an additional 30 days beyond the current May 16th deadline. Such an extension would afford us a chance for proper analysis and provide more meaningful feedback. [EPA-HQ-OAR-2019-0055-1064-A1, p.1]

Organization: *Pennsylvania Motor Truck Association (PMTA)*

Finally, we believe it important to point out that 34 business days is a wholly inadequate public comment period for a highly technical, 475-page proposed regulation, especially for these small businesses who struggle every day to manage the challenges of a supply chain crisis, record high-diesel prices, and a workforce shortage to deliver freight for their customers and keep the American economy afloat. Understanding the impact of this regulation on their business is itself a challenge, much less putting it into words in time to meet the May 13 deadline. We would ask that EPA consider these limitations as it assesses the comments (or lack thereof) that are submitted within the timeframe given. [EPA-HQ-OAR-2019-0055-1202; this is an additional comment provided by PMTA included with their State Trucker Associations (2) letter.]

EPA Summary and Response

Summary:

The five entities listed above stated that the comment period for this rule was too short. Two of these entities, American Bus Association (ABA) and New Flyer of America, sent letters specifically requesting EPA Administrator Regan to extend the comment period. In addition, Coach USA and Navistar, as well as ABA and PMTA, mentioned the length of the comment period in their written comments, and Navistar urged EPA to extend the comment period.

In their formal request letter, ABA noted that an extension was needed for three reasons:

1. The length and complexity of responding to the proposal;
2. The need to review and obtain technical assistance as part of the review; and

3. The hinderance of limited outreach to the public.

ABA reminded the Administrator that an extension was granted for EPA's Phase 2 GHG rule. They also stated that significant rules often provide a 60-120-day comment period and that extensions are often granted even when the original comment period was 60 days. Finally, they noted their concern that the Agency did not give much attention to the motorcoach industry when preparing the rule.

In their subsequent written comments, ABA expressed disappointment in EPA's formal response to their request for an extension of the comment period. While the Agency noted that a pre-publication version of the proposal had been available since March 7, ABA observed that pre-publication versions of rules often change, that additional materials were added to the docket after March 7 (nearly 450 documents), and they would also need to review the materials associated with CARB's actions that were added to the docket. ABA noted their concern about "limiting the process for a rulemaking proposal of this scope as it will result in costly, unintended consequences that will diminish anticipated benefits and hinder future cooperation between the public and private sectors." ABA also commented that their organization and the motorcoach industry are experiencing resource limitations as they recover from economic impacts of the recent pandemic.

Response:

EPA responded to the two formal requests for extension of the comment period by letter dated May 13, 2022, denying the requests (see EPA-HQ-OAR-2019-0055-1152 and 1153). As we explained in that response, we continue to believe that the comment period length was appropriate and provided a meaningful opportunity to comment on the proposed rulemaking. Four of these commenters joined hundreds of others in submitting detailed comments on the rule before the end of the comment period. In addition, we posted a copy of the pre-Federal Register publication of the notice of proposed rulemaking on the EPA website on March 7th, when we issued the press release for the proposed rule. Finally, we conducted three days of public hearings (April 12, 13, 14, 2022) for stakeholders to provide oral presentation of data, views, and arguments. Because we held a third day of public hearing for the proposed rule, we also extended the public comment period to 49 days.

Our response letter to the request for extension of comment period indicated that we intended to issue a final rule later in 2022, and that further extending the comment period would likely preclude that timeline. We did not say that "very few suggestions for modifications to this rule proposal will be evaluated or considered very seriously" as indicated by ABA in their comment above. The Agency has been, is, and will continue to be committed to considering timely comments received on proposed rules. The compressed final rule schedule is necessary to finalize the standards this year to ensure that these important emission reductions occur as soon as possible. However, EPA still fully considered timely submitted comments in this final action.

Finally, the vast majority of the provisions contained in the pre-publication version of the notice of proposed rulemaking were not changed in the publication version, and the commenters failed to indicate any significant changes apart from the addition of another day for the public hearing and an extension of the comment period.

We agree that the motorcoach industry plays an important role. As noted in our response to the American Farm Bureau in section 18.9 of this Response to Comments, we understand ABA's concerns regarding the economic factors impacting their industry, but we are acting on our authority under Clean Air Act section 202(a)(3)(A). We hope, as everyone does, that the current economic conditions – inflation, the pandemic, etc. – are alleviated by the time the new standards are being implemented.

17.3 Information Collection Request (ICR)

<u>Comments by Organizations</u>

Organization: *Daimler Truck North America LLC (DTNA)*

This is to inform you that Daimler Truck North America ("DTNA") is developing comments on the U.S. Environmental Protection Agency ("EPA") "Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards; Proposed Rule," 87 Fed. Reg. 17,414 (March 28, 2022) (the "Proposed Rule"). DTNA's comments will address in detail EPA's burden and cost estimates for the Proposed Rule, including some of the information requested in the Information Collection Request ("ICR") that is under review by the Office of Management and Budget ("OMB"). DTNA notes that the ICR for the Proposed Rule (EPA ICR Number 2621.01) has not been posted to the regulatory docket and that EPA's "Supporting Statement" for the ICR was only posted to the OMB ICR Dashboard on April 19, 2022. [EPA-HQ-OAR-2019-0055-1045, p.1]

Under these circumstances, there has not been sufficient time for review and meaningful comment on the ICR in advance of the April 27, 2022 OMB comment deadline. DTNA thus plans to address EPA's cost and burden estimates in its comments on the Proposed Rule and will submit a copy of these comments to OMB in addition to EPA. We appreciate your consideration of these comments, which DTNA plans to submit on or before the EPA deadline of May 13, 2022. [EPA-HQ-OAR-2019-0055-1045, p.1]

[Daimler Truck North America LLC subsequently provided a comment in a footnote to their main comments; see EPA-HQ-OAR-2019-0055-1168-A1, p.11]

> 9 While Daimler Truck focuses primarily here on increased incremental technology, warranty, and other direct/indirect compliance costs, we also note that paperwork burdens would increase under EPA's proposal. The Proposed Rule implicates a number of information collection activities, all of which will significantly increase compliance burdens and costs for manufacturers. Daimler Truck has reviewed EPA's 'Supporting Statement for Information Collection Request' (EPA ICR Number 2621.01) (April 19, 2022) and notes that EPA's summary—in particular the respondent burden and cost estimates in Table 3 of

> the 'Supporting Statement'—captures some but perhaps not all of the information collection burdens and costs accompanying implementation of the Proposed Rule. These costs should not only be factored in to OMB's consideration of the Proposed Rule under the Paperwork Reduction Act, but should also be accounted for in evaluating whether EPA's proposal reflects adequate consideration of costs as required under CAA Section 202.

Since EPA does not specify how powertrains should be categorized for this testing, we assume that the Agency expects manufacturers to run this test for each configuration that could result in a different outcome; therefore manufacturers could be expected to test many configurations. Even employing a reasonable categorization strategy—per vehicle family as defined in Part 1037, for example—manufacturers could be required to demonstrate many configurations at great expense, particularly given that today's typical vehicle families already contain several different ZEV architectures.136 [EPA-HQ-OAR-2019-0055-1168-A1, p.122]

> 136 This increased expense and the attendant compliance burden should be weighed heavily in OMB's review and decision whether to approve the information collection components of the Proposed Rule, in accordance with the Paperwork Reduction Act. Each test takes about 40 hours to run (per vehicle). Given the many configurations that manufacturers may have to test, it is difficult to approximate exactly how much cost and how many personnel hours would be involved, but Daimler Truck expects that the burden would be significant.

EPA Summary and Response

Summary:

EPA received only one comment pertaining to the draft Supporting Statement for Information Collection Request, Proposed Changes to Certification and Compliance Requirements for Heavy-Duty Engines and Vehicles (Proposed Rule) – EPA ICR Number 2621.01; OMB Control Number 2060-NEW. DTNA indicated in their April 27, 2022, letter that they intended to provide comments to OMB and EPA on EPA's cost and burden estimates. However, in DTNA's subsequent comments on the proposal (EPA-HQ-OAR-2019-055-1045), the cost and burden information they provided was specific to direct manufacturing costs of the expected technologies or indirect costs of longer warranty periods; they did not provide additional information related to implementing test procedures, keeping records, or reporting to EPA.

Response:

We did not revise our ICR burden estimates after consideration of this comment, given that DTNA did not provide detailed comments about their concerns. However, some of the data used to calculate the burden were revised for the final ICR to reflect the Agency's current knowledge with respect to the number of respondents, adjustments due to changes in the final requirements as compared to the proposal, and the number of hours required to assemble and submit data to EPA.

In addition, DTNA commented that there would be increased expense and compliance burden for manufacturers choosing to generate NOX emissions credits from ZEVs due to the proposed test procedures for ZEVs; as discussed in preamble Section IV.G and section 12 of this Response to Comments document, we are not finalizing the proposal to allow manufacturers to generate NOX emission credits from ZEVs, and thus have removed these estimates from the ICR for the final rule.

18 Costs

18.1 Individual technology piece costs

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

U.S. EPA has estimated the projected costs of compliance for the proposed emission standards associated with both Option 1 and Option 2. Although the incremental technology costs for the Option 1 emission standards are generally higher than the corresponding technology costs for the Option 2 emission standards, the difference in such costs is minor (the maximum difference in technology costs between Options 1 and 2 is $716 in technology costs for a Class 8 heavy heavy-duty vehicle), and the largest incremental costs associated with the Option 1 standards only constitute a fraction of the base technology costs of new vehicles,90 thereby falling within the range of allowable cost increases. [EPA-HQ-OAR-2019-0055-1186-A2, p.38]

90 For example, the incremental cost of the Option 1 2031 MY standards for Class 8 heavy heavy-duty diesel vehicles is $3931; the base price of a Class 8 heavy heavy-duty diesel vehicle is $8465 (NPRM at 17570).

Furthermore, it is especially notable that U.S. EPA has also determined that the total technology and operating costs associated with Option 1 are lower than the costs associated with Option 2. 91 The total technology and operating costs associated with Option 1 and Option 2's criteria pollutant standards are similar in the early years, but overall (during the 2027 to 2045 time period) the costs for Option 1 are lower than the costs for Option 2 over the 2027 though 2045 time period by $2 to $3 billion dollars.92 [EPA-HQ-OAR-2019-0055-1186-A2, pp.38-39]

91 Compare Table V-16, (Option 1 costs), 17576, with Table V-17 (Option 2 costs), 17577.

92 Discounted at 3 and 7 percent rates, ($2017)

CARB staff believes the following assumption U.S. EPA made is incorrect and should be amended: 'Note the direct manufacturing costs for proposed Options 1 and 2 are equivalent because we expect the same technologies would be needed to meet the standards in each option.'186 Although the type of technology driven by the two options would be similar, as described in greater detail above in section 5.a.B., Option 2 would not encourage full use of technically feasible and cost -effective NOx reduction technologies that have been demonstrated. Indeed, the design and material of technologies would differ in cost due to unique elements directly related to optimizing for the different target emission standards such as aftertreatment sizing and catalyst loading. For example, for LHDD, MHDD, and HHDDs through IUL Option 1 has a 60 percent lower emissions limit for NOx when compared to Option 2. The large difference in the two options would be expected to cause a proportional change in direct manufacturing costs. For example, CARB's Omnibus regulation has a 2024 MY standard identical to Option 2, however, with a 435,000 mile UL. The technology package for meeting the 2024 standards did not include technologies, such as the addition of a light-off SCR or CDA to meet the standard. Increasing the UL to the Option 2 NPRM UL of 600,000 miles would require consideration for additional catalyst degradation such as enlarging catalyst size or using improved catalyst substrate but would not drive the need for adding additional aftertreatment technologies. The Omnibus regulation did recognize the need for additional aftertreatment technologies to meet the more stringent 2027 MY 20 mg/bhp-hr NOx standards to assure effective emission control with significantly improved thermal management. CARB staff believes that U.S. EPA's Option 1 2027 MY 35 mg/bhp-hr NOx standard would require these added technologies, consistent with the NPRM Option 1 technology cost estimates. Thus, CARB staff recommends that U.S. EPA reevaluate the technology cost for Option 2 and only identify the technology changes need to meet the 50 mg/bhp-hr NOx standard. In fact, U.S. EPA will be able to obtain more accurate information from manufacturers designing engines to meet the Omnibus upcoming 2024 MY standards. [EPA-HQ-OAR-2019-0055-1186-A2, p.122]

186 NPRM at 17566.

Organization: *Ingevity Corporation (Ingevity)*

EPA estimated the average cost of adding ORVR to HHDGVs at $25 per vehicle for a 70-gallon fuel tank volume. This average cost was based on an unspecified mix of single and dual fuel tanks, use of either an enlarged single canister or two existing canisters, and use of either liquid or mechanical seals. The retail price equivalent (RPE) mark-up in Chapter 7 of EPA's draft RIA is 1.36, yielding an average per vehicle cost of $34.3 Ingevity believes these estimates are conservative, as a 70-gallon tank is towards the upper range of the distribution of HHDGV product offerings4. [EPA-HQ-OAR-2019-0055-1213-A1, p. 3]

3. See Table 7-10 of US EPA draft RIA "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, EPA-420-D-22-001, March 2022.

4. A review of 2022 HHDGV product offerings on the OEMs commercial and medium-duty truck web pages indicates that fuel tank volumes fall into two categories. For single tank HHDGVs, the tank volumes range from 35-40 gallons; for dual tank vehicles the total volume is nominally 80 gallons. Low production volume school bus chassis may have total fuel tank volumes of about 100 gallons.

We note that EPA's cost estimate does not include a cost for increased vapor vent hose diameter between the fuel tank outlet and the canister inlet as was done in previous EPA analyses.5 It may be that with a Tier 3 HHDGV there is no net vapor line hardware cost increase when going from a Tier 3 evaporative configuration to a Tier 3 evaporative plus ORVR configuration. It would be helpful if EPA would clarify this point in any future analysis. [EPA-HQ-OAR-2019-0055-1213-A1, p. 3]

5. More detail can be found in Table 5.1, US EPA, "Final Regulatory Impact Analysis: Refueling Emission Regulations for Light Duty Vehicles and Trucks and Heavy-Duty Vehicles," January 1994.

Organization: *Manufacturers of Emission Controls Association (MECA)*

MECA agrees with EPA's cost analysis conducted to support this rulemaking. Similar to EPA, our estimates of the incremental technology costs to meet the Proposed Option 1 show that the technology packages on MY 2027 trucks would yield cost effective NOx reductions. In support of cost-benefit analyses funded by CARB and conducted by NREL as part of the development of the Omnibus, MECA estimated the costs (in 2019$) of the technologies employed in current trucks to meet today's emission standards as well as the technologies projected to be employed on trucks in future years to meet the requirements proposed in the Omnibus. In our cost analysis, we first estimated a cost range of current heavy-duty emission controls systems based on meeting today's FTP-limit of 0.2 g/bhp-hr over a useful life of 435,000 miles. The hardware included the DOC, DPF and SCR catalysts along with the DEF dosing system and OBD sensors and controllers necessary to comply with current OBD requirements. We estimated costs for two engine sizes, 6-7L and 12-13L. The former is often found in Class 4-6 heavy-duty vehicles while the latter is found in Class 7-8 vehicles. [EPA-HQ-OAR-2019-0055-1320-A1, pp.25-26]

The direct hardware cost estimate for a current aftertreatment system on a vehicle with a 6-7L engine is about $2,600 to $3,500. This is similar to the costs estimated by the ICCT ($2,807) in their most recent cost analysis [37]. For a Class 8 line-haul tractor with a 12-13L engine, we estimate a direct hardware cost of the engine and aftertreatment hardware to be in the range of $3,500 to $4,600 per truck. Similar to the 6-7L engine above, our cost is in-line with ICCT's latest estimate ($4,365) [37]. An older ICCT report estimated the cost of a 2015 exhaust emission control system (not including EGR) in the U.S. or Europe was about $5,068 or 3% of the cost of the average retail truck price reported as $157,000 [38]. It is important to note that the average price of a heavy-duty line-haul truck has historically increased by about 1% per year [38] due to safety, operational and other customer demanded enhancements that truck manufacturers have made to trucks. At the same time, emission control technology suppliers are typically expected to reduce the costs of their components through manufacturing improvements and other optimization by about 2-3% per year [37]. The year-over-year supply chain reductions can account for much of the cost difference between recent cost estimates compared to those reported by ICCT in 2016. Given declining emission control system costs and increases in the average price of a heavy-duty truck, the emission control system cost has become a smaller portion of the total truck price. [EPA-HQ-OAR-2019-0055-1320-A1, p.26]

[37] F. Posada, A. Isenstadt and H. Badshah, 'Estimated cost of diesel emissions-control technology to meet the future California low NOx standards in 2024 and 2027,' 2020.

[38] F. Posada, S. Chambliss and K. Blumberg, ‘Costs of Emission Reduction Technologies for Heavy-Duty Diesel Vehicles,’ International Council on Clean Transportation, Washington, DC, 2016.

The second part of our analysis involved estimating the cost of meeting an FTP certification standard of 0.02 g/bhp-hr and proposed LLC certification standard in 2027 with an emission control system that includes a close-coupled SCR combined with a traditional aftertreatment system. To meet these tighter standards, the technology evolution (discussed in our white papers referenced herein) includes incremental improvements to substrates and catalysts as well as the addition of a close-coupled SCR and dual dosing system with one heated doser, additional NOx sensors and an ammonia sensor in an upgraded OBD system. In addition, this analysis assumed the use of CDA and an EGR cooler bypass system. All of these technologies have been demonstrated by SwRI. Two cost estimates were prepared – one that assumed today's durability and warranty requirements, and one assuming one million mile useful life (FUL) and 800,000 mile warranty for class 8 and 550,000 mile FUL and 440,000 mile warranty for Class 4-7 starting in 2027. These durability and warranty levels were chosen because they were initially proposed by CARB during the Omnibus rulemaking [39]. Given EPA's Proposed Option 1 includes lower durability and warranty requirements than assumed in our cost analysis, we expect the cost estimate for longer FUL and warranty provided below to represent a worst-case scenario. [EPA-HQ-OAR-2019-0055-1320-A1, p.26]

[39] CARB, ‘Heavy-Duty Low NOx Program Workshop: HD UL & Step 2 warranty,’ 23 January 2019. [Online]. Available: https://www.arb.ca.gov/msprog/hdlownox/files/workgroup_20190123/04-HD_UL_&_Step_2_warranty_WS01232019.pdf.

For a vehicle with a 6-7L engine, the incremental hardware improvements needed to meet a 0.02 g/bhp-hr certification limit on the FTP cycle and future LLC standard at today's durability and warranty requirements were estimated to add about $1,300 to $1,800 to the cost of the engine efficiency and emission control technologies. For a Class 8 tractor with a 12-13L engine similar incremental improvements were estimated to add about $1,500 to $2,050 (less than 1.2%) to the cost of a MY 2027 truck, projected to be approximately $177,000, based on a historical 1% annual rate of MSRP increase reported by ICCT. The estimated incremental costs to meet the above referenced increased durability and warranty requirements for a 6-7L engine and 12-13L engine were $1,800 to $2,450 and $2,000 to $2,750, respectively. The estimated total additional emission control cost in 2027, including a 0.02 g/bhp-hr FTP tailpipe limit, LLC limit, 1-million-mile durability requirement and 800,000 mile warranty, would be $3,100 to $4,250 for 6-7L engines and $3,550 to $4,800 for 12-13L engines. If a Class 8 truck with 12-13L engine is assumed to sell for an average price of $177,000 in 2027, based on the historical 1% annual rate of increase reported previously, the additional cost of emission controls on this truck will account for roughly 2-2.7% of the total vehicle price. It is important to reiterate that these cost estimates are biased high since they are based on more stringent requirements than those included in Propose Option 1. [EPA-HQ-OAR-2019-0055-1320-A1, pp.26-27]

The ICCT recently conducted an analysis that estimated the cost of diesel emissions control technology to meet CARB's Omnibus standards [37]. Their study included direct manufacturing costs and indirect costs for two engine sizes, but costs of proposed longer warranty requirements were excluded. The methodology follows the steps outlined in previous ICCT cost studies where both in-cylinder technology aftertreatment costs are estimated and scaled to account for engine size [38]. In order to meet the proposed MY 2027 standards (similar to EPA Proposed Option 1), ICCT estimated both low-cost and high-cost durability cases. The resulting incremental cost range estimated to meet the Omnibus requirements was $1,800 to $2,500 for a 7L engine and $2,200 to $3,200 for a 13L engine. The ICCT results are roughly 10-20% lower than those estimated by MECA, and this may be explained by differences in assumptions for useful life and baseline year for cost between the two analyses. [EPA-HQ-OAR-2019-0055-1320-A1, p.27]

[37] F. Posada, A. Isenstadt and H. Badshah, ‘Estimated cost of diesel emissions-control technology to meet the future California low NOx standards in 2024 and 2027,’ 2020.

[38] F. Posada, S. Chambliss and K. Blumberg, ‘Costs of Emission Reduction Technologies for Heavy-Duty Diesel Vehicles,’ International Council on Clean Transportation, Washington, DC, 2016.

It should be noted that the cost estimates developed by NREL included the costs due to the extended warranty requirements, despite a lack of adequate information available from suppliers or OEMs to estimate these. Similarly, costs analyses conducted by ACT Research and Ricardo made assumptions for significant warranty costs due to the new regulation based on confidential surveys. NREL and CARB acknowledged that the cost estimates for extended warranty are very uncertain. CARB subsequently conducted its own analysis of costs needed to meet extended warranty requirements, and these are substantially lower than those estimated in the NREL report as well as those estimated by ACT Research and Ricardo. After the Omnibus was approved by its Board, CARB staff convened a working group of OEMs, EMA, and MECA to review warranty costs. This working group resulted in a final report in which CARB staff concluded that the methodology used to support the Omnibus Regulation warranty-related cost estimates is reasonable and defensible and they did not believe changes to those estimates were needed [45]. As stated above, this uncertainty in costs estimated to meet extended durability and warranty provides an opportunity for future collaborative work in the form of a study that includes fleets, industry stakeholders, CARB and EPA staff. [EPA-HQ-OAR-2019-0055-1320-A1, pp.27-28]

[45] CARB, ‘California Air Resources Board Staff Report on the Warranty Cost Study for 2022 and Subsequent Model Year Heavy-Duty Diesel Engines,’ 2021.

Organization: *RV Industry Association (RVIA)*

As we understand the proposal, the cost increases that will be realized by gas and diesel motorhome chassis suppliers in MY27 will be as follows:

Note: The cost shown below are the so-called 'Option 1' costs, not the more expensive 'Option 2 costs.'

Diesel motorhomes

• Class B diesel motorhomes (8501-14000 lbs. GVWR - class 2b/3 trucks): $7,952.3
• Class C diesel motorhomes (14,001-19,500 lbs. GVWR - class 4/5 trucks): $8,032.4
• Class C diesel motorhomes (19,501-33,000 lbs. GVWR – class 6/7 trucks): $8,358.5
• Class A diesel motorhomes (>33,000 lbs. GVWR – class 8 trucks): $13,382.6 [EPA-HQ-OAR-2019-0055-1270-A1, p. 2]

3. Table 7-14: MY2027 Technology Costs for LHD2b3 Diesel, Average per Vehicle, 2017 Dollars, Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, Draft Regulatory Impact Analysis, US EPA, EPA-420-D-22-001, March 2022, page 328.

4. Table 7-16: MY2027 Technology Costs for LHD45 Diesel, Average per Vehicle, 2017 Dollars, Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, Draft Regulatory Impact Analysis, US EPA, EPA-420-D-22-001, March 2022, page 328.

5. Table 7-18: MY2027 Technology Costs for HHD67 Diesel, Average per Vehicle, 2017 Dollars, Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, Draft Regulatory Impact Analysis, US EPA, EPA-420-D-22-001, March 2022, page 329.

6. Table 7-20: MY2027 Technology Costs for HHD8 Diesel, Average per Vehicle, 2017 Dollars, Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, Draft Regulatory Impact Analysis, US EPA, EPA-420-D-22-001, March 2022, page 329.

Gas motorhomes

• Class A and C motorhomes (14,001-19,500 lbs. GVWR – class 4-8 trucks): $1,944.7 [EPA-HQ-OAR-2019-0055-1270-A1, p. 3]

7. Table 7-24: MY2027 Technology Costs for LHD45, MHD67 & HHD8 Gasoline, Average per Vehicle, 2017 Dollars, Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, Draft Regulatory Impact Analysis, US EPA, EPA-420-D-22-001, March 2022, page 330.

Separate from the increased engine costs listed above are the additional costs that would be directly incurred by manufacturers of gasoline motorhomes. These costs are associated with changing manufacturing or other process to accommodate compliant refueling emission control systems. EPA has projected these costs will be $2,528 per company in the first year of the new program. [EPA-HQ-OAR-2019-0055-1270-A1, p. 3]

As indicated above, EPA is projecting that this regulation will add $7,952 to $8,358 per vehicle for the cost of the diesel engines used in motorhomes < 33,000 lbs. GVWR. For motorhomes > 33,000 lbs. GVWR, the cost increase is projected to be $13,382 per vehicle. As we understand it, these are cost increases that will be seen by the buyer of the engine (i.e., the motorhome chassis supplier). Because the chassis supplier must make some profit, the motorhome manufacturer is likely to see cost increases 1.2 times the cost seen by the chassis supplier. A similar markup could be seen by the motorhome retailer and then again by the motorhome customer. Thus, an $8000 cost increase imposed by the engine manufacturer will likely result in a $9600 price increase for the chassis supplier. This will lead to a $11,520 price increase for the motorhome manufacturer, a $13,824 price increase for the motorhome retailer, and finally, a $16,588 price increase to the motorhome customer. In effect, the ultimate end user is likely to see twice the cost increase levied by the engine manufacturer. [EPA-HQ-OAR-2019-0055-1270-A1, p. 3]

EPA Summary and Response

We thank CARB and MECA for their detailed comments on the proposal. In general, MECA's estimates for emissions control system costs are comparable to the costs used by EPA within our analyses for the final rule. As explained in preamble Sections III, IV, and V, the final emission standards and useful life provisions are feasible, giving appropriate consideration to the cost associated with the application of technology EPA determined will be available for the model year the final standards apply (i.e., cost of compliance for the manufacturer associated with the application of such technology) and other statutory factors. EPA's assessment of the relevant statutory factors in CAA section 202(a)(3)(A) justify the final emission standards. As explained in preamble Section IV, the final warranty periods are appropriate. We also evaluated additional factors, including factors to comply with E.O. 12866; our assessment of these factors lend further support to the final rule. See responses in the remainder of this section 18 of this documents for additional responses regarding our cost estimates, including for warranty.

With respect to specific cost difference issues raised by CARB, EPA believes that the direct manufacturing costs that we have developed for the final rule based upon the FEV "tear-down" studies of valvetrain systems and diesel emission control systems provide the most accurate and up-to-date assessment of direct manufacturing costs for these systems. The FEV "tear-down" studies used a highly detailed bill-of-materials methodology for determining direct manufacturing costs that was both completely transparent and independently peer-reviewed. See RIA Chapter 3.1 for more information on the FEV "tear-down" study.

Ingevity Corporation commented on EPA's costs estimates associated with ORVR stating that Ingevity considered the estimates to be conservative but that EPA had also failed to consider the cost for increased vapor vent hose diameter between the fuel tank outlet and the canister inlet as was done in previous EPA analyses. The previous analysis to which the commenter referred was a 1994 EPA Regulatory Impact Analysis. EPA notes that our ORVR cost estimate was meant to reflect the "needed" new hardware on a modern system. Many new vehicles have canisters directly mounted to the tank assembly to minimize the need for extra lines/connections that are ultimately unnecessary costs and present durability/leakage concerns.

RV Industry Association (RVIA) commented about the costs of engines installed in motor homes. However, the costs pointed to by RVIA were actually the total technology costs of the baseline plus the proposed rule, not the incremental increase in technology costs associated with the proposal. RVIA simply misunderstood the tables presented in the proposed preamble and/or RIA. One such table is shown below, Table 7-20 from the draft RIA.

Table 7-20 MY2027 Technology Costs for HHD8 Diesel, Average per Vehicle, 2017 Dollars

Scenario	DMC	Warranty	R&D	Other	Profit	Tech Cost Sum
Baseline	$6,457	$194	$323	$1,873	$323	$9,169
Baseline+Proposed Option 1	$8,668	$1,170	$598	$2,514	$433	$13,382
Baseline+Proposed Option 2	$8,668	$910	$648	$2,514	$433	$13,172
Option 1 increase from Baseline	$2,210	$976	$275	$641	$111	$4,213
Option 2 increase from Baseline	$2,210	$716	$325	$641	$111	$4,003

In their comment, RVIA states that the cost increase of the proposed Option 1 would be "Class A diesel motorhomes (>33,000 lbs. GVWR – class 8 trucks): $13,382.6." As shown in the second row of the above, reprinted table, $13,286 is the "Baseline+Proposed Option 1" cost. However, the increased cost due to the proposed Option 1 was estimated to be $4,213 (see row 4 of the table above), much lower than the value noted by RVIA. RVIA had this same misunderstanding with the other values they noted in their comments.

18.2 Direct manufacturing costs and learning effects

Comments by Organizations

Organization: *Advanced Engine Systems Institute (AESI)*

Each independent and government study of the potential incremental cost of the 2027 standards have projected hardware and durability costs that are a small fraction (20% or less) of the $38,000 estimate offered by truck manufacturers. [EPA-HQ-OAR-2019-0055-1281-A1, p. 2]

Organization: *Agricultural Retailers Association (ARA) (1241 and 1421)*

These new federal standards attempt to match those implemented by the state of California last year. However, the trucking industry and manufacturers have maintained that it is not technically feasible to meet the new standards and have never demonstrated that to be the case. It has been reported in December 2021 that the Truck and Engine Manufacturers informed the White House that no manufacturer has said they can produce a complying product. The result of this mandate going into effect means equipment manufacturers will spend hundreds of millions of dollars chasing an impossible standard rather than strategically deploying scarce financial resources on proven technologies. [EPA-HQ-OAR-2019-0055-1251-A1, p. 3]

Organization: *American Bus Association (ABA) (1070 and 1308)*

Although ABA has insufficient time to fully analyze the cost data included in the Proposal to meet the comment deadline, these comments will address cost concerns on a broad basis. From a fundamental standpoint, the Proposal will increase costs significantly for engine manufacturers, and in turn for heavy-duty vehicle users. There will be increased costs associated with research and development necessary to achieve the proposed new standards, costs to produce the new

technology, costs to improve the durability of components to meet the proposed extended useful life of the engine and to support the proposed extended warranty time period. These costs will in inevitably be passed on to customers, in other words heavy-duty vehicle purchasers.
EPA suggests these costs will be minor, in terms cost increases, but estimates of the actual costs associated with the Proposal suggest the cost increases for a heavy-duty engine could exceed $42,000 per vehicle per other commenters such as the Truck & Engine Manufacturers Association. [EPA-HQ-OAR-2019-0055-1308-A1,pp.5-6]

Organization: *American Farm Bureau Federation (Farm Bureau)*

Farm Bureau also believes discrepancies must be addressed regarding the proposal's forecasted compliance costs. In short, there is an enormous disparity—approximately an order of magnitude— between EPA's compliance cost estimates and those projected by engine manufacturers, which are forecast to be up to $35,000 per truck. If EPA's cost estimates are too low, then other key factors influencing the proposal will be affected in turn. [EPA-HQ-OAR-2019-0055-1163-A1, p.1]

Organization: *American Truck Dealers (ATD)*

The current average cost of a new MY 2022 Class 8 CMV is $140,826.8 ATD suggests that EPA has underestimated what the average cost of similar CMVs will be in MYs 2027-2030. Analyses conducted by Ricardo Strategic Consulting (RSC) found that the incremental costs for Option 1 will be $42,051,9 which contrasts with EPA's prediction that incremental costs will be $16,750. [EPA-HQ-OAR-2019-0055-1321-A1, p. 4]

8. NADA, ATD Data 2021 (Midyear Report), p.8 (2021).

9. Includes increased operating costs. Ricardo, Review of EPA NRPM and Compliance Cost Assessment Study, p.32 (Apr. 25, 2022). An earlier cost study conducted by the National Renewable Energy Laboratory (NREL) on NOx standards being considered by the California Air Resources Board (CARB) reached similar conclusions. NREL, On-Road Heavy-Duty Low-NOx Technology Cost Study, p. 60 (May 2020).

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

Daimler Truck has undertaken its own analysis of incremental compliance costs for Class 8 diesel engines and trucks under the Proposed Rule, and it has consulted the available cost impact studies for achieving EPA's 'next-tier' standards and the similar requirements of CARB's Omnibus Low-NOx Regulations. Based upon this review, EPA's cost projections underestimate both direct and indirect costs that manufacturers would necessarily incur to achieve compliance. Further, the Agency's estimates differ significantly from the figures published in a number of recent third-party cost impact studies, without explanation of what factors account for the differences. Finally, EPA's operator cost estimates do not include the potentially significant expenditures that vehicle owners would have to make to maintain critical emissions components after the warranty period expires, which could chill fleet owner investment in next-generation vehicles produced to comply with the Proposed Rule. These issues are discussed in turn below. [EPA-HQ-OAR-2019-0055-1168-A1, p.11]

Direct Manufacturing Costs. Based upon an internal study of direct costs that the Company would incur on a per-unit basis to comply with the Proposed Rule, Daimler Truck believes that EPA significantly underestimates per-vehicle direct manufacturing costs (DMC) for Class 8 diesel vehicles. In the Proposed Rule, EPA estimates the incremental DMC increase for such vehicles in MY 2027 to be **$2,210** to achieve compliance with the Agency's proposed Options 1 and 2. 11 This estimate is based upon EPA's itemized material cost estimates in the draft RIA. 12 [EPA-HQ-OAR-2019-0055-1168-A1, pp.11-12]

11 See Proposed Rule, 87 Fed. Reg. at 17,566, Table V-1 (providing estimated MY 2027 incremental diesel technology package direct manufacturing costs associated with Proposed Options 1 and 2 in 2017 dollars).

12 See Draft RIA at Tables 3-26 and 3-27. Daimler Truck notes that in certain categories, EPA's itemized cost estimates align to a certain extent with its 0\¥ 11. For example, EPA estimates the cost of NOx sensors that would be part of the technology package used to meet the new standards under Options 1 or 2 at around $170 (or 3 sensors for a total of $510). This is not far off of Daimler Truck's estimate that the material cost would be around [redacted] per NOx sensor. Other estimates in the draft RIA rule unrealistically low, however. For instance, EPA estimates selective catalytic reduction (SCR) canning costs at around $834 for the SCR system, whereas Daimler Truck's estimate is closer to $ [redacted].

In marked contrast to this figure, Daimler Truck conservatively estimates material costs for Class 8 diesel vehicles at $ [redacted] 13 for the first year of implementation under either Option 1 or Option 2 for the Proposed Rule, accepting EPA's premise that the same technologies would be used to meet the standards in each option. 14 Based upon this figure, Daimler Truck believes that actual per-unit incremental costs of first-year compliance with the Proposed Rule would be **approximately [redacted] % greater** than EPA's $2,210 per-vehicle DMC estimate. [EPA-HQ-OAR-2019-0055-1168-A1, p.12]

13 Daimler Truck has redacted its material cost estimates from these comments, as they are based upon confidential business info1mation. The Company will make these estimates available to EPA in a confidential setting.

14 See Proposed Rule, 87 Fed. Reg. at 17,566.

Given the confidential nature of this information, Daimler Truck is not able to specify in these comments the particular technology package that it believes would be best to achieve the proposed standards for Class 8 diesel trucks, other than to note that the technology solution under consideration is based upon a combination of new engine hardware, improved catalyst formulations and layouts, including close-coupled selective catalytic reduction (CCSCR), and vehicle-side improvements to accommodate engine and aftertreatment system changes. The package under consideration would also include a thermal management system to accelerate warmup of the aftertreatment system for improved emissions performance during cold-start. 15

The above estimate is based upon the technology package that, using sound engineering judgment, Daimler Truck believes would best achieve the proposed standards without compromising performance and safety. Notably, the Company's direct cost estimates incorporate only material costs and do not include labor costs, as EPA's DMC estimates did. 16 Further, they are in present-day dollars and do not reflect adjustments for inflation. [EPA-HQ-OAR-2019-0055-1168-A1, p.12]

15 At a high level, Daimler Truck's $ [redacted] DMC cost estimate is comprised of several categories of material costs, including $ [redacted] for engine upgrades, $ [redacted] for the the1mal management system, $ [redacted] for ATS improvements, and $ [redacted] for vehicle-side costs necessa1y to inco1porate these new systems. As noted above, Daimler Truck will make the detailed breakdown available to EPA in a confidential setting.

16 See id. at 17,565.

Discussed immediately below are more holistic cost assessments set forth in the numerous published cost studies prepared in anticipation of EPA’s proposed rule and the similar proposal by CARB in its Omnibus rulemaking. [EPA-HQ-OAR-2019-0055-1168-A1, p.15]

Comparison of EPA Estimates to Other Cost Studies. As EPA notes in the draft RIA, there are a number of available studies that analyze anticipated incremental cost increases associated with next-tier NOx compliance and associated regulatory requirements. These studies, based upon extensive OEM, trade group, and supplier input, are largely consistent with one another as far as what the main cost drivers will be and what individual program components will cost. Yet EPA does not fully explain why its DMC and indirect cost assessments diverge—in some cases, quite significantly—from the estimates in these studies. Below is a summary of the principal conclusions on estimated compliance costs for Class 8 diesel trucks from four different studies: (1) the Ricardo Cost Study; (2) the NREL Cost Study; (3) a 2020 Cost Study prepared by ACT Research (the ‘ACT Cost Study’); and (4) a 2020 Cost Study prepared by the International Council on Clean Technology (the ‘ICCT Cost Study’). [EPA-HQ-OAR-2019-0055-1168-A1, p.15]

Ricardo Cost Study. The Ricardo Cost Study was prepared for the Truck and Engine Manufacturers Association (EMA) in April 2022, in support of EMA’s analysis of the Proposed Rule, and examines the impacts of EPA’s proposed Option 1 and Option 2 on the cost of heavy-duty diesel engines (HDDEs). The Ricardo Cost Study assumed that the Southwest Research Institute (SWRI) Stage 3 prototype technology package would be sufficient to attain EPA’s proposed low-NOx targets and related requirements, and its estimates encompass incremental costs associated with new hardware, extended warranty and useful life periods, in-use compliance, R&D, engineering, and testing.26 Relative to a MY 2021 baseline, the study estimates that the total incremental cost per HDDE for meeting anticipated regulatory requirements under Option 1 is approximately **$18,650** in MY 2027 and **$31,246** in MY 2031, and under Option 2 is approximately **$16,091** starting in MY 2027.27 These figures reflect *only* the Ricardo Cost Study estimates of direct and indirect incremental costs to manufacturers (in 2017$) and do not include the significant incremental operating costs that are also provided in the study.28 [EPA-HQ-OAR-2019-0055-1168-A1, pp.15-16]

26 Ricardo Cost Study at 24.

27 Id. at 32, Table 26. The figures provided here were calculated by subtracting the operating cost estimates in Table 26 from the 'Total' figures provided in 2017$ that table. Using this calculation method, the corresponding cost estimates in 2021$ would be $20,702 in MY 2027 and $34,682 in MY 2031 under Option 1, and $17,861 starting in MY 2027 under Option 2.

28 Notably, the Ricardo Cost Study estimates incremental per-engine operating costs to be around $11,993 under Proposed Rule Option 1, and $7,176 under Option 2 (in 2021$). See id.

NREL Cost Study . The NREL Study was commissioned by CARB in support of its Omnibus rulemaking and was published in May 2020. The study included a review of engine and exhaust afte1treahnent technologies that could achieve 0.02 g/bhp-hr NOx on certification test cycles, including a low-load cycle. 29 For Class 8 diesel applications, NREL surveyed trade organizations, Tier 1 suppliers, and OEMs, requesting that they provide incremental cost estimates on two unique diesel engine technology packages (charge air, exhaust gas recirculation (EGR), and turbine cooler bypass vs. cylinder deactivation) combined with two unique aftertreatment technology packages. 30 From the responses, NREL constructed proposed low-, average-, and high-cost combined engine and aftertreatment technology packages, generating cost ranges for each package.31 The survey assumed 0.02 g/bhp-hr NOx regulation beginning MY 2027 and included FTP and SET-RMC steady-state test cycles, as well as a proposed new LLC cycle. It also considered an extended full useful life of 1,000,000 miles/15 years, and a regulatory warranty period of 800,000 miles/12 years. The study encompassed California production volumes only. The survey responses provide an illustrative range of the low, average, and high cost estimates for each of the three categories of technology packages considered (i.e. , low-, average-, and high-cost) and reflect that increased warranty costs are a key driver of incremental cost increases under CARB 's proposed regulato1y framework, as illustrated below: [EPA-HQ-OAR-2019-0055-1168-A1, p.16]

29 NREL Cost Study at vii.

30 Id. at 12.

31 Id.

ACT Cost Study . ACT Research prepared an analysis for EMA of costs associated with CARB's proposed Omnibus rule in March 2020.35 The analysis focused on CARB's proposed standards and requirements for the Omnibus rule in both 2027 and 2031 , and concluded the following with respect to incremental costs for heavy HDVs on a per-unit basis: [EPA-HQ-OAR-2019-0055-1168-A1, pp.16-17]

35 See ACT Research, Cost Study: Proposed Heavy-Duty Engine and Vehicle Emissions Regulations (March 19, 2020) ('ACT Cost Study').

Adding these incremental cost estimates together, the ACT Cost Study concludes that the total cost increase per unit to meet CARB 's proposed combined MY 2027 and MY 2031 vehicle standards on a nationwide basis would be **$25,963** applying a 7% discount rate and **$37,079** applying a 3% discount rate. As found in the other cost studies referenced herein, the ACT Cost Study concludes that the extended warranty and useful life requirements in the CARB Omnibus rule were key drivers of incremental cost increases.[EPA-HQ-OAR-2019-0055-1168-A1, p.17]

ICCT Cost Study. Finally, the ICCT Cost Study was published in May 2020 and estimates the costs of technology required to meet CARB's proposed regulato1y changes for the Omnibus rule in 2024 and 2027. 38 While the ICCT Cost Study did review the anticipated impact of increased useful life requirements, the effect of lengthened regulatory warranty periods was outside of the scope of the analysis. A principal conclusion of the study is that meeting CARB's MY 2027 targets39 ‘would require significant changes in current technology and costs, driven by 90% lower FTP NOx targets, LLC requirements, and long use useful life mandates. ‘40 The ICCT Cost Study assumes that cylinder deactivation and EGR bypass would need to be added to future engines to achieve the projected CARB MY 2027 requirements.41 It also assumes that aftertreatment changes would include the addition of CCSCR and changes to the urea dosing system, and it assumes changes to catalyst volume and wash coat fo1mulations, as well as sensor replacement to meet the extended regulat01y useful life requirement. 42 Based upon these assumptions, the ICCT Cost Study estimates the total incremental cost of meeting the CARB MY 2027 standards to be **$5,919 - $6,013** as the ‘low-cost durability case’ and **$6,864 - $6,988** as the ‘high-cost durability case.’43 While these figures purport to include account for direct and indirect costs associated with meeting the CARB MY 2027 proposal, they do not include a number of key cost inputs, including the indirect costs that would be associated with CARB’s extended warranty requirement. Further, it is important to note that ICCT’s estimates are based upon available literature, trade publications, and expert reviews and not actual cost data from manufacturer or supplier surveys. The absence of these crucial inputs may account for the relatively low estimates in the ICCT Cost Study as compared to other studies with more robust data inputs. [EPA-HQ-OAR-2019-0055-1168-A1, pp.17-18]

38 See Posada et al., International Council on Clean Transportation, White Paper, 'Estimated Cost of Diesel Emissions-Control Technology to Meet Future California Low-NOx Standards in 2024 and 2027' (May 2020) (the 'ICCT Cost Study').

39 The ICCT Cost Study is based upon the following proposed requirements for MY 2027 in the CARB Omnibus proposed rule (which, except for the NOx limits, closely resemble EPA Option 1 in the Proposed Rule): NOx FTP limit of 0.02 g/bhp-hr, LLC limit of 1-3 times the FTP limit, 600,000 mile useful life in MY 2027 and 800,000 miles by MY 2031. See id. at Table 1.

40 Id. at 2.

41 Id.

42 Id.

43 Id., Table ES-2.

Comparison to EPA Total Technology Cost Per Vehicle Numbers. EPA estimates total per-vehicle technology costs (in 2017 dollars) for Class 8 diesel trucks as follows:44

- Option 1:
    - MY 2027: $4,213
    - MY 2031: $3,931
- Option 2:
    - MY 2027: $4,003
    - MY 2031: $3,215 [EPA-HQ-OAR-2019-0055-1168-A1, p.18]

44 See Proposed Rule, 87 Fed. Reg. at 17,571, Table V-11. As EPA explains in the Proposed Rule, these figures reflect incremental cost increases over a baseline or 'no action' case consisting of engine or emission control systems meeting 2019-era criteria emission standards. Id. at 17,565, n. 726.

Considering EPA's total technology cost estimates alongside Daimler Truck's direct material and warranty cost estimates discussed above, alongside the cost estimates in the Ricardo, NREL, ACT, and ICCT cost studies, it is clear that EPA underestimates what actual costs of compliance with its Proposed Rule standards and requirements would likely be.45 EPA's per unit estimate range of **$3,215 - $4,213** (in 2017 dollars) is far lower than even the most conservative ICCT estimates of **$5,919 - $6,988** (in 2019 dollars) and Daimler Truck's partial-cost estimates of $ [redacted] (in today's dollars). EPA's ranges are well off the mark when compared to the more realistic Ricardo Cost Study range of **$16,091 - $31,246** (in 2017 dollars) the NREL Cost Study range of **$10,697 - $50,846** (in 2018 dollars), and the ACT Cost Study range of ***$25,963 - $37,079*** (in 2019 dollars). The fact that EPA's estimates differ so dramatically from the other leading cost studies warrant re-visiting its methods and assumptions to account for the vast disparities, particularly given that EPA has not explained how it can justify such a departure. [EPA-HQ-OAR-2019-0055-1168-A1, p.18]

45We note that while the details and assumptions of each of the above-cited cost studies are slightly different (e.g., 2017$ vs. 2019$, the assumed applicable NOx standard, the assumed applicable regulatory useful life and warranty periods), these studies generally considered very similar technology packages and their premises are roughly similar, such that they provide reasonable benchmarks for the expected program costs on a per-vehicle basis.

EPA cost projections have historically undercounted the effects of its rulemakings, as compared to sales data and pricing information gathered by analysts working directly with the manufacturing sector to gather cost data. A 2012 study published by American Truck Dealers (ATD) examined EPA cost projections for 1997, 2000, and 2001 HD truck rules that phased in new emission standards between MY 2004 and 2010, specifically the degree to which—and possible reasons why—EPA's RIA for these standards dramatically underestimated real world costs of the regulations. 46 The ATD Study concluded that EPA underestimated compliance costs by a factor of 2-5, and that these higher-than-projected costs resulted in significantly lower-than projected new truck sales, reducing the environmental benefits associated with the standards reviewed.47 The figure below, taken from the ATD Study, reflects that actual manufacturing cost increases for MY 2010-compliant heavy HD trucks were around three times higher than the costs that EPA had projected during the rulemaking process:48 [EPA-HQ-OAR-2019-0055-1168-A1, pp.18-19]

46 See Calpin et al., American Truck Dealers, 'A Look Back at EPA's Cost and Other Impact Projections for MY 2004-2010 Heavy-Duty Truck Emissions Standards' (February 13, 2012) (the 'A.TD Study').

47 Id. at 2.

48 See id. at 9, Figure 3. As explained by A.TD, this figure reflects truck OEMs and year of invoice on the X-axis, as well as per-vehicle regulatory compliance premiums on the Y-axis. Dollars are standardized to 2010 with surcharges adjusted for inflation. The EPA estimate is a MY 2009 projection made in December 2000, inflation adjusted.

EPA should revisit its cost projections made in support of the Proposed Rule, and utilize the wealth of information available on *actual* manufacturing cost increases that accompanied implementation of EPA's previous-generation emission standards, as well as the numerous available studies on the currently-proposed next-tier standards and requirements. [EPA-HQ-OAR-2019-0055-1168-A1, p.19]

Organization: *International Council on Clean Transportation (ICCT)*

The total cost to meet a standard is traditionally split between direct and indirect cost of manufacturing. Direct manufacturing cost (DMC) covers in broad terms the hardware; indirect costs (IMC) cover warranty, R&D, profit, and other cost elements that would impact the cost depending on how many units are sold. Figure 5 shows estimates of the incremental direct manufacturing costs derived from meeting the standards, including estimates from ARB’s Low NOx Omnibus and EPA’s NPRM (Option 1). The deviation is relatively small compared to the deviation found in the total costs table. The DMC values are close to $2,000 for EPA NPRM and ICCT costs. ARB’s cost for the Low NOx Omnibus rule is based on NREL's OEM survey, which explains the agreement in values. ARB’s values corrected by volume to better represent national HDV sales reduce DMC by ~30% and are close to DMC values reported by Ricardo under contract for EMA in 2021. However, EMA-Ricardo’s values and NREL values were obtained from surveying vehicle manufacturers and provide few details to explain how the numbers were derived. Cost surveys among regulated entities tend to generate values well above those found via bottom-up cost analysis, as detailed by ICCT and EPA. [EPA-HQ-OAR-2019-0055-1211-A1, p. 13]

Additional sources from the industry also confirm the DMC range. Eaton’s analysis shows that the total incremental cost to meet the proposed regulation while reducing GHG emissions ranges from $1,700 to $2,900 and includes cylinder deactivation, e-heater, LO-SCR, and a 48V, and supports a 25-35% full-time NOx compliance margin to 435k miles useful life. [EPA-HQ-OAR-2019-0055-1211-A1, p. 13]

Organization: *National Association of Chemical Distributors (NACD)*

This severe cost to the chemical distribution industry and American economy would not only harm those directly impacted, but it would also make it more difficult to take future steps to reduce emissions. This loss in jobs and economic output would also burden manufacturers of heavy-duty engines and vehicles as there would be fewer purchases of their vehicles. Since the 1970s, the EPA and trucking industry have successfully reduced the emissions of particulate matter (PM) and nitrogen oxide (NOx) by 98%. With the emissions of PM and NOx from heavy-duty trucks already reduced to such a small fraction of where they were previously, pushing for an even lower amount will be less cost-effective than previous rules and will force manufacturers to reallocate resources that are currently being dedicated towards the research and development of zero emission vehicles. [EPA-HQ-OAR-2019-0055-1279-A1, p. 2]

The proposed rule estimates an increase in each vehicle of only about $4,000; however, research from the Truck and Engine Manufacturers found that a more realistic increase in the cost of vehicles is $42,000, roughly ten times that of EPA estimates.1 [EPA-HQ-OAR-2019-0055-1279-A1, p. 2]

> 1. Truck & Engine Manufacturers Association, 'By the Numbers: Unintended Consequences of EPA's Proposed Truck Emissions Rule,' https://cleantruckfacts.org/, EMA, https://drive.google.com/file/d/1XD8yHIgfkoFbCdmXJLM_ZXfgBMxofCcb/view

Organization: *New York Farm Bureau (NYFB)*

NYFB also believes discrepancies must be addressed regarding the proposal's forecasted compliance costs. In short, there is an enormous disparity—approximately an order of magnitude— between EPA's compliance cost estimates and those projected by engine manufacturers, which are forecast to be up to $35,000 per truck. If EPA's cost estimates are too low, then other key factors influencing the proposal will be affected in turn. [EPA-HQ-OAR-2019-0055-1268-A1, p. 1]

Organization: *PACCAR, Inc (PACCAR)*

In particular, PACCAR agrees with the following aspects of EMA's comments: The proposed extended useful life (UL), and durability demonstration testing requirements, coupled with the increased recall liability, could result in manufacturers building-in assumptions regarding the need to replace the aftertreatment systems at approximately 500,000 miles (or sooner), which would cause substantial price increases for new HDOH vehicles. [EPA-HQ-OAR-2019-0055-1346-A1, p.2]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EMA retained Ricardo to conduct a comprehensive assessment of the direct and indirect costs, as assessed on a per-vehicle basis, that likely will result from EPA's implementation of the low-

NOx regulations, particularly with respect to new regulations centered around Option 1. The Ricardo compliance cost assessment (Exhibit “B” hereto) is based on its exhaustive review of public data sources, evaluation of recommended cost-estimation methods, and a detailed survey and analysis of the HDOH vehicle and engine manufacturing industry, which Ricardo completed in mid-2021 and then updated in 2022. Table 26 from the Ricardo report, reproduced below, summarizes Ricardo’s findings regarding the aggregated per-vehicle cost impacts from EPA’s Option 1 and Option 2 proposals: [EPA-HQ-OAR-2019-0055-1203-A1, pp. 148 - 149]

As reflected above, Ricardo estimates that the per-vehicle incremental costs for HHD vehicles under EPA’s Option 1 will total $42,051 (in 2017 dollars) as of 2031, including increased operating costs. When Ricardo’s per-vehicle cost number is compared against EPA’s estimated per-vehicle cost number ($3,931 for HHD vehicles in 2031), it is clear (again) that EPA has understated the per-vehicle costs of its proposed rulemaking by an order of magnitude. The same conclusion holds when comparing Ricardo’s calculation of likely per-vehicle HHD warranty, UL and component replacement costs in 2031 ($26,376) with EPA’s calculation of those indirect costs ($1,458).32 [EPA-HQ-OAR-2019-0055-1203-A1, p. 149]

32. It is worthy of note that EPA significantly underestimated the costs of its last HDOH rulemaking by at least a factor of four (4). See ATF Report, Feb. 2012, “A Look Back At EPA’s Cost And Cyber Impact Projections For MY 2004- 2010 Heavy-Duty Truck Emission Standards.”

Unlike EPA’s cost assessment, Ricardo conducted an actual comprehensive survey of all leading OEM’s to assess the likely direct and indirect cost impacts of the Option 1 standards, and so was able to make detailed determinations of the per-vehicle direct and indirect cost impacts that will result from EPA’s proposal as of 2027 and 2031. As explained in the Ricardo Report, the cost-assessment that Ricardo utilized is inherently more reasonable and robust than the assumption driven and extrapolation-based approach that EPA has taken. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 149 - 150]

From the foregoing comparisons of cost estimates, it is clear that the main differences between EPA’s estimates and Ricardo’s relate to the direct costs for CDA systems, and the indirect costs associated with the proposed extensions of emissions warranty and UL periods. More specifically, EPA assumes that the all-in per-vehicle costs associated with the deployment of the required complex CDA systems will be only $206, a number that EPA derived from assessing costs at the component-supplier level. Ricardo, on the other hand, based its assessments of all of the relevant CDA-integration costs at the OEM level, and has calculated those per-vehicle costs to be $1,512. (See Ricardo Report, p. 20.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 150]

Beyond that. the more significant cost differentials stem from how EPA and Ricardo have estimated the per-vehicle costs associated with EPA’s proposals to extend the regulatory UL and emissions warranty periods. EPA’s estimate of those costs (as adjusted upward by Ricardo) — based on the Agency’s assumption that aftertreatment components will not need to be replaced during the extended UL period — amounts to just $2,373 per vehicle, a figure that is inherently unrealistic and that is less even than CARB’s much shorter “Step 1” warranty, as discussed further below. Ricardo, on the other hand, based on real data from OEMs, and on the OEMs’ direct confirmation that ERCs will need to be replaced if an 800,000 mile UL is mandated, has calculated that the actual incremental per-vehicle UL and warranty costs will be $26,376. Here too, EPA has under-estimated the actual incremental costs of Option 1 by more than an order of magnitude. Ricardo's Report explains these critical differences with greater particularity, and demonstrates that EPA's cost projections are unreasonable, which means that they are an insufficient basis for this rulemaking. [EPA-HQ-OAR-2019-0055-1203-A1, p. 150]

A side-by-side comparison of the cost elements of EPA's Option 1 and 2 proposals, as estimated by EPA and by Ricardo is set forth below: [EPA-HQ-OAR-2019-0055-1203-A1, p. 150]

As already discussed, EPA's order-of magnitude miscalculations of cost are rooted in large part in the Agency's unsupported assumption that manufacturers will not fully adjust the costs of their HHD and MHD vehicles to recoup the full projected costs that will result from EPA's proposals to extend emission warranties and regulated FULs, and from the increased compliance liabilities that will stem from the substantially expanded list of emissions-related components that will be covered under the lengthened warranties. But it is fundamentally unreasonable to assume that manufacturers will choose to absorb the quantumly increased costs and risks of the low-NOx regulations, and so will not attempt to fully recoup those costs through corollary vehicle price increases. Based on consistent historical experience, and as a matter of sensible business practice, manufacturers will calculate and fully recoup those regulatory costs through corollary per-vehicle price increases. [EPA-HQ-OAR-2019-0055-1203-A1, p. 151]

Organization: *Truck Renting and Leasing Association (TRALA)*

In its proposed rule, the EPA has asked the public to comment on two options for reducing Nitrogen Oxides (NOx) emissions. Option 1 would lead to a 90% reduction of NOx from the current 0.2 g/bhp-hr standard to an ultra-low .02 standard in 2031, which would be in line with the California Air Resources Board's (CARB) Heavy-Duty Engine and Vehicle Omnibus Regulation that was finalized on December 22, 2021. The new NOx standard that CARB has set will lead to a substantial increase in the cost of a new Heavy-Duty vehicle, as well as significantly disrupt the new truck market. After discussions with several OEMs, TRALA is not confident this level of NOx reduction is even possible by the target date, and therefore, TRALA opposes Option 1 as it is currently not technologically feasible. [EPA-HQ-OAR-2019-0055-1180-A1, p. 2]

As noted in the comments of the Truck and Engine Manufacturer Association (EMA) that were submitted to CARB on August 27, 2020, an independent study was performed by Americas Commercial Transportation Research Company (ACT Research), which found that CARB's NOx regulation would result in a $58,000 increase in the cost of a new Model Year 2031 heavy heavy-duty vehicles and a $51,000 increase for medium heavy-duty vehicles. Since those cost estimates were made prior to the inflationary period that the economy is going through now, TRALA believes the actual cost of this regulation on a per-vehicle basis may be higher than $58,000. These costs cannot simply be absorbed by TRALA members, and a requirement for a 90% reduction in NOx will ultimately result in higher lease payments for TRALA customers. [EPA-HQ-OAR-2019-0055-1180-A1, p. 2]

The majority of TRALA customers are small businesses who need trucks to operate a segment of their business and they are inclined to lease instead of purchase a fleet of trucks. The typical customer will lease two or three trucks for a period of four to six years, and at the end of their lease contract they will turn in their truck to the lessor and enter into a new lease on a new truck. The lessor will either keep that truck as a part of their rental fleet or sell the truck on the secondary market. This model has reduced the overall cost of ownership for small businesses, while also putting new trucks out on the road faster than other segments of the trucking industry. Increasing the cost of new diesel trucks by a significant amount will lead to customers opting into longer lease contracts, or in many cases, opting to renew their current vehicle lease instead of leasing a newer, more environmentally friendly truck. Longer lease terms and renewals of current leases will significantly slow the velocity of new trucks entering the marketplace once these new rules go into effect. [EPA-HQ-OAR-2019-0055-1180-A1, p. 2]

Organization: *U.S. Chamber of Commerce*

EPA openly acknowledges that the proposed rule's impacts on the cost of new medium- and heavy-duty trucks, and the impacts of its associated unprecedented and untested useful life and warranty requirements, are highly uncertain. Indeed, there is an enormous and troubling disparity—approximately an order of magnitude—between EPA's compliance cost estimates and those projected by engine manufacturers. Such factual issues merit very careful attention and consideration by the agency.

Specifically, a detailed April 2022 analysis by Ricardo Strategic Consulting forecasts that EPA's Option 1 would impose incremental compliance costs of $42,000 per truck.12 The report concluded that, based on historical cost data, "most OEMs do not experience the steep cost reductions that EPA uses in its analysis of the introduction of new emission-control technologies." [EPA-HQ-OAR-2019-0055-1245-A1, p. 5]

> 12. Review of EPA NRPM and Compliance Cost Assessment, April 25, 2022. Available at https://drive.google.com/drive/folders/1PdGgvJMGBLNM8pFLd3SXuD8ZS0VcNh-g

EPA Summary and Response

The comments summarized above focus primarily on assertions about:

- EPA's costs being too low, largely because EPA did not consider aftertreatment replacement costs in its cost analysis; and,
- EPA's cylinder deactivation costs being too low when compared to estimates by manufacturers generated via surveys; and,
- EPA's cost reductions resulting from the learning-by-doing phenomenon being too aggressive.

Several commenters stated that costs would be much higher than estimated by EPA, as high as $42,000 per HHD8 engine (Advanced Engine Systems Institute, American Bus Association, American Farm Bureau Federation, American Truck Dealers (ATD), Daimler Truck North America LLC (Daimler), National Association of Chemical Distributors (NACD), PACCAR, Truck and Engine Manufacturers Association (EMA), New York Farm Bureau (NYFB), U.S. Chamber of Commerce, Truck Renting and Leasing Association (TRALA)). The source of these cost estimates is the EMA comments which included a study done for EMA by Ricardo which estimated costs as high as $42,000 per engine. The primary difference between EPA's cost estimates and the higher cost estimates from commenters was a difference in approach associated with the proposal's Option 1, particularly for the Heavy HDE NOx standards and useful life values for MY 2031, which the EMA/Ricardo study and comments argued would require aftertreatment system replacement during the useful life of the vehicle at a cost of as much as $20,000. As explained in preamble Sections III and IV, the useful life values under the proposal's Option 1 in MY 2031 for Heavy HDE are not part of the final rule, and the final useful life values for Heavy HDE are both shorter and associated with higher numeric emission standards (i.e., less stringent levels of NOx control) than proposed Option 1 in MY 2031. More specifically, 1) EPA's final rule does not require the longer useful life considered in the EMA/Ricardo study (800,000 miles), 2) the EPA final numeric NOx standards are not as stringent as the values considered in the EMA/Ricardo study, and 3) as explained in preamble Sections III and IV, the EPA final NOx standards for the HHD8 engines explicitly include consideration of compliance margin, which was one of the primary technical concerns identified by EMA as driving the asserted need for the projected aftertreatment replacement requirements in the EMA/Ricardo study. In addition, EPA's final rule does not include the 600,000 mile emissions warranty for the HHD8 engine class which was considered in the EMA/Ricardo study. These factors, plus EPA's analysis and determination that the final standards and useful life values are technically feasible for MY 2027 and later engines, obviate the need to replace aftertreatment systems to maintain compliance during the useful life and thus make a comparison of the EPA final cost estimate and the EMA/Ricardo study an apples-to-oranges comparison.

Another area of significant difference, in EPA's view, is EPA's reliance on a very detailed set of bottom-up cost estimates, including tear-down efforts for CDA system costs. The EPA final rule cost estimates for the aftertreatment system and the CDA system rely upon peer-reviewed, externally commissioned, detailed and transparent cost estimates. In contrast, the EMA/Ricardo study estimates are based on manufacturer surveys with little to no detail behind what survey respondents may have included or not included in their estimated costs. ICCT noted in their comments that, "Cost surveys among regulated entities tend to generate values well above those found via bottom-up cost analysis," and EPA shares that concern. A possible source of difference between EPA estimates and typical manufacturer survey estimates has to do with assumptions about how some or all indirect costs are recovered. In the HD2027 analysis, EPA estimates that indirect costs continue indefinitely at a multiple of the direct manufacturing costs. In contrast, it is possible that manufacturer respondents, or some respondents, may have assumed that indirect costs would have to be recovered over a short time frame, amortizing those costs over one or only a few model years of sales. The limited detail provided in the EMA/Ricardo study estimates makes it difficult for EPA to evaluate whether that is in fact the case.

EMA also commented on the "substantially expanded list of emissions-related components that will be covered under the lengthened warranties." As we describe in Section 4.1, we did not intend to expand the list of components covered under warranty and we are revising the proposed warranty provisions in the final rule to clarify that emission-related warranty covers components listed in 40 CFR part 1068, appendix A, consistent with current requirements.

The U.S. Chamber of Commerce also commented on the rate of cost reductions in the EPA cost analysis, stating that "most OEMs do not experience the steep cost reductions that EPA uses in its analysis of the introduction of new emission-control technologies." This appears to be a reference to the EMA/Ricardo study comments and, specifically, the Ricardo study. In section 5.6 of that Ricardo study, Ricardo mistakenly claims that EPA used certain learning curves that EPA did not actually use in the proposal (or this final rule). Ricardo did not provide a source for the learning curves they attribute to EPA.[40]

Importantly, Ricardo did not make clear that EPA also applies learning effects to the baseline technology costs, although at an appropriately lower rate. Since EPA's primary focus is on the incremental costs associated with standards, the costs under the standards versus those under the baseline is of most relevance. Without learning in the baseline, the baseline cost would not decrease while the action case cost would continue to decrease downward toward the baseline cost, thereby decreasing the marginal cost much more rapidly than the approach used by EPA. Therefore, EPA believes that this claim of EPA having used inappropriately high rates of learning is simply not accurate, especially when combined with the fact that learning is also applied in the baseline. EPA is using the same approach to learning in the final analysis (see Chapter 7.1.1 of the final RIA for all of the learning effects applied in the final analysis).
At least one manufacturer provided more detailed cost estimates but redacted those estimates in their comments to the public docket. These estimates, while higher than EPA's proposal, included costs for replacement of parts during the useful life based on the manufacturer's views of the EPA proposed Option 1. However, as explained further in preamble Sections III and IV, EPA is not finalizing the complete Option 1 standards, useful life values, and warranty periods as proposed and, as explained above, the final standards are feasible without replacement of aftertreatment systems to maintain compliance during the final regulatory useful life values. In three key drivers of costs (emission standards, emissions warranty, and regulatory useful life) the EPA final rule has less stringent numeric requirements than considered by this manufacturer and is thus similarly an apples-to-oranges comparison for the same reasons explained above with regard to the EMA/Ricardo study cost estimates.

The National Association of Chemical Distributors (NACD) commented that so much has already been done through the years to clean up heavy-duty trucks that this rule will be less cost-effective than those prior efforts. NACD also commented, as did the Agricultural Retailers Association, that this rule is requiring R&D expenditures that could be focused on zero emission vehicles. In EPA's judgment, despite the evolution of zero emission technology, as discussed in preamble Sections VII and VIII, the projected emissions and negative impacts on public health and welfare from internal combustion engine trucks cannot be ignored. Clean Air Act section 202(a)(3)(A) requires EPA to set emission standards for NOx, PM, HC, and CO for heavy duty engines that reflect the greatest degree of emission reduction achievable through the application of technology that the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology. CAA section 202(a)(3) neither requires that EPA consider all the statutory factors equally nor mandates a specific method of cost analysis;

[40] The approach used by EPA in estimating learning effects is explained in the final RIA Section 7.1.1 and was derived from "Cost Reduction through Learning in Manufacturing Industries and in the Manufacture of Mobile Sources, Final Report and Peer Review Report," EPA-420-R-16-018, November 2016.

rather EPA has discretion in determining the appropriate consideration to give such factors. See, e.g., Sierra Club v. EPA, 325 F.3d 374, 378 (D.C. Cir. 2003) (explaining that similar technology forcing language in CAA section 202(l)(2) ‘‘does not resolve how the Administrator should weigh all [the statutory] factors in the process of finding the ‘greatest emission reduction achievable’ ’’); Husqvarna AB v. EPA, 254 F.3d 195, 200 (D.C. Cir. 2001) (explaining that under CAA section 213’s similar technology-forcing authority that ‘‘EPA did not deviate from its statutory mandate or frustrate congressional will by placing primary significance on the ‘greatest degree of emission reduction achievable’ ’’ or by considering cost and other statutory factors as important but secondary). As explained in preamble Sections I, III and V, in setting the final emission standards, EPA appropriately assessed the statutory factors specified in CAA section 202(a)(3)(A), including giving appropriate consideration to the cost associated with the application of technology EPA determined will be available for the model year the final standards apply (i.e., cost of compliance for the manufacturer associated with the application of such technology). EPA’s assessment of the relevant statutory factors in CAA section 202(a)(3)(A) justify the final emission standards. We also evaluated additional factors, including factors to comply with E.O. 12866; our assessment of these factors lend further support to the final rule. This rule is projected to result in a significant reduction in heavy-duty truck emissions which, as described in the final rule preamble and final RIA, is projected to reduce air pollution and improve public health and welfare. In addition, we note that EPA’s analysis demonstrates that the rule is cost beneficial to society in that its benefits outweigh its costs. Given these considerations, how this rule’s cost-effectiveness compares to prior emission control regulatory programs is not germane.

NACD also commented that loss in jobs and economic output would burden manufacturers of heavy-duty engines and vehicles, as there would be fewer purchases of their vehicles. We respond to these comments in sections 25 through 26 of this document.

TRALA also commented with respect to what we call low-buy, where truck purchasers may decrease purchases of new trucks due the to the final program thereby reducing the benefits of the program. We respond to such comments in section 25 of this document.

18.3 Indirect costs – Warranty

Comments by Organizations

Organization: *Allison Transmission, Inc. (Allison)*

In order to calculate the cost of longer warranty and useful life periods, EPA relied on one analysis (the Fleet Advantage study) over another (the American Transportation Research Institute (ATRI) study.30 EPA’s rationale for relying on the first study was that it was centered on “both short-haul and long-haul combination trucks.”31 EPA theorized that the ATRI study would “suggest a higher weighting of older vehicles with higher repair and maintenance costs/mile relative to the weighting of costs/mile in the Fleet Advantage study.”32 For this reason, EPA apparently chose the Fleet Advantage study over the ATRI study with its concomitant lower costs (10.48 cents/mile versus 17.1 cents/mile). [EPA-HQ-OAR-2019-0055-1231-A1, p.14]

30 Draft RIA at 342.

31 Id.

32 Id.

Organization: *American Trucking Associations (ATA)*

One of the more controversial potential cost increases under HD2027 is the requirement to significantly extend mandatory warranties paid for by the initial vehicle purchaser. Warranty pricing is not a stand-alone operational cost line-item. It is wrapped into the category of truck lease or purchase payments complete with a 12% Federal Excise Tax tacked on. A potential sixfold increase in warranty coverage will not come cheap. [EPA-HQ-OAR-2019-0055-1326-A1, p. 11]

Many factors determine equipment turnover cycles for fleets including the financial health of the economy and the company, depreciation, type of operation, maintenance levels, and trade-in values. There is no need for a company that has a short fleet turnover cycle to purchase an extended warranty package. These fleets already have the lowest emission profiles in the industry given they routinely purchase the newest equipment on the market. It is these fleets that will be disproportionally impacted financially if they are required to purchase warranties that exceed their mileage needs. Requiring the purchase of extended warranties not normally needed may potentially have the unintended consequence of fleets holding onto their current trucks longer thereby decreasing the introduction of new ultra-low NOx trucks into the secondary marketplace. [EPA-HQ-OAR-2019-0055-1326-A1, p. 11]

Fleets have widely varied approaches to their purchase of extended warranties depending on their business models and financial means. The one common factor that exists is that fleets purchase extended warranties based upon their specific needs and costs. The following five real life examples illustrate this point and are based upon today’s technologies, not those involving the next generation of more highly complex and expensive pathways: [EPA-HQ-OAR-2019-0055-1326-A1, p. 11]

Example #1

Fleet A is a large Less-Than-Truckload (“LTL”) fleet that purchases new Class 8 trucks and uses them for the life of the truck which is roughly 1.6 million miles or 15 years. Fleet A has emission control/maintenance work that typically costs $10,000 at around 400K mile intervals. They purchase the longest extended warranties available in the market. Emission control equipment falling outside the warranty period is typically repaired at dealerships. [EPA-HQ-OAR-2019-0055-1326-A1, p. 11]

Example #2

Fleet B is a large Truckload (“TL”) fleet that purchases new Class 8 trucks and uses them for around 400-450K miles before reselling their vehicles. Fleet B pays over $4,000 above the standard 100K mile/5-year warranty for extra emission systems coverage (i.e., they purchase a 5-year 450K mile aftertreatment extended warranty). Their extended warranty purchases align with their expected use of their equipment. Fleet B notes that they must purchase an extended engine warranty package (i.e., 4-year 450K mile engine extended warranty) to purchase the extended aftertreatment warranty package therefore both costs are reflected in their $4,000+ figure. Both warranty packages cover different aspects of the emission control system. Fleet B also noted that given their large volume of orders, they are able to negotiate a substantially lower extended warranty package per power unit compared to fleets that are not able to leverage economies of scale. Given Fleet B's consistent fleet turnover cycles, there is no need to purchase warranties beyond their period of ownership which is the case for all similarly situated fleets. [EPA-HQ-OAR-2019-0055-1326-A1, p. 12]

Example #3

Fleet C is a small trucking company that conducts LTL, TL, and drayage operations. Fleet C purchases new Class 8 trucks that include the standard 100K mile/5-year manufacturers' warranty. They do not purchase extended warranties and they operate their trucks for their entire operational life. Major repair work outside the standard warranty period is conducted at dealerships. [EPA-HQ-OAR-2019-0055-1326-A1, p. 12]

Example #4

Fleet D is a medium-sized trucking company that operates flatbeds. Fleet D purchases new Class 8 trucks and they also purchase the extended warranty packages that cover 500k miles including clutch and towing. Their additional cost beyond the standard 100K mile/5-year warranty (excluding their clutch and towing warranty cost) costs $7,000 for an additional 500,000 miles of warranty coverage. They operate their fleet until the end of their equipment operational life, sometimes as much as 2 million miles. Major repair work outside their warranty periods is undertaken at dealerships. [EPA-HQ-OAR-2019-0055-1326-A1, p. 12]

Example #5

Fleet D is a small trucking company that operates 10 Class 8 trucks. Their operations include TL, dry van, temperature-controlled, and flatbed. Fleet D only purchases used trucks and operates them for the remainder of their operational life, typically 800,000 to 1,000,000 miles. Fleet D buys used trucks having between 300,000 to 400,000 miles but that may change given the tremendous escalation in used truck prices that have now exceeded $100,000 per tractor – the highest prices on record for used Class 8 trucks.8 They do not normally purchase extended warranties on their used equipment due to high warranty prices. In addition, they noted that they are charged between $500 to $1,000 per vehicle up-front per vehicle for pre-inspections for extended warranty applications whether they decide to buy an extended warranty or not. [EPA-HQ-OAR-2019-0055-1326-A1, pp. 12 - 13]

8. "March's Average Used Class 8 Retail Price Breaks $100,000," Transport Topics (April 26, 2022).

There is an exceptionally wide variation in projected warranty cost estimates between CARB, the U.S. Department of Energy's National Renewable Energy Laboratory ("NREL"), EPA, and the OEMs – a matter that is creating great concern amongst fleets as they anticipate their future equipment purchasing paths. Depending on where extended warranties are set, the cost of such warranties paid for up-front by the initial vehicle purchaser – whether they need such coverage or not – could potentially cost more than the technology needed to achieve compliance. This would be a historical first in our industry. [EPA-HQ-OAR-2019-0055-1326-A1, p. 13]

As an example, CARB estimated the cost increase of raising the minimum emissions warranty from 100,000 miles to 350,000 miles would range from $285 - $413 on a per-vehicle basis.9 According to a sampling of ATA member companies, the cost of purchasing a CARB-certified vehicle with the minimum 350,000 mile warranty added more than $1,000 to the vehicle purchase price when compared to the same federally-certified vehicle without this added warranty.10 [EPA-HQ-OAR-2019-0055-1326-A1, p. 13]

9. California Air Resources Board, Public Hearing To Consider Proposed Amendments To California Emission Control System Warranty Regulations and Maintenance Provisions for 2022 and Subsequent Model Year On-Road Heavy-Duty Diesel Vehicles And Heavy-Duty Engines with Gross Vehicle Weight Ratings Greater Than 14,000 Pounds and Heavy-Duty Diesel Engines in such Vehicles, p. IX-6 (May 8, 2018).

10. See Appendix A.

These member companies have indicated that, while their minimum manufacturer's emission warranty is closer to 250,000 miles, on average, many do purchase extended warranties to cover their expected mileage during their ownership period. The cost of these extended warranties was reported to be roughly $1,000 per 100,000 miles of warranty. [EPA-HQ-OAR-2019-0055-1326-A1, p. 13]

These real-world warranty costs are in sharp contrast to the previous regulatory cost estimates that have been presented by CARB. EPA should take note of these differences and ensure that their warranty cost estimates are thoroughly evaluated and vetted. [EPA-HQ-OAR-2019-0055-1326-A1, p. 13]

The proposed increases in coverage as well as the complexity of the technologies being covered have raised concerns within the trucking industry. Cost estimates prepared by truck manufacturers have consistently projected significantly higher warranty costs for future increases. These cost disparities, which are as much 8 times higher than the EPA estimates, highlight the need to get it right. As we have experienced with the CARB 2022 warranties, adding thousands of dollars to the cost of a new truck, especially when a return-on-investment is not apparent, will result in fleets reevaluating the purchase decisions and could result in adverse purchase impacts. [EPA-HQ-OAR-2019-0055-1326-A1, p. 13]

Additionally, nearly every fleet sampled indicated they did not receive a residual value from any unused portion of their emissions warranty when they resold a truck. This may partly explain why fleets that purchase extended warranties attempt to purchase coverage for only the mileage they accrue under ownership. It should be noted that secondary buyers still have the ability to purchase additional warranty coverage through the secondary market should they want such coverage. [EPA-HQ-OAR-2019-0055-1326-A1, pp. 13 - 14]

Warranties are intended to cover defects in materials and workmanship which cause the failure of a warranted part to be identical in all material respects to that part as described in the vehicle or engine manufacturer's application for certification. Warranties are not intended to cover failure of parts that are not designed properly. In the simplest of terms, CARB contends in its December 2021 "California Air Resources Board Staff Report on the Warranty Cost Study for 2022 and Subsequent Model Year Heavy-Duty Diesel Engines" that components fail because manufacturers are not properly engineering their performance within their useful life – a rather simplistic and absurd response. Manufacturers invest millions of dollars in research and development to ensure components function and perform properly. The relationships between manufacturers and fleets are built over decades with performance, price, and quality tied to continued brand loyalty. Equipment that continually breaks down or is constantly in service bays does a fleet no favors. We have a saying in the trucking industry that a non-moving truck is an un-productive truck. [EPA-HQ-OAR-2019-0055-1326-A1, p. 14]

Extended warranties, durability, and vehicle downtime are all interconnected. As useful life increases, the theory is that components will become more durable and in turn lead to fewer repairs and less downtime for fleets. Extended warranties are not free. They can best be compared to insurance in guaranteeing different degrees of coverage for repairs. A useful life figure never guarantees the performance of a part or system. What extended warranties do not cover are towing fees and downtime after a breakdown. Between hook-up and mileage fees, it is not unusual for a fleet to receive a $5,000 bill for a 100-mile tow. Once at a repair shop, fleets will likely experience parts and technician shortages. It is not uncommon for a truck to be out of circulation for days, weeks, and even more than a month. For these reasons, downtime costs frequently exceed repair costs – even under different warranty packages. Monthly payments on equipment not in use remain the same as payments for equipment actively hauling freight. Extended warranties are not the end-all solution in making timely repairs and keeping the nation's supply chain connected. [EPA-HQ-OAR-2019-0055-1326-A1, p. 14]

When lower NOx standards take effect and longer useful life and warranty requirements are phased-in, expect increased repair costs due to higher unit prices for parts due to longer useful life and the introduction of premature new technologies likely to have elevated failure rates. Manufacturers have no choice but to substantially increase warranty prices -- including extra margins -- to cover cost and frequency of repair uncertainties. Such technologies were aged in the lab, not under actual on-road operating conditions. Again, the financial burdens fall squarely on the shoulders of fleets, not manufacturers. [EPA-HQ-OAR-2019-0055-1326-A1, p. 14]

Organization: *California Air Resources Board (CARB)*

Option 2 matches CARB's less stringent Step 1 warranty, which took effect with model year 2022 and which was intended only as an intermediate step to the longer warranty periods in the Omnibus Regulation (termed Step 2 warranty). Although the small incremental Step 1 represents was appropriate as an intermediate step toward the longer warranty periods of Omnibus

Regulation, it is inadequate as an endpoint for 2027 MY and later engines. As discussed in comment b of this section, the voluntarily purchased longer warranties should be considered as part of the regulatory warranty baseline. Using California State University, Sacramento survey data and information shared by the manufacturers and third-party warranty providers, CARB staff more accurately accounted for current warranty buying practices by fleets and owner/operators, and hence CARB staff's warranty baseline is higher than in the other analyses. [EPA-HQ-OAR-2019-0055-1186-A2, pp.109-110]

The incremental change of warranty coverage of Option 2, which is equivalent to CARB's Step 1 warranty, is small especially after voluntarily purchased longer warranties are considered. In CARB staff's analysis in the Step 1 warranty rulemaking, heavy HD vehicles are estimated to travel about 316,000 miles on average under warranty in the baseline condition prior to Step 1 warranty because of the significant uptake of voluntary longer warranties beyond the regulatory 100,000 miles. For example, 40 percent of vehicle owners who voluntarily purchased 5 years/500,000 miles warranties already would not be affected by Step 1 warranty, which lowered CARB staff's estimated incremental costs. The miles covered under warranty was estimated to increase to 348,100 miles under Step 1 warranty, which means the warranty coverage, on average, only increased by about 10 percent. [EPA-HQ-OAR-2019-0055-1186-A2, p.110]

CARB staff have concerns regarding the 'Vehicle miles traveled based scaling factors' used in U.S. EPA's calculation of warranty cost. The warranty calculation method assumes the warranty cost of a HD diesel engine is 3 percent of the direct manufacturing cost of diesel technology package multiplied by the corresponding scaling factor. For example, the scaling factor of heavy HD vehicles for MY 2031 and later is assumed to be six because the current mileage of the regulatory warranty is 100,000 miles, and Option 1 proposes to extend warranty to 600,000 miles. This assumption can overstate the relative cost impact of longer warranty periods for two reasons:

1. **The estimated warranty cost includes the cost of voluntary longer warranties currently purchased by the majority of vehicle owners.** As noted in page 17507 of the proposed rule, nearly 50 percent of new HD Class 8 vehicles are sold with a 500,000 mile extended warranty. In California's Step 1 warranty rulemaking, CARB staff estimated based on survey data that only 15 percent of Class 8 vehicles rely on the 100,000 mile warranty period, with the remainder having an extended warranty to 250,000 miles (45 percent) or 500,000 miles (40 percent).173 As specified in 40 CFR 86.004-2 as well as in the proposed section 1036.120 (b), the emission warranty period should not be less than the basic mechanical warranty period that the manufacturer provides with or without additional charge to the purchase of the engine. Therefore, the current purchase practice of extended warranty should be considered as part of the regulatory baseline to reflect the average real cost fleets will encounter when purchasing vehicles with the proposed longer warranty period.

173 Appendix C Economic Impact Analysis / Assessment, page C-3, https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/hdwarranty18/appc.pdf?_ga=2.65626670.1089019171.1648488649-859068364.1628622434

2. **The warranty cost method overestimates the total mileages accumulated by all the vehicles** because it assumes every vehicle reaches the mileage limit before reaching the hour or year limit (e.g., reaching 600,000 miles limit before 10 years or 30,000 hours for HHDD). Although the different usage patterns of different vehicles categories are accounted for in the calculation of repair costs (section 7.2.3), this difference is not considered in the warranty cost. In other words, the repair cost analysis accounts for different usage patterns of different vehicle categories through the vehicle's service life, but the upfront warranty cost estimate does not. This assumption can exaggerate the warranty cost increase of low-mileage vehicles that can reach the hour or year limit before the mileage limit. To account for the different limiting factors of warranty periods, i.e., mileage, years, or hour limit, CARB staff used the 'miles covered under warranty' in estimating the incremental change of usage due to the longer warranty periods of Step 1 warranty and Omnibus warranty. A similar analysis using U.S. EPA's Motor Vehicle Emission Simulator should be considered to represent the appropriate warranty cost more accurately for low-mileage vehicle categories. Revising the analysis as recommended would lower the cost of warranty Option 1, which provides another rationale for supporting the stronger, more effective Option 1. [EPA-HQ-OAR-2019-0055-1186-A2, pp.110-111]

It is important to note that the same factors significantly contributed to the difference in warranty cost estimates of CARB's Omnibus Regulations presented by CARB staff compared to those prepared by industry stakeholders. Detailed analysis is available in the final report of the Board-Directed HD Warranty Cost Study Working Group.174 [EPA-HQ-OAR-2019-0055-1186-A2, p.111]

174 See section IV.E (page 43-44) of the final report regarding CARB's analysis of the difference between CARB and other warranty cost estimates, https://ww2.arb.ca.gov/sites/default/files/2022-01/warranty_cost_study_final_report.pdf

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

Indirect Costs. EPA's indirect cost estimates are similarly inaccurate and are well below what Daimler Truck estimates will be the actual costs of implementing the Proposed Rule under either Option 1 or 2. As explained in Section IV.A of these comments, and as acknowledged by EPA in the Proposed Rule, the proposed extension of useful life and emission warranty periods will be the main drivers of indirect cost increases for manufacturers. EPA does not acknowledge the magnitude of these cost increases, while providing estimates that understate the compliance burdens associated with these aspects of the proposal. [EPA-HQ-OAR-2019-0055-1168-A1, p.12]

As explained in Section IV.A, it is widely expected that to meet the more stringent numerical standards for the extended useful life timeframes under Option 1 of the Proposed Rule, it may be necessary to repair and/or replace the aftertreatment system and related components during the useful life of the vehicle and likely during the emission warranty period. In the draft RIA, EPA acknowledges the National Renewable Energy Lab (NREL) technology cost study conducted in conjunction with the development of CARB's Low-NOx Omnibus rule, in which NREL factors in to its cost scenarios the need to replace the aftertreatment system at one or more times during the useful life of the vehicle to meet the 0.02 g/bhp-hr NOx standard adopted by CARB in the Omnibus rule.17 Similarly, a recent Ricardo Strategic Consulting analysis of incremental increased costs associated with the Proposed Rule assumes replacements of existing and new emission-related components throughout the extended emission warranty periods and takes these into account in estimating indirect costs.18 Both the NREL and Ricardo Cost Studies are based upon extensive input by manufacturers and reflect a reasonable assumption (which is explained in more detail in Section IV.A) that aftertreatment system and/or component replacement will likely be necessary at some point during the extended regulatory useful life and potentially the warranty period, given the stringent standards that EPA is proposing. [EPA-HQ-OAR-2019-0055-1168-A1, pp.12-13]

17 See NREL, On-Road Heavy-Duty Low-NOx Technology Cost Study (May 2020) at (the ‘NREL Cost Study’).

18 See Ricardo Strategic Consulting, Review of EPA NPRM and Compliance Cost Assessment, prepared for Truck and Engine Manufacturers Association (April 25, 2022) at 28-30 (the ‘Ricardo Cost Study’) (submitted with Truck and Engine Manufacturers Association comments on EPA-HQ-OAR-2019-0055[-1203]).

Yet EPA rejects this reasonable assumption without full explanation, stating simply that it assumes ‘that manufacturers would not pursue such an approach’ (i.e., complete system replacement at some point during the useful life of the engine/vehicle), pointing to what it characterizes as industry practice ‘by and large since emission controls were introduced in the 1970s and 1980s.’19 EPA thus rejects a central component of the NREL and Ricardo cost impact studies and a key driver of indirect costs to manufacturers. This is not reasoned decision-making20 and reflects that the Agency’s proposal does not acknowledge what compliance with significantly more stringent standards for the increased regulatory useful life periods, as well as the increased costs associated with longer warranty periods, will actually cost under Option 1.21 Daimler Truck provides a detailed technical explanation for why and how these costs are likely to be incurred in Section IV.A, which supports the conclusion that EPA’s assumption is unreasonable. [EPA-HQ-OAR-2019-0055-1168-A1, p.13]

19 Draft RIA at 327.

20 Cf. FCC v. Fox Television Stations, Inc., 556 U.S. 502, 515, 129 S.Ct. 1800, 173 L.Ed.2d 738 (2009) (noting ‘the requirement that an agency provide reasoned explanation for its action’).

21 Because the Agency’s cost-benefit analysis does not account for the likelihood of aftertreatment system replacements, it also fails to address the inherent inefficiencies of such replacements, where a fully-functional emission control system must be traded out for a marginally more effective one to ensure that EPA’s stringent standards are met for full useful life. For a complete evaluation of costs and benefits associated with the Proposed Rule, particularly under Option 1, it is recommended that EPA conduct an

assessment of the significant cost of aftertreatment system replacements in comparison to their marginal environmental benefits.

As noted above, Daimler Truck has undertaken its own internal study of incremental cost increases associated with the Proposed Rule, including indirect costs attributable to the extended warranty periods in the proposal. Table 2 below reflects the Daimler Truck's warranty cost estimates in comparison to EPA's under proposed Option 1 and Option 2: Table 2 reflects the large disparity between EPA and Daimler Truck warranty cost estimates, the latter of which are more in line with industry expectations based upon many years of service and emission warranty experience. As reflected in the table, the most costly phase of EPA's proposal would start in MY 2031 under Option 1, where manufacturers of Class 8 Trucks would have to meet very stringent NOx standards for an unprecedented 800,000 mile useful life, including a 600,000 mile emission warranty period. Daimler Truck estimates that during this time, per-vehicle warranty costs would be **upwards of $ [redacted]**, many times more than EPA's incremental cost projection of $1,210 per vehicle.25 EPA's warranty cost estimates under Option 2 ($716 for MY 2027-2030 and $641 for MY 2031 +) are similarly inaccurate and are well below Daimler Truck's more realistic $ [redacted] cost estimate. Daimler Truck's cost estimate under Option 2 is suppo1ied by real-world data from the first phase of implementation of CARB's 'Step 1 ' warranty period extension for Class 8 bucks under the Omnibus rule, which imposed a 350,000 mile/5 year warranty period for MY 2022-2026. Due to Daimler Truck's actual average production cost increases, vehicle prices in fact increased during CARB's 'Step 1' phase by **$ [redacted]** (depending upon the vehicle). Notably, this phase has not required the installation of additional engine or afte1ireatment technology as compared to MY 2021 builds, in contrast to EPA' s proposal. [EPA-HQ-OAR-2019-0055-1168-A1, pp.13-14]

25 The Ricardo Cost Study estimates incremental costs associated with extended emission warranties as high as $9,942 strut ing in MY 2027 and $16,268 starting in MY 2031 under Proposed Rule Option 1, and $5,800 under Proposed Rule Option 2. Daimler Truck's figure is thus reasonably aligned with the warranty costs estimated in the Ricardo Cost Study, which is based upon industry expe1t input and OEM responses to a confidential survey. See Ricardo Cost Study at 28.

On the basis of the cost estimates presented above, Daimler Truck conservatively estimates that incremental material and warranty costs alone will total:

- $ [redacted] per MY 2027-2030 Class 8 truck under Option 1.
- $ [redacted] per MY 2031+ Class 8 truck under Option 1.
- $ [redacted] per MY 2027+ Class 8 truck under Option 2. [EPA-HQ-OAR-2019-0055-1168-A1, p.15]

Again, it is important to note that Daimler Truck estimates only direct material costs and indirect costs associated with extended warranty periods. It has not taken into account other factors such as markup, R&D, or profit margins for the service centers that perform warranty work. Thus, Daimler Truck's estimates should be considered a starting point for cost increases that would be incurred under the Proposed Rule. [EPA-HQ-OAR-2019-0055-1168-A1, p.15]

EPA estimates that, for MY 2031 Class 8 HHD trucks, its proposed warranty periods in Option 1 will add only $1,227 in incremental warranty costs, and that Option 2 would add only $641 in incremental warranty costs.97 These figures conflict with readily and widely available information. For instance, CARB's recently enacted 'Step 1 Warranty' standards in the Omnibus rule extended the warranty period for heavy HDVs to 350,000 miles (as compared to the federal 100,000 mile requirement) but did not require the addition of more complicated emissions hardware and associated warranty costs. Pricing differences between 'EPA-certified' and 'CARB-certified' vehicles with the exact same powertrains are readily available to the public, and illustrate the cost of CARB's extended warranty products. As noted in Section II.B.1 of these comments, for Daimler Truck Class 8 trucks, the extended CARB warranty has added as much as $ [redacted] to the price of a vehicle—and nearly $ [redacted] to the price of a high-volume on-highway engine like the Detroit DD15. These increased costs are solely attributable to the extended warranty terms under the CARB Omnibus rule, thus are a benchmark of the likely cost increases that will be associated with EPA's warranty period proposal. [EPA-HQ-OAR-2019-0055-1168-A1, p.72]

97 See Draft RIA at 330, Table 7-21.

Organization: *International Council on Clean Transportation (ICCT)*

The largest source of cost variability comes from indirect cost assessments. The values reported on indirect costs from each study are summarized in Figure 6. The root of this wide range of values are assumptions and methods to evaluate the cost impact of increasing emission control system useful life (UL) and warranty requirements. [EPA-HQ-OAR-2019-0055-1211-A1, pp. 13 - 14]

Two different UL and warranty requirement evaluation methodologies were used by the different authors of the reports presented here. The first group (EPA, ICCT and ARB) assumed that suppliers and manufacturers have several years to make production-ready the next generation of control technology to comply with the CARB proposal for NOx limits, UL and warranties. Most would increase the size of some components to meet the new requirements. As the cost impact of the size increases is already accounted for in the DMC values, the impact on IMCs is minimized. [EPA-HQ-OAR-2019-0055-1211-A1, p. 14]

In addition, EPA reflected the warranty and UL costs in the IMC by including Retail Price Equivalent (RPE) multipliers. RPEs are one of the main methods EPA has used to estimate IMCs. Warranty costs that traditionally have a RPE of 0.02 were increased by a factor derived from the mileage increase to meet the MY2027 and MY2031 warranty, i.e., a VMT-based scaling factor. The warranty-RPE scaling factor ranged from 4.5 to 6.0. The UL requirement costs were accounted for in the R&D component of the IMC. RPEs for R&D were increased by a VMT-based scaling factor of 1.33 to 1.38. [EPA-HQ-OAR-2019-0055-1211-A1, p. 14]

The second group relied on surveys of engine and truck manufacturing OEMs. This approach was adopted by NREL under contract to ARB, and by Ricardo under contract to EMA. The main assumption these make is that an average truck would experience a complete system replacement during the warranty period covering the useful life of the vehicle. By oversimplifying, this approach implies thousands of dollars of additional increased warranty costs per vehicle that exceed those over other estimates. [EPA-HQ-OAR-2019-0055-1211-A1, p. 14]

Given that emission control system manufacturers have historically been able to meet their UL and warranty requirements since the inception of emission standards in the 70's, that the bulk of the technology required is an incremental improvement on existing technology, and that the industry still has 8 years to develop durable and reliable technology, it would be wrong to assume that complete system replacements would be required to meet more ambitious UL and warranty requirements. [EPA-HQ-OAR-2019-0055-1211-A1, p. 14]

Organization: *Manufacturers of Emission Controls Association (MECA)*

It should be noted that the cost estimates developed by NREL included the costs due to the extended warranty requirements, despite a lack of adequate information available from suppliers or OEMs to estimate these. Similarly, costs analyses conducted by ACT Research and Ricardo made assumptions for significant warranty costs due to the new regulation based on confidential surveys. NREL and CARB acknowledged that the cost estimates for extended warranty are very uncertain. CARB subsequently conducted its own analysis of costs needed to meet extended warranty requirements, and these are substantially lower than those estimated in the NREL report as well as those estimated by ACT Research and Ricardo. After the Omnibus was approved by its Board, CARB staff convened a working group of OEMs, EMA, and MECA to review warranty costs. This working group resulted in a final report in which CARB staff concluded that the methodology used to support the Omnibus Regulation warranty-related cost estimates is reasonable and defensible and they did not believe changes to those estimates were needed [45]. As stated above, this uncertainty in costs estimated to meet extended durability and warranty provides an opportunity for future collaborative work in the form of a study that includes fleets, industry stakeholders, CARB and EPA staff. [EPA-HQ-OAR-2019-0055-1320-A1, pp.27-28]

> [45] CARB, 'California Air Resources Board Staff Report on the Warranty Cost Study for 2022 and Subsequent Model Year Heavy-Duty Diesel Engines,' 2021.

Two cost estimates were prepared – one that assumed today's durability and warranty requirements, and one assuming one million mile useful life (FUL) and 800,000 mile warranty for class 8 and 550,000 mile FUL and 440,000 mile warranty for Class 4-7 starting in 2027. These durability and warranty levels were chosen because they were initially proposed by CARB during the Omnibus rulemaking [39]. Given EPA's Proposed Option 1 includes lower durability and warranty requirements than assumed in our cost analysis, we expect the cost estimate for longer FUL and warranty provided below to represent a worst-case scenario. [EPA-HQ-OAR-2019-0055-1320-A1, p.26]

> [39] CARB, 'Heavy-Duty Low NOx Program Workshop: HD UL & Step 2 warranty,' 23 January 2019. [Online]. Available: https://www.arb.ca.gov/msprog/hdlownox/files/workgroup_20190123/04-HD_UL_&_Step_2_warranty_WS01232019.pdf.

For a vehicle with a 6-7L engine, the incremental hardware improvements needed to meet a 0.02 g/bhp-hr certification limit on the FTP cycle and future LLC standard at today's durability and warranty requirements were estimated to add about $1,300 to $1,800 to the cost of the engine efficiency and emission control technologies. For a Class 8 tractor with a 12-13L engine similar incremental improvements were estimated to add about $1,500 to $2,050 (less than 1.2%) to the cost of a MY 2027 truck, projected to be approximately $177,000, based on a historical 1% annual rate of MSRP increase reported by ICCT. The estimated incremental costs to meet the above referenced increased durability and warranty requirements for a 6-7L engine and 12-13L engine were $1,800 to $2,450 and $2,000 to $2,750, respectively. The estimated total additional emission control cost in 2027, including a 0.02 g/bhp-hr FTP tailpipe limit, LLC limit, 1-million-mile durability requirement and 800,000 mile warranty, would be $3,100 to $4,250 for 6-7L engines and $3,550 to $4,800 for 12-13L engines. If a Class 8 truck with 12-13L engine is assumed to sell for an average price of $177,000 in 2027, based on the historical 1% annual rate of increase reported previously, the additional cost of emission controls on this truck will account for roughly 2-2.7% of the total vehicle price. It is important to reiterate that these cost estimates are biased high since they are based on more stringent requirements than those included in Propose Option 1. [EPA-HQ-OAR-2019-0055-1320-A1, pp.26-27]

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

The proposed standards will result in increased warranty costs. Some OEMs don't even return parts to suppliers. Even if parts are returned, they only provide data on failed parts, with little or no data on surviving components. Different components have dramatically different service lifetimes. Considering this, MEMA recommends an interim review before the second phase. Suppliers have real concerns about the longevity of DEF sensors, and other electronic sensors. EPA should designate certain replaceable parts as maintenance service items rather than as warranty service items. Having such a long warranty on new vehicles, will drive significant additional costs into the vehicle purchase price for additional warranty coverage due to the lack of data as well as known additional costs based on part life. This may result in pre-buys of older technology or owners keeping their trucks for extended times versus buying new vehicles. [EPA-HQ-OAR-2019-0055-1322-A1, p. 7]

Organization: *Navistar, Inc. (Navistar)*

EPA's extended warranty cost estimates are understated by an order of magnitude. Navistar provided EMA with actual data regarding the warranty costs incurred when customers purchased extended warranty packages. We support EMA's comments on this issue, which reflect the cost data Navistar provided to EMA. [EPA-HQ-OAR-2019-0055-1318-A1, p. 6]

Organization: *New York Farm Bureau (NYFB)*

Specifically, NYFB is concerned that the agency's projection of extremely modest technology and warranty costs associated with the rule will result in a significant overestimation of future fleet turnover and underestimation of the negative emissions consequences associated with large-scale 'pre-buys' prior to compliance deadlines. To its credit, EPA openly admits that its projections are guesswork, but it does not quantitatively explore how underestimating costs could drive higher pre-buy behavior that could significantly delay and undermine emissions reductions benefits that are the central purpose of the rule. So, before finalizing this rule, NYFB urges EPA to work collaboratively with industry, states, and other affected stakeholders to resolve discrepancies related to technology costs and achievability, warranty impacts, corresponding fleet turnover and environmental impacts of the proposal. [EPA-HQ-OAR-2019-0055-1268-A1, p. 2]

Organization: *PACCAR, Inc (PACCAR)*

In particular, PACCAR agrees with the following aspects of EMA's comments: The increase in manufacturers' costs to cover the proposed extended warranty requirements will be substantial, and necessarily will be passed on to purchasers at the point of sale. [EPA-HQ-OAR-2019-0055-1346-A1, p.2]

Organization: *Small, George (OOIDA)*

it is my hope that the cost for clean air is affordable for small businesses and that those emissions components are very reliable and come with a strong warranty in the pass some emissions components were not under warranty and these systems are very expensive to replace and that affects my bottom line. [EPA-HQ-OAR-2019-0055-1266-A2, p.3]

Organization: *Truck and Engine Manufacturers Association (EMA)*

The proposed Option 1 requirements also likely would be cost-prohibitive, principally because of the incremental costs that would result from the proposed mandates for extended emissions warranty and full useful life ("FUL") periods. [EPA-HQ-OAR-2019-0055-1203-A1, p. 12.]

One of the consequences of that reality is that the Option 1 proposal cannot be implemented in a cost-effective manner. In that regard, EPA's Regulatory Impact Analysis (RIA) has not factored-in manufacturers' anticipated costs of having to replace and pay for the multiple "Stage 3" catalyst systems. More specifically, at page 327 of the RIA, EPA concedes that its cost estimates – unlike the detailed cost analyses prepared by Ricardo and the National Renewable Energy Laboratory (NREL) (discussed infra) – do not include a scheduled replacement of the new envisioned multi-component aftertreatment systems, notwithstanding that EPA's proposal will, in effect, extend the useful life requirements for those systems out to 650,000 miles or even to 800,000 miles, for HHD engines. On that point, EPA states as follows: Our understanding is that, while the costs associated with warranty and useful life are quite high [in the NREL study], they were estimates associated with complete system replacement at some point during the extended useful life of the engine/vehicle. We have assumed that manufacturers would not pursue such an approach and would, instead, include upfront (i.e., at the point of end user purchase) [sic] with the expectation that the parts would last the full useful life without a mandatory replacement. For that reason, we have chosen not to use the warranty and useful life cost estimates presented by NREL [or by Ricardo], and have instead used [our own] approach. (RIA, p. 327.) (Emphasis added.) [EPA-HQ-OAR-2019-0055-1203-A1, pp. 12 - 13]

EPA's assumption in that regard is neither reasonable nor correct. HDOH engine and vehicle manufacturers have expressly and repeatedly informed EPA that they will be compelled to include a replacement of aftertreatment systems in their design and cost calculations to ensure that low-NOx emissions performance can remain stable and compliant out to the significantly extended useful life periods. EPA's decision to disregard the information provided by manufacturers has led to the Agency's inaccurate estimates of the overall costs of its proposal. On that point, the Agency likely has underestimated costs by an order of magnitude. For example, while EPA estimates that the per-vehicle incremental cost of its Option 1 proposal will amount to approximately $4,000 for HD vehicles (see 87 FR at p. 17571, Tables V-10 and V-11; RIA, p. 329, Tables 7-19 and 7-20), Ricardo's cost estimate, in line with NREL's, is that those per-vehicle incremental costs will be closer to $42,000, including increased operating costs. The net result is that EPA's proposal, as it stands, is not based on sound assumptions and is not cost-effective. [EPA-HQ-OAR-2019-0055-1203-A1, p. 13]

Notwithstanding the foregoing, EPA claims that extending the useful life and warranty periods as proposed actually will lead to lower costs, and that the Option 1 proposal, even though more stringent than Option 2, will be less costly than Option 2 because the shorter Option 2 warranties will result in higher net emissions-related repair costs than under the Option 1 proposal. (87 FR at p. 17428.) That too is not correct. It assumes, incorrectly, that engine and vehicle manufacturers would not fully account for their increased emissions-related repair obligations under Option 1's extended useful life and warranty requirements in setting their increased purchase prices for Option 1-compliant products. In fact, EPA itself has rebutted that assumption: "Manufacturers include warranty repairs in the price of an engine or vehicle." (87 FR at p. 17511.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 13.]

Independent experts at Ricardo and the National Renewable Energy Laboratory (NREL) have conducted a comprehensive cost study regarding the proposed low-NOx requirements and have determined that regulations centered around Option 1 would result in an approximate $42,000 per-vehicle cost increase (in 2017 dollars – the metric EPA has used) for heavy heavy-duty (HHD) vehicles, when factoring in increased operating costs. [EPA-HQ-OAR-2019-0055-1203-A1, p. 144]

EPA's cost assessment, as presented in the RIA, stands in sharp contrast to the detailed cost assessments that Ricardo and NREL have prepared. The primary difference between EPA's cost "teardown" assessment, which did not rely on input from HDOH engine and vehicle manufacturers, and those that Ricardo and NREL developed, which did utilize manufacturers' input, relates to whether the extended Option 1 UL periods would compel manufacturers to factor in the costs of a replacement aftertreatment system (or multiple aftertreatment system components) at or before the 500,000 mile point. Ricardo and NREL, based in part on direct input from manufacturers, concluded that the replacement of aftertreatment system components likely would be required within the Option 1 extended UL period. EPA has assumed otherwise. In the NPRM, EPA offers only the following conclusory statement for its contrary position: We believe our proposed useful life periods are feasible and would not require manufacturers to adopt component replacement as part of critical emission-related maintenance strategies. (87 FR at p. 17496.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 144]

EMA fundamentally disagrees. The known degradation of catalyst substrates and related components, including as observed with EPA's Stage 3 prototypes, creates material risks of noncompliance with the proposed Option 1 requirements, especially if the UL period is extended out to 800,000 miles. Manufacturers will have to account for and mitigate those risks in developing their compliance and maintenance strategies, and likely will include aftertreatment component replacements as manufacturer-covered maintenance at or before 500,000 miles. The risk of recall liability – which liability can amount to several hundred million dollars – is simply too high to rely on a different strategy. Assuming that all SCR systems can maintain better than 99.5% conversion efficiencies and can maintain steady NOx levels no higher than 0.04 g/bhp-hr all the way out to 800,000 without aftertreatment component replacement is not reasonable. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 144 - 145]

The cost to the manufacturer to schedule replacement of the aftertreatment system is significant. If EPA were to misjudge whether manufacturers will have to bear the cost of scheduled aftertreatment systems within the extended UL periods (and pass that cost on to customers at the time of purchase), it will have a significant bearing on the benefits-to-costs ratio. [EPA-HQ-OAR-2019-0055-1203-A1, p. 145]

EMA acquired actual cost data from four manufacturers reflecting what they pay in total to a dealer when a current HHDDE US10 aftertreatment package is replaced under warranty. Those costs, including labor, ranged from approximately $6,500 to $17,750.31 Again, those are costs associated with current aftertreatment configurations. Ricardo estimates the cost of aftertreatment systems consistent with the Stage 3 solution will further increase by $2,588, with labor costs potentially impacted significantly due to the additional time required to access, extract and replace the LO-SCR packaged as close to the turbocharger as physically practical. Thus, in total, EPA is dismissing as much as $20,000 in costs with its unsupported assumption that those systems would not require replacement within the extended ULs. That assumption is wholly incorrect. [EPA-HQ-OAR-2019-0055-1203-A1, p. 145]

> 31. Labor consistently represented well less than $1,000 within these costs. Costs did not include ECU's, wiring harnesses, DEF injectors, or pressure or temperature sensors.

In its assessment of this critical cost issue, EPA has acknowledged that its assumption is contrary to the data-driven assessment that NREL made when it conducted a cost analysis of CARB's version of Option 1. In its RIA, EPA has offered the following explanation of its disagreement with NREL: We are aware of a recent study conducted by the National Renewable Energy Lab (NREL) for the California Air Resources Board (CARB). In that study, NREL surveyed parts suppliers and engine/vehicle manufacturers regarding estimated costs associated with the [Stage 3] technologies being considered within the context of CARB's Heavy-Duty Low NOx program. As part of that study, NREL considered costs associated with increased warranties and increased useful life periods being considered by CARB. Our understanding is that, while the costs associated with [Option 1] warranty and useful life are quite high, they were in fact estimates associated with complete system replacement at some point during the extended useful life of the engine/vehicle. We have assumed that manufacturers would not pursue such an approach and would, instead, include upfront (i.e., at the point of end user purchase) with the expectation that the parts would last the full useful life without a mandatory replacement [sic]. For that reason, we have chosen not to use the warranty and useful life estimates presented by NREL and have instead used [our own] approach. (RIA, p. 327.) (Emphasis added.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 145]

The foregoing explanation makes it clear that EPA's disagreement with NREL (and Ricardo) is based more on opinions and assumptions than data. That is not sufficient to support a rulemaking of this magnitude. [EPA-HQ-OAR-2019-0055-1203-A1, p. 145]

Notwithstanding EPA's choice, in effect, to disregard NREL's work, the NREL cost study that CARB commissioned is, in fact, very instructive. As an initial matter, it confirms that, when attempting to assess indirect costs, such as the potential impacts of expanded warranty and UL requirements, OEMs are the entities best positioned to estimate those costs, which implicitly confirms that EPA's indirect "teardown" cost-assessment method – i.e., scaling from previously established "RPE factors" for warranty costs and R&D (RIA, p. 325) – is not an optimal approach. NREL's specific conclusions on that point is as follows: "Engine OEM participation was crucial, as only they could provide estimates for indirect costs that represented a significant portion of the total cost. Incremental costs are largely driven by indirect costs associated with engineering research and development costs and warranty costs. Indirect costs are highly dependent on production volumes over which to amortize research and development costs. Indirect costs due to warranty are high, reflecting high uncertainty with new technologies and the introduction timeframes." (NREL Report, p. vii,) [EPA-HQ-OAR-2019-0055-1203-A1, p. 146]

The NREL Report is most telling, of course, in the bottom-line results it presents. Specifically, the NREL Report concludes that for HHD vehicles, the per-vehicle cost for compliance with CARB's version of Option 1 would range from $28,868 to $47,042, with the higher range being the more likely outcome. That number is an order of magnitude greater than the per-vehicle costs that EPA has posited (i.e., $4,213 per-vehicle for HHD vehicles; see RIA, p. 329, Tables 7-19 and 7-20), and is consistent with the detailed cost analysis that Ricardo has prepared based on nationwide HHD sales volumes (discussed infra). [EPA-HQ-OAR-2019-0055-1203-A1, p. 146]

With respect to the incremental per-vehicle costs associated with Option 1-like extended emission warranties and ULs, NREL concluded that, on average, those aggregate indirect costs would range from $23,424 to $38,898. (See NREL Report, pp. vii-viii, 40, and Table 20.) That too is largely consistent with Ricardo's findings, and confirms that the majority of the incremental costs that would result from the implementation of Option 1 would stem from the proposed significant increases in ULs and emission warranties. As discussed in more detail below, Ricardo concluded that the indirect incremental costs associated with the Option 1 ULs and warranties would be as high as approximately $27,000 (in 2017 dollars) per-vehicle, within the range posited by NREL. (See Ricardo Report, Table 26.) In contrast, EPA has posited that the incremental per vehicle costs stemming from the Option 1 extended UL and emission warranties will only amount to approximately $1,300 for vehicles. (See RIA, pp. 329-330.) Once again, the EPA cost estimates differ markedly from NREL's and Ricardo's more reasonable and data-based conclusions by at least an order of magnitude. [EPA-HQ-OAR-2019-0055-1203-A1, p. 146]

In addition to dismissing the need to account for aftertreatment replacements, and, as a result, substantially understating the UL and warranty costs at issue, EPA's cost assessment also relies on an under-inclusive and inapt estimation method for indirect costs. At pages 323-325 of its RIA, EPA describes its use of previously established "retail price equivalent (RPE) multipliers" to calculate the indirect costs that can be derived from the ratio of revenues-to-direct costs. As EPA explains it, "using RPE multipliers [ranging from 1.28 to 1.5] implicitly assumes that incremental changes in direct manufacturing costs produce common incremental changes in all indirect cost contributors as well," including the costs associated with substantially extended UL and emissions warranty periods. (RIA, p. 323.) EPA applies this proportional methodology notwithstanding the Agency's recognition that, "[t]he use of RPEs, with their assumption that all technologies have the same proportion of indirect costs, is likely to overestimate the costs of less complex technologies and underestimate the costs of more complex technologies." (RIA, p. 323.) [EPA-HQ-OAR-2019-0055-1203-A1, pp. 146 - 147]

This rulemaking clearly involves a whole suite of new "more complex" technologies. Nonetheless, and despite its own admonition, the Agency has proceeded to rely on the implicit assumption that all of the quantumly increased indirect costs at issue will remain uniformly proportional to the increased direct costs at issue. Applying this "implicit assumption," EPA then accounts for the cost of the proposed extended UL and warranty periods by applying additional "VMT-based scaling factors" to the R&D and Warranty costs derived from the underlying RPE based calculations of indirect costs. (RIA, p. 325.) For example, when assessing the indirect cost impacts from extending the current warrant periods from 100,000 miles initially to 450,000 miles, and then to 600,000 miles under Option 1, EPA offers the following explanation of its VMT-scaled RPE-based methodology: Proposed Option 1 would extend the required warranty period for a Class 8 diesel to 7 years or 450,000 miles for MYs 2027 through 2030, and then extend further to 10 years or 600,000 miles for MY 2031 and beyond. As such, in our analysis of proposed Option 1 for Class 8 diesel trucks we applied a scaling factor of 4.5 (450/100) to the 0.03 [RPE-based] warranty cost contribution factor for MYs 2027 through 2030, and applied a scaling factor of 6.0 (600/100) for MYs 2031 and later. The same approach is followed for the other regulatory classes (RIA, p. 325.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 147]

There are multiple concerns with EPA's VMT-based RPE-derived scaling approach to assess UL and warranty costs. At its core, EPA's analysis assumes that the indirect costs attributable to the significantly extended UL and warranty periods will increase on a linear VMT weighted basis from the previously-derived RPEs that the Agency "used in prior rule-makings setting new greenhouse gas standards for heavy-duty trucks." (RIA, p. 324.) That is not a sound assumption, as detailed in Ricardo's Report. [EPA-HQ-OAR-2019-0055-1203-A1, p. 147]

EPA's low-NOx proposal will require manufacturers to develop and rely on the types of innovative highly-complex and multi-component aftertreatment systems that have been used in EPA's Stage 3 RW prototype. Those advanced and complex integrated systems, including CDA, are entirely new for HDOH engines, as are the combinations and configurations in which they are being deployed at SwRI. Manufacturers have no prior experience using or packaging those new multi-component systems in the field, and do not know how they will age and whether they can consistently make it out to the substantially extended Option 1 ULs without needing to be replaced. Thus, using linear VMT-based extrapolations from old RPE-based factors to assess the indirect costs associated with these entirely new highly-complex systems and configurations, which will have compliance obligations far beyond any previously proven points of component durability, is not a sound or reasonable methodology. [EPA-HQ-OAR-2019-0055-1203-A1, p. 147]

Manufacturers do not have prior experience with these new “Stage 3” systems. Thus, there is no basis to assume that the resultant indirect costs associated with the extended ULs and emission warranties will be uniformly proportional to the direct manufacturing costs associated with those Stage 3 systems. Simply stated, there is not sufficient data to support the Agency’s assumption that future warranty and UL costs will amount to a VMT-based linearly-scaled increase from previously calculated RPEs, and that no separate considerations need to be given to whether the magnitude of those indirect costs should include the costs of replacement aftertreatment components. Consequently, the indirect cost estimates that EPA has derived from its extrapolation method are not reasonable. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 147 - 148]

The net result is that EPA’s assessment of the aggregate per-vehicle incremental cost impacts from its Option 1 proposal are significantly understated – most likely by an order of magnitude. Focusing on Class 8 vehicles, EPA estimates that the total incremental per-vehicle costs from implementing Option 1 will be $4,213 in MY 2027, and $3,931 in MY 2031. With respect to the indirect-cost portion of that total incremental cost amount, the Agency estimates that for the extended ULs (treated as R&D costs) and emission warranties at issue, those indirect costs will amount to $1,251 per-HHD-vehicle in 2027, and $1,458 per-HHD-vehicle in 2031, as reflected below in Tables 7-20 and 7-21 from the Agency’s RIA (RIA, pp. 329-330): [EPA-HQ-OAR-2019-0055-1203-A1, p. 148]

As noted, these per-vehicle incremental cost estimates are more than an order of magnitude lower than those derived by NREL and Ricardo. They also utilize an unrealistic “learning curve” to derive even lower estimates for the overall MY 2031 cost projections. In addition, they assume that the more stringent requirements for 2031 MY products will result in lower incremental costs than the less stringent requirements for MY 2027 products. Simply stated, EPA’s cost estimates are not reasonable. [EPA-HQ-OAR-2019-0055-1203-A1, p. 148]

As detailed next, Ricardo has developed a far more robust assessment of the cost impacts of EPA’s Option 1 proposal, including the indirect costs attributable to EPA’s proposed extended ULs and emission warranties. The Agency will need to account for Ricardo’s detailed analysis and data-driven conclusions (as well as Ricardo’s critique of the Agency’s cost assessment) before finalizing this rulemaking. [EPA-HQ-OAR-2019-0055-1203-A1, p. 148]

EPA has tied the cost-effectiveness of its Option 1 proposal to the unsupported assumption that the replacement of aftertreatment components will not be necessary, and that the incremental indirect costs associated with extending the HHD UL period from 435,000 miles to 800,000 miles, along with extending the emissions warranty period from 100,000 miles to 600,000 miles as of 2031, will only total $1,458 per-vehicle. (See RIA pp. 329-330.) That is well off the mark. [EPA-HQ-OAR-2019-0055-1203-A1, p. 151.]

Currently available market data and pricing information show that the incremental costs associated with CARB's "Step 1" extended emission warranties — which went into effect this year, and which extend those warranties for HHD vehicles from 100,000 miles to just 350,000 miles — amount to approximately $2,500 per-vehicle. That is what the extended "Step 1" warranty requirements actually add to the cost of HHD vehicles that are actually being bought and sold in the market today. What this shows, therefore — and, in fact, proves — is that EPA is unreasonably assuming that an emission warranty that is more than 70% longer than CARB's "Step 1" warranty as of 2031 will cost approximately 25% less than the actual cost of the much shorter "Step 1" warranty today. EPA's assumption in this regard is obviously and fundamentally wrong, as further underscored by Ricardo's (and NREL's) analyses. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 151 - 152]

EMA took additional steps to evaluate EPA's emissions warranty cost projections, turning to two sources of actual warranty cost data for warranties that extend long beyond the current baseline regulated emission-related component ("ERC") warranties, and also beyond manufacturers' "base" powertrain warranties (that also cover emissions-related components). The first additional analysis is based on pricing rates of aftermarket warranty packages, and the second is based on HHDDE manufacturers' actual warranty costs incurred when customers purchase extended warranty packages. Both of these additional analyses show (again) that EPA's cost projections related to the proposed extended emissions warranty coverage requirements are grossly understated. [EPA-HQ-OAR-2019-0055-1203-A1, p. 152]

EMA consulted with one of the largest aftermarket warranty companies in the U.S. to understand the warranty products they offer and the pricing structure for them. Those warranty packages include certain component groupings, such that ERCs (including aftertreatment systems) can be segregated for comparison against the company's price sheet. Pricing was set up based on the included component packages, the age and mileage of the vehicle to be covered, and the years and mileage of extended the warranty coverage. It was therefore possible to estimate the subscription price to cover an additional warranty period from today's ERC warranty coverage (which we assumed to be 5 years/250,000 miles to account for the combination of the 5 year/100,000 mile regulated ERC warranty and the typical manufacturer's warranty of 2 years/250,000 miles) to EPA's proposed Option 1 extended warranty period of 10 years/600,000 miles. [EPA-HQ-OAR-2019-0055-1203-A1, p. 152]

The aftermarket warranty provider's business model involves relying on OEM dealer networks and provider-approved independent repair centers to perform warranty repairs that are subsequently billed to the provider. This means that the warranty provider does not operate any vehicle repair centers, and does not employ or train any repair technicians. Instead, the provider simply reviews repair invoices and pays the OEM dealers and repair centers from the funds accumulated from the customers' extended warranty subscriptions. Under this model, EMA assumed a 20% profit margin should be subtracted from the pricing model to estimate the actual costs of the ERC warranty repairs. [EPA-HQ-OAR-2019-0055-1203-A1, p. 152]

Using this information, it was a relatively straightforward mathematical exercise to draw parallels between the aftermarket extended emissions component warranty coverage costs, and EPA's extended warranty costs. The aftermarket warranty costs included in this additional analysis were limited to the ERCs in current US10-compliant products. Future warranties, however, will also be compelled to cover any new emissions-related components deployed by manufacturers to comply with the proposed 2027 and 2031 emissions standards. To estimate those warranty costs, EMA multiplied the aftermarket warranty costs by the ratio of future emissions-related component costs to current emissions-related costs. Current ERC costs were estimated to be $10,000 for a HHDDE, and future costs were estimated at approximately $4,000 (See Ricardo Report, Table 22). For the new ERC's, the warranty costs from 0 miles to today's ERC warranty coverage was estimated by the same component cost ratio approach. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 152 - 153]

The resultant warranty cost increase to engine manufacturers calculated from this analysis process was approximately $11,900 per HHDDE. There are two other factors that should be considered in this analysis. The first is the impact that the extremely stringent proposed NOx standards may have on warranty costs of existing (US10-compliant engine) components. This factor can manifest itself in the following ways: (1) the cost of various components could increase to support longer UL requirements, (2) the OBD system may more often trigger the MIL due to faults of the existing component set due to the overall greater complexity of the Stage 3 system, increasing frequency of repair, (3) EPA's new requirements in §1036.120(c) will expand the current ERC list to include "all components whose failure would increase emissions," and (4) the inspection and maintenance programs being implemented by various states will increase repair frequency. (See Ricardo Report, Tables 22 and 30.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 153]

The second factor that could increase the cost of emissions warranties beyond the estimation from this analysis stems from the fact that new technologies (e.g., CDA, EGR cooler bypass, heated DEF doser, and NH3 sensors, which have seen only limited use to date) or new applications of existing technologies (e.g., close coupled SCR) can experience higher failure rates in the early years of production than those of more mature components. Recall that the warranty cost projection for the new (Stage 3-based) ERCs in this analysis was based on the cost ratio of the new ERCs to the existing ERCs, where the existing ERCs are mature components with mature failure rates. An adjustment would be required to account for the historical, and unavoidable, elevated failure rates for new components. [EPA-HQ-OAR-2019-0055-1203-A1, p. 153]

For the purpose of this analysis, if we assume an increase in warranty costs for existing components of 20% for the first factor described above, and a 20% elevated failure rate for new technologies and new applications of existing technologies as described for the second factor, the estimated increase to warranty costs relative to today's products is approximately $14,900. [EPA-HQ-OAR-2019-0055-1203-A1, p. 153]

While admittedly a somewhat crude analysis, this estimation has its basis in real-world expenses that are being incurred today. There may be some elements in the analysis that could be revised, but the point is not to use the process to get a precise estimation of warranty costs for rulemaking purposes; rather, it is to check the scale of EPA's estimates against actual data available today. In that regard, EPA's warranty cost estimates ($976 to $1,227) are, once again, clearly understated by an order of magnitude. Indeed, if EPA's estimates reflected a more accurate assessment of extended warranty costs, that would imply that purchasers of aftermarket warranties are paying multiple times the value they get from those coverages, an outcome highly unlikely given how astute most trucking companies are when it comes to controlling costs and managing their businesses. [EPA-HQ-OAR-2019-0055-1203-A1, p. 153]

The second analysis EMA conducted offers a more direct assessment of extended warranty costs. EMA obtained from OEMs actual data reflecting the warranty costs that those OEMs have incurred when customers purchased extended warranty packages. Three manufacturers culled their warranty expense databases to collate the warranty coverage expenses incurred from the time a vehicle passed the point of a standard warranty (combination of regulated ERC warranty and the manufacturer's base warranty) to the end of the purchased extended warranty period. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 153 - 154]

The graph below shows the range of extended warranty costs incurred on emissions-related components by these three HHDDE manufacturers. To be clear, this is a data-capture of actual costs incurred from extended emissions warranty repairs, not how much the manufacturers charged the customer for the extended warranty. Most of the data is based on purchased extended warranties to approximately 5 years and 500,000 miles, though some included longer warranty coverage periods. Each manufacturer's input is shown in the graph as a shaded area. The analysis was based on average per-vehicle costs from a population of covered vehicles. The data is represented as a range through the shaded areas because each manufacturer had his own way of sharing the data depending on how their tracking systems were structured. (For example, one OEM provided three consecutive model years of data, while another tracked the figures by low-HP range and high-HP range within a platform.) In total, data from more than 250,000 engines is included in the following graph: [EPA-HQ-OAR-2019-0055-1203-A1, p. 154]

Once again, it is clearly evident from this actual ERC incremental cost data – incremental to base warranty costs -- that EPA's incremental cost estimates attributed to the proposed extended warranty requirements are significantly understated. Importantly, the data presented above is based on today's ERCs installed in US10-compliant engines. Even though the data above does not include the additional ERCs that will be required to comply with the new low-NOx emissions standards, the costs as captured are nonetheless significantly greater than EPA's projections that do include those additional components. [EPA-HQ-OAR-2019-0055-1203-A1, p. 154]

It is instructive to apply the cost ratio techniques used in the aforementioned aftermarket warranty analysis to these real-world actual cost-data to project what the "all-in" incremental warranty costs could be. Considering the graph below, we might conservatively assume that the line indicated by the circled marker "1" is a conservative projection of warranty costs that would be incurred on today's existing ERC's if subject to a 10year/600,000 mile warranty. If we apply the cost ratio technique of the aftermarket warranty data analysis to estimate the warranty cost coverage on existing and the new ERCs, that would move the estimation to the level indicated by the "2" marker as shown. This second estimation includes the estimated cost of the warranty to cover the new ERCs from mile 0 to today's emissions warranty. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 154 - 155]

Also noted on the graph above, for reference, is the Ricardo estimate of incremental ERC warranty costs resulting from the EPA proposal, which aligns very well with the extrapolated cost estimation. Finally, the EPA estimate of $1,227, an order of magnitude lower, is noted. [EPA-HQ-OAR-2019-0055-1203-A1, p. 155]

It is very safe to conclude from these two additional analyses – the aftermarket warranty analysis and the actual purchased extended warranty costs analysis – both of which are based on real-world experience, that EPA's projection of incremental ERC warranty costs is grossly understated. While the detailed underlying cost information used to conduct these analyses is not included in these comments for confidentiality reasons, EMA is open to discussing these analyses in more detail with EPA. In that regard, it is imperative for EPA to correct its cost assessment in order to fashion a final rule that can be implemented in a cost-effective manner. [EPA-HQ-OAR-2019-0055-1203-A1, p. 155]

On top of that, the significant direct and indirect costs that are to be borne by the trucking industry, and thereby consumers, to meet those new UL standards will be impacted even more by the additional costs associated with the proposed 6-fold increase in the required emission warranties. [EPA-HQ-OAR-2019-0055-1203-A1, p. 171]

Perhaps even more concerning are the necessary data-generation projects that are completely unplanned at this time. More specifically, EPA intends to complete this rulemaking without having access to the following: It appears that EPA will not undertake any effort to resolve the considerable discrepancy between the Agency's cost estimates and those of NREL and Ricardo. Cost impacts are extremely important to justifying the many onerous requirements included in this rulemaking. Further, there has been no effort to understand the benefits/cost ratio of any of the individual elements of this multi-faceted rulemaking package, such as whether the extended warranty requirements will yield emissions benefits commensurate with the very considerable costs to be incurred by customers. [EPA-HQ-OAR-2019-0055-1203-A1, p. 172]

Organization: *Truckload Carriers Association (TCA)*

An incremental cost would also reflect manufacturers' added stringency for emissions and an increase in useful life and warranties for emission-related components. One report found that if the proposed standards go into effect, the price of heavy-duty diesel engines would increase between $18,000 to $35,000 per vehicle, depending on the level of requirement4. [EPA-HQ-OAR-2019-0055-1160-A1, p. 2]

> 4. Ricardo Strategic Consulting, "Cost Impact Study for Potential Next-Tier EPA HDOH Emission Regulations", January 14, 2022, 360b6600755b47/t/625cbec8f7aef559cbc4c9a7/1650245321849/Ricardo.pdf

Organization: *U.S. Chamber of Commerce*

EPA openly acknowledges that the proposed rule's impacts on the cost of new medium- and heavy-duty trucks, and the impacts of its associated unprecedented and untested useful life and warranty requirements, are highly uncertain. Indeed, there is an enormous and troubling disparity—approximately an order of magnitude—between EPA's compliance cost estimates and those projected by engine manufacturers. Such factual issues merit very careful attention and consideration by the agency. [EPA-HQ-OAR-2019-0055-1245-A1, p. 5.]

Similarly, and as EPA notes in the proposal, there is considerable uncertainty surrounding the feasibility of and cost impacts associated with dramatically extended useful life and warranty requirements under the rule. As EPA acknowledges, key technical assumptions in the rule pertain to performance and durability data for engines and emissions control systems that have yet to be operated on a broad scale for an extended length of time. Without detailed real-world performance data, such technical assumptions should remain conservative (i.e., they should not be unduly optimistic) and should be expressed in terms of a range. [EPA-HQ-OAR-2019-0055-1245-A1, pp. 5 - 6.]

Instead, the rule applies extremely aggressive assumptions for these technologies that raise serious questions about feasibility and practical achievability. For example, the proposal would nearly double useful life mileage expectations for heavy-heavy duty engines (HDE)—from 435,000 miles to 800,000 miles. The factual basis for proposing such a vast increase seems unclear. [EPA-HQ-OAR-2019-0055-1245-A1, p. 6]

The ultimate cost of corresponding warranty requirements is unknown, and while EPA seeks feedback on "uncertainty in how the emissions control technologies would deteriorate in the field and across different vehicle applications," even the most informed estimates necessarily involve a high degree of uncertainty due to the unprecedented and untested nature of the requirements. [EPA-HQ-OAR-2019-0055-1245-A1, p. 6]

According to the Ricardo report, "EPA's warranty cost estimation methodology grossly underestimates the expected incremental warranty costs…due to fundamental weaknesses in the Agency's warranty estimation approach." This is in large part because EPA assumes that warranty costs rise linearly with mileage, when in fact it is commonly accepted that product and technology failures tend to rise exponentially with increased mileage, particularly in the later years of a vehicle's operational life. [EPA-HQ-OAR-2019-0055-1245-A1, p. 6]

We also recommend that EPA undertake a sensitivity analysis that considers the potential for modest variations in cost inputs to influence the overall economic and emissions impacts of the rule. For example, even if EPA concludes after further analysis that warranty costs would indeed remain linear throughout an 800,000-mile warranty period, the Agency should undertake a sensitivity analysis estimating cost impacts under an exponential warranty cost distribution. [EPA-HQ-OAR-2019-0055-1245-A1, p. 6]

EPA Summary and Response

The comments summarized above focus primarily on assertions about:

- EPA's estimated warranty costs being too low in part because EPA failed to consider necessary emission-control system replacements needed to comply with the long warranty and useful provisions of proposed Option 1; and,
- EPA failed to consider the number of extended warranties on engines in today's fleet in its estimates of warranty costs in the baseline; and,

- Longer warranties often fail to benefit second and subsequent purchasers of HD vehicles.

Allison commented on our use of the Fleet Advantage Whitepaper to estimate warranty and emission-related repair costs. EPA has developed a new approach to estimating warranty costs as described below and further in Chapter 7.1.2 of the final RIA, after consideration of and in response to comments from EMA and others. As for use of the Fleet Advantage Whitepaper in estimating emission-related repair costs, we respond to these comments from Allison in section 18.6 of this response to comments document.

The American Trucking Association (ATA) commented on several aspects of the proposed longer warranty provisions. First, they raise the issue of upfront warranty costs coming under the 12 percent Federal Excise Tax. Currently, longer warranties, or extended warranties, are purchased separately from the new vehicle purchase and, therefore, do not incur the 12 percent excise tax that is applied to the new vehicle purchase.[41] EPA is not accounting for the excise tax in our cost analyses. Because the tax is paid by purchasers of vehicles, as opposed to manufacturers, the tax is not part of the manufacturers' costs of compliance. In addition, taxes, being a transfer payment from one entity to another, are also generally excluded from social cost analyses.[42] EPA thus generally excludes taxes in our cost analyses that are geared toward estimating social costs, such as those undertaken to comply with E.O. 12866.

ATA also commented that different users/purchasers currently make different decisions regarding whether to purchase extended warranties depending on their unique business and use case. ATA provided several examples but, in short, they argued that a purchaser that keeps trucks for short periods, maybe only 2 to 3 years, is less likely to purchase an extended warranty than one that purchases a vehicle with the intention of operating for its full operational life and would be less likely to get the full benefit from paying the increased purchase price of a longer federal warranty. To the extent that fleets currently base their turnover cycle of 2-3 years on the time at which today's warranty periods expire, we expect they would consider adjusting their current business model to accommodate the longer warranties in this final rule. ATA also noted that their members report to them that they receive very little residual value for extended warranties when they resell a truck. We think this is understandable when extended warranty contracts vary from purchaser to purchaser and may be difficult to transfer to subsequent owners, but that would not be the case with the warranty provisions under the final rule. All second or subsequent purchasers will know the remaining warranty period and will know whether and to what extent they would be covered by that remaining warranty.

The California Air Resources Board (CARB) suggested that any voluntarily purchased extended warranties should be considered in the baseline costs. Because many heavy-duty vehicles are sold with extended warranties, we agree with this suggestion and have done so in our updated analysis for this final rule. CARB also expressed concerns regarding EPA's use of mileage scalers applied to the warranty contribution to indirect costs as a means of estimating warranty

[41] See IRS form 510: Excise Taxes (July 2021), Chapter 6: Retail Tax on Heavy Trucks, Trailers, and Tractors.

[42] See, e.g., Guidelines for Preparing Economic Analyses, U.S. EPA, December 2010, updated March 2016 at page 1-5; Circular A-4 from the Office of Management and Budget, available at https://obamawhitehouse.archives.gov/omb/circulars_a004_a-4/#e (providing guidance to Federal agencies in measuring and reporting benefits and costs of Federal regulatory actions to comply with E.O. 12866).

costs. EPA has moved away from that approach in the updated analysis for this final rule, as explained in Chapter 7 of the final RIA. CARB also commented that EPA had considered only the mileage provisions and not the age or hours provisions when estimating warranty duration. This is not correct for the proposed rule, nor for the approach EPA has used for this final rule. While EPA did not use the hours provisions in the proposed analysis, the ages were used and served as the limiting factor for several vehicle types (those with lower mileage accumulations such as refuse trucks, etc.) For the updated final analysis, EPA has included the hours provisions in addition to miles and ages.

Daimler, Navistar, PACCAR, EMA, TCA and the U.S. Chamber of Commerce commented on the disconnect between the EMA-sponsored cost study and EPA with respect to warranty costs. These commenters suggested warranty costs ranging from $5,000 to $15,000, depending on model year and option, for a Class 8 diesel truck. EPA has reanalyzed the costs for the final rule and has taken into consideration the data provided by EMA regarding real-world warranty claims data (see pages 148 through 152 of the EMA comments). For the final rule, EPA has used the EMA data to estimate warranty costs on a $1,000 per year of coverage basis. There are three important additional factors applied to that $1,000 per year of warranty coverage: (1) since the data were specific to heavy heavy-duty engines, EPA has scaled the warranty cost for non-heavy heavy-duty engines (e.g., light-heavy and medium-heavy engines) by the ratio of the non-heavy heavy-duty engine's emission control system direct costs to the heavy heavy-duty engine's emission control system costs; (2) EPA applies the warranty cost per year not to the mandated length of the warranty but to the estimated length of the warranty based on estimates of the miles and speeds driven by different vehicles and estimating the age at which warranty would be reached (the minimum of the 3 possible ages based on required years, required miles or required hours); and, (3) unlike in the proposal, where EPA calculated warranty costs assuming that engines were covered only by the mandated warranty period, for the final rule EPA has considered that many engines are sold today with extended warranty coverage and, therefore, are already incurring some extended warranty costs. We present a discussion of our updated methodology in Chapter 7 of the final RIA and we believe that our updated approach is consistent with the data provided by EMA.

DTNA commented that EPA did not acknowledge the magnitude of the cost increases associated with longer warranty and useful life provisions. This is not correct. While EPA understands that most industry commenters found our proposed cost estimates to be low, it is not true that EPA did not acknowledge their costs. We estimated costs associated with longer useful life as part of our research and development estimates. Importantly, the EMA/Ricardo study estimates did not call into question EPA's estimates of R&D costs and actually used the EPA costs in their summation of costs. The primary difference between industry and EPA, as discussed in Section 18.2 of this document, is with respect to aftertreatment system replacement costs, which EPA believes will not occur under the final program because, as explained further in preamble Sections III and IV, EPA is not finalizing the complete Option 1 standards, useful life values, and warranty periods as proposed. As described in the preamble and RIA for this final rule, EPA's technical analysis demonstrates that next generation aftertreatment systems can achieve the EPA final rule NOx standards at the final rule useful life with compliance margins and thus we do not believe based on the available data and the standards and requirements contained in this final rule that manufacturers would need to include a full aftertreatment system replacement as part of their compliance approach.

EMA also commented on additional warranty cost factors associated with a 20 percent increase in warranty costs for existing components due to the stringent new standards, and a 20 percent increase in failure rates for new technologies and new applications of existing technologies. After considering these comments, we do not believe it is appropriate to apply any such factors. As noted above, EMA provided warranty data showing that warranty costs were roughly $1,000 per year of warranty coverage. Further, EMA showed data extending over an eight-year timeframe. EPA believes that over an eight-year period certainly some if not many of the engines reflected in the data included new technology and new applications of existing technology. In other words, it seems reasonable to assume that the warranty costs of any such increased failure rates are included in the data and are, therefore, included in the $1,000 per year value. In addition, because in the final rule's analysis we now apply warranty costs on a cost per year basis, we carry the increased warranty cost per year for more years relative to the baseline. In the end, we consider our updated methodology to provide a robust, thorough and reasonable accounting of the costs associated with the final warranty provisions.

The Motor & Equipment Manufacturers Association (MEMA) commented that having such a long warranty on new vehicles will drive significant additional costs into the vehicle purchase price. MEMA was not clear as to whether they meant any warranty longer than the mandated 100,000 miles or if they were referring specifically to the NPRM's Option 1 warranty period of 600,000 miles (for Class 8 diesel engines). Nonetheless, EPA agrees the longer warranty periods will increase purchase costs and we have estimated those costs for the final warranty periods, though we note that EPA has not finalized the proposed Option 1 600,000 mile warranty period for Class 8 heavy-heavy diesel engines.

George Small commented in favor of the longer warranty provisions given that emission control systems are expensive to replace. EPA expects that, with the final standards, more emission-control system repairs will be done during the warranty period and will, therefore, be paid by the OEM. However, it is expected that those costs will be borne at vehicle purchase, so EPA does not attempt to claim that the longer warranty provisions will result in lower costs overall. As explained above in this section, EPA does not expect that emission control systems will be replaced to meet the final new standards.

18.4 Indirect costs - R&D

Comments by Organizations

Organization: *International Union, United Automobile, Aerospace & International Union, United Automobile, Aerospace & Agricultural Implement Workers of America - UAW Region 1A*

To be effective, the final rule must be: A bridge to a zero-emissions future. The final rule must not prevent continued progress toward zero-emissions commercial vehicles by forcing excessive, costly redesigns of traditional combustion engines at the expense of investments in the research and development of zero emissions vehicles, nor add cost to these new technologies. [EPA-HQ-OAR-2019-0055-1062-A1, pp.1-2]

EPA Summary and Response

The International Union, United Automobile, Aerospace & International Union, United Automobile, Aerospace & Agricultural Implement Workers of America - UAW Region 1A commented that the final rule must not prevent continued progress toward zero-emission commercial vehicles by forcing R&D on conventional vehicles. However, EPA must keep in mind that, despite the evolution of zero emission technology, the projected emissions from conventional engines cannot be ignored. EPA's final standards, useful life values, and warranty periods are consistent with EPA's authority under the CAA, as explained in the preamble of the final rule and sections 3 and 4 of this document, and include appropriate consideration of costs. In setting the final emission standards, EPA appropriately assessed the statutory factors specified in CAA section 202(a)(3)(A), including giving appropriate consideration to the cost associated with the application of technology EPA determined will be available for the model year the final standards apply (i.e., cost of compliance for the manufacturer associated with the application of such technology). EPA's assessment of the relevant statutory factors in CAA section 202(a)(3)(A) justify the final emission standards. We also evaluated additional factors, including factors to comply with E.O. 12866; our assessment of these factors lends further support to the final rule (see, e.g., Section IX of the preamble, which explains that this rule is cost beneficial to society in that its benefits outweigh its costs).

18.5 Indirect costs – Other

Comments by Organizations

Organization: *Taxpayers Protection Alliance (TPA)*

This last category is particularly important, given the rampant price inflation experienced by consumers over the past year. The Consumer Price Index (CPI) increased by 8.5 percent for the year ended March 2022, the most significant increase since 1981.4 Supply chain difficulties are a key contributor to this price increase and stringent fuel/pollution controls will have a further upward pressure on CPI. Manufacturers of compression ignition engines will likely respond to new, required laboratory tests (i.e., 'a new low- load cycle (LLC) test procedure to demonstrate that emission controls are meeting proposed LLC standards when the engine is operating under low-load and idle conditions') by passing costs along to companies further downstream in the supply chain (e.g., e-commerce companies) who may in turn raise prices on consumers. [EPA-HQ-OAR-2019-0055-1102-A1, pp.1-2]

4 Jeanna Smialek, 'Inflation Hits Fastest Pace Since 1981, at 8.5% Through March,' The New York Times (Apr. 12, 2022).

These inflationary pressures not only harm consumers, they also pose significant environmental consequences. The current structure of the supply chain in the U.S. tends to reduce emissions by reducing the amount of energy required to transport each product unit to reach consumers' doorstep.5 The increased integration of the supply chain has resulted in a proliferation of heavy-duty vehicles willing to take products all (or most) of the way to their final destination. But, if heavy-duty vehicle deliveries are 'taxed' by an onerous regulatory regime, it may become more economical for these fleets to travel shorter distances and deliver products at stores rather than going the last mile to households. This reduction in e-commerce would result in increased consumer trips to stores to pick up their orders, resulting in increased emissions via roadway congestion. Given that the EPA's estimated net benefits ($8-9 billion in 2045) are small, introducing these unintended consequences into the equation could result in large net costs for the proposed rulemaking. [EPA-HQ-OAR-2019-0055-1102-A1, p.2]

5 Prologis, Inc., 'Logistics Real Estate and E-Commerce Lower the Carbon Footprint of Retail' (Jan. 14, 2021).

TPA urges the agency to take all costs into account when promulgating rulemaking. [EPA-HQ-OAR-2019-0055-1102-A1, p.2]

EPA Summary and Response

The Taxpayers Protection Alliance (TPA) commented that inflationary pressures to date, with an "onerous" regulatory regime on top, will cause costs to increase, fleets to stop delivering to households, and consumers to make more store trips to pick up orders. EPA agrees that costs will increase but does not believe it will disrupt the trends of household deliveries, particularly because the cost increase is only a small part of the overall cost of shipping. TPA has not provided data on past EPA actions that could shed light on possible outcomes associated with the final standards.

18.6 Operating costs – Repair

Comments by Organizations

Organization: *Allison Transmission, Inc. (Allison)*

Allison first questions EPA's reliance on the Fleet Advantage study in measuring this crucial element of EPA's cost analysis. For one, it seems inapposite EPA's rationale for extending useful life and warranty periods to utilize a study based on a seven-year average of costs of vehicles from 0 to 7 years of age versus a study that utilized vehicles ranging in age from 4.4 years to 8.5 years old. As proposed, EPA would extend useful life and warranty periods for all vehicles in all weight classes and the time period(s) that extend beyond those currently utilized. Thus, it would appear more directly relevant to EPA's analysis to use data from a more diverse fleet of different ages versus a study which averaged out the cost of older vehicles with newer vehicles when costs for older vehicles sharply increased in later years.33 [EPA-HQ-OAR-2019-0055-1231-A1, p.14]

> 33 In the first year of operation, costs were 2.07 cents/mile versus 19.82 cents/mile at year 7.

Second, EPA also appears to have “flat-lined” costs at 8 years.34 EPA’s rationale in doing so is that the vehicles are “beyond useful life.” However, this assumes that all vehicles will be beyond useful life periods based on mileage. While this may be so with long- and short-haul fleet vehicles, this analysis certainly does not extend to all vehicles, particularly many vocational vehicles which may not accumulate large amounts of daily mileage or be used daily as is typical in the freight-hauling sector. See Table 1 below.35 Allison has provided mileage accumulation data to represent 70% of various vocational application’s annual accumulation which shows a low end of range of 10,800 miles for fire, pumper application to high end of range 72,000 miles annually for intercity coach application, demonstrating that vocational usage differs significantly from tractor usage. Many vocational applications vary between 15,600 miles to 48,000 miles annually. For such vehicles, hours of operation may be the operative factor with respect to the extent of warranty coverage, not mileage. Again, EPA’s assumption tends to slant the cost data in a direction that is not reflective of the broader HDV sector.[EPA-HQ-OAR-2019-0055-1231-A1, pp.14-15]

34 Draft RIA, Figure 7-2 at 345.

35 Table values were derived from Allison Transmission, Inc. warranty data.

Third, it is likely that more “stop-and-go” operation of a vehicle and increased transient operation is likely to put different kinds of demands on vehicle components than the steady-state operation that appears to dominate the Fleet Advantage data. Solely by the selection of vehicles involved, the Fleet Advantage data reflects relatively longer periods of time spent on highways, in high-speed operation. But EPA does not account or adjust this data to account for the operational characteristics of other vehicles that may not predominantly handle freight, or may be used in many varied applications. Different demands will be placed on an automobile that completes a 50-mile commute each day on the interstate versus a 5-10 mile creep through heavy traffic to a downtown area. These obvious differences are only accentuated in the commercial, vocational vehicle sector where vehicles are not only used in vastly different ways from line-haul, but developed and constructed in a manner so as to service discrete commercial needs. EPA’s cost data is inherently biased against such vehicles. [EPA-HQ-OAR-2019-0055-1231-A1, p.15]

Allison has decades of experience serving vocational markets and designing our products to accommodate the work demanded of such vehicles. To a much greater extent in its cost analysis, EPA should consider and/or develop additional information for this segment of the heavy-duty fleet due to its combined market size representing roughly 190,000 vehicles sold annually across CL6/7/8.36 While vocational markets are fragmented across a variety of applications for specific customer uses, in aggregate vocational applications including bus and straight truck which may serve construction, municipal, heavy haul, refuse, emergency response, utility, pick-up and delivery, etc., account for over 90% of Class 6 & 7 and approximately 25% of Class 8 builds on an annual basis. See Table 2 below. [EPA-HQ-OAR-2019-0055-1231-A1, pp.15-16]

Footnote 36 was not included in comment.

As demonstrated by the data presented above, EPA should also consider that in smaller, fragmented, more diverse market segments in the vocational vehicle sector, the costs that will be incurred for research and development activities will be different. In general, the relative research and development costs will be greater to validate the technology needed to serve these markets if only for the fact that such costs will need to be spread over lesser numbers of vehicles in discrete sub-categories and markets. Testing that will be required will also vary from that which we would expect in the short- and long-haul sector. A variety of diverse duty cycles and operating environments will need to be considered, again likely resulting in greater costs than vehicles which may be expected to "age out" based on mileage accumulation. For vocational applications that accumulate miles more gradually, the emissions maintenance cost ratio for manufacturers to operators is likely higher than what EPA has assumed in the seven-year repair cost analysis based on 75,000-144,000 annual mileage accumulation on Fleet Advantage data. [EPA-HQ-OAR-2019-0055-1231-A1, pp.16-17]

In sum, Allison believes that research and development and indirect costs are undercounted for Option 1 and should also be better reflected in both Options to consider a more diverse array of vehicles. Higher costs will lead to higher initial prices for vehicles under Option 1 (as well as for vehicles under the Alternative) which is likely to result in reduced emissions benefits in the near- and middle-term since the higher costs will affect the "pre-buy" and "low-buy" impacts than EPA assumes elsewhere in its analysis.[EPA-HQ-OAR-2019-0055-1231-A1, p.17]

Organization: *Agricultural Retailers Association (ARA) (1241 and 1421)*

ARA recommends that EPA propose modest and achievable nitrogen oxide (NOx) emissions standards that are affordable, dependable, durable, fuel efficient and meet the needs of agricultural retailers, trucking companies, and all other impacted industries. It is our understanding that the current costs for the maintenance and repairs of emissions-related equipment is at least $5,000 annually. The new proposal will make those average annual maintenance and repair costs soar even higher. [EPA-HQ-OAR-2019-0055-1251-A1, pp. 2 - 3]

Organization: *American Bus Association (ABA) (1070 and 1308)*

Additionally, there will also be added costs for vehicle purchasers associated with operating engines with more complex emissions control systems, such as increased maintenance intervals, replacement component products, supply chain issues, and ease in diagnosing and facilitating repair. Although EPA suggests the Proposal would actually lower emission system repair costs, by extending the useful life of the engine and the warranty period, these changes would still come at a cost as engine manufacturers will be taking on more liability – and these costs will be reflected in the purchase price of a new vehicle and some components may end up being in short supply as censors and chips are currently. Also, EPA makes assumptions on future repair costs in the Notice; however, the motorcoach industry already bears a costly burden under the current heavy-duty emissions regulations as a result of EPA's inducement policy and design strategy. Perhaps unanticipated in the initial emissions control rulemaking, it is a very real and costly burden to the heavy-duty vehicle industry, and it is not fully addressed in terms of cost analysis in the Proposal, as it will likely increase even with EPA's proposed inducement provisions. EPA includes discussion of the cost burden in the Notice under Section IV. D, based on comments from the Advanced Notice of Proposed Rulemaking in this proceeding. These comments identify a number of real world, burdensome costs to truck and motorcoach operators, including unnecessary repair expenses for replacing non-faulty parts, towing costs, lost time and schedule impacts, reimbursement costs for passenger tickets, and cost to reputation as a result of inducements or derates. However, above and beyond these costs is the largest cost risk for motorcoach operators: the risk to human life by placing in peril stranded passengers, as a result of this design strategy. ABA cannot sufficiently underscore the hazard created by EPA's inducement policy and the fear within the industry because of the increased risk o human life caused by the Proposal's potential to increase derate occurrences. [EPA-HQ-OAR-2019-0055-1308-A1,p.7]

In sum, ABA believes EPA underestimates the cost impacts of the Proposal, in terms of the cost to manufacture an engine with an emissions control system to meet the proposed standards and testing, along with the added cost to extend the useful life and warranty periods. These costs will lead to an increase in vehicle purchase price and maintenance and repair costs for vehicle purchasers. ABA also, again, points out that EPA has not fully accounted for or undervalued the benefits of travel by motorcoach and the importance of encouraging such travel, rather than making motorcoach operations prohibitively and unreasonably expensive, slowing down fleet turnover and making motorcoach operations unviable. [EPA-HQ-OAR-2019-0055-1308-A1, p.8]

Organization: American Trucking Associations (ATA)

Trucking companies meticulously track their business costs. The American Transportation Research Institute ("ATRI") has prepared and issued annual trucking operational cost reports since 2008. ATRI's latest report, An Analysis of the Operational Costs of Trucking: 2021 Update, analyzed calendar year 2020 industry data and concludes once again what our industry already knew – it is becoming more and more costly to own and operate trucking businesses -- especially for the 97% of the industry which are small businesses. 4 [EPA-HQ-OAR-2019-0055-1326-A1, p. 9]

4. American Transportation Research Institute. An Analysis of the Operational Costs of Trucking: 2020 Update, November 2021.

The most recent survey presents data representing 138,930 truck-tractors. Additionally, the data includes 418,520 trailers of varying types, and represents over 12 billion vehicle miles traveled. As shown in Figure 2, a majority of respondents (53%) represent fleets of 100 or fewer power units. [EPA-HQ-OAR-2019-0055-1326-A1, p. 9]

The ATRI survey found that for most trucking companies, labor is again their top operating expense per mile (45%), followed by fuel (19%), and truck payments (16%). Since 2011, marginal operating costs per mile for truck/trailer payments have increased 43% while labor costs per mile have increased by 21% (See Table 2). [EPA-HQ-OAR-2019-0055-1326-A1, p. 10]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

Operator Costs. Daimler Truck notes that EPA also underestimates operator costs in the draft RIA and in the Proposed Rule, in particular the potential costs of critical emissions maintenance after the warranty period expires. This is particularly so if manufacturers require scheduled maintenance for replacing after treatment components, which will be covered by the manufacturer during useful life but not after. [EPA-HQ-OAR-2019-0055-1168-A1, p.19]

Further, EPA does not account for higher upfront costs for operators related to the extended emission warranty. As explained in the NREL Cost Study, 'because aftertreatment package repair costs are either paid by the vehicle owner or the vehicle manufacturer through the warranty (if applicable), one may expect the higher upfront cost incurred to the vehicle owner for an aftertreatment package with extended full useful life and extended warranty.'49 NREL further explains that while these higher upfront costs may be offset to a certain degree by the aftertreatment repair cost savings over the life of the vehicle, incremental upfront purchase costs 'would be significantly higher than the repair cost savings that vehicle owners would realize.'50 [EPA-HQ-OAR-2019-0055-1168-A1, pp.19-20]

49 NREL Cost Study at 50.

50 Id.

Organization: *Engine and Truck Organizations*

Based on our assessment, EPA's "Option 1" rule as proposed will be:

- Disruptive of business. The additional costs and downtime associated with increased repairs and maintenance will directly impact our customers' day-to-day operations and inhibit their ability deliver goods and services. [EPA-HQ-OAR-2019-0055-1177-A1, p.1]

Organization: *Esler, Bob (OOIDA)*

"A friend of mine bought a new cat engine when all new emissions controls. That engine was in the shop more than it was on the road. It was a very expensive experience. The EPA was successful in putting one engine maker out of business. Who are they after next." [EPA-HQ-OAR-2019-0055-1266-A2, p.3]

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

EPA is interested in stakeholder input on their approach for estimating emission reductions from lengthening useful life and warranty periods and on their estimate of repair costs for emission control system components. MEMA would suggest that the analysis is very mileage focused. Data from a minimum of 75,000 miles/year and a maximum of 144,000 miles/year was used to make all repair model estimates. The effects of continued usage outside of that range is unknown. In addition, significantly more repair is required for many vocational applications being performed in rough environments. [EPA-HQ-OAR-2019-0055-1322-A1, p. 8]

Organization: *Sell, Richard (OOIDA)*

I have seen 10 Freightliners of ours go down with one box faults. Every time one goes down it cost approximately $20,000 to fix. This cost is bad enough, now you want to add a new program on emissions that manufacturers cannot meet. The deadline you're setting is unacceptable with the current and in the foreseeable future advances in technology. We now have record high fuel prices coupled with high truck prices. We cannot afford this. The trucking industry moves this nation. The cost of this program would need passed onto the consumer. The consumer will not be able to pay the increase. Most families are struggling just to make ends meet. This is being caused by high gas prices, grocery prices caused by inflation. These problems need to get rectified before any new rules are implemented. [EPA-HQ-OAR-2019-0055-1266-A2, p.3]

Organization: *United Motorcoach Association (UMA)*

Currently, a typical new motorcoach will cost $500,000 to $600,000. The cost and maintenance of these vehicles is amortized over the life of the vehicle, expected to be 20-plus years, through sales of the various services bus and motorcoach companies offer. Safety technologies, artificial intelligence, semi-automated driving is rapidly coming to market; however, these safety technologies are very expensive and any savings from predicted crash reductions may only be realized many years after the acquisition and implementation. [EPA-HQ-OAR-2019-0055-1311-A1, p.2]

Another layer of mandated emissions reductions will add more cost to the bus and motorcoach. Considering there are limits the consumers of bus and motorcoach services can absorb, providers will be less likely to adopt safety technologies. EPA must consider the unintended consequences of displacing safety technologies and the subsequent adverse cost of bodily injury, property damage, and fatalities when mandating additional engine technologies. [EPA-HQ-OAR-2019-0055-1311-A1, p.2]

EPA Summary and Response

The comments summarized above focus primarily on assertions about:

- EPA's use of a Fleet Advantage Whitepaper to estimate emission-related repair costs rather than the more established and annual ATRI study; and,
- EPA having underestimated emission-related repair costs; and,
- EPA's focus on miles driven rather than operating hours in estimating emission-related repair costs.

Allison Transmission, Inc. (Allison), commented with respect to EPA's use of the Fleet Advantage study over the American Transportation Research Institute (ATRI) study in developing a repair cost estimate. In short, EPA used the Fleet Advantage study to estimate emission-related repair costs and how those would change in the event of longer warranty and useful life periods. That said, the Fleet Advantage and ATRI costs were not dissimilar. The Fleet Advantage costs ranged from roughly 2.7 cents per mile in the first year of life to 19.6 cents per mile by age 6 or 7. This increasing cost with age allowed for development of a cost curve as a function of age. In contrast, the ATRI study developed a cost per mile value, 17.1 cents per mile, for every age. We used the former in the proposal since it seemed reasonable that repair costs would increase in some manner with age. That said, the most recent release of the ATRI study includes data spanning 10 years, making for a nice dataset upon which to base a cost per mile estimate. Further, the ATRI study includes a repair and maintenance cost per operational hour value and Allison also argued that certain vehicle types, such as vocational vehicles, tend to have repair costs more closely aligned with operating hours than with operating miles due to slower speeds and/or stop-and-go type operation. After careful consideration of these facts, and as described in Chapter 7.2.3 of the final RIA, the final cost analysis makes use of the ATRI study and of both its repair and maintenance cost per mile and cost per hour estimates.

Allison also questioned EPA's use of a maximum cost per mile value for vehicles beyond their useful life. This aspect of Allison's comment seems to be contrary to their prior point in their comment, just discussed, which seemed to argue for a constant cost per mile value of 17.1 cents per mile for all ages in a vehicle life. EPA used a maximum cost per mile value beyond useful life because the Fleet Advantage data did not extend beyond around 7 years of vehicle age. As noted above, the final cost analysis makes use of the ATRI study, as also suggested by Allison, and scales upward the emission-related repair cost per unit (mile or hour) value based on the direct manufacturing costs of the given HDE in the action scenario relative to its baseline. This scaling approach is described in Chapter 7.2.3.

Allison also commented that vocational vehicles may experience more stop-and-go operation than do the combination vehicles upon which the Fleet Advantage data were based. This is a valid point and we agree it is possible that stop and go operation could result in higher annual repair costs than would otherwise be estimated using a cost per mile approach. However, while providing good qualitative arguments, Allison did not include a better estimate of emission-related repair costs for those vehicles. While pointing out what Allison considered to be flaws in the EPA approach, Allison did not provide sufficient data such as typical hours of operation for various vehicle types that could be used for an emission-repair cost estimation approach based on hours of operation. Allison provided estimated miles driven per year for several vocational vehicle types, but EPA used Federal Highway Administration's (FHWA) Highway Statistics series, as well as Annual Energy Outlook (AEO2018), for vehicle miles travelled for both inventory and cost analyses to maintain internal consistency.[43] That being said, EPA has added to the methodology a check of hours of operation in the estimation of the age at which warranty and useful life would be reached. That estimation process now considers the required age, the age at which the miles provision is estimated to be reached, and the age at which the hours provision is estimated to be reached. The methodology assumes that all vehicles within a MOVES source type are operated at the average speeds within MOVES (see Chapter 7 of the final RIA for more detail). Had Allison provided more detail regarding hours of operation for each vehicle type, we would have considered using it, and we would have considered using repair costs per hour had such data been provided. Note that the ATRI study provides a repair and maintenance cost per hour, but that number is simply a conversion from the repair and maintenance cost per mile value along with an assumed average speed of roughly 40 miles per hour. We have used that value when determining repair costs for most vocational vehicles,

[43] Sonntag, Darrell. Population and Activity of Onroad Vehicles in MOVES_CTI_NPRM. Attachment to Memorandum to Docket EPA-HQ-OAR-2019-0055: "Updates to MOVES for Emissions Analysis of the HD 2027 NPRM." May 2021.

calculating their repair costs based on estimated hours of operation rather than miles of operation.

The Agricultural Retailers Association (ARA) and the American Trucking Associations (ATA) commented that the rule would result in soaring maintenance and repair costs. EPA has estimated the impact on emission-related repair costs associated with the more costly emission control systems expected to be employed to comply with the new standards. We present our methodology and results in Chapter 7 of the final RIA.

The American Bus Association (ABA) commented about the increased costs of emission controls, the increased repair costs, safety concerns surrounding derates and an assertion that EPA has not considered the benefits of bus travel. EPA acknowledges that the final program will result in costs on the regulated industry, and may result in new operating costs and savings for owner/operators of new MY2027 and later HD vehicles. However, EPA finds those costs are associated with significant net benefits to society as explained in Sections VIII and IX of the preamble.

Daimler argued that EPA had underestimated operator costs associated with emission-related repairs. However, EPA estimated emission-related repairs for a diesel long-haul tractor of over $40,000 over the first 18 years of the tractor's lifetime. The marginal costs during those 18 years were over $6,000 for each of the proposed options. EPA is not sure if the commenter considered those costs as too low, or if the commenter may have been unclear about what costs had been estimated in the proposed rule's presentation of emission-related repair costs. Note that the EMA comments and associated Ricardo study failed to properly reflect EPA's estimated emission-related repair costs, which suggests commenters may have been unclear about the presentation in the draft RIA. EPA has tried to make the presentation clearer in Chapter 7 of the final RIA. Daimler also commented on EPA's warranty costs, which have been updated for the final analysis as discussed in more detail in Section 18.3 of this document.

The Engine and Truck Organizations stated that proposed Option 1 would result in additional costs and downtime associated with increased repairs and maintenance and will directly impact our customers' day-to-day operations and inhibit their ability to deliver goods and services. As explained further in preamble Sections III and IV, EPA is not finalizing the complete Option 1 standards, useful life values, and warranty periods as proposed. We also touch upon how our final standards do not incorporate some of the provisions of most concern to some commenters in section 18.2 of this document.

Bob Esler suggested that EPA had put Caterpillar out of business. To the extent that the commenter is referring to past EPA actions, the comment is beyond the scope of this rulemaking. In any event, EPA has not put Caterpillar out of business, as Caterpillar continues to be a large manufacturing firm that produces and sells a wide range of construction, mining, marine, power generation and other industrial equipment. The commenter may be referring to the decision by Caterpillar to exit the on-highway diesel engine market more than ten years ago in 2010. The commenter provides no basis for the assertion that Caterpillar made this decision in response to an EPA action. EPA does not believe this comment is relevant to this rulemaking, and the commenter does not provide an explanation of why this claim regarding Caterpillar is relevant to this rulemaking. The commenter implies that EPA standards have the effect of putting an engine manufacturer out of business. EPA disagrees with this comment, and our detailed feasibility and cost analysis for this rulemaking demonstrates there are technologies available for the engine industry to develop and produce that will meet the standards established in this final rule.

MEMA commented on EPA's request for input regarding the emission-related repair cost estimates in the proposal. MEMA expressed a concern about the EPA methodology, stating that it was very focused on mileage. MEMA's primary concern appeared to be that data from a minimum of 75,000 miles/year and a maximum of 144,000 miles/year was used to make all repair model estimates. MEMA also stated that the effects of continued usage outside of that range is unknown and that significantly more repair is required for many vocational applications being performed in rough environments. Regarding the mileage focus, this was true in the proposed analysis, but EPA has updated the final analysis to use operating hours for vocational vehicles (rather than miles driven). EPA does not understand MEMA's comment that EPA used data from 75,000 to 144,000 miles for all repair estimates. A cost per mile approach was used, but the miles driven (in the proposal) and/or hours operated (in the final analysis) are unique to each vehicle and do not use a static 75,000 or 144,000 mile per year value. Regarding the costs for vocational vehicles in rough environments, MEMA did not provide data that EPA could consider for the final analysis.

Richard Sell suggested that high gas prices and grocery prices due to inflation had to be rectified before any new rules are implemented. Clean Air Act section 202(a)(3)(A) requires EPA to set emission standards for NOx, PM, HC, and CO that reflect the greatest degree of emission reduction achievable through the application of technology that the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology. EPA is finalizing this rule consistent with this authority. See also our response to similar comments in section 18.7 of this document.

The United Motorcoach Association (UMA) argues that the rule and its costs may displace the introduction of safety technologies and that EPA must consider this possibility. EPA does not believe that the new emission standards would conflict with regulatory safety standards that apply to any highway vehicle, including motorcoaches. The UMA makes a hypothetical argument that, because the EPA standards will increase the costs of a motorcoach, which they acknowledge in their comments can cost $500,000, the final standards would discourage vehicle purchasers from buying safety equipment. However, UMA failed to provide data or analysis demonstrating that this effect would occur. EPA does not agree with this hypothetical argument and believes it is unlikely that the marginal costs are high enough to create this result for a $500,000 vehicle.

18.7 Operating costs – Fuel

Comments by Organizations

Organization: *Agricultural Retailers Association (ARA) (1241 and 1421)*

Advanced and cellulosic biofuels have been proven to provide low-cost and low emission alternative based fuel that EPA can help promote by reducing the regulatory backlog stifling fuel technologies that can allow the nation to harness cleaner, renewable energy available from agricultural residue, corn fiber, and waste. ARA supports the EP A's lifting of the restrictions on the sale of E 15 for the 2022 summer driving season, but this policy decision needs to be made permanent in order to allow consumers access to E15 on a year-round basis. According to Growth Energy, the lifting of E 15 restrictions for this summer will save drivers as much as 50 to 60 cents a gallon. [EPA-HQ-OAR-2019-0055-1251-A1, p. 3]

Organization: *American Trucking Associations (ATA)*

Over the past 10 years, both vehicle-based and driver-based costs per mile have fluctuated. Slight variability of individual cost components year-over-year may appear to be insignificant, but overall financial impacts on a fleet can be substantial. [EPA-HQ-OAR-2019-0055-1326-A1, p. 10]

For example, fuel costs for one truck travelling 100,000 miles per year in 2020 at $2.56 per gallon averaging 6.2 miles per gallon would equate to an annual fuel expense increase of $41,290.5,6 A fleet running 100 vehicles would recognize a $4.1 million annual fuel bill upcharge. [EPA-HQ-OAR-2019-0055-1326-A1, p. 10]

5. U.S. Department of Transportation, U.S. Federal Highway Administration Highway Statistics 2020.

6. U.S. Department of Energy, U.S. Energy Information Administration, U.S. On-Highway Diesel Fuel Prices, Gasoline and Diesel Fuel Update - U.S. Energy Information Administration (EIA), (May 9, 2022).

Using today’s diesel price of $5.62 per gallon -- a 220% increase from the average diesel fuel price in 2020 -- the fuel bill for one truck is now $90,645, an increase of nearly $49,355 per year.7 That 100 vehicle fleet would expect an annual fuel bill of over $9.1 million a year, a $5 million dollar increase compared to only two years ago. In an industry that operates on razor thin profit margins, many trucking companies continue to teeter on the edge of insolvency. [EPA-HQ-OAR-2019-0055-1326-A1, pp. 10 - 11]

7. Id.

While not reflected in Table 2, significant cost increases in 2022 resulting from record inflation, parts and equipment shortages, historically high fuel and labor costs, and rising insurance premiums, will likely set new fleet operating expense records in next year’s ATRI operational cost report. These costs, along with the additional financial impacts that will be created under HD2027, must all be considered in that increased costs associated with any one individual rule by any state or federal agency may very well lead to trucking companies shuttering their operations. [EPA-HQ-OAR-2019-0055-1326-A1, p. 11]

Organization: *Booth, Norman (OOIDA)*

"I know that this is all a scam I have a 2021 389 Pete my close friend has a 2017 389 Pete glider We have on several occasions ran together and he will get 2 miles better fuel economy than I do (loaded) and even better than that empty And we are comparing apples to apples We both pull tankers and had the same weight of 45000. His truck does not put out no more black smoke that my new one does. Thanks." [EPA-HQ-OAR-2019-0055-1266-A2, p.2]

Organization: *Ingevity Corporation (Ingevity)*

On an ORVR-equipped vehicle, refueling emission vapors are captured in the activated carbon canister, purged during driving, and used as fuel. In the draft RIA, EPA estimated that 1.48 ml of gasoline would be recovered as fuel for each gram of vapor purged from the canister. [EPA-HQ-OAR-2019-0055-1213-A1, p. 3]

It is useful to compare the monetary value of this recovered fuel over an HHDGV lifetime period in miles (e.g., 150,000) to the suggested $34 RPE cost estimate. Four values are needed to calculate total gallons recovered: the uncontrolled refueling emission rate (g/gal), the control efficiency of ORVR, the vehicle fuel economy (miles/gal), and the adjustment for energy density since refueling emissions are mostly butane. Using a 150,000-mile driving lifetime, a 4.1 g/gal refueling emission rate (assuming a mechanical seal), a 98% control efficiency of ORVR6, 11 miles/gallon fuel economy,7 and a 1.117 energy density adjustment factor (as per the EPA draft RIA), yields a total fuel recovery of 22.4 gallons over the HHDGV life. In the draft RIA, EPA used the AEO 2018 $/gal gasoline price projections.8 For the period 2027-2038 this value is about $3.40, which gives an undiscounted fuel recovery value of about $76 over the vehicle life. [EPA-HQ-OAR-2019-0055-1213-A1, p. 4]

6. Passavant G., 2017 Summary and Analysis of 2000-2015 Model Year IUVP Evaporative and Refueling Emission Data, SAE Technical Paper 2017-01-5008

7 The 11-mpg projection for 2027+ for HHDGV fuel economy is based on information on page 8-8 and Table 5-15 for vocational vehicles as found in EPA's RIA entitled "Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles - Phase 2," EPA-420-R-16-900, August 2016.

8 Energy Information Administration (U.S. EIA). 2020. Annual Energy Outlook 2020 with Projections to 2050. January. www.eia.gov/aeo.

While the cost of ORVR is incurred at the time of purchase, the recovery credits are accrued over the years as the vehicle is driven. In previous documents, EPA based its mobile source emission inventories on annual vehicle miles travelled (VMT) with the VMT for any given vehicle decreasing each year after it enters the fleet.9 Using the "mileage accumulation rate per vehicle" in Table 1.4.4 of reference 9, a given vehicle will accumulate 150,000 miles in 12 years.

Applying a 3 percent discount rate to the stream of fuel recovery credits in years 1 through 12 (calculated as a function of annual mileage) yields an adjustment factor of 0.888 for a discounted recovery credit value of about $67 for the 150,000-mile use period. [EPA-HQ-OAR-2019-0055-1213-A1, p. 4]

9. See Table 1.4.4 of US EPA "Compilation of Air Pollutant Emission Factors Highway Mobile Sources, EPA 460/3-81-005, March 1981. Data for the "mileage accumulation rate per vehicle" for heavy duty gasoline vehicles used.

This discounted $67 recovery credit is much greater than the $34 RPE price-adjusted estimate. The VOC cost effectiveness on a $/ton basis is -$550/ton. This analysis does not include the additional environmental and health benefits that would be realized from the recovery of the fuel vapor, as evaporated fuel vapors are a precursor to the formation of ozone and secondary particulate matter (PM 2.5). [EPA-HQ-OAR-2019-0055-1213-A1, p. 4]

Organization: *Starnes, Elvin (OOIDA)*

"I own a 2014 Prostar and I have had numerous problems with the EGR coolers and DPF problems at a cost of $3,700 to as much of $9,500 at least once a year. The fuel economy is worse than my older truck that didn't have any emissions on it also I wish that I never got rid of the older truck." [EPA-HQ-OAR-2019-0055-1266-A2, p.1].

Organization: *Streenstrup, Hank (OOIDA)*

Every Diesel vehicle I have has been negatively affected by updating the emissions systems. My current heavy truck is a Glider kit with a pre-emissions, re-built engine in order to avoid the downtime and reduced fuel economy that I experienced with my previous truck. I do not go to any "emissions regulated" areas in my class 8. I also own a 1ton Mercedes Sprinter that had the emissions update this January. This has resulted in a reduction in fuel economy, resulting in more fuel expense during these times of very high fuel costs anyway. I'm all for being "environmental", but it makes no sense to burn 20-40 percent more fuel………and this results in fewer emissions?????? I also operate a HD pickup that is currently consuming excessive fuel because of the emissions systems. These costs must be passed on through higher rates to my customers. I am slowly retiring early because of the increased costs. I have become VERY SELECTIVE with what loads that I contract, because of costs and loss of flexibility in operating my business." [EPA-HQ-OAR-2019-0055-1266-A2, p.2]

Organization: *Zero Emission Transportation Association (ZETA)*

Finally, the economic benefits of electrifying HDVs are significant. The total cost of ownership of HDEVs is lower than that of fossil fuel-powered HDVs (as explained in detail in the following section), especially amidst record-high gasoline and diesel prices. A new ZETA report found that gas-powered vehicles are 3-5 times more expensive to drive per mile than EVs,9 and those effects are multiplied in low-efficiency gas-powered vehicles like HDVs. [EPA-HQ-OAR-2019-0055-1283-A1, p.3]

9 https://www.zeta2030.org/news/electric-vehicles-are-delivering-cost-savings-to-drivers-strong-electric-vehicle-tax-credits-will-ensure-that-all-americans-benefit-from-clean-transportation

EPA Summary and Response

The Agricultural Retailers Associated (ARA) stated support for a permanent lifting of restrictions on the sale of E15. This is outside the scope of this rulemaking.

The American Trucking Associations (ATA) commented that the recent upswing in fuel costs, combined with increased costs associated with the new standards, must be considered in estimating costs of the rule. We understand the concern, but our cost analysis is intended to estimate the incremental costs on regulated entities. Since there are almost no diesel fuel consumption impacts associated with the new standards (there is a small fuel savings associated with captured fuel during refueling events for gasoline vehicles), there is no incremental cost impact associated with fuel prices since they would be, except for gasoline vehicles, the same in the no-action and the final rule scenarios. See also our response to a similar comment in section 18.6 of this document.

Norman Booth, Elvin Starnes, and Hank Streenstrup provided anecdotes regarding their truck's fuel consumption compared to a friend's truck and/or a prior owned truck, but there did not appear to be a comment with respect to any portion of our proposal in the anecdotes.

Ingevity Corporation (Ingevity) provided a detailed accounting of costs and fuel savings associated with the ORVR requirements on gasoline engines. The comment was supportive of the proposal.

The Zero Emission Transportation Association (ZETA) commented that electrified heavy-duty vehicles have a more favorable total cost of ownership than fossil fuel-powered heavy-duty vehicles. EPA has not looked closely at total cost of ownership in the analysis for the proposal or the final rule because the rule is focused on criteria emission control, not ownership costs. Note also that we didn't evaluate costs of electric vehicles for the criteria emission standards since the final standards are not based on projected utilization of electric vehicle technology, as explained further in preamble Section III, and we are not taking final action at this time on the GHG standards portion of the proposal.

18.8 Operating costs - Diesel Exhaust Fluid (DEF)

Comments by Organizations

Organization: *Champion Auto Carriers*

Having been in the transportation industry for over 35 years I have witnessed what the DEF regulations has cost my business and drivers since 2012. Down time for DEF issues account for 90% of my overall downtime and driver expense. Maybe the EPA should be looking at better technology or systems to reduce NOx but allow for better performance and uptime. We can't afford any extra truck costs or maintenance costs and still deliver the goods and services trucking provides. [EPA-HQ-OAR-2019-0055-2733, p.1]

Organization: *CSM Trucking*

Emission control devices on heavy commercial vehicles are non effective in business use and environmental use. They cost consumers more money in parts and maintenance, and generate more waste to public landfills as def jugs contribute tons of plastic containers to landfills also. [EPA-HQ-OAR-2019-0055-2131, p.1]

Trucks running def are unreliable and not cost effective. More waste is produced using said emissions control vs not using them. Lastly many trucks get worse mpg than older motors not using def units. [EPA-HQ-OAR-2019-0055-2131, p.1]

Clean burning trucks are can be generated in cleanly or accurately tuned vehicles. [EPA-HQ-OAR-2019-0055-2131, p.1]

EPA Summary and Response

Champion Auto Carriers and CSM Trucking commented that EPA should be looking at better technology or systems to reduce NOx but allow for better performance and uptime. EPA does not mandate the technology to be used by industry for compliance with EPA emission standards – the standards are performance standards. EPA does not understand the argument that the SCR and DEF systems are causing reduced performance (by which EPA assumes the commenter means fuel consumption performance) for today's heavy-duty vehicles. While we understand there was some decrease in fuel consumption with the introduction of the model year 2007 diesel engines which added particulate filters for the first time for majority of the Class 8 truck market, those impacts were reversed with the introduction of the 2010 SCR-catalyst technologies, and with the implementation of the EPA GHG standards in 2014, today's highway heavy-duty Class 8 tractors are the most fuel efficient vehicles the industry has ever produced. The EPA GHG Phase 2 standards in 2024 and 2027 require further reductions in CO_2 emissions. As discussed in Section III of the preamble, EPA expects those products will continue the trend of improved fuel consumption and lower fuel operating costs while also complying with the final program.

18.9 Other comments on costs

Comments by Organizations

Organization: *Agricultural Retailers Association (ARA) (1241 and 1421)*

The proposed rule must protect the continued use of the internal combustion engine and promote the use of low-emission biofuels. The EP A's push towards zero-emission vehicles and support for efforts to ban the internal combustion engine, which this latest proposal is designed to do, will cause major job losses, decrease farm income, cause a decline in the U.S. GDP, and adversely impact corn and soybean prices. In October 2020, before the nation's started to see record high inflation, ARA released a commissioned study that analyzed the impact of increased electric vehicle penetration on U.S. biofuels, agriculture, and the economy. Proposals to ban internal combustion engine vehicles, which is a goal of this proposal, by 2035 and 2050 served as the economic models for the study, along with a base case provided by the U.S. Energy Information Administration's Annual Energy Outlook. Key findings of the 'Economic Impacts to U.S. Bio fuels, Agriculture, and the Economy from Subsidized Electric Vehicle Penetration'1 include the following:

- U.S. light-duty and freight vehicle consumption of ethanol and biodiesel could decline up to 90 percent to 1.1 billion gallons and up to 61 percent to 0.8 billion gallons, respectively
- Corn and soybean consumption decrease by up to 2.0 billion bushels and up to 470 million bushels, respectively
- Corn prices fall up to 50 percent to $1.74 per bushel
- Soybean prices fall up to 44 percent to $4.92 per bushel
- U.S. Net Farm Income decreases by up to $27 billion
- U.S. GDP declines by up to $26.4 billion, resulting in cumulative GDP losses of up to $321 billion
- U.S. job losses could reach up to 255,300 in the year 2050 [EPA-HQ-OAR-2019-0055-1251-A1, p. 2]

1. https://www.aradc.org/news/ag-biofuels-study

Organization: *Allison Transmission, Inc. (Allison)*

As EPA notes, costs are imposed both directly (e.g., through the cost of new emission technology) and indirectly (e.g., through the need of a manufacturer to account for the risks and potential financial exposure from extended useful life and warranty periods). At least in some cases, the direct technology costs for new emission control technology to address Options 1 and 2 may be similar due to the need under both options to substantially reduce NOx emissions. In such an instance, however, the indirect cost of extended useful life and warranty periods may be substantially different and realistically impact the prices paid by the ultimate purchaser. This is especially true under Option 1, where manufacturers will need to assess the risks (and uncertainties) of being financially responsible for recalls and/or warranty repairs for extended periods, in some cases up to 6 times the length of current periods.24 [EPA-HQ-OAR-2019-0055-1231-A1, p.12]

> 24 EPA’s proposed Option 1 would implement an emissions warranty period of 600,000 miles in MY 2031 for Heavy HDE vehicles as compared with current standards requiring 100,000 miles.

Organization: *American Bus Association (ABA) (1070 and 1308)*

However, the Proposal does not really address motorcoach operations, or the benefits derived from travel by motorcoach. Because of EPA’s emphasis on trucks or freight carrying services, ABA believes the assumptions and analyses EPA relies upon for support are either inaccurate or incomplete. Passenger carrying transport, and specifically motorcoach operations, differ significantly from freight transport. For example, the impacts on air quality from bus and motorcoach operations should not be solely evaluated in the context of engine emissions but must also take into account the number of the other vehicles removed from the road by virtue of providing mass transportation. Motorcoach operations can take up to 50 personal vehicles off the road (MJ Bradley & Associates (Ed.). (2019, June). Updated Comparison of Energy Use & Emissions from Different Transportation Modes - https://www.buses.org/assets/images/uploads/general/2019%20UPDATE%20Comparative%20Fuel%20CO2%20FINAL-July%202019.pdf). When you consider the potential removal of 600 million passengers worth of personal vehicles from our roadways, we believe that the motorcoach industry should receive some special considerations under this rulemaking and should certainly be acknowledged for their positive impact on the environment. It is short-sighted and inaccurate to entirely discount the benefits to air quality from removing other vehicles from the road in terms of both emissions as well as congestion. At the same time, if conducting motorcoach operations becomes cost prohibitive or untenable, it will cause the demise of the motorcoach industry, leading to an increase of vehicles on the road and increased congestion for urban areas, reversing the strides made to limit pollution and improve air quality. [EPA-HQ-OAR-2019-0055-1308-A1, p.4]

Further, the proposed rule leaves major open questions about its impact on engine size and weight. Any significant increase in either the size or weight of engines could counter-productively serve to potentially reduce the number of passengers that could be transported on a motorcoach. For example, both under federal and state laws buses are subject to strict weight limits (23 USC 127). However, the proposed rule contains no useful analysis of its bus weight implications. Vehicle redesign costs to accommodate any increased weight to the engine or emissions control system components should have also been considered in the Regulatory Impact Analysis. [EPA-HQ-OAR-2019-0055-1308-A1, pp.4-5]

The EPA needs to incorporate more data on the motorcoach industry, motorcoach services and the role motorcoaches play in the national transportation system, into its analysis and assumptions for this rulemaking. Motorcoach transportation provides a significant benefit to air quality by removing other vehicles from the road. If motorcoach operations in this country were to decline, it will have a negative impact on air quality, and effect the economy through job loss and by limiting transportation options, particularly for undeserved communities who rely heavily on motorcoach transportation, in addition to the military and emergency response network. [EPA-HQ-OAR-2019-0055-1308-A1,p .5]

As previously noted, the private motorcoach industry suffered consequential economic losses as a result of the COVID-19 pandemic. Motorcoach operations, overall, were running at 5-10% of capacity throughout 2020, and only recovered to about 45-50% in 2021. Many of the motorcoach operators who survived and continue in operation today were forced to defer payments on their heavy-duty equipment fleets for months. Even now these operators are still trying to recover from the financial hole caused by these deferments. As well, the motorcoach equipment market was flooded with excess equipment from foreclosures and abandonment during this time period, sinking the value of both equipment and businesses overall. Motorcoach manufacturers were particularly hard hit, with so much excess capacity as new motorcoach sales plummeted down from an average of 2,200 units annually (2016-2220) to less than 1,000 in 2021 (https://www.buses.org/aba-foundation/research-summary/quarterly-sales-data). The industry is experiencing an unprecedented driver shortage, leaving equipment sitting idle. All to say, the motorcoach industry, economically, remains in an unstable position for the foreseeable future, and equipment costs plays a major role in business decisions. [EPA-HQ-OAR-2019-0055-1308-A1, pp.7-8]

ABA believes EPA underestimates the cost impacts of the Proposal, in terms of the cost to manufacture an engine with an emissions control system to meet the proposed standards and testing, along with the added cost to extend the useful life and warranty periods. These costs will lead to an increase in vehicle purchase price and maintenance and repair costs for vehicle purchasers. ABA also, again, points out that EPA has not fully accounted for or undervalued the benefits of travel by motorcoach and the importance of encouraging such travel, rather than making motorcoach operations prohibitively and unreasonably expensive, slowing down fleet turnover and making motorcoach operations unviable. [EPA-HQ-OAR-2019-0055-1308-A1, p.8]

Organization: *American Farm Bureau Federation (Farm Bureau)*

Finally, heavy-duty trucks are the lifeblood not only of farms and ranches, but also throughout the entire supply chain. Increasing costs, decreasing availability and potentially encouraging negative environmental impacts through public policy should always be avoided. Yet, this proposed rule would multiply the supply chain, inflationary and input pressures American farmers, ranchers and consumers are already facing. [EPA-HQ-OAR-2019-0055-1163-A1, p.2]

Specifically, we are concerned that the agency’s projection of extremely modest technology and warranty costs associated with the rule will result in a significant overestimation of future fleet turnover and underestimation of the negative emissions consequences associated with large-scale 'pre-buys' prior to compliance deadlines. To its credit, EPA openly admits that its projections are guesswork, but it does not quantitatively explore how underestimating costs could drive higher pre-buy behavior that could significantly delay and undermine emissions reductions benefits that are the central purpose of the rule. So, before finalizing this rule, we urge EPA to work collaboratively with industry, states, and other affected stakeholders to resolve discrepancies related to technology costs and achievability, warranty impacts, corresponding fleet turnover and environmental impacts of the proposal. [EPA-HQ-OAR-2019-0055-1163-A1, p.2]

Organization: *American Trucking Associations (ATA)*

ATA has established 12 fleet Guiding Principles that should be considered in the development of HD2027 including:

• Cost impacts must include warranty upcharges, downtime, operation and maintenance, research and development recoupment, profit margins, and training expenses. [EPA-HQ-OAR-2019-0055-1326-A1, p. 5]

Organization: *Coach USA, Inc. (Coach USA)*

EPA has failed to provide sufficient study or data concerning the safety, operational and cost implications of its proposed rules on the bus industry, which has been economically devastated by the COVID pandemic and which can scarcely afford any regulations that will significantly increase the cost of new buses and possibly impose a significant weight issue that could make bus travel less efficient. [EPA-HQ-OAR-2019-0055-1307-A1, p. 3]

Given the economic challenges still facing the motorcoach industry, any rules that will increase the cost of a new bus by over $40,000, as proposed here (and that will likely also increase vehicle maintenance and repair costs) will counterproductively encourage the continued use of older, less emissions-efficient motorcoaches. Such rules could also have the perverse effect of forcing some motorcoach operators to abandon the business altogether, as many have already done in recent years. The impact could well be more personal cars on the highway, and higher emissions. To prevent these results, EPA needs to be more mindful of the role of motorcoaches in the nation's transportation system and develop emissions rules that balance reasonable emissions goals with the constraints facing our industry. [EPA-HQ-OAR-2019-0055-1307-A1, p. 3.]

Finally, Coach USA urges EPA to obtain information from engine manufacturers to assess implications from the added weight and increased temperatures associated with SCR and derate-related equipment. As noted above, interstate buses are subject, throughout the country, to heavily-enforced weight restrictions; any exceedance caused by SCR or derate-related equipment that causes a bus to be overweight would be unacceptable to sustaining interstate bus operations. Likewise, any increased temperatures caused by such equipment – which may cause buses to be less reliable or otherwise potentially impair driver/passenger safety – would also be unacceptable to Coach USA. [EPA-HQ-OAR-2019-0055-1307-A1, p. 7]

Organization: *International Council on Clean Transportation (ICCT)*

The implementation of the proposed standards and new certification and in-use NOx requirements will require technology changes in HDVs sold in MY2027 and beyond. These technologies would have an impact on costs. For the past 10 years, the ICCT has been publishing detailed cost information to ensure that national regulators in countries where we work can have access to that type of information. EPA's NPRM presents a careful revision and update of emission control technologies for diesel and gasoline HDVs in the U.S., and the proposal presents a detailed analysis of the expected cost to meet the proposed targets. The draft RIA often refers to ICCT's work as the basis for its cost assessment. Our detailed review of the cost numbers shown in the draft RIA agrees with our own analysis. The RIA provides an even deeper look into the cost elements that influence the total incremental cost to meet the proposed standards. [EPA-HQ-OAR-2019-0055-1211-A1, p. 12]

The California Air Resources Board (CARB) recently adopted a new rule, referred throughout this document as the HDV omnibus, to significantly reduce real-world nitrogen oxide (NOx) emissions from new on-road heavy-duty engines sold in the state beginning in 2024. The cost information from that process is relevant in this discussion as the current EPA NPRM is closely linked to the CARB regulation. [EPA-HQ-OAR-2019-0055-1211-A1, p. 12]

Six studies were published that analyzed the cost to manufacturers of the low-NOx regulation between 2019 and 2021: one by the ICCT, one from the Manufacturers of Emissions Control Association (MECA); one by the California Air Resources Board; one by the National Renewable Energy Laboratory (NREL); and two by the Truck and Engine Manufacturers Association (EMA). [EPA-HQ-OAR-2019-0055-1211-A1, p. 12]

The table below shows what each of the six studies found to be the incremental 12L–13L engine cost to the manufacturer of full compliance with the final step of CARB’s regulation and EPA’s NPRM. The estimates range from $2,200 (the lowest, from ICCT’s study) to $80,821 (the highest, from EMA-ACT Research)—a huge difference. These can be compared to EPA’s estimated $3,200 to $3,900 compliance cost to meet the HHDV regulatory requirements for MY 2031, depending on the regulatory option adopted. We find that the highest estimates are inaccurate largely due to their overestimation of indirect costs, as discussed below. For reference, the MSRP of a leading MY2022 Class 8 tractor-trailer model, the Freightliner Cascadia, is listed today at $168,274. 14 [EPA-HQ-OAR-2019-0055-1211-A1, p. 12]

14. Source: Price Digests https://app.pricedigests.com/login. Accessed 4 May 2022.

Organization: *Labor Network for Sustainability (LNS)*

The Proposed Rule does not appear to take into account the reality of the independent contractor/owner operator model and the significant risk of unjustly increasing the costs that truck drivers will bear as a consequence of its implementation. The Proposed Rule breaks down the costs associated with getting compliant vehicles on the road into three categories: Technology Package Costs, Operating Costs, and Program Costs. Without further action by the EPA, these costs will worsen the already inequitable burdens shouldered by misclassified truck drivers. As we show more fully below, this omission jeopardizes the efficacies of the Proposed Rule itself. [EPA-HQ-OAR-2019-0055-1257-A1, p.7]

Technology Package Costs, comprise both the direct costs of new technology and the indirect costs of bringing those technologies to market.31 EPA projects that these costs, ‘while first incurred by manufacturers of new engines, are presumed to be passed on to the consumers of those engines (i.e., heavy-duty truck manufacturers and, ultimately, their purchasers/owners).’32 Operating Costs are the costs ‘associated with the truck and bus operation that are projected to be impacted by the proposal.’33 EPA acknowledges that these costs will also be ‘incurred by truck and bus purchasers/owners.’34 Program Costs are the sum of the Technology Package Costs and the Operating Costs taken together representing EPA’s best estimate of the Proposed Rule’s ‘costs to society.’35 [EPA-HQ-OAR-2019-0055-1257-A1, p.8]

31 EPA, Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards: Draft Regulatory Impact Analysis 313 (2022), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10144K0.pdf

32 Ibid.

33 Ibid.

34 Ibid.

35 Ibid.

At an informational meeting hosted by EPA on April 18th, 2022, EPA officials presented an overview of the Proposed Rule. When questioned about the regulation's impacts on misclassified truck drivers, one EPA official answered that EPA estimated a 2% - 3% increase on the purchase price of a new compliant vehicle. Since the purchase prices of heavy-duty vehicles are already high (on average $150,000 36), this increase is significant given the major costs that have been shifted to truck drivers described above. The increased costs of regulation will further push drivers to the economic edge. [EPA-HQ-OAR-2019-0055-1257-A1, p.8]

36 Sarah Harris, How Much Does a Semi Truck Cost?, FreightWaves, (Nov. 16, 2021), https://ratings.freightwaves.com/how-much-does-a-semi-truck-cost/

As EPA expects essentially all of the cost increases associated with the Proposed Rule to be borne by the end-purchasers, drivers that purchase their own trucks but also drivers that lease their trucks from trucking firms will likely have these costs passed through to them. [EPA-HQ-OAR-2019-0055-1257-A1, p.8]

This is highly inequitable and should and can be addressed. This is not pure speculation. California has faced this very issue in connection with its heavy-duty regulation. Analysts who have studied the impact of that regulation have concluded that '[a]dded expenses are truly company overhead and should not be the responsibility of the driver.'37 [EPA-HQ-OAR-2019-0055-1257-A1, p.8]

37 Sears, supra note 23 at 42.

Moreover, we strongly support the comments and recommendations of others, including the more than 50 organizations that make up the Moving Forward Network (MFN), that the Proposed Rule inadequately addresses the public health and environmental dangers of continued use of fossil-fuel powered vehicles; we need to embark sooner and faster on a road to full electrification of medium and heavy duty vehicles. But, electrification carries with it additional equity considerations especially to workers who currently manufacture diesel powered trucks and to communities who rely on the tax income generated by factories that make these products. [EPA-HQ-OAR-2019-0055-1257-A1, p.8]

We support the comments made during the public hearings by UAW representative Josh Nassar that the cost impacts of greening the transportation sector should not be borne by the workers least able to afford them. Since our Comments here primarily address the impacts on workers of the Proposed Rule as currently written, we do not elaborate on the additional implications of full vehicle electrification. [EPA-HQ-OAR-2019-0055-1257-A1, p.9]

Organization: *Marathon Cheese Transport*

Perhaps our government should subsidize the heavy duty truck cost increases by finally eliminating the onerous Federal Excise Tax already being added to each piece of equipment fleets have to purchase. Another example of political parties pushing agendas without proper research at the expense of trucking companies who are already fighting an uphill battle with higher labor costs, insurance premiums, fuel costs, shipper detention times, time/cost delays due to traffic, and safety programs. [EPA-HQ-OAR-2019-0055-2516, p.1]

Organization: *Natural Gas Vehicles for America (NGVAmerica)*

NGVAmerica and its members submit the following recommendations for policies and programs that the EPA and other federal agencies can advance to encourage the use of cleaner trucks.

9) Ensure that federal funding provided under the CMAQ Program and the DERA Program and other programs enacted as part of the Bipartisan Infrastructure Law are competitively awarded for projects that provide the most cost-effective emission reductions and offer increased funding levels for engines and vehicles that are certified to more demanding standards in advance of EPA's adoption of such standards; [EPA-HQ-OAR-2019-0055-1330-A1, p.14]

13) Work with Congress to amend the federal excise tax on new trucks to reduce the impediment to fleets and businesses purchasing cleaner new trucks by either eliminating the tax altogether since it discourages new purchases or amend the tax so that it does not penalize more costly, lower polluting technologies (i.e., eliminate the excise tax on the incremental cost). [EPA-HQ-OAR-2019-0055-1330-A1, p.14]

EPA Summary and Response

The Agricultural Retailers Association (ARA) commented about the proposal's goals being to push towards zero-emission vehicles and provide support for efforts to ban the internal combustion engine. EPA's goal with these standards is to reduce air pollution from highway heavy-duty engines and vehicles to improve public health and welfare. Congress has given EPA that responsibility via the Clean Air Act and has directed EPA to promulgate standards that are technology-forcing and feasible after giving appropriate consideration to certain listed factors. The standards promulgated are performance-based standards that do not require a specific technology and are not based on projected utilization of electric vehicle technology. The analyses that EPA has done show that the final standards fall within EPA's authority under Clean Air Act. The commenter also focuses on the Annual Energy Outlook's findings of possible economic impacts to the U.S. biofuels industry associated with a subsidized electric vehicle penetration without also presenting possible economic benefits. Regardless, a subsidized electric vehicle penetration program is outside the scope of the proposal or final rule.

Allison Transmission, Inc. (Allison) commented that the costs of longer warranty and useful life periods must be considered. EPA has done so and has provided our best cost estimates for those new provisions. EPA notes that the final analysis makes use of many suggestions by industry for improving the final analysis. EPA notes these changes largely in section 18.3 above in this document and in Chapter 7 of the final RIA.

The American Bus Association (ABA) commented that EPA should have considered weight impacts on motor coaches associated with the standards. It is true that we have not considered the very small weight impacts in our cost analysis. The technology teardown work we had done by FEV suggests that the new aftertreatment systems may weigh from 40 to 80 kilograms more than current aftertreatment systems. This is the weight of a single passenger or a few suitcases, and EPA believes these small changes are not sufficient to disrupt the motorcoach industry. ABA also commented with respect to the motor coach industry and the difficult economic times during the pandemic. EPA has no desire to limit or discourage motor coach ridership and we do not believe that this final rule will do so. Regarding economic hardships, EPA understands that the U.S. economy has experienced such hardships. EPA has updated the cost analysis in the final rule and believes that the costs are properly characterized, and that the reduction in heavy-duty emissions and air pollution that will result from this final rule are significant, and that EPA has given appropriate consideration of the costs of this rulemaking. EPA agrees with ABA that the motor coach industry provides a valuable service to society and that its emissions per passenger mile are likely less than would be the case were those passengers to travel by personal vehicle. EPA disagrees that the costs associated with the final standards are likely to push people out of motor coach travel and into personal vehicles because travel by motor coach will almost certainly remain less costly in comparison.

The American Farm Bureau Federation (Farm Bureau) also commented with respect to the challenging economic times brought on by the pandemic. The Farm Bureau argues that increasing costs and decreasing availability would multiply the supply chain, inflationary and input pressures American farmers, ranchers and consumers are already facing. EPA understands the concern, but Clean Air Act section 202(a)(3)(A) requires EPA to set emission standards for NOx, PM, HC, and CO that reflect the greatest degree of emission reduction achievable through the application of technology that the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology. In other words, the Clean Air Act requires the criteria pollutant standards for heavy duty engines set by EPA to be technology forcing and the CAA does not require that EPA consider all the statutory factors equally, rather EPA has discretion in determining the appropriate consideration to give such factors as costs.[44] EPA has updated the cost analysis in the final rule and believes that the costs are properly characterized, and that the reduction in heavy-duty emissions and air pollution that will result from this final rule are significant, and that EPA has given appropriate consideration of the costs of this rulemaking. As explained elsewhere in this document and the final rule preamble, EPA's final standards were determined after consideration of the required factors and are within EPA's authority and appropriate. EPA also notes that EPA conducted additional analyses that demonstrate the impacts of the final program to be cost-beneficial to society (i.e. the benefits

[44] See, e.g., Sierra Club v. EPA, 325 F.3d 374, 378 (D.C. Cir. 2003) (explaining that similar technology forcing language in CAA section 202(1)(2) ''does not resolve how the Administrator should weigh all [the statutory] factors in the process of finding the 'greatest emission reduction achievable' ''); Husqvarna AB v. EPA, 254 F.3d 195, 200 (D.C. Cir. 2001) (explaining that under CAA section 213's similar technology-forcing authority that ''EPA did not deviate from its statutory mandate or frustrate congressional will by placing primary significance on the 'greatest degree of emission reduction achievable' '' or by considering cost and other statutory factors as important but secondary).

outweigh the costs). EPA hopes, as everyone does, that the current economic conditions – inflation, the pandemic, etc. – are alleviated by the time the final program is being implemented.

The American Farm Bureau Federation (Farm Bureau) and the New York Farm Bureau (NYFB) stated that "EPA openly admits that its projections are guesswork." It is not clear where these commenters got this impression, but EPA wants to make clear that the EPA proposed costs projections, as well as the cost projections in this final rule, are not guesswork – and in fact, EPA's cost estimates are based on detailed engineering studies, modeling work and proven estimation approaches as we have detailed throughout our regulatory documents (both for the proposal and this Final Rule). Regarding the Farm Bureau's comments on pre-buy, we respond to those comments in Section 25 of this document.

Regarding the comments from the American Trucking Associations (ATA), EPA believes that it has estimated all the costs that should be considered in setting the new standards. EPA has estimated costs for new technology, including the indirect costs (including profits and R&D) to be incurred by engine and truck manufacturers (i.e. regulated entities for the new standards). EPA has also conducted additional analyses, and estimated increased operating costs consisting of repair, DEF consumption and fuel consumption impacts.

Coach USA expressed concerns regarding the increased weight associated with the new exhaust aftertreatment systems. As noted above in response to the ABA, EPA believes that weights may increase from 40 to 80 kilograms, depending on the regulatory class. EPA acknowledges that no accounting of this weight increase is included in our cost analysis, but EPA believes that the increase is not large enough for weight restrictions to suddenly become a problem for motor coach operators. The temperature impacts associated with the new systems are responded to in Section 3. Coach USA also suggested that a rule that imposes $40,000 in costs is too much for the motorcoach industry to handle given Covid and its effects on the industry. As noted throughout this section 18, EPA disagrees with the claims of $40,000 in costs expressed by Coach USA and other commenters.

EPA appreciates the comments from the International Council on Clean Transportation (ICCT). We have updated our analysis for the final rule and present our updated cost analysis in Chapter 7 of the final RIA.

The comments from the Labor Network for Sustainability (LNS) appear to be directed not so much at the cost estimates or the methodology, but instead on who pays those costs. The concern is over contracted drivers and those drivers not being treated as employees of the companies that should bear the burden of the rule (in the commenter's opinion). This issue is outside the scope of the regulation or the analysis supporting it. EPA has estimated the costs and noted that the costs will be borne, largely, by purchasers of the engines and vehicles (i.e., the owner/operators). By whom those owner/operators are employed is outside EPA's scope, as is how some operators are compensated by the owners of the vehicles.

Marathon Cheese Transport suggests that the Federal Excise Tax be eliminated. This is outside the scope of this EPA rulemaking.

Natural Gas Vehicles for America (NGV America) suggested that EPA ensure that federal funding under the CMAQ and DERA programs be competitively awarded and that EPA work with Congress to amend the federal excise tax. Both of these comments are outside the scope of this action.

19 Inventory impacts

19.1 MOVES model

Organization: *Retail Industry Leaders Association (RILA)*

The estimated cost and benefits that are anticipated because of a proposed rule are important to assess the effectiveness and viability of the changes it contains. Such estimates are typically based on advanced models that rely on a set of forecasted assumptions. In the case of EPA's proposed rule focused on heavy-duty engine emissions, forecasted impacts appear to be at least in part based on an updated Motor Vehicle Emissions Simulator (MOVES) model. The documentation for this analytical model is included in the rulemaking's docket,1 providing a detailed view of the depth and breadth that the model encompasses. [EPA-HQ-OAR-2019-0055-1189-A2, p.4]

1 'MOVES_CTI_NPRM', May 2021. https://www.regulations.gov/document/EPA-HQ-OAR-2019-0055-0594

Although the model's soundness is not in question, the published documentation is unclear regarding some of EPA's modeling assumptions. For example, the model appears to rely on the data from the U.S. Energy Information Agency's (EIA) 'Annual Energy Outlook 2018' 2 (AEO2018) as an input to its projected vehicle populations (Section 4.2 of MOVES_CTI_NPRM documentation, 'Projected Vehicle Populations (2017-2060)'). The AEO2018 document forecasts a considerable increase in electricity and natural gas as a transportation fuel when forecasting anticipated fuel mix out to 2050. However, there are several areas within MOVES_CTI_NPRM documentation that appear to indicate a forecasted fuel-mix through 2060 that does not include much (if any) electricity of natural gas. [EPA-HQ-OAR-2019-0055-1189-A2, pp.4-5]

2 'Annual Energy Outlook 2018', Feb 6, 2018.
https://www.eia.gov/outlooks/archive/aeo18/pdf/AEO2018.pdf

Although EPA's modeling assumptions and inputs will not have a direct impact on the actual real-world costs and benefits if the proposed rule is implemented, the use of consistent and accurate assumptions is critical to promote confidence in the proposed rule's projected costs and benefits. Although such figures are not being questioned here, EPA is urged to include additional context and transparency around modeled assumptions, especially in areas where the documentation may appear to indicate inconsistencies. [EPA-HQ-OAR-2019-0055-1189-A2, p.5]

There are also additional factors that EPA might not have currently incorporated in its forecasting fuel mix or vehicle quantity. For example, consumer preferences have shifted recently (over the past 5-10 years) for many products away from as many in-person purchases to making more purchases online for home delivery. It's therefore possible that EPA's forecasting assumptions underestimates the magnitude of this increase 'last-mile' delivery truck operations, which typically happen at low-speed and idle in areas of higher population density. Another example is the potential shift towards lighter vehicle classes being used more commonly in last-mile delivery of goods than currently assumed, especially in denser population centers. Such shifts would likely be too recent or insignificant for inclusion in EPA's modeling, but it is worth reviewing EPA's assumptions around such trends in future rulemakings.[EPA-HQ-OAR-2019-0055-1189-A2, p.5]

EPA Summary and Response

Retail Industry Leaders Association (RILA) commented on some of the modeling assumptions and inputs in the EPA’s MOVES_CTI_NPRM model (which was used for the inventory analysis for the proposed rule). An example they mentioned was a potential inconsistency in EPA’s use of the Annual Energy Outlook (AEO) 2018 data from the U.S. Energy Information Agency (EIA), particularly about the projected numbers of electric and natural gas vehicles. RILA also commented on the importance of properly accounting for the “shifts” in heavy-duty fleet characteristics and the activity patterns, such as the increases in “last-mile” delivery truck operations.

EPA thanks Retail Industry Leaders Association (RILA) for their comments on the underlying assumptions in the MOVES model. As described in the MOVES_CTI_NPRM documentation, we used AEO 2018 primarily to project future vehicle population for the conventional vehicles with internal combustion engines.. Since the standards in the proposed rule, as well as the final rule, are not based on the projected utilization of zero-emission vehicles (ZEVs), such as battery-electric/fuel cell-electric vehicles, we assumed no electric vehicles in the heavy-duty fleet for both the baseline and control scenarios of the inventory analysis. Natural-gas-powered vehicles are included as part of the MOVES national default heavy-duty vehicle fleet.

EPA agrees with RILA’s comment related to the importance of properly accounting for the “shifts” in heavy-duty fleet characteristics and the activity patterns. For the final rule analysis[45], EPA used an updated version of the MOVES model (“MOVES3”) which takes into account more recent information on the heavy-duty vehicle fleet characteristics and activities (such as FHWA Highway Statistics Series 1990-2017, AEO 2019 and other supplementary data sources). MOVES3 also includes updated fuel type and regulatory class distributions for each MOVES sourcetype based on IHS2014 data.

19.2 Comments presenting emissions inventory analyses

[45] For details, refer to Chapter 5 of the Regulatory Impact Analysis (RIA) document of the final rule.

Organization: *Elders Climate Action*

The two scenarios tested are the emission reductions achieved by applying the proposed NOx standards for HDVs in Option 1 to OOS trucks operating in the AQMDs, and a scenario that reduces emissions from those trucks to zero based on a zero emission standard. [EPA-HQ-OAR-2019-0055-1218-A1, p. 13]

Figures 1 and 2 show the portion of the SIP inventory that would benefit from the proposed federal rule for both the South Coast and San Joaquin Valley air basins. Although the state will be able to reduce NOx emissions from light and medium duty trucks, heavy duty truck emissions in both severe nonattainment areas will eventually plateau by 2024. [EPA-HQ-OAR-2019-0055-1218-A1, p. 14]

In calculating baseline emissions benefits, the EMFAC 2021 model was used to identify emission factors for California vehicles in state and subject to the California Heavy Duty omnibus rule and other CA regulations. The emission factors for model years 2027+ were used to develop the emission profile. A baseline modeling run for 2035 was conducted for Class 8 trucks assuming current California regulations were in place for heavy duty trucks and no new federal NOx regulations were promulgated. The baseline inventory also includes the ZEV requirements associated with CARB's Advanced Clean Truck Rule. [EPA-HQ-OAR-2019-0055-1218-A1, p. 15]

In developing the adjusted baseline that incorporates the emissions reductions associated with the federal Heavy Duty Vehicle Low NOx Rule, it was assumed that any vehicle meeting the federal NOx standard would have an emissions profile similar to a California vehicle meeting the California Omnibus Standard in that year. Class 8 vehicles are a combination of in-state and out-of-state purchased vehicles. Out-of-state vehicles are identified by EMFAC Categories T7 NNOOS Class, T7 NOOS Class and T7 CAIRP Class 8 in the EMFAC model. It was assumed that all NNOOS and NOOS are purchased out of state and that In-State Tractors, Port and CAIRP vehicles include both in-state purchased vehicles and out-of-state vehicles which vary by the age of the fleet in the first column of Table 1 below. [EPA-HQ-OAR-2019-0055-1218-A1, p. 15]

To calculate the adjusted baseline, these "California-specific" low NOx emission factors were then substituted back into the EMFAC emission inventory for out-of-state Class 8 trucks in model years 2027 to 2036. [EPA-HQ-OAR-2019-0055-1218-A1, p. 15]

As shown in Table 2, the baseline NOx inventory for the South Coast and San Joaquin Air Basins is predicted to 32.2 and 29.6 tons per day, respectively. The Adjusted Baseline Scenario that adds the promulgation of the federal Heavy Duty Vehicle Low NOx Rule would reduce daily NOx emissions from Class 8 Long Haul OOS vehicles in the South Coast and San Joaquin Air Basins to 21.7 and 19.3 tons, respectively. The accelerated implementation of 2027+ ZEV would further reduce both NOx inventories to 13.4 and 10.8 tons per day, respectively. [EPA-HQ-OAR-2019-0055-1218-A1, p. 16]

In addition to analyzing the impact of an accelerated Federal ZEV requirement in 2027 (that would apply to both CA and OOS trucks), the emissions that would be avoided from these 3 model years were also evaluated by isolating a portion of the inventory for the NOx and CO2 emissions from trucks from only these 3 model years. The CO2 emissions were extrapolated to 2050 assuming that these trucks would remain in service 20 years or until 2050. [EPA-HQ-OAR-2019-0055-1218-A1, p. 16]

EPA Summary and Response

Elders Climate Action estimated the impact of the EPA's proposed rule on the NOx emissions from out-of-state Class 8 heavy duty vehicles operating in the State of California using the EMFAC model. The analysis predicts a significant reduction in NOx inventory for the South Coast and San Joaquin Air Basins areas with the adoption of EPA's HD2027 standards for the out-of-state Class 8 fleet in California. Additional analysis showed that an accelerated federal ZEV requirement would result in further reductions of NOx inventories for the areas studied, as well as substantial reductions of CO_2 emissions.

EPA thanks Elders Climate Action (ECA) for the helpful analysis they provided on the impacts of the proposed rule on the out-of-state Class 8 vehicle fleet emissions in California. Their analysis indicates that the proposed Option 1 standards would produce substantial improvements in controlling mobile source emissions of the areas studied, which is consistent with the findings from EPA's analyses as documented in the draft RIA. See preamble Section III for discussion on the technology pathway we evaluated for complying with the final standards, and the ability for manufacturers to use other technology pathways to comply with the performance-based final standards (e.g., electrification, including plug-in hybrid electric vehicles, battery-electric or fuel cell electric vehicles).

19.3 Comments related to upstream or other non-tailpipe emissions

Organization: *Alliance for Vehicle Efficiency (AVE)*

AVE urges EPA to move beyond tailpipe only definitions for ZEVs and integrate lifecycle analysis for future standards. [EPA-HQ-OAR-2019-0055-1280-A1, p. 5]

Defining ZEVs only at the tailpipe distorts the environmental gains of vehicles with known upstream emissions. Relying on the current definition of ZEVs serves as a barrier to automotive technologies that can deliver significant real-world emission reductions. For example, hydrogen combustion engines can deliver significant emission reductions, and when compared to other vehicles on a lifecycle basis, can match the environmental impact of vehicles currently defined as ZEVs. [EPA-HQ-OAR-2019-0055-1280-A1, p. 5]

Continuing to focus solely on tailpipe emissions for future standards also ignores President Biden's January 25, 2021, Executive Order, in which he stressed the need for environmental standards to account for all greenhouse gas emissions. [EPA-HQ-OAR-2019-0055-1280-A1, p. 5]

“Sec. 5. Accounting for the Benefits of Reducing Climate Pollution. (a) It is essential that agencies capture the full costs of greenhouse gas emissions as accurately as possible, including by taking global damages into account. Doing so facilitates sound decision-making, recognizes the breadth of climate impacts, and supports the international leadership of the United States on climate issues.” 10 [EPA-HQ-OAR-2019-0055-1280-A1, p. 5]

> 10. 7040 Federal Register / Vol. 86, No. 14 / Monday, January 25, 2021 / Presidential Documents

Congress is also encouraging EPA to assess lifecycle emissions when setting future vehicle standards: [EPA-HQ-OAR-2019-0055-1280-A1, p. 5]

Vehicle Emissions Lifecycle Analysis. — The Committee believes it is essential that when setting future standards for reducing greenhouse gas emissions, the Agency fully evaluate emission impacts of vehicle technologies and transportation fuels (including electricity used as a fuel) from well to wheel, and the vehicle cycle through material recovery and vehicle disposal in order to capture the full impacts of greenhouse gas emissions as accurately as possible. The Committee encourages the Agency to develop standardized modeling to evaluate the full lifecycle of vehicle technologies and transportation fuels, as new standards to reduce pollutants are being developed, and to coordinate as necessary, with other federal agencies that are conducting similar models for vehicles in an effort to accurately determine the full impact of reducing greenhouse gas emissions when conducting cost-benefit analyses of regulatory and other actions. 11 (Emphasis added) [EPA-HQ-OAR-2019-0055-1280-A1, p. 5]

> 11. See, H. Rept. 117-83 – Dept. of the Interior, Environment, & Related Agencies Appropriations Bill, 2022 at P. 84.

Organization: *BorgWarner*

BorgWarner supports lifecycle analysis for all future vehicle regulations. We support the transition from a tailpipe-based standard (i.e., tank-to-wheel) to a more holistic assessment (e.g., well-to-wheel emissions, or more completely, full lifecycle emissions) as the proper metric for determining the environmental impact of the vehicle as a product. This approach is consistent with technology neutrality, global carbon neutrality goals, and a holistic environmental impact assessment. [EPA-HQ-OAR-2019-0055-1234-A1, p. 3]

Organization: *National Association of Small Trucking Companies (NASTC)*

Moreover, the reputed “clean” technologies this rulemaking apparently aims to advantage over diesel may well fall short. “In a study, the American Transportation Research Institute found the process of extracting the materials used in lithium-ion batteries for battery electric vehicles creates a significant amount of emissions. Lithium-ion battery production generates more than six times the carbon of diesel truck production, ATRI officials said in a press release.”1 [EPA-HQ-OAR-2019-0055-1130-A1, p. 4]

1. Heavy Duty Trucking Staff, “ATRI: Zero-Emissions Trucks Still Generate Significant Emissions,” Trucking Info, May 4, 2022. https://www.truckinginfo.com/10169798/atri-zeroemissions- trucks-still-generate-significant-emissions

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

As we have advocated in the past, it would also be beneficial to look at the entire lifecycle rather than just “tailpipe” emissions. As vehicles become significantly more fuel efficient, both upstream and downstream emissions become much more important when attempting to truly compare them. Significant infrastructure requirements would also come along with these rules, so if EPA were to try to match CARB there would need to be significant coordination with DOE in terms of planning for the national electric grid. [EPA-HQ-OAR-2019-0055-1322-A1, p. 8]

Organization: *State Soybean Associations*

Additionally, the proposal overemphasizes the benefits of EVs while overlooking their negative impacts. Specifically, EPA fails to adequately account for the lifecycle emissions associated with EVs, including the significant upstream emissions resulting from charging batteries. [EPA-HQ-OAR-2019-0055-2035-A1, p.3] [Also included in Section 28.5 of this document]

Organization: *Valero Energy Corporation*

Before allowing electric vehicles to generate any emission credits, EPA should consider upstream emissions of criteria pollutants in its analysis of costs and benefits associated with allowing BEVs, FCEVs, and HEVs to generate NOx emission credits as zero- or near-zero NOx generating technologies. [EPA-HQ-OAR-2019-0055-1328-A2, p.6]

EPA's eGRID2020 data show the NOx Output Emission Rate for the U.S. Average Grid as 0.509 lb/MWh (equal to 172 mg/hp-hr),8 while EPA is considering 35 mg/hp-hr or 50 mg/hp-hr as the baseline against which credits would be given for BEVs. EPA should consider the NOx emissions associated with stationary source emissions at the power plant, and should take into consideration the losses that occur during electricity transmission and charging. [EPA-HQ-OAR-2019-0055-1328-A2, p.6]

8 https://www.epa.gov/egrid, accessed March 8, 2022

Further, because these emissions will result in localized increases at power plants, these potential adverse impacts must be considered in EPA's environmental justice analysis. EPA only accounted for reduced highway emissions; it did not account for increased emissions of all pollutants from the power plants in the communities where the power is generated. [EPA-HQ-OAR-2019-0055-1328-A2, p.6]

In the final LD GHG standards, in response to comments, EPA said that upstream emissions would be accounted for in standards for MY 2027 and later. EPA should be consistent and account for upstream emissions for criteria pollutants and GHG emissions in these standards for MY 2027 and later HD vehicles and engines. [EPA-HQ-OAR-2019-0055-1328-A2, p.7]

EPA Summary and Response

Several commenters stated that the EPA should account for the lifecycle emissions associated with heavy-duty vehicles, particularly heavy-duty electric vehicles, when conducting analyses for the final rule. Many commenters urged EPA to evaluate upstream emissions from charging or refueling heavy-duty zero emissions vehicles (ZEVs); one commenter pointed to Executive Order 13990 as, in the commenter's view, supportive of evaluating upstream emissions from ZEVs. Some commenters further stated that EPA should conduct life cycle analysis (LCA) to fully understand the emissions and potential exposures from actions related to generating electricity and mining battery materials. One commenter also urged EPA to move beyond tailpipe only definitions for ZEVs and integrate lifecycle analysis for future standards; the commenter pointed to language in a report accompanying a 2022 Appropriations Bill as an indication that Congress supports the use of LCA when setting GHG standards. A subset of these commenters focused on the GHG emissions impacts that occur across the vehicle lifecycle. For instance, one commenter stated that producing lithium-ion batteries creates emissions and those emissions are greater than the emissions from producing diesel vehicles.

Other commenters argued that EPA should consider emissions of criteria pollutants that occur upstream of the vehicle (e.g., from power plants providing electricity to ZEVs) when conducting an analysis of costs and benefits, and that the analysis should be conducted before allowing HEVs and ZEVs to generate NO_X emissions credits. Commenters cited data from an EPA database on NO_X emissions rates from power plants across the U.S., as well as a press release announcing an ARTI study on the carbon emissions impacts of mining lithium for batteries.

EPA acknowledges commenters' suggestions to evaluate upstream emissions or otherwise conduct lifecycle analysis for the final rule. As an initial matter, the cost and benefit analyses we conduct evaluate the impacts of the final standards and requirements in a rulemaking. This final rule does not require the production or use of ZEVs, and the final standards are not premised upon increased ZEV penetration. As such, lifecycle analysis for GHGs and ZEVs is outside the scope of this final rule and of the cost and/or benefit-cost analysis of this final rule. We explain this further in the two points below:

1. As discussed in preamble Section I and Section 28 of this Response to Comments document, EPA is not taking final action at this time as part of this final rule on any changes to the HD GHG Phase 2 regulations. It appears that many of the comments regarding upstream emissions were in response to that aspect of the proposal. Since EPA is not finalizing that aspect of the proposal in this action, any comments regarding that aspect of the proposal are accordingly beyond the scope of this final rule.

2. The final standards in this rule are not based on the projected utilization of ZEV technology, though manufacturers may choose to comply with the standards by using ZEV technology. Moreover, while we believe there will be increased penetration of ZEVs in the HD fleet by MY2027 and later,[46] we are also not including in the final rule an allowance for

[46] For example, the recently passed Inflation Reduction Act (IRA) has many incentives for promoting zero-emission vehicles, see Sections 13403 (Qualified Clean Vehicles), 13404 (Alternative Fuel Refueling Property Credit), 60101

manufacturers to generate NO_X emissions credits from ZEVs under ABT, see preamble Section IV.G for details. That is, any actual increased ZEV adoption will not reduce the environmental benefits associated with this rule.

More generally, EPA also disagrees that it is required to perform a lifecycle analysis of vehicle and fuel production before setting engine and vehicle emission standards, or to treat emissions of air pollutants attributable to electricity generation, or the mining, production or disposal of batteries for electric vehicles, as emissions “from” new motor vehicles under CAA section 202(a). The Clean Air Act’s entire structure evidences a clear divide between stationary sources (regulated under other sections of the Act, especially Title I) and mobile sources (regulated under Title II). There may be indirect impacts of stationary source regulation on mobile sources and vice versa, and it may be appropriate to consider those impacts in some circumstances. But it would be inappropriate and contrary to the plain text of the Clean Air Act to conflate the consideration of indirect impacts, when appropriate, with actually treating stationary source emissions as mobile source emissions. Cf. Coal. for Responsible Regul., Inc. v. E.P.A., 684 F.3d 102, 128–29 (D.C. Cir. 2012), aff'd in part, rev'd in part sub nom. Util. Air Regul. Grp. v. E.P.A., 573 U.S. 302 (2014), and amended sub nom. Coal. for Responsible Regul., Inc. v. Env't Prot. Agency, 606 F. App'x 6 (D.C. Cir. 2015) (“EPA was not arbitrary and capricious by not considering stationary-source costs in its analyses”). EPA interprets the Clean Air Act as generally directing EPA to consider regulation of emissions for each sector according to the applicable statutory requirements for each program. While EPA may also elect to consider upstream emissions in certain appropriate circumstances, such consideration is not required by statute. Nor is such consideration appropriate here, for the reasons stated further above.

EPA also disagrees with commenters that we should consider upstream emissions of criteria pollutants from HEVs as part of our analysis of costs and benefits before allowing HEVs to generate NOx emission credits.[47] We are not projecting an increase in PHEVs in response to the final standards and the final standards are not based on projected utilization of PHEV technology; thus, the same number of PHEVs are included in our baseline and control scenarios. The lack of a delta between baseline and control scenarios precludes including PHEVs in our analysis of costs or benefits in the final rule (see preamble Section III for additional discussion on the basis of the final standards). We note that we are not assuming a zero-emissions tailpipe performance of HEVs in the final rule; as discussed in preamble Section III, manufacturers must declare their family emissions limit (FEL) for HEVs based on testing both the charge depleting and charge sustaining operations (see preamble Section III.B.2 for details on testing hybrid powertrains). As such, the final rule only allows manufacturers to generate NO_X emissions credits from HEVs that are reflective of their tailpipe NO_X emissions performance.

(Clean Heavy-Duty Vehicles), 60102 (Grants to Reduce Air Pollution at Ports), and 70002 (United States Postal Service Clean Fleets) of H. R. 5376.

[47] Note that the term hybrid electric vehicles (HEVs) refers to vehicles that are propelled by both an on-board engine using a consumable fuel (e.g., diesel internal combustion engine, hydrogen fuel cell) and an energy storage device (e.g., battery, capacitor). For a subset of HEVs, the energy storage device can be recharged by either the on-board engine or by plugging a charging cable into an external electrical source (i.e., plug-in hybrid electric vehicles, PHEVs). Since the commenter focuses on upstream emissions from HEVs (i.e., emissions that would occur from plugging in a PHEV), we focus on PHEVs in this response.

20 Air quality impacts

20.1 Modeling of Inventory and Air Quality Contribution

Comments by Organizations

Organization: *Lake Michigan Air Directors Consortium (LADCO)*

U.S. EPA's March 28, 2022 proposed rule to reduce pollution from highway diesel vehicles targets a source of pollution that recent work by my organization identifies as a significant contributor to ground level ozone in the Great Lakes region. The Lake Michigan Air Directors Consortium (LADCO) conducted air quality modeling of the year 2016 that used emissions tracers to quantify the contributions of different air pollution sources to ground level ozone at receptors in the eastern United States1. [EPA-HQ-OAR-2019-0055-1034-A1, p. 2]

> 1. LADCO 2016 Base and Future Year Modeling Protocol. Available for download at: https://www.ladco.org/wp-content/uploads/Modeling/2016/CAMx/LADCO_2016-Platform_Air-Quality-Modeling-Protocol_06May2021.pdf

The figures on the next page summarize the emissions tracer results of the LADCO 2016 air quality modeling. Figure 1 shows that the model attributed approximately 10% of the surface ozone at key monitors in the eastern half of the U.S. to roadway diesel emissions sources (or_diesel). Similarly, Figure 2 illustrates that the model indicates that roadway diesel emissions contribute 9% of the ozone concentrations on average across all surface ozone monitors in U.S. EPA Region 5. [EPA-HQ-OAR-2019-0055-1034-A1, p. 2]

LADCO's modeling shows that relative to other source types, emissions from roadway mobile sources are the largest contributors to surface ozone in the Great Lakes region. Regulatory actions that result in emissions reductions from roadway mobile sources will impact a major source of ozone precursor emissions in this region. [EPA-HQ-OAR-2019-0055-1034-A1, p. 2]

Organization: *Manufacturers of Emission Controls Association (MECA)*

MECA recently co-funded an emission inventory and air quality modeling analysis based on the emission limit values and durability requirements proposed by CARB to quantify the air quality benefits if a national standard were set by U.S. EPA under the Clean Trucks Rule to align with the CARB proposed limits and implementation dates [1] [2]. The analysis did not incorporate the compliance program changes or warranty revisions into our model assumptions. [EPA-HQ-OAR-2019-0055-1320-A1, p.2]

[1] MECA, 'MOVES Inventory Modeling of a Potential Cleaner Trucks Initiative Scenario,' 2020. Online at https://www.meca.org/wp-content/uploads/2022/01/CTI-MOVESInventoryModelingProjectSummary-0122Finalrev.pdf.

[2] Alpine Geophysics, 'Air Quality Model Analysis of a Potential Cleaner Trucks Initiative Scenario,' 2020.

The foundation of the evaluation was the current U.S. EPA inventory projection for 2028. The 2028 inventory projection is that of the 2016v1 emissions modeling platform. It is a product from the agency's National Emissions Inventory Collaborative and includes a full suite of the base year (2016) and the projection year (2023 & 2028). This part of the analysis is referred to as the '2028 Base Case' inventory in this study and corresponds closely with a 2027 implementation date for the Clean Trucks Rule. From that inventory foundation, two new inventory scenarios were developed as follows.

- The '2035 Base Case' inventory was developed to include an on-road fleet projection to 2035 with no change in the underlying regulatory context.
- The '2035 Control Case' inventory was developed to include both the 2035 fleet projection and the impacts of adoption of federal FTP standards for heavy-duty trucks of 0.05 g/bhp-hr beginning with MY 2024 and 0.02 g/bhp-hr beginning with MY 2027, as proposed by CARB, on on-road vehicle emissions. [EPA-HQ-OAR-2019-0055-1320-A1, p.3]

The 2035 on-road fleet projection estimated hours, VMT and vehicle populations at the county, roadway type, fuel type and vehicle class level. The resources used to create the fleet projection were U.S. EPA's 2023 and 2028 activity projections (used to capture trends at the desired resolution by county, roadway type, fuel type and vehicle class level) and the current version of the Energy Information Administration (EIA) Annual Energy Outlook 2019 (used for national-level vehicle and VMT projections on which the trends were renormalized to match the national growth rate estimated by the EIA). The fleet-turnover impacts included in the 2035 inventories – both with and without the impacts of the Clean Trucks Regulation – were modeled with U.S. EPA's MOVES2014b model (MOVES2014b-20181203, which includes the December 2018 technical update). Fleet-turnover effects were modeled relative to the 2028 Base Case with MOVES at the national scale. Inputs into this modeling included U.S. EPA's 2028 age distribution data aggregated to the national level – assumed unchanged for 2035 – and emission factor updates to include the impacts of the Clean Trucks Rule. [EPA-HQ-OAR-2019-0055-1320-A1. p.3]

Results from the inventory analysis show that the new modeled FTP limits would result in a nationwide reduction of 330,000 tons per year of NOx in 2035. On a state-by-state level, the NOx inventory reductions from the heavy-duty fleet are about 60-70% below the 2028 base case. When taking a more refined look at the location of the NOx benefits at the county level, those counties currently in nonattainment or maintenance with the 2015 ozone NAAQS will receive some of the highest NOx reductions (e.g. > 145 tons NOx in 2035) from a 0.02 g/bhp-hr heavy-duty engine FTP standard. In addition to the modeled NOx reductions, our preliminary analysis suggests reductions of 2,300 tons of VOCs and 83,000 tons of carbon monoxide in 2035. Both NOx and VOC contribute to ozone formation. [EPA-HQ-OAR-2019-0055-1320-A1, p.3]

The modelled 2028 base year 8-hour ozone design values were found to be above the 70 ppb NAAQS for 75 monitoring locations. Applying the California Omnibus standards to the 2028 base year eliminates ozone nonattainment everywhere east of the Rockies, while several monitoring sites (mostly in California) are projected to have reduced ozone levels that yet remain in nonattainment. The greatest ozone reduction impact of the strategy is seen in urban areas and along highway corridors with reductions of up to 6.5 ppb seen in the west (San Bernardino) and 4.9 ppb seen in the east (Atlanta). It is important to note that even though the 2015 ozone NAAQS was finalized at 70 ppb, EPA's Clean Air Scientific Advisory Committee (CASAC) in 2015 supported a range of 60-70 ppb for the 8-hour primary ozone standard. Without a federal HD low NOx regulation, nearly 300 monitoring sites are projected to have 8-hour ozone design values between 60 and 70 ppb, and standards consistent with Proposed Option 1 will reduce these by an average of 2.35 ppb and up to a max of 5 ppb. [EPA-HQ-OAR-2019-0055-1320-A1, pp.3-4]

Organization: *Midwest Ozone Group (MOG)*

In these comments MOG will not only offer its support for the CTI and relative contribution findings generated by others, but also offer the results of air quality modeling data performed for MOG by Alpine Geophysics that assess the contribution that mobile sources make to ozone concentration at various monitors in the East. This data confirms the significant role that mobile sources play in determining the quality of our air and the importance of the rule that EPA has proposed and is consistent with the findings of EPA published with this proposed rule. [EPA-HQ-OAR-2019-0055-1272-A1, p.2]

The air quality analysis prepared by Alpine Geophysics offers ozone source apportionment data relative contribution calculations for the various source sectors from multiple upwind states to downwind receptors5 which continues to demonstrate that local source emissions from mobile categories have the greatest relative contribution to projected ozone concentrations in the domain. [EPA-HQ-OAR-2019-0055-1272-A1, p.3]

5
http://www.midwestozonegroup.com/files/Ozone_Modeling_Results_Supporting_GN_SIP_Obligations_Final_Dec_2017_.pdf

Figure 1 provides recent ozone source apportionment results for the Queens County, New York monitor (360810124) in the 2023 projection year. The figure shows geographic, source category-based relative contribution to the 2023 ozone design value predicted at the monitor. In the figure, the height of each bar represents the relative contribution to other geographic (state or region) sources of category-based emissions (individual colors within each bar). Of importance in this figure, the bars for New York and adjacent state New Jersey dominate the list of anthropogenic emission contributions and within that bar, the blue (onroad mobile) and orange (nonroad mobile + area + marine/rail/air) are of greatest relative modeled contribution. [EPA-HQ-OAR-2019-0055-1272-A1, p.3]

When we look at the aggregate of all categories, regardless of geography (Figure 2), we also see that motor vehicles (15%) and nonroad mobile + area + marine/rail/air (33%) dominate the relative contribution to projected ozone concentrations. [EPA-HQ-OAR-2019-0055-1272-A1, pp.3-4]

Similar results are seen in Figure 3 at the coastal Connecticut site at Fairfield (090010017) with emissions from New York, New Jersey, and Connecticut dominating the geographic contributions. Again, like the Queens County, New York monitor, emissions from the blue (onroad mobile) and orange (nonroad mobile + area + marine/rail/air) combine for over 56% of the modeled ozone concentrations. This is also seen in Figure 4 when geography is removed from the equation. [EPA-HQ-OAR-2019-0055-1272-A1, p.4]

This pattern is also seen across most of the eastern U.S. and as seen in Figure 5, motor vehicle emissions (red piece of each pie) are a significant percentage of relative contribution to 2023 ozone concentration predictions from U.S. anthropogenic sources at most monitors. [EPA-HQ-OAR-2019-0055-1272-A1, p.5]

Through the sponsorship of MECA, Oak Leaf Environmental Inc. (Oak Leaf) completed a 48-state emissions impact analysis of a possible CTI scenario that would result from EPA aligning their final CTI rule to the 90% NOx emission reduction levels as proposed by the California Air Resources Board (CARB) and implemented and phased-in through fleet turnover assumed in MOVES through 2035. This Oak Leaf technical support document is attached to these comments and identified as Exhibit A. The report is also available on the MOG web site.6 The basis for the CTI scenario was the most recent information – available at project commencement – from CARB (September 26, 2019 workshop proposal) with the understanding that EPA and CARB are working on a nationally uniform regulatory framework. [EPA-HQ-OAR-2019-0055-1272-A1, pp.6-7]

6 Modeling Inventory of Potential Heavy-Duty Cleaner Trucks Initiative Scenario Final Report, Prepared By: Jeremy G. Heiken Oak Leaf Environmental, Inc, June 2020 (http://www.midwestozonegroup.com/files/OakLeaf_Report_June_2020.pdf); Appendix A - National & State CTI Scenario Summary (http://www.midwestozonegroup.com/files/Appendix_A_-_National_State_CTI_Scenario_Summary.xlsx); Appendix B - National & State Activity Summary (http://www.midwestozonegroup.com/files/Appendix_B_-_National_State_Activity_Summary.xlsx).

The foundation of the evaluation was the EPA inventory projection for 2028fh7. The ‘2035 Base Case’ inventory was developed to include an on-road fleet projection to 2035 with no change in the underlying regulatory context. The ‘2035 Control Case’ inventory was developed to include both the 2035 fleet projection and the impacts of the proposed CTI on onroad vehicle emissions. Accordingly, the emissions impacts of the CTI are defined by the difference between the 2035 Control Case and 2035 Base Case inventories. [EPA-HQ-OAR-2019-0055-1272-A1, p.7]

7 https://www.epa.gov/air-emissions-modeling/2016v1-platform

This is a consistent methodology for the development of the modeling platform compared to EPA’s proposal in that both analyses maintain the 2028fh projection for non-mobile categories and updating projections for mobile sources. EPA’s modeling for this proposed rule uses a 2045 projection for mobile sources, whereas Oak Leaf has projected to 2035. The Oak Leaf product also differs from the EPA proposal in that Oak Leaf’s estimates assume NOx standards begin in

MY 2024 compared to EPA's action that sets NOx standards beginning in MY 2027. [EPA-HQ-OAR-2019-0055-1272-A1, p.7]

The modeled year of 2035 was chosen to allow as much phase-in of low NOx trucks meeting the future modeled CTI emission limits while still providing adequate confidence from the air quality perspective. Given that the new truck regulations begin implementation in 2024 and heavy-duty trucks last 20-30 years on the road, the 2035 timeframe represents an intermediate level of CTI truck penetration. It is expected that further NOx reductions will be realized beyond the 2035 modeled year as the heavy-duty truck fleet continues to turn over to the cleanest technology vehicles. [EPA-HQ-OAR-2019-0055-1272-A1, p.7]

Figure 6 presents the relative, annual NOx benefit of the potential CTI scenario in 2035 at a county-level resolution. The percent benefit is estimated as a reduction in the total on-road NOx inventory (both light and heavy-duty vehicles). The range in benefit, by county, is between 4 and 60 percent. [EPA-HQ-OAR-2019-0055-1272-A1, p.7]

Working with this 2035 scenario, Alpine Geophysics, LLC (Alpine) through the sponsorship of MOG, merged the onroad emissions data with a 2028 'base case' modeling simulation already completed The Technical Support Document related to Alpine's 2028 'base case' is attached and identified as Exhibit B and is available on the MOG web site.8 [EPA-HQ-OAR-2019-0055-1272-A1, p.8]

8 Air Quality Modeling Technical Support Document for 12km Modeling of EPA 2028fh Base Case Technical Support Document Prepared by: Alpine Geophysics, LLC, May 2020 (http://www.midwestozonegroup.com/files/Alpine_Geophysics_-_CTI_Scenario_Modeling_TSD_-_June_2020.pdf)

Alpine then ran photochemical grid modeling (PGM) with the Comprehensive Air Quality Model with Extensions (CAMx) model to generate future CTI scenario concentrations of ozone and PM2.5. This modeling of the CTI scenario is described in a Technical Support Document that is attached to these comments and identified as Exhibit C and is available on the MOG web site.9 [EPA-HQ-OAR-2019-0055-1272-A1, p.8]

9 Cleaner Trucks Initiative Scenario Modeling Using EPA 2028fh Modeling Platform Technical Support Document Prepared by: Alpine Geophysics, LLC, June 2020 (http://www.midwestozonegroup.com/files/Alpine_Geophysics_-_CTI_Scenario_Modeling_TSD_-_June_2020.pdf)

Together, this work assesses how the change in mobile source emissions between the 2028 base case and the CTI scenario would change the ozone and PM2.5 ambient air quality projections at receptors in the continental United States. [EPA-HQ-OAR-2019-0055-1272-A1, p.8]

As illustrated in Figure 7, the modeled 2028 base year 8-hour ozone design values were found to be above the 70 ppb NAAQS in the states of California, Utah, Colorado, Texas and Connecticut. [EPA-HQ-OAR-2019-0055-1272-A1, pp.8-9]

As shown in Figure 8, applying the 90% NOx emission reduction CTI scenario to the 2028 base year eliminates ozone nonattainment everywhere east of the Rockies and in Denver and leaves only the states of California and Utah with 70 ppb 2015 ozone NAAQS nonattainment areas. Multiple monitors in California and in Salt Lake County, Utah also show modeled attainment with the CTI strategy. [EPA-HQ-OAR-2019-0055-1272-A1, p.9]

As shown in Figure 9, the greatest ozone impact of the strategy is seen in urban areas and along highway corridors with reductions of up to 6.5 ppb seen in the west (San Bernardino) and 4.9 ppb seen in the east (Atlanta). [EPA-HQ-OAR-2019-0055-1272-A1, p.9]

The CTI strategy impacts on the annual PM2.5 design value nationwide are shown in Figure 9 with modeled attainment changes occurring at monitors in Madera, San Joaquin, and Stanislaus counties in California. The greatest annual PM2.5 impacts are reductions of 0.64 μg/m3 (4.1%) seen in the west (Kern County, CA) and 0.21 μg/m3 (2.3%) reduction in the east (Chicago). [EPA-HQ-OAR-2019-0055-1272-A1, p.10]

From a daily (24-hour) PM2.5 perspective, Figure 11 shows daily PM2.5 design values nationwide. As with the annual PM2.5 modeling, areas shown to move to modeled attainment as a result of the CTI strategy include Madera, Merced, and San Joaquin counties in California. The greatest daily PM2.5 impacts are reductions of 4.5 μg/m3 (9.8%) seen in the west (Tulare County, CA) and 0.9 μg/m3 (4.5%) reduction in the east (Chicago). [EPA-HQ-OAR-2019-0055-1272-A1, p.10]

This modeling is consistent with EPA's proposed rule modeling10 of 2045 with the Community Multiscale Air Quality (CMAQ) model in both geography and magnitude for ozone and PM concentrations with the implementation of the control program. [EPA-HQ-OAR-2019-0055-1272-A1, p.11]

10 Air Quality Modeling for the HD 2027 Proposal, Draft Technical Support Document (TSD), EPA-420-D-22-002, February 2022 (https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P101481P.pdf)

The modeling data provided in these comments illustrates the need for measurable improvements to environmental conditions in communities that are heavily impacted by dense traffic. Ambient improvements to PM, PM2.5, and ozone represented by this proposed rule will serve to facilitate the development of implementation outcomes of local environmental benefits attributable to controls on mobile sources like heavy duty trucks. EPA's burden is to effectively implement this rule per Executive Order 12898, 'Federal agencies must identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations.' [EPA-HQ-OAR-2019-0055-1272-A1, p.11]

Given the technical availability and cost effectiveness of achieving a 90% reduction of NOx emissions from heavy duty trucks by 2035 as established by MECA and by 2045 as demonstrated by EPA and given the remarkable improvement in air quality as demonstrated by the Alpine and EPA modeling, MOG urges that EPA finalize a rule calling for a 90% reduction in NOx emissions from heavy duty trucks. [EPA-HQ-OAR-2019-0055-1272-A1, p.11]

Organization: *Ozone Transport Commission (OTC) and Mid-Atlantic/Northeast Visibility Union (MANE-VU)*

To address the region's persistent air quality problems, reducing NOx from heavy-duty truck engines is of the utmost importance due to its role in local and regional ground-level ozone formation, as well as its contributions to PM2.5 and to winter-time visibility impairment at Class 1 areas. The year-round benefits of measures that reduce heavy-duty vehicle NOx emissions are substantial. [EPA-HQ-OAR-2019-0055-1250-A1, p.4]

An OTC analysis, shown in Figure 2, illustrates that onroad diesel vehicles, including heavy-duty vehicles (HDVs), are projected to be the third largest NOx emissions source in the OTR in 2023.8 Emissions from highway trucks are estimated to comprise 20 percent of the region's total NOx emissions. [EPA-HQ-OAR-2019-0055-1250-A1, pp.4-5]

> 8 National Emissions Inventory Collaborative (2019). 2016v1 Emissions Modeling Platform. Retrieved from http://views.cira.colostate.edu/wiki/wiki/10202.

To estimate the impact of onroad diesel emissions – the lion's share of which is emitted by HDVs – the OTC modeled the contribution (ppb) of onroad diesel to 8-hour maximum ozone concentrations at monitors in the OTR.10 An example is provided in Figure 3, which shows the modeled contribution to total ozone from onroad diesel vehicles at each monitor in the OTR for which future-year 2023 photochemical modeling predicts continued nonattainment or maintenance challenges. [EPA-HQ-OAR-2019-0055-1250-A1, p.5]

> 10 OTC, 'Ozone Transport Commission/Mid Atlantic Northeastern Visibility Union 2011 Based Modeling Platform Support Document – October 2018 Update,' 2nd Version, October 18, 2018. Available at https://otcair.org/upload/Documents/Reports/OTC%20MANE-VU%202011%20Based%20Modeling%20Platform%20Support%20Document%20October%202018%20-%20Final.pdf. The modeling evaluated the 8-hour maximum ozone on the 4th highest day, which is the metric EPA uses to evaluate compliance with the ozone NAAQS.

Table 3 lists the percent contribution to total ozone from onroad diesel emissions at additional monitors in the OTR. Onroad diesel emissions are projected to contribute up to 10 ppb to total ozone and the projected contribution makes up between 10 and 17 percent of controllable ozone contributions on these days. Table 3 also shows the onroad diesel category's ranking in terms of the top emissions sectors that contribute total ozone at these monitors. Onroad diesel emissions are consistently projected to be the second, third, or fourth largest contributing sector to ozone, typically only behind area/nonpoint, onroad gasoline vehicles, and in some cases, electric generating units. [EPA-HQ-OAR-2019-0055-1250-A1, p.6]

The OTR had been making progress for over a decade at addressing its regional ozone problem, with ozone levels trending downward due to the adoption of measures that reduce emissions of ozone precursors. In recent years, however, air quality monitoring data no longer show a declining trend. Figure 5 shows the number of days in Connecticut where maximum 8-hour ozone was measured above the 2008 and 2015 ozone NAAQS for each year from 1976 to 2018. After significant improvements in the earlier years, the number of high ozone days in Connecticut has remained level or has slightly increased since 2011. Similar patterns have been recorded in other OTC states, as can be seen in Figure 6. [EPA-HQ-OAR-2019-0055-1250-A1, p.9]

Figure 5 also includes an extensive list of requirements that have been adopted in Connecticut and other OTC states to reduce emission of the ozone precursors from stationary sources, area sources, fuels, mobile sources, and consumer products. Imposing further control requirements on many of these source categories would be more costly than controlling heavy-duty engine emissions and would create disproportionate economic burden for those sources. The OTC estimated that the cost of additional NOx controls for industrial, commercial, and institutional boilers (100 million British Thermal Units per hour in size) ranges from $2,700 to $21,000 per ton of NOx reduced, as compared to a cost range of $1,000 to $5,000 per ton of NOx reduced from HDVs.18,19 [EPA-HQ-OAR-2019-0055-1250-A1, p.10]

> 18 OTC/Lake Michigan Air Directors Consortium (LADCO), ‘Evaluation of Control Options for Industrial, Commercial and Institutional (ICI) Boilers,’ May 2010.
>
> 19 Manufacturers of Emission Controls Association, ‘Technology Feasibility for Heavy-Duty Diesel Trucks in Achieving 90% Lower NOx Standards in 2027,’ February, 2020. Available at https://www.meca.org/wp-content/uploads/resources/MECA_2027_Low_NOx_White_Paper_FINAL.pdf. Accessed May 4, 2022.

As noted previously, the New York-Northern New Jersey-Long Island ozone nonattainment area consistently fails to meet its attainment deadlines for the 2008 8-hour ozone NAAQS (0.075 ppm), and EPA has now proposed to re-classify this area to severe nonattainment status for the NAAQS. [EPA-HQ-OAR-2019-0055-1250-A1, p.10]

Not only have ozone design value improvements stalled, the region has experienced unusually high peak ozone concentrations in recent years. In July of 2018, the New York City metropolitan region saw a 1-hour ozone average of 143 ppb, a peak level not seen in this area in more than 10 years. [EPA-HQ-OAR-2019-0055-1250-A1, p.10]

The satellite imagery in Figure 7 readily shows visible nitrogen dioxide (NO2) pollution (a major component of NOx) along the Northeast Corridor, with the highest concentrations of NO2 in the New York City area. The figure shows the NO2 vertical column concentration measured during daily overpasses by the TROPOMI satellite for weekdays (Monday-Friday) during May through September in 2018. Much of the NO2 pollution is near the surface close to its emission sources. High density ground level NOx emissions in large urban areas not only react to create low elevation ozone, but also mix upward into higher altitudes, which is shown in the NO2 vertical column measurements. Power plants in some locations enhance the vertical column measurements as many of them inject their emissions into higher altitudes. As a result, low-level emissions such as those from HDVs are an important component to local ozone production while power plant emissions have a greater relative tendency to contribute to downwind ozone production. [EPA-HQ-OAR-2019-0055-1250-A1, pp.10-11]

Figure 8 shows satellite imagery of NO2 concentrations during the winter in the Northeast and Mid-Atlantic on February 18, 2019, a day with particularly severe haze. NO2 concentrations are abundant and dominant along the I-91/95 corridor from Virginia to Massachusetts, suggesting a strong mobile source NOx contribution. These are major arteries where goods are being transported by truck from the ports of Baltimore, Philadelphia, and New York. Note how clearly defined the area of red is along I-91 in central Connecticut and Massachusetts. In addition to region-wide stagnation on this particular day, the strength of the NO2 signal also reflects the longer NO2 lifetime in winter. [EPA-HQ-OAR-2019-0055-1250-A1, p.11]

Because of its role in secondary particulate formation, reducing HDV NOx emissions will improve visibility in MANE-VU federal Class I areas. There are seven federal Class I areas in the region that have historically faced some of the worst visibility in the nation. Analyses of monitoring data from the Interagency Monitoring of Protected Visual Environment (IMPROVE) network show the increasing importance of nitrate formation on visibility impairment, in particular at the Brigantine Wilderness Area in the Edwin B. Forsythe National Wildlife Refuge in New Jersey.20 In addition, as was shown in Figure 2, HDVs are the third largest source of NOx emissions in the region. Because of this, the MANE-VU states, through the MANE-VU Regional Planning Organization process, requested that EPA implement a program to reduce NOx emissions from HDVs.21 [EPA-HQ-OAR-2019-0055-1250-A1, p.12]

20 Mid-Atlantic/Northeast Visibility Union. ‘Mid-Atlantic/Northeast U.S. Visibility Data 2004-2017 (2nd RH SIP Metrics),’ December 18, 2018. Available at https://otcair.org/MANEVU/Upload/Publication/Reports/MANE-VU_Trends_2004-2017_Report_Plots_2nd_SIP_11112018.zip.

21 Mid-Atlantic/Northeast Visibility Union. ‘Statement of the MANE-VU States Concerning a Course of Action by the Environmental Protection Agency and Federal Land Managers toward Assuring Reasonable Progress for the Second Regional Haze Implementation Period (2018-2028),’ August 25, 2017. Available at https://otcair.org/MANEVU/Upload/Publication/Formal%20Actions/MANE-VU%20FLM%20Final%20Ask%208-25-2017.pdf.

EPA Summary and Response

Summary:

The commenters support the NOx reductions proposed in the rule and provided results of inventory and air quality modeling analyses that assess the contribution that mobile sources make to ozone and $PM_{2.5}$ concentrations and the impact of the proposal on air quality. Further detail on the assumptions and inputs used in these analyses is included within the comments and references to the comments. There are some differences from EPA’s analysis but overall, the different analyses all indicate that mobile sources are an important contributor to ozone and $PM_{2.5}$ concentrations, and those that represented a hypothetical HD control program are consistent with EPA's air quality modeling analysis.

Lake Michigan Air Directors Consortium (LADCO) commented on their modeling analysis showing that the emissions from roadway mobile sources are leading contributors to the ground level ozone in the eastern United States. LADCO mentioned that EPA’s proposed rule on heavy-duty vehicle emissions would have a major impact with respect to controlling the future ozone level in that region.

Manufacturers of Emission Controls Association (MECA) presented an emission inventory and air quality modeling analysis, also referenced by Midwest Ozone Group (MOG), based on adoption of federal FTP standards for heavy-duty trucks of 0.05 g/bhp-hr beginning with MY 2024 and 0.02 g/bhp-hr beginning with MY 2027. The analysis showed decreases in ozone and $PM_{2.5}$ concentrations in 2035.

Also, OTC and MANE-VU note that NOx reductions from heavy duty trucks are important for addressing the ozone transport region’s (OTR) persistent air quality problems, including ozone concentrations, $PM_{2.5}$ concentrations and wintertime visibility at federal Class I areas. The commenter provides an Ozone Transport Commission (OTC) analysis illustrating that onroad diesel vehicles (including HD vehicles) are projected to be the third largest NOx emissions source in the OTR in 2023. The commenter conducted modeling to project how much ozone comes from on-road diesel vehicles at OTR monitors and on-road diesel is one of the largest contributors. The commenter also mentions that ozone reductions have plateaued in some places and that in some places peak concentrations have been going up recently. The commenter asserts that OTC states have adopted lots of requirements for other NOx emissions sources and further controls would be more costly than controlling HD engines. The commenter states that satellite data shows average NO_2 concentrations during the summer, with maximum concentrations around the NYC area. The commenter asserts that ground level NO_2 emissions (e.g., from HD vehicles) are more likely to contribute to local ozone while NO_2 emissions that are higher aloft are more likely to contribute to ozone concentrations downwind. The commenter states that satellite imagery of a day in wintertime also shows higher NO_2 along major roadways when NO_2 has a longer lifetime. The commenter analyzed IMPROVE data and found that nitrates are becoming increasingly important for visibility in federal Class I areas in the OTR.

Response:

EPA appreciates this evidence that corroborates the modeling analysis undertaken for the proposed rule. EPA agrees that emissions from heavy duty trucks are significant contributors to concentrations of ozone and $PM_{2.5}$ and reducing NOx from this source will help many areas improve their air quality. More information on EPA’s air quality modeling analysis can be found in Chapter 6 of the RIA and the AQM TSD.

20.2 Biofuels would be beneficial for air quality

Comments by Organizations

Organization: *American Soybean Association (ASA)*

The growth of the biodiesel industry, and more recently the renewable hydrocarbon diesel industry, has been spurred by strong federal and state-level policies that promote cleaner, lower-carbon energy sources. Increased utilization of biomass-based diesel over the past several years has had a marked impact on the rural economy. Domestic markets use over 2.5 billion gallons of biomass-based diesel which supports over 65,000 jobs—many in rural America—and creates an economic impact of $17 billion1. Looking ahead, the biomass-based diesel industry is poised for significant growth with the expansion of renewable diesel. The EPA has an opportunity to play a critical role in supporting this industry—not only through the Renewable Fuel Standard, but through emissions rules that continue to allow a pathway for low carbon liquid fuels. [EPA-HQ-OAR-2019-0055-1309-A1, p.1]

> 1 LMC International, 2019. The Economic Impact of the Biodiesel Industry on the U.S. Economy. National Biodiesel Board.

Of note, government and corporate entities around the country are already utilizing biomass based diesel as an opportunity to achieve lower emissions now. For example, New York City requires all 11,000 city fleet vehicles to use biomass-based diesel—from the police department and fire department to the department of sanitation and off-road equipment vehicles. Other cities, like Washington, D.C., are also transitioning their fleets to biomass-based diesel. In 2018, D.C. used 120,000 gallons of biomass-based diesel in their vehicle fleet, which resulted in 1,000 fewer tons of greenhouse gas emissions. In 2020, the D.C. Department of Public Works announced that they would begin running 17 garbage trucks on B100, or 100% biomass-based diesel—an 86% greenhouse gas emissions reduction from a traditional petroleum-fueled garbage truck. The results are so clear that the city plans to double the size of its B100 vehicles in the next year. Through funds granted by EPA's Diesel Emissions Reduction Act program, DC Water Authority is expanding their use of B100 to 31 vehicles where it also benefits worker health. [EPA-HQ-OAR-2019-0055-1309-A1, p. 2]

Soy farmers are proud of the success of biomass-based diesel—not only for the new market opportunities the fuel created for farmers, but also for being able to grow a clean energy solution right in soybean fields. In fact, many soybean growers are using biomass-based diesel in their own farming equipment. Soybean oil represents about half of the feedstock used to produce biomass-based diesel and, according to the analysis of Clean Fuels Alliance America, biomass based diesel has led to a savings of 143.8 million metric tons of carbon since 2010. Further, according to the most recent update to the Greenhouse Gases, Regulated Emissions, and Energy Use in Technologies (GREET) model, it is estimated that the current U.S. biomass-based diesel feedstock mix reduces emissions by approximately 74% compared to traditional petroleum diesel.3 [EPA-HQ-OAR-2019-0055-1309-A1, pp. 2-3]

> 3 Wang, M., A. Elgowainy, U. Lee, A. Bafana, S. Banerjee, P. Benavides, P. Bobba, A. Burnham, H. Cai, U. Gracida- Alvarez, T. Hawkins, R. Iyer, J. Kelly, T. Kim, K. Kingsbury, H. Kwon, Y. Li, X. Liu, Z. Lu, L. Ou, N. Siddique, P. Sun, P. Vyawahare, O.

Winjobi, M. Wu, H. Xu, E. Yoo, G. Zaimes, G. Zang, 2021. Summary of Expansions and Updates in GREET 2021. https://greet.es.anl.gov/publication-greet-2021-summary

The rise of renewable diesel in the United States, in addition to our existing biodiesel capacity, appears poised to help meet the growing need for low-carbon fuels as drivers on our country's roads move to reduce their environmental footprint. American soybean farmers stand ready to support the continued growth of biomass-based diesel to meet our nation's carbon reduction goals. [EPA-HQ-OAR-2019-0055-1309-A1, p. 3]

ASA is eager to continue working with the EPA to support the role of agriculture in diversifying the fuel supply and supporting cleaner fuel options. On behalf of America's soybean farmers, we appreciate this opportunity to comment, and look forward to working with EPA, its partner agencies, and other relevant stakeholders to enact policies that will address climate change while expanding the use of soy-based biofuels and market opportunities for soybean farmers. [EPA-HQ-OAR-2019-0055-1309-A1, p. 3]

Organization: *Clean Fuels Alliance America (Clean Fuels)*

These new proposed Heavy-Duty Engine and Vehicle Standards are an important part of our country's continued push for cleaner air and a cleaner environment. The new Ultra-Low Emissions Diesel Engines (ULEDEs) produced under these regulations will be substantially cleaner than New Technology Diesel Engines (NTDE) in the market today and will approach near-zero regulated emissions of PM, NOx, unburned hydrocarbons, and carbon monoxide. [EPA-HQ-OAR-2019-0055-1248-A1, p.3]

Organization: *Valero Energy Corporation*

There are several critical deficiencies in the data and analysis on which the proposed rule revisions rely. In addition to these specific deficiencies identified below, Valero incorporates as part of these comments a report prepared by Ramboll U.S. Consulting, Inc. for Western States Petroleum Association that evaluates CARB's Heavy Duty Truck strategy1 and concludes that CARB's approach does not deliver results as early and as cost-effectively as an approach that incorporates low-nitrogen oxides ('NOx') emission vehicles coupled with increased introduction of renewable liquid and gaseous fuels. Since EPA's proposal relies heavily on analysis performed by CARB, the conclusions in the Ramboll study are relevant to EPA's proposal. EPA must not blindly follow CARB, but should take these comments, including the Ramboll study, into account. [EPA-HQ-OAR-2019-0055-1328-A2, p.3]

1 'Multi-Technology Pathways to Achieve California's Air Quality and Greenhouse Gas Goals: Heavy-Heavy-Duty Truck Case Study,' prepared for Western States Petroleum Association by Ramboll U.S. Consulting, Inc. (February 1, 2021).

EPA Summary and Response

Summary:

Commenters note that increased biofuel requirements would bring larger GHG reductions more quickly than the proposed program. One commenter cites an ATRI life-cycle analysis done using the Greenhouse Gases, Regulated Emissions, and Energy Use in Technologies (GREET) model, which found that the most realistic approach to decreasing carbon dioxide in ICE vehicles is through alternative fuels like biofuels. Another commenter points to a recent update to the GREET model that shows the current U.S. biomass-based diesel feedstock mix reduces emissions by approximately 74% compared to traditional petroleum diesel. Finally, one commenter refers to an analysis done by Ramboll focusing on California that indicates emissions reductions are greater and happen more quickly if biofuel requirements are also included.

Response:

EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards). Comments related to additional technology pathways, such as alternative fuels, are addressed in section 3.10 of this Response to Comments document. Related to the Ramboll analysis one commenter points to, our response is included in section 3.1 of this document.

20.3 Ozone Transport from Asia

Comments by Organizations

Organization: *American Trucking Associations (ATA)*

A recent study regarding ozone transport from Asia and its impacts on the U.S. found that Asia contributed as much as 65% of the increase in Western ozone in recent years.13 China and India, where many consumer products are manufactured, are the worst offenders. Scientists say that since Asian NOx emissions have tripled since 1990, they will continue to impact gains in U.S. air quality. The research, which was conducted by the National Oceanic and Atmospheric Administration and EPA, was published in the journal of Atmospheric Chemistry and Physics. The study, which analyzed levels of ground-level ozone between 1980 through 2014, concluded that the spike in man-made emissions in Asia "is the major driver" of the rise in ozone levels in the western U.S. for both spring and summer in recent decades.14 [EPA-HQ-OAR-2019-0055-1326-A1, p. 16]

> 13. Lin, M., Horowitz, L. W., Payton, R., Fiore, A. M., and Tonnesen, G.: US surface ozone trends and extremes from 1980 to 2014: quantifying the roles of rising Asian emissions, domestic controls, wildfires, and climate, Atmos. Chem. Phys., 17, 2943–2970, https://doi.org/10.5194/acp-17-2943-2017, 2017.
>
> 14. Id. at 2964.

Aside from Asian ozone transport, EPA’s 2015 National Ambient Air Quality Standard for Ozone projected only 14 counties outside of California will not meet the revised standard of 70 parts per billion (ppb) averaged over 8-hours by 2025 (See Figure 3).15 Yet every trucking company in the U.S., regardless of where they operate, is being asked to pay higher prices for equipment and warranties. IHS Markit data from the end of 2021 indicates that 53% of commercial vehicles are MY 2011 or newer meaning they are powered by engines meeting EPA's most stringent NOx engine emission standards. As the 47% of legacy vehicles gets rotated out of use, the industry's NOx emission profile will continue to decrease. [EPA-HQ-OAR-2019-0055-1326-A1, p. 16]

> 15. Regulatory Impact Analysis of the Final Revisions to the National Ambient Air Quality Standards for Ground-Level Ozone, EPA-452/R-15-007, Page ES-8, September 2015.

Fleets being operated solely in attainment areas question why they will be required to pay such a high price to improve air quality deemed healthy by EPA. These operations, like many others, will assess the anticipated technological and financial impacts of HD2027 on their purchase and operating decisions and adjust accordingly. [EPA-HQ-OAR-2019-0055-1326-A1, p. 17]

Organization: *National Association of Small Trucking Companies (NASTC)*

The proposed NOx and GHG reduction goals and the timetable for achieving them in this NPRM are quite ambitious, especially in light of the remarkable reductions our trucking sector has already achieved. Effectively, post-2010 heavy-duty trucks release cleaner air into the atmosphere than they take in. [EPA-HQ-OAR-2019-0055-1130-A1, p. 4]

The EPA has certainly played a role in the gains that have helped clean our air. Regrettably, the EPA and other government agencies have been party to increasing a substantial regulatory burden on American industry and erecting high hurdles to advancements such as building new, cleaner oil refineries and adequate truck parking. Meanwhile, China continues to use Diesel 2, the precatalytic converter-grade diesel fuel that has long been in disuse in the United States. We note that the current, cleaner-grade diesel fuel used in the United States costs trucking roughly $1 more per gallon than would Diesel 2. To be sure, U.S. diesel fuel today is better for the environment. Presumably, our country's citizens regard the more expensive U.S. diesel fuel and the costs it adds to their cost of living worth the extra money. Yet, China not only benefits economically from cheaper, dirtier diesel fuel, its polluted air reaches the West Coast of the United States. There seems to be a disconnect here. Americans pay dearly to clean our air, which flows eastward, and China sends back its dirty air. [EPA-HQ-OAR-2019-0055-1130-A1, p. 4]

EPA Summary and Response

Summary:

Two commenters noted that ozone transport from Asia is contributing to U.S. ozone concentrations, especially in the Western U.S. One commenter specifically questioned why fleets operating in attainment areas would need to increase their costs to reduce their emissions.

Response:

EPA agrees that ozone and ozone precursors, both from within the U.S. and from outside the U.S., can be transported and contribute to downwind ozone concentrations in the U.S. and beyond. Transport of ozone and ozone precursors also means that emissions from trucks operating in areas attaining the NAAQS can still be impacting downwind areas, and those downwind areas might not be in attainment. In addition, people experience health effects at concentrations below the level of the NAAQS, and reductions in NOx emissions will help areas maintain the ozone and $PM_{2.5}$ NAAQS and help prevent future nonattainment. Overall, reducing NOx emissions across the country will result in improved health outcomes attributable to lower ozone and particulate matter concentrations in communities across the United States.

Our air quality modeling analysis includes emissions within the country and coming in from outside the country. The air quality results, presented in Chapter 6 of the RIA, indicate that this rule will help reduce ozone across the U.S., including in areas that are impacted by long range transport of ozone from outside the country.

20.4 Air Quality Impacts of Buses

Comments by Organizations

Organization: *American Bus Association (ABA) (1070 and 1308)*

However, the Proposal does not really address motorcoach operations, or the benefits derived from travel by motorcoach. Because of EPA's emphasis on trucks or freight carrying services, ABA believes the assumptions and analyses EPA relies upon for support are either inaccurate or incomplete. Passenger carrying transport, and specifically motorcoach operations, differ significantly from freight transport. For example, the impacts on air quality from bus and motorcoach operations should not be solely evaluated in the context of engine emissions but must also take into account the number of the other vehicles removed from the road by virtue of providing mass transportation. Motorcoach operations can take up to 50 personal vehicles off the road (MJ Bradley & Associates (Ed.). (2019, June). Updated Comparison of Energy Use & Emissions from Different Transportation Modes - https://www.buses.org/assets/images/uploads/general/2019%20UPDATE%20Comparative%20Fuel%20CO2%20FINAL-July%202019.pdf). When you consider the potential removal of 600 million passengers worth of personal vehicles from our roadways, we believe that the motorcoach industry should receive some special considerations under this rulemaking and should certainly be acknowledged for their positive impact on the environment. It is short-sighted and inaccurate to entirely discount the benefits to air quality from removing other vehicles from the road in terms of both emissions as well as congestion. At the same time, if conducting motorcoach operations becomes cost prohibitive or untenable, it will cause the demise of the motorcoach industry, leading to an increase of vehicles on the road and increased congestion for urban areas, reversing the strides made to limit pollution and improve air quality. [EPA-HQ-OAR-2019-0055-1308-A1, p.4]

Organization: *United Motorcoach Association (UMA)*

Additionally, buses and motorcoaches significantly reduce emissions by removing private passenger automobiles. Consumers that cannot afford the inevitable fare and charter cost increases will select less efficient means of travel, counterproductive to EPA's goals of reducing overall emissions. [EPA-HQ-OAR-2019-0055-1311-A1, p.2]

Another consideration is the general havoc mandated by the earlier rounds of NOx emissions reductions. [EPA-HQ-OAR-2019-0055-1311-A1, p.2]

EPA Summary and Response

Summary:

Two commenters noted that ridership on buses and motorcoaches can reduce emissions from private passenger automobiles. They also noted that if buses and motorcoaches are not cost-effective to operate for the operators, or are too expensive for riders, then consumers will select less efficient means of travel which runs counter to EPA's goal with this rule. The commenters ask for the positive impact of buses and motorcoaches to be acknowledged and suggest that the industry should receive special considerations.

Response:

EPA agrees that buses and motorcoaches can decrease the need for individual passenger vehicles, which can decrease emissions from the light-duty passenger vehicle sector. Emissions from both light-duty passenger vehicles and heavy-duty buses or motorcoaches contribute to air pollution and its associated health and environmental effects. EPA believes that the increased costs due to this rule would not be enough to have a meaningful impact on the industry; more information on this is provided in Section 25.3 of this document. In addition, responses to comments on special considerations, including inducements related to motorcoaches, are addressed in Section 8 of this document.

21 Criteria pollutant health benefits

21.1 EPA's Benefits Methods are Flawed

Comments by Organizations

Organization: *Truck and Engine Manufacturers Association (EMA)*

Accordingly, and as confirmed by independent expert analyses and reports (see infra at Section 16 of these comments), it is expected that the monetized costs of a program centered around the Option 1 proposal would exceed the potential monetized health-related benefits. [EPA-HQ-OAR-2019-0055-1203-A1, p. 12]

On the benefits side, independent experts at NERA Economic Consulting ("NERA") previously have determined through a "scoping study" that the range of potential monetized health benefits from the implementation of the proposed low-NOx regulations, when focusing primarily on potential reductions in secondary PM2.5 and ozone, as EPA is doing in its benefits analysis, and without accounting for exposure-extrapolation uncertainties, could be as high as approximately $4,500 per-vehicle. [EPA-HQ-OAR-2019-0055-1203-A1, p. 144]

Turning to the potential health-related benefits from EPA's proposal, NERA's expert reports (Exhibit "C" hereto) estimate and quantify those potential benefits. In that regard, NERA conducted a prior "scoping study" to delineate the potential quantitative benefits from the types of low-NOx regulations at issue, and, as a supplement to that, NERA also has prepared a critical review of the portions of the RIA that include the Agency's quantitative risk assessment. [EPA-HQ-OAR-2019-0055-1203-A1, p. 159]

NERA's earlier "scoping study" includes two parts: a conceptual summary of methods and results; and a more detailed technical analysis. As explained in its conceptual summary, NERA conducted a comprehensive "scoping" analysis to estimate, on a per-vehicle basis, the likely maximum range of monetized health benefits that could result over time from the implementation of the envisioned low-NOx standards. The relevant findings and conclusions from NERA's report as they relate to the monetized benefits potentially attributable to reductions in NOx-related secondary PM2.5 and ozone are described below. [EPA-HQ-OAR-2019-0055-1203-A1, p. 159]

NERA focused its benefits calculations on the value of projected health-risk reductions from the projected reductions in ambient ozone and secondary PM2.5 that could result from reduced HDOH truck NOx emissions due to the implementation of substantially tighter HDOH NOx standards. Based on a long history of such benefits calculations (by EPA and many other entities), NERA assumed that approximately 98% of the estimated health benefits from reductions in ozone and PM2.5 would be due to reductions in mortality risks. Thus, NERA focused its benefit-per-truck estimates by estimating only mortality risk benefits, having confidence that this method would have no meaningful impact on any quantified conclusions. [EPA-HQ-OAR-2019-0055-1203-A1, p. 160]

In order to obtain per-truck benefit estimates, NERA first calculated the tons of NOx emissions reductions from an average new truck that would be purchased in 2027 meeting the tighter low-NOx standard, accounting for a potential truck-life of up to 30 years. NERA made that calculation for each of the 8 truck types covered by the assumed low-NOx standards. That computation was carried forward for each year of a truck's operational life. NERA also assessed the average truck's continued operation in each future year based on truck survival rates over time. The emissions reductions in each future year were then translated into a dollar estimate of each year's health benefits using a "reduced form" method in which the precursor emissions changes were multiplied by a "benefit per ton" value. [EPA-HQ-OAR-2019-0055-1203-A1, p. 160]

NERA's methodology generated a time-line from 2027 through 2057 of annual benefits per-truck in each year of the average 2027-vintage truck's operating life, varying across time (generally declining) as the truck ages. NERA discounted that stream of benefits to obtain the present value of benefits per-truck for each of the 8 truck types. Those 8 values were then combined into a single sales-weighted average benefit-per-truck estimate. [EPA-HQ-OAR-2019-0055-1203-A1, p. 160]

The most important input to NERA's benefit-per-ton estimates, and hence the benefit-per truck estimates, is the assumption about the increase in mortality risk per unit change (reduction) in ozone and secondary PM2.5 concentrations. That assumption is usually based on a statistically-derived association between mortality risk and observed pollutant concentrations or exposures, called a concentration-response (C-R) coefficient. The assumed C-R coefficient typically is derived from one or more of many existing epidemiological studies and associated peer-reviewed papers. EPA tends to change the mortality risk assumption as new epidemiology papers are published and as each NAAQS-review cycle is conducted. NERA reviewed statements in EPA's Policy Assessments for PM2.5 and ozone (EPA, 2020 and 2019b) to attempt to anticipate which assumptions EPA might ultimately adopt in the RIA for its rulemaking. Without commenting on the appropriateness of any such studies, NERA decided it would be reasonable to provide a range of estimates for the secondary PM2.5 benefits-per-ton at issue. The lower end of the range is based on a C-R coefficient for all-cause mortality risk derived from the Krewski et al. (2009) study, and the higher end of the range is based on a C-R coefficient estimate for all-cause mortality risk from the Di et al. (2017) study. [EPA-HQ-OAR-2019-0055-1203-A1, p. 160]

There are significant scientific uncertainties when using statistical associations from epidemiological studies to predict risks for different populations and under different air quality concentrations and conditions in the future. At the same time, there are methods for identifying how the uncertainties may be reduced or scaled to derive benefits estimates that have a higher degree of confidence. [EPA-HQ-OAR-2019-0055-1203-A1, p. 160]

More specifically, any use of the derived unit risk estimate from an epidemiology study to predict changes in risks in different locations and under different levels of ambient pollution exposure necessarily involves extrapolation outside of the original range of the study's data. Extrapolation always introduces uncertainties that are not included in any of the original study's statistical measures of confidence. The more extreme is the extrapolation that a risk analysis requires with respect to exposure and population conditions not representative of the original study, the less qualitative confidence one would have in the derived risk estimate. [EPA-HQ-OAR-2019-0055-1203-A1, p. 161]

Such extrapolation can be a particular problem when using studies of associations between ambient air pollutant and health outcomes, even from the relatively recent past, to predict risk in a future year because of the steady declines in ambient pollutant concentrations that have taken place, especially with respect to PM2.5, and that are projected to continue in the future. For example, the average concentrations of PM2.5 experienced by the individuals studied in Krewski et al. (2009) fell by 30% during the period from 1980 to 2000, over which their mortality risk levels were being observed. Furthermore, the EPA dataset that NERA used to project average PM2.5 levels in 2035 are another 50% lower (before any reductions due to a tightened HDOH low- NOx standard) than the average exposures occurring at the end of the Krewski et al. study period (i.e., in 2000). Thus, the uncertainties due to extrapolation issues in this case are significant. Yet EPA did not take them into account at all. [EPA-HQ-OAR-2019-0055-1203-A1, p. 161]

It is possible to adjust the calculated risk estimates from the relevant epidemiology studies to exclude the portions of the estimates that involve the most extreme amounts of extrapolation from the exposure levels at issue in the original studies. As the amount of extrapolation from the original exposure and health-benefits estimates is reduced, confidence in the resulting estimate is qualitatively improved. This creates a "sliding-scale" of benefits estimates from least confident to most confident. [EPA-HQ-OAR-2019-0055-1203-A1, p. 161]

EPA introduced such a sliding confidence scale for its PM2.5 co-benefits estimates in a recent RIA (EPA, 2019a), which employed a health risk estimate for all-cause mortality from the Krewski et al. (2009) epidemiology study. On that sliding scale, the "more confident" end of the spectrum of mortality risk estimates was calculated by excluding those portions of the underlying exposure and risk calculations that applied the original study's risk factor to PM2.5 pollutant exposures below the 25th percentile of the originally-observed range of PM2.5 exposures. The 25th percentile of a data set is generally viewed as the point where sparseness of exposure observations begins to undercut the ability to determine if an average C-R slope detected over the entire set of originally-observed exposure levels still remains at those lower and less frequently experienced exposure levels. [EPA-HQ-OAR-2019-0055-1203-A1, p. 161]

NERA applied that sliding-scale approach in the calculation of benefits that could be ascribed to the type of HDOH low-NOx standards at issue. In doing so, by requiring more confidence in the benefit-per-truck estimates, the estimates declined somewhat, since they exclude benefits that are in areas with projected baseline PM2.5 concentrations that are below various percentile levels of the pollutant observations in the original study (e.g., below the 25th percentile of exposures). [EPA-HQ-OAR-2019-0055-1203-A1, p. 161]

There is no way to select a single "best" cut-off point for limiting extrapolation uncertainties. In its last PM2.5 NAAQS decision (i.e., the 2013 rulemaking), the EPA Administrator discussed how insufficient confidence in the continued existence of health risk associations would arise somewhere between the 10th to 25th percentiles of a study's range of observations. She chose to set the standard near the lowest of the 25th percentiles of available studies. NERA made an even more conservative choice in its analysis in this instance, and set its "best estimate" values at the 10th-percentile cut-off point of exposures from the underlying epidemiological studies. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 161 - 162]

In addition, in recognition of the significant differences in the projected PM2.5 concentration distributions that exist between California and the rest of the country, NERA recomputed its benefits-per-truck for California and for the "Rest of the U.S.," separately. NERA's results, including the effects of the sliding-scale confidence-adjustments, are provided for PM2.5 in Tables 4 and 5 of NERA's Report, which are reproduced below: [EPA-HQ-OAR-2019-0055-1203-A1, p. 162]

It should be noted that the benefits estimates in NERA's scoping study reports are conservative or, stated differently, weighted to the high side. That conservative approach stems from the fact that in conducting its analyses, NERA assumed, among other things, that: there is no exposure threshold to PM2.5 or ozone below which mortality effects are no longer evident; the slope of the relative risk function for mortality is linear all the way down to zero exposure; and (as noted) it is appropriate to assess quantified benefits values at the 10th percentile of the exposure levels at issue in the underlying epidemiological studies, as opposed to utilizing a cut-point at the 25th percentile of exposures. Applying different assumptions regarding any of the foregoing points would lead to a reduction in the calculated benefits estimates. (NERA Report pp. 3-6, 9, 11, and 14-15.) [EPA-HQ-OAR-2019-0055-1203-A1, pp. 162 - 163]

As noted earlier, if confidence-adjusted values are not used, the potential benefits from the Agency's low-NOx proposal could be as high as approximately $4,500 per vehicle. On the other hand, based on NERA's confidence-adjusted analysis, and excluding only up to the 10th-percentile of the exposure data from the underlying epidemiology studies, and also applying a 3% discount rate as opposed to a 7% discount rate, the national per-truck benefits that could be derived from the types of HDOH low-NOx regulations at issue range from approximately $4,300 on the high-side to $3,100 on the low-side, for an average per-truck benefit of $3,700. Comparing that confidence-adjusted average per-truck benefit against the average per-HHD-truck cost as determined by Ricardo ($42,000) yields a costs-to-benefits ratio for HHD trucks (or a negative benefits-to-costs ratio) of approximately 10:1, which indicates that the proposed regulations, if not revised, will be cost-prohibitive. [EPA-HQ-OAR-2019-0055-1203-A1, p. 163]

More recently, as a follow-up to its scoping study, NERA has conducted a critical review of the Agency's methodology for estimating the potential quantitative health benefits associated with the rulemaking proposal at issue, as spelled out in the Agency's RIA. A copy of NERA's technical comments on the Agency's benefits estimates is included in Exhibit "C." [EPA-HQ-OAR-2019-0055-1203-A1, p. 163]

NERA's detailed critique demonstrates that EPA's RIA has a number of significant methodological flaws leading to a significant over-estimation of potential health-related benefits. The principal methodological flaws in the Agency's estimation of benefits include the following: EPA has elected to base its estimates of ozone-related mortality risks on a 2016 study by Turner, et al. that derived an unrealistic C-R factor for chronic ozone exposures. As a consequence of its unreasonable reliance on the Turner, et al. C-R factor, EPA has estimated high-end mortality ozone risks that are higher than the estimated mortality risks for PM2.5, a result that is completely at odds with the established scientific consensus regarding the relative magnitude of the potential mortality risks associated with PM2.5 exposures. As NERA explains, "risk estimates for ozone-related respiratory mortality using the Tuner, et al. (2016) study are theoretically and technically unreliable." (NERA Critique, p. 22.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 163]

The principal methodological flaws in the Agency's estimation of benefits include the following: The Turner, et al. (2016) study is flawed principally because it: applies an incorrect exposure window to the underlying data set, thereby underestimating exposures (which biases risks upward); applies a year-round exposure metric, as opposed to an ozone-season metric; and fails to account for the threshold of effects for longterm mortality that emerged from the underlying data, which threshold for ozone was approximately 56 ppb. The net result from that flawed analyses is the derivation of a risk ratio for ozone mortality that "has completely upended the long established history of multi-pollutant air quality benefits assessments in which ozone mortality benefits are substantially smaller than PM2.5 benefits." (NERA Critique, pp. 6, 14.) Accordingly, NERA assigns "zero reliability to estimates based on the Turner, et al. C-Rs" (id at p. 13), and concludes that the study "should be removed from the benefits analysis" (Id. at pp. 9, 17.) NERA further recommends that EPA should "omit long-term respiratory mortality from the Draft RIA altogether." (NERA Critique, p. 13.) [EPA-HQ-OAR-2019-0055-1203-A1, pp. 163 - 164]

The principal methodological flaws in the Agency's estimation of benefits include the following: Significantly, the Agency's RIA is at odds with the Agency's own 2020 NAAQS review process where the Agency-drafted Integrated Science Assessment (ISA) found inconsistent associations between ozone and respiratory mortality, did not ascribe confidence in any quantitative estimates of ozone respiratory risks, and so included no quantitative estimates of such risks. (See also NERA Critique, pp. 10- 13.) Thus, the Agency – the same Agency that has issued the draft RIA for this rulemaking – has expressly concluded that the evidence is suggestive of, but not sufficient to infer, a causal relationship between long-term ozone exposure and cardiovascular effects, respiratory mortality or total mortality. (See ISA, Tables 4- 2 and 6-2, pp. 4-65, 6-30, 6-43), and has specifically stated (citing the Tuner study) that there is "little evidence for an association between long-term exposure and total mortality." (ISA, p. 6-28.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 164]

Importantly, the scientific consensus on that point has not changed. Indeed, very recently, on April 29, 2022, and as a part of the pending reconsideration of the 2020 NAAQS, EPA issued a review draft of its Policy Assessment (PA) for ozone. In that PA, EPA specifically concludes that the newer available studies "do not materially change the findings of the 2020 ISA or warrant reopening of the air quality criteria" for ozone. (See EPA Staff Presentation to CASAC, slide 6, April 29, 2022.) Significantly, in that just-released PA for ozone, EPA chose not to rely on Turner, et al. (2016), noting that the "air quality data are not described [in the PA/ISA] for that study as it relied on estimated O3 concentrations for the years 2002-2004 as surrogates for study population O3 concentrations during the 1982- 2004 period." (See PA, p. 3B-33.) (See also NERA Critique, pp. 10-11.) Thus, the EPA staff with the greatest expertise in this area have actually agreed with NERA that the Turner, et al. (2016) study relies on an incorrect exposure window, and so should not be used to derive C-Rs. EPA's draft RIA flies in the face of its own more robust scientific conclusions, and so is patently unreasonable. [EPA-HQ-OAR-2019-0055-1203-A1, p. 164]

The principal methodological flaws in the Agency's estimation of benefits include the following: The Agency has failed to provide for any confidence-weighting to its benefits estimates. That has led to highly overestimated benefits due to the inherent unsupported assumption that the derived C-R relationships continue to hold fully, well below the ranges of exposure observations on which those C-R relationships were based. (NERA Critique, pp. 2-3.) When appropriate confidence-weighting factors are applied, it is clear that the Agency's RIA has substantially overestimated the health-related benefits at issue, most likely by more than an order of magnitude. (Id., Tables 1 and 2, pp 2-3, 18-30.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 164]

EPA Summary and Response

Summary:

The above commenter asserts, for various reasons, that EPA's benefits methodology is flawed. In the response immediately below we provide some additional information on the comments included in this section, with additional details available in the comment excerpts above (Section 21.1).

Response:

We disagree with the premise that our benefits methodology is flawed. EPA's analysis is consistent with applicable guidance and best practices for conducting benefit-cost analyses, including OMB Circular A-4 and EPA's Guidelines for Preparing Economic Analyses. Guidance in both Circular A-4 and EPA's Guidelines directs the Agency to quantify and monetize all impacts associated with a particular rulemaking to the extent feasible. We consider our analysis consistent with the guidance, methodologically rigorous, and a best estimate of the projected societal benefits and costs associated with the final program. In the proposal, we found that the benefits of both scenarios we analyzed, Option 1 and Option 2, far outweighed the costs associated with those same scenarios. We have considered the comments and we have retained our approach to estimating benefits and have not made any changes to the analysis for the final rule.

In Chapter 18 of this document, EPA responds to the claim that EPA's cost estimates should be higher, finding that the primary difference between EPA's cost estimates and the higher Ricardo cost estimates was a difference in approach associated with the proposal's Option 1. Please refer to that section for more detail.

Furthermore, and as explained in Sections I and III of the preamble, EPA is promulgating the final emission standards pursuant to its authority under CAA section 202(a)(3)(A). In setting the final emission standards, EPA appropriately assessed the statutory factors specified in CAA section 202(a)(3)(A), including giving appropriate consideration to the cost associated with the application of technology EPA determined will be available for the model year the final standards apply (i.e., cost of compliance for the manufacturer associated with the application of such technology). EPA's assessment of the relevant statutory factors in CAA section 202(a)(3)(A) justify the final emission standards. We also evaluated additional factors, including factors to comply with E.O. 12866; our assessment of these factors lends further support to the final rule, including that the benefits of the proposed options outweigh their costs.

We do not agree with the basis for the commenter's claim that the proposed options are "cost-prohibitive" based on a comparison of per-truck benefits and costs (as described in the "Scoping Study"). EPA has based its estimation of the health-related benefits attributable to the proposed and final program using analytical tools, methods and assumptions that have been peer reviewed and are consistent with best practices and analytical guidance. EPA has estimated the full suite of spatially and temporally allocated emissions impacts associated with the multiple components of the standards (RIA Chapter 5 describes EPA's emissions modeling methods and assumptions). We have conducted full-scale photochemical air quality modeling that accurately projects levels of criteria and air toxic pollutants and captures the complex atmospheric chemistry related to ambient concentrations of $PM_{2.5}$, ozone, and air toxics (RIA Chapter 6 describes EPA's air quality modeling methodology and assumptions). Reductions in ambient $PM_{2.5}$ and ozone attributable to the standards are used as inputs to the health benefits analysis, which quantifies and monetizes improvements in human health due to avoided premature deaths and avoided non-fatal illnesses (RIA Chapter 8 describes EPA's benefits methodology and assumptions). The Scoping Study assumed a hypothetical emission reduction scenario that was different from the form of the proposed regulatory program. As the basis for a comparison of the costs and benefits of the proposed and final program, EPA's analysis is appropriate and its tools and methods peer reviewed. We also note that many of the responses we provide below, related to the commenter's critical review of the Agency's methodology for estimating the quantitative health benefits associated with the NPRM, also apply to methodological critiques we have with the Scoping Study.

As a first step in quantifying $PM_{2.5}$- and ozone-related human health impacts, the Agency consults the most recent Integrated Science Assessments (ISA) for each pollutant.[48,49,50] These documents synthesize the toxicological, clinical and epidemiological evidence to determine whether PM and ozone are causally related to an array of adverse human health outcomes associated with either short-term (i.e., hours or days-long) or long-term (i.e., years-long) exposure; for each outcome, the ISA reports this relationship to be causal, likely to be causal, suggestive of a causal relationship, inadequate to infer a causal relationship or not likely to be a causal relationship. Historically, the Agency estimates the incidence of air pollution effects for those health endpoints that the ISA classified as either causal or likely-to-be-causal. The focus on categories identified as having a "causal" or "likely to be causal" relationship with the pollutant of interest allows for the estimation of pollutant-attributable human health benefits in which the Agency is most confident.

Though we begin with studies identified in ISAs, the goals of an ISA differ greatly from those of benefits assessments. ISAs evaluate the overall state of the science and develop overarching conclusions regarding the relationship between exposure to the pollutant of interest and adverse health effects. The ISA considers the potential for some groups of people, such as people with pre-existing conditions, to experience risks that may not be generalizable to the entire U.S. population. For a benefits analysis, EPA systematically reviews the body of available epidemiological studies and risk estimates identified in the ISAs using explicit criteria to identify which studies and risk estimates are a best fit for use in a benefits analysis. These criteria include factors such as study design, geographic coverage, demographic populations, and health

[48] U.S. EPA (2020). Integrated Science Assessment for Ozone and Related Photochemical Oxidants. U.S. Environmental Protection Agency. Washington, DC. Office of Research and Development. EPA/600/R-20/012. Available at: https://www.epa.gov/isa/integrated-science-assessment-isa-ozone-and-relatedphotochemical-oxidants.
[49] U.S. EPA (2019). Integrated Science Assessment (ISA) for Particulate Matter (Final Report). U.S. Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment. Washington, DC. U.S. EPA. EPA/600/R-19/188. December 2019. Available at: https://www.epa.gov/naaqs/particulate-matter-pmstandards-integrated-science-assessments-current-review.
[50] U.S. EPA (2022). Supplement to the 2019 Integrated Science Assessment for Particulate Matter (Final Report). U.S. Environmental Protection Agency, Office of Research and Development, Center for Public Health and Environmental Assessment. Research Triangle Park, NC. U.S. EPA. EPA/600/R-22/028. May 2022. Available at: https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=354490.

endpoints. EPA's systematic review process and study selection criteria are presented in its Technical Support Document, "Estimating $PM_{2.5}$- and Ozone-Attributable Health Benefits" (Benefits TSD).[51]

The commenter states a principal flaw in the Agency's estimation of benefits is that the Agency's RIA is at odds with the Agency's own 2020 NAAQS review process where the Agency-drafted Integrated Science Assessment (ISA) found inconsistent associations between ozone and respiratory mortality. This is incorrect for both the short- and long-term causality determination for ozone exposure and respiratory outcomes, including respiratory mortality.

The 2020 Ozone ISA determined that there exists a "causal" relationship between short-term ozone exposure and respiratory outcomes (U.S. EPA, 2020b). The short-term exposure causality determination "was made on the basis of a strong body of evidence integrated across controlled human exposure, animal toxicological, and epidemiologic studies, in addition to established findings from previous [Air Quality Criteria Documents], demonstrating respiratory effects due to short-term exposure to ozone." While the ISA found that "recent epidemiological evidence for respiratory mortality is limited, …there remains evidence of consistent, positive associations, specifically in the summer months." The ISA also found that "when recent evidence is considered in the context of the larger number of studies evaluated in the 2013 O3 ISA, there remains consistent evidence of an association between short term ozone exposure and respiratory mortality." Due to the strength of the ISA evidence relating short-term exposures to respiratory mortality, estimates of respiratory mortality impacts are included in the main benefits assessment of ozone-attributable health impacts.

Regarding the selection of which study and risk estimate to use to quantify long-term ozone-related mortality benefits, the 2020 Ozone ISA determined that there exists a "likely to be causal" relationship between long-term ozone exposure and respiratory outcomes (U.S. EPA, 2020b). The overall "likely to be causal" determination for long-term exposures "was based on epidemiologic evidence of associations between long-term ozone exposure and asthma development, respiratory symptoms in children with asthma, and respiratory mortality." More specifically, the ISA found that "there is strong coherence between animal toxicological studies of changes in lung morphology and epidemiologic studies reporting positive associations between long-term ozone exposure and new onset asthma, respiratory symptoms in children with asthma, and respiratory mortality" and the "several multicity studies and a multi-continent study reported associations between short-term increases in ozone concentrations and increases in respiratory mortality." Overall, the 2020 Ozone ISA concluded there was "some evidence that long-term ozone exposure is associated with respiratory mortality, but the evidence is not consistent across studies." Due to the strength of the ISA evidence relating long-term exposures to respiratory mortality, we included estimates of respiratory mortality impacts when estimating benefits attributable to changes in ozone exposure associated with the proposal.

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[51] U.S. Environmental Protection Agency (U.S. EPA). 2021. Estimating PM2.5- and Ozone-Attributable Health Benefits. Technical Support Document (TSD) for the Final Revised Cross-State Air Pollution Rule Update for the 2008 Ozone Season NAAQS. EPA-HQ-OAR-2020-0272. March. Available at: https://www.epa.gov/sites/default/files/2021-03/documents/estimating_pm2.5-_and_ozone-attributable_health_benefits_tsd_march_2021.pdf.

The study and risk estimate EPA identified as most suitable to quantify long-term ozone-related mortality benefits was Turner et al., 2016, which examined the relationship between long-term ozone exposure and mortality (all-cause, cause-specific) in American Cancer Society Cancer Prevention Study-II participants (aged 30-99 years). We found that the Turner study provides strong evidence that demonstrates positive associations between long-term ozone exposure and respiratory mortality. Compared to alternative long-term ozone mortality studies such as Jerrett et al., 2009, the Turner study has a larger study size, more U.S. study locations, and a different exposure estimation technique. EPA's Technical Support Document, "Estimating PM2.5- and Ozone-Attributable Health Benefits" describes the study and criteria used in its selection in more detail.[52]

The commenter took issue with the selection and use of the Turner study in the proposal claiming several deficiencies: that it applies an incorrect exposure window to the underlying data set; that it applies a year-round exposure metric, as opposed to an ozone-season metric; and that it fails to account for a long-term mortality threshold. We address each of these claims in turn.

We acknowledge that there is uncertainty whenever temporal misalignment exists between pollutant exposure and outcome data in the air pollution health effects literature. That uncertainty also applies to the exposure window assumptions Turner et al. used to derive the risk estimate we applied in the proposal's high-end estimate of ozone-related benefits. The Turner study acknowledged this uncertainty but observed that "[t]hough we lacked historical ozone data, there was little difference in respiratory mortality HRs in previous work when researchers examined specific exposure time windows or ozone exposures matched more closely in time. Recent ozone concentrations are correlated with past estimates. Correlations between 1998–2000 concentrations and those from 1988–1990 and 1978–1980 were 0.80 and 0.58, respectively." Despite this uncertainty, the rigorous study review and study selection criteria we apply (described earlier in this response) identified the Turner et al. study as the most suitable to quantify long-term ozone-related respiratory mortality benefits. We qualitatively address this source of uncertainty in the Benefits TSD.

Regarding the comment that we erroneously applied a year-round exposure metric instead of an ozone-season metric, this is incorrect. Turner et al., 2016, provided a warm-season specific hazard ratio of 1.08 (1.06-1.11) per 10 ppb increase in seasonal average of daily 8-hour maximum ozone concentrations, which we used with air quality surfaces for the summer season (April – September). Notably, the study compared annual mortality with warm-season ozone exposures, so full-year baseline incidence rates were used with risk estimates from this study. We therefore appropriately quantified annual cases of ozone-related respiratory mortality attributable to the seasonal average change in ozone associated with proposal.

The commenter also faulted the Agency for failing to account for a threshold of effects in its estimation of long-term mortality benefits. The 2020 final Ozone ISA evaluated many studies

[52] U.S. Environmental Protection Agency (U.S. EPA). 2021. Estimating PM2.5- and Ozone-Attributable Health Benefits. Technical Support Document (TSD) for the Final Revised Cross-State Air Pollution Rule Update for the 2008 Ozone Season NAAQS. EPA-HQ-OAR-2020-0272. March. Available at: https://www.epa.gov/sites/default/files/2021-03/documents/estimating_pm2.5-_and_ozone-attributable_health_benefits_tsd_march_2021.pdf.

examining the shape of the concentration-response relationship for long-term ozone exposure and mortality using various different statistical techniques, including linear models and restricted cubic splines, which were used to inform the long-term ozone-attributable respiratory mortality relationship (U.S. EPA, 2020b). The ISA concluded that:

> Generally linear, no-threshold relationships exist down to 35−40 ppb, although the results were not entirely consistent. Some studies observed a sublinear relationship, indicating larger changes in risk for higher ozone concentrations compared with lower ozone concentrations. Several studies also included threshold analyses and support the possibility of a threshold near 35 to 40 ppb. (U.S. EPA, 2020b, section 6.2.7)

The ozone ISA also found that:

> Recent multicity studies continue to support a linear [concentration-response] relationship with no evidence of a threshold between short term ozone exposure and mortality over the range of ozone concentrations typically observed in the U.S. Studies that used different statistical approaches and ozone averaging times (i.e., 24 hour avg and 8 hour max) provide evidence of a linear concentration-response relationship, with less certainty in the shape of the curve at lower concentrations [i.e., 40 ppb for 24 hour avg and 30 ppb for 8 hour max]. An examination of whether a threshold exists in the ozone mortality concentration-response relationship provided no evidence of a concentration below which mortality effects do not occur when examining 5 μg/m3 (~2.55 ppb) increments across the range of 1 hour max concentrations reported in the U.S. and Canadian cities included in [a large cohort]. (U.S. EPA, 2020b, section 6.1.8)

Collectively, these results continue to support the conclusion of the 2006 Ozone Air Quality Criteria Document that "if a population threshold level exists in ozone health effects, it is likely near the lower limit of ambient ozone concentrations in the U.S." and thus we assume linear, no-threshold relationships exist between ozone and health impacts in the benefits that were estimated for the proposal.

The Turner study did not provide threshold models or find evidence supporting a threshold associated with warm-season effects, which is the hazard ratio we selected from the study. The Turner study did find "some evidence that a threshold model improved model fit for respiratory mortality at 35 ppb (P = 0.002) compared with a linear model using year-round but not summertime O3 (HR per 10 ppb using threshold ozone indicator at 35 ppb for respiratory mortality, 1.17; 95% CI, 1.11–1.22)." We believe the no-threshold assumption continues to be appropriate for both the high-end estimate of long-term ozone mortality benefits (based on Turner et al.), and the low-end estimate of short-term ozone mortality benefits (based on Katsouyanni et al., 2009).

The commenter takes issue with the fact that EPA estimates the number and value of respiratory mortality associated with long-term exposure to ozone as a high-end estimate of ozone-related benefits, and note that by monetizing those benefits, we have "completely upended the long-established history of multi-pollutant air quality benefits assessments in which ozone mortality benefits are substantially smaller than $PM_{2.5}$ benefits." This statement ignores the possibility that scientific progress allows for the expansion of benefits quantified and monetized by the Agency along with the fact that different air quality regulations reduce ambient $PM_{2.5}$ and ozone exposures in different scales and proportions. It is not unexpected that a rule predominantly controlling NO_X emissions would yield large ozone-related health benefits.

The commenter also alleges that the Agency substantially overestimated benefits in the proposal because we did not apply a confidence-weighting approach to account for declining confidence in the relationship between pollution exposure and health response. We believe this confidence-weighting approach is not consistent with the approach to estimating benefits recommended by the National Academy of Sciences' National Research Council (NRC) and the Science Advisory Board (SAB),[53,54] and is not supported by the literature upon which our primary estimate of benefits for the proposal was based.

EPA has long acknowledged that there are multiple sources of uncertainty present in its benefits analyses that may bias benefits in either a downward or upward direction. To demonstrate the uncertainty associated with air pollution exposures observed in health studies compared to exposures modeled in the proposal, we provided a stylized graphic that makes the point that we are more confident in the magnitude of the risks we estimate from simulated pollutant concentrations that coincide with the bulk of the observed concentrations in the epidemiological studies that are used to estimate the benefits. The graphic is not meant to convey any certainty about where along that spectrum a cut-off (or threshold) exists below which there would be no health benefit from reduced exposure. EPA does not view the lower end of the distribution of concentration levels reported in the mortality studies as a threshold below which we would not quantify the health benefits of air quality improvement, nor do we believe that cut-offs exist at arbitrary percentiles of the distribution or even at the level of the NAAQS. Rather, the benefits estimates reported in the proposal were the most appropriate estimates because they reflect the full range of air quality concentrations associated with the emission reduction program that was evaluated. In fact, as demonstrated in Figure 8-2 of the proposal, the range of baseline $PM_{2.5}$ pollution concentrations are almost entirely above the lowest recorded PM levels in the studies, the population-weighted mean concentration of the distribution is between 7 and 8 ug/m3, and the distribution of concentrations is skewed more toward the level of the NAAQS than the lowest recorded concentration levels.

Regarding the commenter's specific assertion that EPA has overestimated $PM_{2.5}$-related benefits due to "the inherent unsupported assumption that the derived C-R relationships continue to hold fully, well below the ranges of exposure observations on which those C-R relationships were based," we reject this premise. As detailed in the 2019 PM ISA and previous assessments in support of the PM NAAQS, EPA's review of the science has consistently found no evidence of a threshold below which exposure to $PM_{2.5}$ yields no health response. Specifically, the 2019 PM ISA found that "extensive analyses across health effects continues to support a linear, no-threshold concentration-response (C-R) relationship." This conclusion in the 2019 PM ISA is

[53] NRC (2002). Estimating the public health benefits of proposed air pollution regulations. 0309086094. National Academies Press; NRC (2008). Estimating the Mortality Risk Reduction and Economic Benefits from Controlling Ozone Air Pollution.
[54] U.S. Environmental Protection Agency—Science Advisory Board (U.S. EPA-SAB). 2010. Review of EPA's Draft Health Benefits of the Second Section 812 Prospective Study of the CAA.

supported by the more recent evaluation of the health effects evidence detailed in the recently released Draft Supplement to the PM ISA which found "continued evidence of a linear, no-threshold concentration-response (C-R) relationship."

Based on the evidence and lack of nonlinear relationships between long-term $PM_{2.5}$ exposure and health impacts, we continue to assume a linear, no-threshold relationship and do not quantitatively assess uncertainties related to the shape of the concentration-response relationships, either through a so-called "confidence weighting" approach or otherwise. We instead address this uncertainty qualitatively.

In summary, we believe that the primary estimate of benefits presented in the proposal for both Option 1 and Option 2 is based on methods and assumptions that are consistent with applicable guidance and best practices for conducting benefit-cost analyses and reflect a best estimate of the total health-related benefits from the proposed program that we are able to quantify and monetize. The benefits of both scenarios, Option 1 and Option 2, far outweigh the costs associated with those same scenarios. See Preamble Section VIII for the benefits estimates for the final program and Preamble Section IX for a comparison of benefits and costs of the final program. Like the proposed options, these estimates are based on methods and assumptions that are consistent with applicable guidance and best practices for conducting benefit-cost analyses and reflect a best estimate of the total health-related benefits from the final program that we are able to quantify and monetize, and the benefits outweigh the costs.

21.2 EPA Should Clarify its Economic Assumptions

Organization: *Institute for Policy Integrity at New York University School of Law (Policy Integrity)*

EPA should clarify its economic assumptions to better explain its choices in its methodology. In particular, EPA should provide additional discussion regarding how the agency incorporates income changes into the value of a statistical life, considers the cost of illness, and accounts for learning-by-doing in calculating compliance costs. [EPA-HQ-OAR-2019-0055-1256-A1, p. 2]

In the Proposed Rule, EPA has adjusted the value of statistical life ("VSL") over time for an increase in GDP per capita84 consistent with its own most recent guidelines.85 We applaud the agency for taking this theoretically and empirically correct choice.86 However, to strengthen the Final Rule, EPA should further clarify its reasoning and process in adjusting VSL over time. [EPA-HQ-OAR-2019-0055-1256-A1, p. 15]

84. DRIA, supra note 41, at 379.

85. EPA Guidelines, supra note 35, at App'x B.

86. See W. K. Viscusi & C. J. Masterman, Income Elasticities and Global Values of a Statistical Life, 8 J. BENEFIT-COST ANALYSIS 226–50 (2017); C. J. Masterman & W. K. Viscusi, The Income Elasticity of Global Values of a Statistical Life: Stated Preference Evidence, 9 J. BENEFIT-COST ANALYSIS 407–34 (2018).

Currently, the RIA states that it discusses how "evidence and theory suggest that one's willingness-to-pay (WTP) for health and environmental improvements should increase as real income increases" in the accompanying Technical Support Document ("TSD").87 However, Policy Integrity was unable to identify this discussion in the TSD. Critically, as the quantity of life is limited (i.e., individuals have only one life) in comparison to most consumption goods, the relative value of a statistical life increases over time as GDP rises over time. In other words, as consumption goods become less scarce relative to non-market goods such as the environment and health goods and services, the relative price of these non-market goods and services rises in contrast to the more abundant market goods.88 [EPA-HQ-OAR-2019-0055-1256-A1, pp. 15 - 16]

87. DRIA, supra note 41, at 379 (referencing Sections 5.4 and 6.4.3 of the TSD)

88. M. Hoel & T. Sterner, Discounting and Relative Prices, 84 CLIMATIC CHANGE 265–80 (2007); T. Sterner & U. M. Persson, An Even Sterner Review: Introducing Relative Prices into the Discounting Debate, 2 REV. ENV'T ECON. & POL'Y 61 (2008).

EPA should also discuss more clearly its calculation of the VSL in the RIA. EPA lays out the source for income (i.e., GDP per capita) growth calculations and extends "income growth adjustment factors out to 2045" as growth is expected to increase into the future leading to a rise in the VSL.89 However, EPA does not introduce the magnitude of the income elasticity and its corresponding source. Presumably, it uses the central value of 0.4 given in Appendix B of EPA's Guidelines for Preparing Economic Analyses.90 However, recent research finds a higher value for the United States between 0.5 to 0.7 with a best estimate of 0.55.91 Accordingly, EPA should clarify why it selected its current value of 0.4, particularly given that it has previously used a value of 0.55.92 EPA should conduct a literature review to determine the most appropriate value. It should also explain its reasoning for not including sensitivity analysis with respect to this parameter given that EPA's guidelines specify a wide range between 0.08 to 1.0.93 This empirical question is important because a higher income elasticity will increase the benefits of reducing air pollution. 94 [EPA-HQ-OAR-2019-0055-1256-A1, p. 16]

89. DRIA, supra note 41, at 379.

90. EPA Guidelines, supra note 35, at B-4.

91. Viscusi & Masterman (2017), supra note 86; Masterman & Viscusi (2018), supra note 86.

92. 85 Fed. Reg. 24,174, 24,827 (April 30, 2020).

93. EPA Guidelines, supra note 35, at B-4.

94. EPA correctly adjusted VSL for rising GDP per capita, but not individuals or sub-populations within the United States. This is consistent with Appendix B of EPA's

Guidelines for Preparing Economic Analyses, supra note 35. It is also consistent with the United States's use of a uniform VSL applied to all individuals equally within the United States.

EPA should also consider addressing the impact of the rising relative value of statistical life on household decisions. Specifically, a rise in the real value of a statistical life should lead the household to take more protective action for air quality. In other words, as households become richer and place more value on reducing risk, we should see more defensive behavior on the extensive and intensive margins. For example, households should buy more air purifiers, cleaners, or filters and run them more frequently, as well as take other actions such as wearing face masks and staying indoors until their marginal benefit equals their marginal cost.95 Ideally, the agency would quantitively calculate the impact of rising income on the baseline and alternative scenarios, as well as the cost of this defensive behavior. As the cost differences between these scenarios are likely to be small, this could reasonably be addressed with a qualitative discussion. [EPA-HQ-OAR-2019-0055-1256-A1, pp. 16 - 17]

95. Ruth Dittrich & Stuart McCallum, How to Measure the Economic Health Cost of Wildfires—A Systematic Review of the Literature for Northern America, 29 INT'L J. WILDLAND FIRE 961–73 (2020).

EPA underestimates the true economic value of air pollution reduction as it uses the cost of illness approach ("COI") instead of society's willingness-to-pay for changes in risk of a given health effect. EPA should discuss the type of impacts omitted from valuing morbidity impacts using this approach and the potential magnitude of these omissions. [EPA-HQ-OAR-2019-0055-1256-A1, p. 17]

For example, a COI approach omits many important impacts of illness, including the lower quality of life that individuals experience from illness. Beyond the suffering associated with morbidity, which the EPA briefly mentions,96 the COI approach also excludes lost productivity from workers facing higher air pollution. At a minimum EPA should address this qualitatively, ideally in conjunction with a sensitivity analysis using willingness-to-pay estimates from the existing literature.97 [EPA-HQ-OAR-2019-0055-1256-A1, p. 17]

96. See DRIA, supra note 41, at 387 ("These cost-of-illness (COI) estimates are typically a lower bound estimate of the true value of reducing the risk of a health effect because they reflect the direct expenditures related to treatment, but not the value of avoided pain and suffering.")

97. Dittrich & McCallum (2020), supra note 95.

In using the COI approach, the EPA does not clearly state whether its estimates include opportunity costs such as income losses due to absence from work, which a willingness-to-pay approach is more likely to reflect. This is critical, as the COI approach "only looks at direct costs from morbidity: it sums the resource and opportunity costs from being sick – the treatment cost and lost wages – without considering the disutility associated with pain, discomfort, and lower quality of life... The cost of the preventative action taken to avoid becoming sick is also not taken into account (e.g. the cost of buying an air cleaner)."98 [EPA-HQ-OAR-2019-0055-1256-A1, p. 17]

98. Id.

EPA states in the RIA that its cost estimates account only for direct treatment costs99—excluding the lost wages recommended in the literature. If EPA's COI approach does not go beyond direct treatment costs, the agency is underestimating morbidity costs in its COI calculations. As the COI approach is already an underestimate as compared to the willingness-to-pay approach, only accounting for direct treatment costs would represent a significant underestimation of the morbidity impacts. This is concerning and should be addressed qualitatively at a minimum. [EPA-HQ-OAR-2019-0055-1256-A1, p. 17]

99. DRIA, supra note 41, at 398 ("cost-of-illness (COI) estimates…reflect the direct expenditures related to treatment").

Regardless, the EPA's use of the COI approach and its potential underestimation implies that the net benefits of regulation are potentially significantly higher. EPA should explicitly take this into account when selecting between alternatives. [EPA-HQ-OAR-2019-0055-1256-A1, p. 17]

EPA Summary and Response

Summary:

The commenter provided input and recommendations for improving the documentation of methodological assumptions related to income growth adjustment, the VSL, COI estimates, and the impact of rising income on household decisions to avert risk.

Response:

EPA acknowledges the commenter's input and recommendations for improving the documentation of methodological assumptions related to income growth adjustment, the VSL, COI estimates, and the impact of rising income on household decisions to avert risk. We may consider these suggestions in future rulemakings.

For more information on the derivation of income elasticity estimates EPA uses to develop income growth adjustment factors, please refer to the memorandum available here: https://www3.epa.gov/ttnecas1/regdata/Benefits/IncomeElasticityUpdate_Recommendationswithappendices.pdf. We note that a quantitative sensitivity analysis of income growth adjustment factors is included in the Benefits TSD. We also note that EPA has consistently applied the central income growth adjustment (or the "mid" value) to the WTP for each corresponding health endpoint, as referenced in the Benefits TSD. EPA may consider the suggestion to conduct a literature review for future rulemakings.

For more information on the estimation of the Value of a Statistical Life (VSL), please refer to Appendix B of EPA's Guidelines for Preparing Economic Analyses (Guidelines), which can be downloaded here: https://www.epa.gov/environmental-economics/guidelines-preparing-economic-analyses. As stated in RIA Chapter 8, the Agency is committed to using scientifically sound, appropriately reviewed evidence in valuing changes in the risk of premature death and continues to engage with the Science Advisory Board to update its mortality risk valuation estimates.

Chapter 5 of the Benefits TSD provides detail on what is and is not included in the Cost-of-Illness valuation estimates for each endpoint. Chapter 7 of the Guidelines also describe Cost-of-Illness (COI) valuation estimates in more detail. We agree that there are additional human health and environmental benefits associated with reductions in exposure to ambient concentrations of $PM_{2.5}$, ozone, and NO_2 that EPA has not quantified due to data, resource, or methodological limitations, including the limitations of the COI approach to capture the value of avoiding non-fatal health endpoints. The estimated benefits of the proposal and the final rule would be larger if we were able to monetize all unquantified benefits. We do not expect that the monetization of unquantified benefits would modify our consideration of alternatives.

The approach used by EPA in estimating learning effects is explained in the final RIA Section 7.1.1 and was derived from, "Cost Reduction through Learning in Manufacturing Industries and in the Manufacture of Mobile Sources, Final Report and Peer Review Report," EPA-420-R-16-018, November 2016.See our response in section 21.2 of this document regarding the factors EPA assessed in setting the final standards and in promulgating the final rule.

21.3 NO_2-related Health Benefits

Organization: *Various Academic Researchers*

NOx emissions are precursors to PM2.5 and ozone, which contribute tens of thousands of premature deaths each year in the U.S. Heavy-duty trucks and buses are responsible for a substantial share of PM2.5- and ozone-attributable premature deaths. Traffic-related air pollution is responsible for an estimated 22,000 premature deaths in the U.S. each year, about 19% of all PM2.5- and ozone-attributable deaths in the U.S.1 On-road diesel vehicles contribute an estimated 43% of these traffic-related air pollution deaths. The vast majority of diesel vehicles in the U.S. are the heavy-duty vehicles that would be affected by the proposed emissions standards. [EPA-HQ-OAR-2019-0055-1220-A1, p. 1]

> 1. Anenberg, S. C.; Miller, J.; Henze, D. K.; Minjares, R.; Achakulwisut, P. The Global Burden of Transportation Tailpipe Emissions on Air Pollution-Related Mortality in 2010 and 2015. Environ. Res. Lett. 2019, 14 (9), 094012. https://doi.org/10.1088/1748-9326/ab35fc.

Health impacts from NO2 pollution were not accounted for in the Regulatory Impact Analysis (RIA) for this proposed rule. Our research has revealed that NO2 pollution could be responsible for a large fraction of new onset of pediatric asthma in U.S. cities.2 For example, we estimated that NO2 was responsible for about 33% of new pediatric asthma cases in Los Angeles and New York City, and about 25% in Washington, DC.4 The proposed strengthening of NOx emissions limits for HDVs would substantially reduce NO2 pollution, with important benefits for children’s respiratory health and development. These health benefits are not just statistics; asthma affects children throughout their entire lives. The exclusion of NO_2-attributable health impacts leads to underestimated benefits in the RIA. [EPA-HQ-OAR-2019-0055-1220-A1, pp. 1 - 2]

2. Khreis, H.; Kelly, C.; Tate, J.; Parslow, R.; Lucas, K.; Nieuwenhuijsen, M. Exposure to Traffic-Related Air Pollution and Risk of Development of Childhood Asthma: A Systematic Review and Meta-Analysis. Environment International 2017, 100, 1–31. https://doi.org/10.1016/j.envint.2016.11.012.

4. Achakulwisut, P.; Brauer, M.; Hystad, P.; Anenberg, S. C. Global, National, and Urban Burdens of Paediatric Asthma Incidence Attributable to Ambient NO_2 Pollution: Estimates from Global Datasets. The Lancet Planetary Health 2019, 3 (4), e166–e178. https://doi.org/10.1016/S2542-5196(19)30046-4.

Improved methods are needed to estimate health and environmental justice benefits from reduced NO_2 concentrations

The RIA for this proposed rule estimates that the emissions standards would avoid up to 2,100 premature deaths and 6,700 hospital admissions and emergency department visits from reduced $PM_{2.5}$ and ozone, among other health benefits. The RIA discusses how communities of color disproportionately live near high-volume roads. It also includes a demographic analysis of air quality changes resulting from the standards, finding that “the largest predicted improvements in both ozone and $PM_{2.5}$ are estimated to occur in areas with the worst baseline air quality, where a substantially larger number of people of color are expected to reside.” [EPA-HQ-OAR-2019-0055-1220-A1, p. 2.]

The Justice40 Initiative is aimed at ensuring that 40% of the benefits of governmental programs accrue to overburdened communities. The proposed HDV NO_x emissions standards are likely to dramatically narrow the inequities in traffic-related air pollution exposure and associated health risks across the U.S. and within individual U.S. cities. But the current RIA, as well as traditional methods EPA uses to estimate health benefits of improved air quality, are unable to capture the distributional benefits, particularly for rules that have the potential to dramatically narrow inequities, like rules affecting NO_x emissions from vehicle tailpipes. [EPA-HQ-OAR-2019-0055-1220-A1, p. 3.]

In particular, several key limitations preclude the RIA for these proposed standards from revealing which communities could experience the greatest improvements in air quality and associated health benefits. First, the chemical transport model simulations were conducted at 12km x 12km spatial resolution, too coarse to capture neighborhood-scale impacts. Second, the RIA did not include a demographic analysis of the health benefits of the rule. Finally, the analysis focused only on ozone and $PM_{2.5}$, and did not include NO_2, a pollutant that is one of the most inequitably distributed in U.S. cities and that is also most affected by HDV NO_x emissions standards. Thus, while this proposed rule could dramatically narrow inequities in air pollution-attributable health risks across the U.S., particularly for NO_2, the demographic distribution of the rule's air quality and health benefits is currently unknown. [EPA-HQ-OAR-2019-0055-1220-A1, p. 3.]

Improved methods are therefore needed to estimate health and environmental justice benefits from reduced PM2.5, ozone, and NO2 concentrations resulting from this proposed rule. This should include high spatial resolution chemical transport modeling to estimate neighborhood-scale changes in air pollution concentrations; considering NO2 concentrations as well as PM2.5, ozone, and NO2 health impacts; and population and disease rates that are spatially disaggregated. [EPA-HQ-OAR-2019-0055-1220-A1, p. 3.]

EPA Summary and Response

Summary:

The commenter notes that the proposed standards would bring about substantial health benefits, including to those who live near roads and to those who live in communities with EJ concerns. The commenter also suggests that the Agency should consider methods to better estimate the health and environmental justice benefits from reduced NO2 concentrations like those that would be achieved by the proposed and final program.

The commenter specifically noted three key limitations to our analysis: the spatial resolution of our photochemical air quality modeling, the absence of a demographic analysis of health benefits, and the omission of quantified and monetized NO2 health impacts.

Response:

Thank you for your comments. We agree that the proposed standards would bring about substantial health benefits, including to those who live near roads and to those who live in communities with EJ concerns. We also agree that the Agency should consider methods to better estimate the health and environmental justice benefits from reduced NO_2 concentrations like those that would be achieved by the proposed and final program. EPA intends to continue to consider how to better reflect NO_2-related benefits as well as the overall distributional implications of future regulatory actions.

The commenter specifically noted three key limitations to our analysis: the spatial resolution of our photochemical air quality modeling, the absence of a demographic analysis of health benefits, and the omission of quantified and monetized NO_2 health impacts. We will address the first and third of these limitations here and refer the reader to Section 22 of this document for a response to comments regarding demographic analyses of health benefits.

We agree that the chemical transport model simulations that were conducted at a 12km x 12km grid cell spatial resolution are too coarse to capture neighborhood-scale impacts. EPA is considering how to better estimate the near-roadway air quality impacts of its regulatory actions and how those impacts are distributed across populations. Because the heavy-duty standards apply nationally and will be implemented consistently across roadways throughout the U.S., we can still make useful observations of demographic trends at a national scale using the air quality modeling data at a 12km x 12km resolution. The Agency continues to research highly resolved air quality data and intends to incorporate new methods and modeling techniques after they become available.

Regarding the quantification and monetization of NO_2-related health impacts, the Integrated Science Assessment for Oxides of Nitrogen makes clear that given the current literature, it is difficult to disentangle the effects of other pollutants, such as PM and ozone, from NO_2 to specifically estimate health effects such as premature mortality.[55] There is, however, evidence that NO_2 can be associated with asthma incidence, and the Agency intends to continue to consider how best to quantify this endpoint in future regulatory actions. Such consideration could apply the same systematic process for selecting, quantifying, and monetizing NO_2-related health impacts as it has for $PM_{2.5}$ and ozone. This process includes: applying criteria for identifying and selecting studies and risk estimates most appropriate to inform a benefits analysis for an RIA; identifying pollutant-attributable health effects for which the ISA reports strong evidence and that may be quantified in a benefits assessment; collecting baseline incidence and prevalence estimates and demographic information; developing appropriate economic unit values; and characterizing uncertainty with quantified benefits estimates.

21.4 General Comments About the Benefits of the Proposal

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

According to EPA's own analysis, Option 1 would produce at least $11 billion and up to $50 billion more in present-value monetized benefits than Option 2 (depending on the discount rate and other factors) due to reduced mortality and avoided illnesses. See DRIA at 403–04 & Table 9-1. And those figures do not account for the additional unquantified but valuable human health and environmental benefits that Option 1 would create. 87 Fed. Reg. at 17,428, 17,590. [EPA-HQ-OAR-2019-0055-1302-A1, p.50]

Organization: *International Council on Clean Transportation (ICCT)*

The human health costs are high and will increase each year the U.S. fails to reduce pollutants from the most-polluting vehicles on the road. An ICCT study showed in 2015, the U.S. lost 2,982 lives to premature death caused by on-road diesel vehicle NOx emissions, largely from heavy-duty vehicles that were shown to have 10 times the impact of light-duty diesel cars.xl Given that the travelled mileage from heavy-duty trucks in the U.S. is rising – about 13 percent from 2010 to 2020xli – more stringent NOx standards for HDTs that pollute at disproportionately high levels are a crucial piece of protecting public health. [EPA-HQ-OAR-2019-0055-1310-A1, p.7]

> xl ICCT, New Study Quantifies Global Health, Environmental Impacts of Excess Nitrogen Oxide Emissions from Diesel Vehicles, May 15, 2017, https://theicct.org/new-

[55] U.S. EPA (2016). Integrated Science Assessment for Oxides of Nitrogen – Health Criteria. U.S. Environmental Protection Agency. Washington, DC. Office of Research and Development. EPA/600/R-15/068. Available at: https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=310879.

study-quantifies-global-health-environmental-impacts-of-excess-nitrogen-oxide-emissions-from-diesel-vehicles/

xli U.S. Department of Transportation, Bureau of Transportation Studies, 'Single-Unit 2-Axle 6-Tire or More Truck Fuel Consumption and Travel (metric), https://www.bts.gov/content/single-unit-2-axle-6-tire-or-more-truck-fuel-consumption-and-travel-0.

Previous ICCT research has shown that achieving a 90% NOx reduction for model year 2027 and later diesel engines could avoid more than $1 trillion in air pollution-related health damages cumulatively from 2027–2050. [EPA-HQ-OAR-2019-0055-1211-A1, p. 7]

The EPA analysis shows the adoption of Option 1 will result in substantial air quality benefits. Annual NOx reductions in 2030 and 2040 are 16.4 and 55.9 percent. PM2.5 emissions are reduced 3.4 and 23.7 percent. And benzene, an air toxic, is reduced 4.1 and 23.1 percent. Reducing the health impacts of exposure to these pollutants is especially important to residents of communities located close to high truck traffic. [EPA-HQ-OAR-2019-0055-1211-A1, p. 14]

EPA's analysis of health benefits indicates the proposed Option 1 standards when fully implemented in 2045 will reduce premature deaths by about 3,000 per year. The average monetized value of all health benefits of Option 1 (at a 7 percent discount) is 5.3 times the total cost of compliance. Option 2 provides lower benefits and higher costs with a less favorable benefit/cost ratio of 3.8. [EPA-HQ-OAR-2019-0055-1211-A1, p. 15]

Organization: *Public Citizen and Healthy Port Communities Coalition (HPCC)*

We support the Proposal's inclusion of a health benefits analysis that demonstrates Option 1's significant health savings of $12 to $33 billion (3% discount rate) or $10 to $30 billion (7% discount rate). Many of these benefits will be delivered to communities that are overburdened by pollution from sources beyond transportation-related emissions. Some of these communities may also lack adequate access to health insurance and health care services, so prevention of pollution and resulting disease could provide much needed relief to those harmed by pollution from heavy-duty vehicles. [EPA-HQ-OAR-2019-0055-1417-A2, p. 1]

Our own work shows that vehicle turnover and electrification can reduce health and financial burdens on the public. In 2017, Public Citizen and our partners at the Healthy Port Communities Coalition worked with University of Houston researchers to better understand the benefits that cleaning up transportation-related pollution would have on the greater Houston region in terms of the amount and distribution of air pollution and health benefits. The study found over $1.5 billion in monetized health benefits from aggressive electrification where 70% of the fleet in Greater Houston (both light- and heavy-duty vehicles) is electrified in model year 2040. This scenario would prevent nearly 200 premature deaths per year.1 [EPA-HQ-OAR-2019-0055-1417-A2, pp. 1 - 2]

1. https://www.citizen.org/wp-content/uploads/migration/public-citizen-air-quality-transportation-houston-report-october-2018.pdf

Organization: *Zero Emission Transportation Association (ZETA)*

According to the American Lung Association, the widespread transition to zero-emission transportation by 2050 can annually produce up to $72 billion in avoided health costs, save approximately 6,300 lives, and prevent more than 93,000 asthma attacks and 416,000 lost workdays.6 These positive health impacts will be most significant among frontline communities, whose members are disproportionately likely to live near highways and suffer from poor air quality.7 This higher exposure burdens underserved residents with negative health outcomes and higher healthcare costs. [EPA-HQ-OAR-2019-0055-1283-A1, p.2]

6 https://www.lung.org/ getmedia/99cc945c-47f2-4ba9-ba59-14c311ca332a/electric-vehicle-report.pdf

7 https://www.smithsonianmag. com/history/how-federal-government-intentionally-racially-segregated-americancities-180963494

Beyond its negative health impacts, transportation-based pollution damages the environment in myriad ways. The VOCs and NOx emitted by diesel vehicles react to form dangerous ground-level ozone, which forms smog and leaves agricultural crops and forests particularly susceptible to stunted growth and a decreased ability to sequester CO_2. Likewise, nitric acid, another tailpipe pollutant, forms acid rain that leaches into the ground and waterways. Perhaps the most dramatic effect of diesel burning is its emission of global warming-causing GHGs. Global warming, in turn, causes extreme weather patterns, reductions in air quality, a rise in sea levels, and leads to widespread species extinction.8 [EPA-HQ-OAR-2019-0055-1283-A1, p.2]

8 https://www.epa.gov/dera/learn-aboutimpacts-diesel-exhaust-and-diesel-emissions-reduction-act-dera

EPA Summary and Response

Summary:

The commenters noted that the health benefits of the regulatory options analyzed in the proposal are significant and meaningful both to the U.S. population as a whole and to communities currently overburdened by pollution, and that Option 1 yielded higher benefits than Option 2. Commenters also noted the potential benefits of electrification.

Response:

Thank you for your comments. EPA agrees that the health benefits of the regulatory options analyzed in the proposal are significant and meaningful both to the U.S. population as a whole and to communities currently overburdened by pollution. We also agree that the benefits of the proposed program outweigh their costs, as they also do for the final program. See RIA Chapter 8 for a complete description of the benefits analysis conducted for the final program. In response to comments on the potential benefits of electrification, the final standards are not based on the projected utilization of ZEV technology; however, manufacturers may choose to comply with the standards by using other technologies, including ZEV technologies (see preamble Section III.A for discussion).

22 Demographic Analysis of Air Quality

Comments by Organization

Organization: *Alliance for Vehicle Efficiency (AVE)*

AVE supports incentives to accelerate the adoption of technologies that lower NOx and PM to improve air quality for at-risk communities. [EPA-HQ-OAR-2019-0055-1280-A1, p. 7]

On-road Heavy Duty trucks account for close to 60% of this country's annual NOx emissions which serves as the leading factor of ozone. EPA has an opportunity to improve the air quality and reduce ground level ozone for millions of Americans living in projected Ozone Nonattainment areas. [EPA-HQ-OAR-2019-0055-1280-A1, p. 7]

As of December 2020, approximately 50% of all commercial diesel trucks in operation, nationwide, were purchased after MY 2010 or later, while 50% of the heavy-duty trucks now on the roads continue to operate without the benefit of NOx and PM emissions control technologies. New heavy-duty trucks will be operational for decades. Incentives for compliant trucks, not just ZEVs, purchased prior to the MY 2027 will bring tremendous health benefits to at-risk communities and the nation. [EPA-HQ-OAR-2019-0055-1280-A1, p. 7] [Also in Section 13.4 of this document]

Although states are required to develop and follow pathways to comply with National Ambient Air Quality Standards (NAAQS), NOx emission from on-road heavy duty trucks is a national problem. As heavy-duty trucks travel long distances and often across state lines, a strong and robust federal emissions program is vital to meeting Ozone NAAQS while, at the same time, providing regulatory certainty to the industry and state air regulators across the country. As shown in the chart below, urban areas across the country suffer from significantly unhealthy levels of NOx and PM. [EPA-HQ-OAR-2019-0055-1280-A1, p. 7]

13.6 million Americans living in 11 large and small urban areas and rural counties experienced over 100 days of ozone pollution at levels above what the EPA considers "good" in 2020. [EPA-HQ-OAR-2019-0055-1280-A1, p. 8]

An additional 57.3 million Americans living in 90 large and small urban areas and rural counties experienced between 31 and 100 days of elevated ozone pollution. [EPA-HQ-OAR-2019-0055-1280-A1, p. 8]

Air pollution levels are uneven within cities, contributing to persistent health disparities between neighborhoods and population sub-groups. Highly spatially resolved information on pollution levels and disease rates is necessary to characterize inequities in air pollution exposure and related health risks.14 [EPA-HQ-OAR-2019-0055-1280-A1, p. 8]

14. https://pubmed.ncbi.nlm.nih.gov/34765851/#:~:text=We%20find%20that%20PM2.5,(between%202014%20and%202018).

Organization: *Institute for Policy Integrity at New York University School of Law (Policy Integrity)*

EPA should revise and expand its distributional analysis to better reflect the impacts of the Proposed Rule on vulnerable subpopulations. EPA should conduct a more geographically granular analysis and reconfigure its subpopulation analysis. In addition, EPA should conduct a distributional analysis of all regulatory alternatives under consideration in order to evaluate incremental distributional benefits among alternatives. [EPA-HQ-OAR-2019-0055-1256-A1, p. 1]

EPA Summary and Response

Summary:

Commenters noted that people who live in both urban and rural areas experience elevated exposures to pollution from the heavy-duty engines that would be regulated by the proposed standards.

Commenters also suggested that EPA conduct a more "spatially resolved," "geographically granular" demographic analysis.

The commenter also suggested that EPA conduct a distributional analysis of all regulatory alternatives under consideration in order to evaluate incremental distributional benefits among alternatives.

Response:

We agree with the commenter that people who live in both urban and rural areas experience elevated exposures to pollution from the heavy-duty engines that would be regulated by the proposed standards. The proposed and final standards would bring about substantial health benefits, including benefits to those who live near roads and to those who live in communities with EJ concerns.

The commenters suggest that EPA conduct a more "spatially resolved," "geographically granular" demographic analysis. For the proposal, we conducted chemical transport model simulations at a 12km x 12km grid cell spatial resolution. A limitation of this analysis is the 12km x 12km horizontal grid spacing of the air quality modeling domain. Such resolution is unable to capture the heterogeneity of human exposures to pollutants within that area, especially pollutant concentration gradients that exist near roads. EPA is considering how to better estimate the near-roadway air quality impacts of its regulatory actions and how those impacts are distributed across populations. Because the heavy-duty standards apply nationally and will be implemented consistently across roadways throughout the U.S., we can still make useful observations of demographic trends at a national scale using the air quality modeling data at a 12km x 12km resolution.

The commenter also suggested that EPA conduct a distributional analysis of all regulatory alternatives under consideration in order to evaluate incremental distributional benefits among alternatives. EPA considers computational efficiency when conducting national analyses of policy-relevant air quality scenarios. Conducting full-scale photochemical modeling for all scenarios was not feasible. Furthermore, because the scope of each policy scenario was national, the reductions in secondarily-formed $PM_{2.5}$ and ozone were regional, and the form of the standards did not fundamentally affect the spatial allocation of emissions changes, we believe the demographic analysis we conducted for the proposal was a representative characterization of the distribution of air quality impacts. See RIA Chapter 6 for a description of the demographic analysis of air quality.

23 Environmental Justice

23.1 EPA Needs More Detailed Environmental Justice Analysis

Comments by Organizations

Organization: *Moving Forward Network (MFN)*

The Freight Transportation System Imposes Unacceptable Levels of Cumulative Impacts on Environmental Justice Communities. People who live near freight hubs or "diesel death zones"—including ports, highways, warehouses, and rail and intermodal yards—are disproportionately exposed to high concentrations of pollution from the combined activity of diesel-fueled heavy-duty trucks, equipment, rail, and vessels.10 Countless studies show that diesel-powered vehicles emit fine particulate matter (PM2.5) and nitrogen oxides (NOx), which lead to numerous adverse health outcomes and even premature death. Additionally, heavy-duty trucks and buses are also a major source of climate-warming greenhouse gas (GHG) emissions. [EPA-HQ-OAR-2019-0055-1277-A1, p. 7]

> 10. See, e.g., Loma Linda University, Report, Project ENRRICH: A Public Health Assessment of Residential Proximity to a Goods Movement Railyard, available at http://www.aqmd.gov/docs/default-source/clean-air-plans/clean-communitiesplan/enrrich_final_report_29may2014.pdf.

Unfortunately, a huge number of people in the U.S. are affected by this pollution every day. For example, in 2016, EPA estimated that approximately 39 million people in the United States—mostly low-income people of color—live close to ports and are exposed to elevated levels of diesel pollution.11 Another 45 million people live within 300 feet of a highway.12 People of color and low-income households are disproportionately exposed to elevated levels of diesel pollution.13 Indeed, our health, air pollution, and climate crises are among the most urgent environmental justice issues of our time. [EPA-HQ-OAR-2019-0055-1277-A1, p. 7]

11. EPA, National Ports Strategy Assessment, at 1, 4 (Sept. 2016) available at https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100PGK9.pdf.

12. Office of Transportation and Air Quality. "Near Roadway Air Pollution and Health: Frequently Asked Questions." US EPA, August 2014. https://www.epa.gov/sites/default/files/2015-11/documents/420f14044_0.pdf.

13. ICF International, October 2019; Rosenbaum, Arlene, Seth Hartley, and Chris Holder. "Analysis of Diesel Particulate Matter Health Risk Disparities in Selected US Harbor Areas." American Journal of Public Health 101, no. S1 (December 1, 2011): S217– 23. https://doi.org/10.2105/AJPH.2011.300190.

Today, a person's zip code remains the most significant predictor of health and wellbeing. In fact, low income neighborhoods and communities of color breathe in an average of 28 percent more NOx pollution than higher-income and majority white neighborhoods.14 For residents of environmental justice communities, this means that their lives can be 10-20 years shorter because of environmental pollution, compared to residents in wealthy white communities.15 [EPA-HQ-OAR-2019-0055-1277-A1, pp. 7 - 8]

14. Mary Angelique G. Demetillo et al., Space-Based Observational Constraints on NO2 Air Pollution Inequality From Diesel Traffic in Major US Cities, Geophys. Research Letters, Vol. 48 No. 17 (Aug. 25, 2021) https://doi.org/10.1029/2021GL094333

15. https://www.ucsusa.org/resources/environmental-racism-heartland#read-online-content; https://www.today.com/specials/howzip- code-affects-health-black-women/

The science behind cumulative impacts is substantial and growing.29 In fact, MFN and its members have long pressed the federal government to acknowledge the multiple and thus cumulative environmental threats environmental justice communities face and their heightened vulnerability to those threats. Specifically, these cumulative impact analyses recognize not only that some individuals and communities face more pollution than others, but also that the same amount of pollution can result in more harm to people facing additional and compounded stressors than to people who do not face such stressors. It also recognizes that these multiple stressors are too often interrelated in their origins. The results are clear— people of color and people with low incomes face some of the highest levels of pollution, and are least equipped to ward off the consequences of this pollution.30 [EPA-HQ-OAR-2019-0055-1277-A1, pp. 10 - 11]

29. Yukyan Lam, Kim Wasserman, Juliana Pino, Olga Bautista, Peggy Salazar and Maria Lopez-Nunez, "Seeing the Whole: Using Cumulative Impacts to Advance Environmental Justice," February 2022, at 9-16 (discussing extrinsic and intrinsic factors).

30. Yukyan Lam, Kim Wasserman, Juliana Pino, Olga Bautista, Peggy Salazar and Maria Lopez-Nunez, "Seeing the Whole: Using Cumulative Impacts to Advance Environmental Justice," February 2022, at 9-16 (discussing extrinsic and intrinsic factors).

For example, a new study released in March 2022 examines the link between port-related traffic and hospital visits for respiratory, heart-related, and psychiatric issues, and concludes that people of color are more vulnerable to health impacts as a result of increased goods movement operations.31 Adding just one vessel or increasing overall vessel tonnage in a nearby port leads to more than 3 additional hospital visits per year per thousand Black residents, compared to about 1 visit per thousand for white residents in the same area.32 Relatedly, the study also found that reducing fossil fuel use in ports would significantly reduce air pollution concentration, and have an acute and positive benefit to local Black residents. [EPA-HQ-OAR-2019-0055-1277-A1, p. 11]

31. Kenneth Gillingham and Pei Huang, Racial Disparities in the Health Effects from Air Pollution: Evidence from Ports (Mar. 15, 2022), available at https://resources.environment.yale.edu/gillingham/RacialDisparitiesAirPollution.pdf.

32. Kenneth Gillingham and Pei Huang, Racial Disparities in the Health Effects from Air Pollution: Evidence from Ports (Mar. 15, 2022), at p. 32, available at https://resources.environment.yale.edu/gillingham/RacialDisparitiesAirPollution.pdf.

Yet, despite all these well-documented harms, the freight industry continues to grow rapidly in the very communities that are already overburdened, making it more urgent than ever that we fully and properly address our air pollution and climate crises. In fact, over the last three years, more people in the U.S. have experienced “very unhealthy” or “hazardous” air quality than in the last two decades, and people of color are now 3.6 times more likely than white people to live in a county with failing air quality, according to the American Lung Association.33 [EPA-HQ-OAR-2019-0055-1277-A1, p. 11]

33. American Lung Association, 2022 State of the Air, Key Findings, (last visited May 5, 2022), https://www.lung.org/research/sota/key-findings.

Likewise, truck traffic at ports, railyards, and warehouses is on the rise due to historic levels of online shopping, e-commerce, and congestion associated with the COVID-19 pandemic. According to the California Air Resources Board (CARB), during the second half of 2021, truck pollution associated with a surge in cargo volumes at the Ports of Los Angeles and Long Beach contributed almost 2 tons of additional NOx pollution every single day, on top of the existing emissions associated with business-as-usual cargo volumes prior to the pandemic.34 Other freight-impacted communities have also seen spikes in activity as the e-commerce industry expands. The American Lung Association found that in the last three years, more US residents experienced “very unhealthy” or “hazardous” air quality than in the last two decades, with people of color 3.6 times more likely than white people to live in a county with failing air quality.35 [EPA-HQ-OAR-2019-0055-1277-A1, p. 11]

34. Cal. Air Res. Bd., Emissions Impact of Freight Movement Increases and Congestion near Ports of Los Angeles and Long Beach: Jan. 2022 (Jan. 27, 2022 Update), available at https://ww2.arb.ca.gov/sites/default/files/2022-01/SPBP_Freight_Congestion_Emissions_Jan2022.pdf.

35. American Lung Association, 2022 State of the Air, Key Findings, (last visited May 5, 2022), https://www.lung.org/research/sota/key-findings.

Moreover, critically, the COVID-19 pandemic has escalated the negative consequences from living in a “diesel death zone” or a region with poor air quality. Numerous studies now show that long-term exposure to air pollution makes people more vulnerable to complications and death from COVID-19.36 That neighborhoods with high proportions of Black and Latinx residents experience disproportionately high levels of air pollution may help explain why these groups have suffered disproportionately from the COVID-19 pandemic.37 Indeed, a recent study found that Los Angeles neighborhoods with the worst air pollution have experienced a 60 percent increase in mortality from COVID-19 compared to Los Angeles neighborhoods with the best air quality.38 COVID-19 infections have been known to be more severe for people who are already diagnosed with asthma. A recent study from Harvard University found that a small increase in long-term exposure to PM2.5 leads to a large increase in the COVID-19 death rate.39 One of the reasons that BIPOC (Black, Indigenous, and people of color) communities, are dying at higher rates from COVID-19 is because of the underlying health conditions like diabetes, heart disease, and asthma, all of which are linked to the disportionately high levels of air pollution in these communities. As Dr. Sacoby Wilson says, “Context matters. Place matters.”40 For EJ communities, place matters, and EPA should only be proposing regulations that guarantee health benefits and emission reductions for overburdened communities, especially as we now have the increased threat from COVID-19. [EPA-HQ-OAR-2019-0055-1277-A1, p. 12]

36. Xiao Wu et al., Air pollution and COVID-19 mortality in the United States: Strengths and limitations of an ecological regression analysis, 6 Science Advances 45 (2020), https://projects.iq.harvard.edu/covid-pm.

37. Jonah Lipsitt et al., Spatial analysis of COVID-19 and traffic-related air pollution in Los Angeles, 153 Env’t Int’l. 106531 (Aug. 2021), https://doi.org/10.1016/j.envint.2021.106531.

38. Id.

39. Fine particulate matter and COVID-19 mortality in the United States, a national study on long-term exposure to air pollution and COVID-19 mortality in the United State, https://projects.iq.harvard.edu/covid-pm/home

40. https://e360.yale.edu/features/connecting-the-dots-between-environmental-injustice-and-the-coronavirus

EPA documented some of the connections between this rulemaking and environmental justice in the NPRM164, but it needs a more detailed analysis if it is going to actually reduce harms in environmental justice communities. Environmental racism in the impacts from heavy-duty truck pollution shows up in multiple ways—not limited to disproportionately high exposure to pollution, already elevated incidence rates of health risks such as asthma and premature mortality, and amplified effects of environmental exposures from social vulnerabilities such as cumulative physiological “wear and tear” and stress.165 We recommend that EPA further consider the disparate impacts of the rule and alternatives through analyzing race/ethnicity-stratified health benefits. This is already being done in other EPA rulemakings, and would more accurately capture the distribution of health impacts to environmental justice communities and result in a more accurate total health benefit as well. [EPA-HQ-OAR-2019-0055-1277-A1, p. 41]

164. 87 FR 17451-54 (Section II.B.8)

165. Morello-Frosch, Rachel, Miriam Zuk, Michael Jerrett, Bhavna Shamasunder, and Amy D. Kyle. "Understanding The Cumulative Impacts Of Inequalities In Environmental Health: Implications For Policy." Health Affairs 30, no. 5 (May 2011): 879– 87. https://doi.org/10.1377/hlthaff.2011.0153.; Payne-Sturges, Devon C., Gilbert C. Gee, and Deborah A. Cory-Slechta. "Confronting Racism in Environmental Health Sciences: Moving the Science Forward for Eliminating Racial Inequities." Environmental Health Perspectives 129, no. 5 (May 2021): EHP8186, 055002. https://doi.org/10.1289/EHP8186.; Spiller, Elisheba, Jeremy Proville, Ananya Roy, and Nicholas Z. Muller. "Mortality Risk from PM2.5: A Comparison of Modeling Approaches to Identify Disparities across Racial/Ethnic Groups in Policy Outcomes." Environmental Health Perspectives 129, no. 12 (December 2021): 127004. https://doi.org/10.1289/EHP9001.

Analyzing race/ethnicity-stratified health benefits is the next logical step from the existing analysis in the RIA. EPA's demographic analysis of air quality impacts of the rule shows that in the 2045 baseline, nearly double the number of people of color live in areas with the worst air quality compared with non-Hispanic Whites. These areas are also where the largest PM2.5 and ozone reductions occur due to Option 1. This is an important analytical step, and it is also important to outline how the resulting health risks are affected by these changes in exposures. As noted above, capturing the differences in exposure and exposure reductions from the rule only captures one part of its environmental justice impacts. A stratified health benefit analysis provides a view on how these exposure reductions are ultimately felt by different groups. These disparities in health impacts are often magnified when compared to disparities in exposure reductions, given the overlay of elevated incidence rates of health risks and the amplified health effects due to other vulnerabilities in communities of color (i.e., "cumulative impacts" as discussed elsewhere in these comments). Lastly, stratified health risk analyses can help communicate the impacts of the rule to stakeholders and promote meaningful involvement.166 [EPA-HQ-OAR-2019-0055-1277-A1, pp. 41 - 42]

166. A goal noted in EPA's definition of environmental justice and "Guidance on Considering Environmental Justice During the Development of a Regulatory Action." Environmental Protection Agency, https://www.epa.gov/environmentaljustice/guidance-considering-environmental-justice-during-development-action

EPA has shown strong documented support for analyzing health impacts by race/ethnicity within their rulemaking. Most notably, the 2019 PM2.5 Integrated Science Assessment (ISA) and draft supplement cite extensive evidence supporting racial and ethnic differences in PM2.5 exposure and health effects, especially within Hispanic and non-Hispanic Black populations.167 EPA's

2016 “Technical Guidance for Assessing Environmental Justice in Regulatory Analysis” recommends analysts to “present information on estimated health and environmental risks, exposures, outcomes, benefits and other relevant effects disaggregated by income and race/ethnicity”, while acknowledging context-specific data limitations, time and resource constraints, and analytic challenges.168 EPA has already conducted such an analysis in its Policy Assessment for the Reconsideration of the National Ambient Air Quality Standards for Particulate Matter (External Review Draft – October 2021), where it analyzed the effects of race/ethnicity-stratified health impact functions and baseline incidence data on mortality risk rate reductions from a number of different NAAQS modeling scenarios. This stratified analysis was reviewed favorably by the Clean Air Scientific Advisory Committee (CASAC), and its methods can be useful in other air quality rulemakings. [EPA-HQ-OAR-2019-0055-1277-A1, p. 42]

167. NRPM at 119. https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=347534 and https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=352823

168. “Technical Guidance for Assessing Environmental Justice in Regulatory Analysis.” Epa.gov, Environmental Protection Agency, https://www.epa.gov/sites/production/files/2016-06/documents/ejtg_5_6_16_v5.1.pdf. (June 2016) at 13.

Showing the distributional effects of the rule is a small additional step in light of the tremendous amount of work done in the rest of the RIA.169 In this case, the health benefit analysis already includes spatially distributed modeled health impact results, and matching this to the projected population distribution by race/ethnicity is a small effort. EPA’s Environmental Justice Strategy and Executive Order 12898 make clear the necessity for distributional analyses to ensure EPA policies and programs do not exacerbate environmental injustices, but it is also important to document where policies have the potential to mitigate disparities, and assess to what extent it does. There are a few caveats when doing this, notably that it is based on modeled exposures and projected population distributions, where populations in each grid cell are assumed to experience the same pollution.170 [EPA-HQ-OAR-2019-0055-1277-A1, p. 42]

169. Banzhaf, H Spencer. “Regulatory Impact Analyses of Environmental Justice Effects,” National Center for Environmental Economics Working Paper Series, 10–08 (2010). https://www.epa.gov/sites/default/files/2014-12/documents/regulatory_impact_analyses_of_environmental_justice_effects.pdf at 17.

170. Post, Ellen S., Anna Belova, and Jin Huang. “Distributional Benefit Analysis of a National Air Quality Rule.” International Journal of Environmental Research and Public Health 8, no. 6 (June 1, 2011): 1872–92. https://doi.org/10.3390/ijerph8061872.

Including racially-specific health benefits can also more accurately assess the total health benefits of the rule. Spiller et al. (2021) has shown that including race/ethnicity-specific mortality incidence rates or health impact functions (HIFs) can both change the distribution of health benefits as well as increase total premature mortality estimates by 9%.171 Similarly, in the case of Proposed Option 1 of this rule, not using race/ethnicity-specific health impact functions underestimates the total PM2.5 premature mortality reduction by around 16%. This translates to a $1.2 billion underestimation of health benefits from PM2.5 premature mortality reduction alone. Notably, benefits to Black populations are underestimated by 64%, benefits to Hispanic populations are underestimated by 36%, and benefits to White populations are overestimated by 16%. Table 3 below shows the full distribution of results from an illustrative stratified analysis. [EPA-HQ-OAR-2019-0055-1277-A1, pp. 42 - 43]

171. Spiller, Elisheba, Jeremy Proville, Ananya Roy, and Nicholas Z. Muller. "Mortality Risk from PM2.5: A Comparison of Modeling Approaches to Identify Disparities across Racial/Ethnic Groups in Policy Outcomes." Environmental Health Perspectives 129, no. 12 (December 2021): 127004. https://doi.org/10.1289/EHP9001.

The benefits in the stratified analysis above are modest compared to the thousands of deaths from diesel pollution across the country every year.173 The use of race/ethnicity stratified HIFs avoids underestimation of total health benefits as well as provides a more accurate portrayal of health benefits by race/ethnicity. This is just an illustrative analysis, and we encourage EPA to conduct its own, acknowledging difficulties in data collection, certainty, and health impact function availability for other health endpoints. Further analysis should situate these policies within a holistic cumulative impacts framing that guarantees reduction of harms in environmental justice communities. [EPA-HQ-OAR-2019-0055-1277-A1, p. 43]

173. https://www.catf.us/deathsbydiesel/

It is critical that, in this rulemaking, USEPA sends a strong signal to the market and regulators that longstanding burdens to communities and increasing disparities in burdens from heavy-duty trucks cannot continue. While Section 202 of the Clean Air Act itself does not on its face address the spatial/geographic distribution of heavy-duty trucks and other vehicles once manufactured and sold, USEPA has obligations under the Clean Air Act and Title VI of the Civil Rights Act to ensure that state agency receiving funds for their air programs address disparities in burdens from heavy duty trucks through their State Implementation Plans (SIPs).174 [EPA-HQ-OAR-2019-0055-1277-A1, pp. 43 - 44]

174. USEPA also may have civil rights obligations to ensure that localities receiving federal funds similarly do not create or perpetuate disparities in pollution and/or cumulative impacts from the logistics sector, as does its federal counterpart the Department of Housing and Urban Development. See 42 U.S.C. § 2000d-1 and 40 C.F.R. 7.15 ("This part applies to all applicants for, and recipients of, EPA assistance in the operation of programs or activities receiving such assistance" (emphasis added).)

USEPA can and should help support states doing so by setting a standard under Section 202 that ensures robust availability of the cleanest trucks across the country, in all states, cities and other municipalities facing the heavy and disparate toll of the logistics industry. [EPA-HQ-OAR-2019-0055-1277-A1, p. 44]

President Biden has directed the entire federal government and the Environmental Protection Agency (EPA) to prioritize protecting and investing in overburdened and underserved communities across America. EPA plays a leading role in delivering environmental and public benefits for communities with environmental justice (EJ) concerns through our policies, programs, and activities.198 [EPA-HQ-OAR-2019-0055-1277-A1, p. 59]

198. https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10144Y3.pdf

EPA Summary and Response

Summary:

The commenter noted that a large portion of the U.S. population is affected by the pollution from heavy-duty vehicles and engines. The commenter also noted that people of color and low-income households are disproportionately exposed to elevated levels of diesel pollution.

The commenter specifically requested that the Agency consider the disparate impacts of the rule through the analysis of race/ethnicity-stratified health benefits. The commenter also noted the impacts of COVID on underserved communities.

Response:

Thank you for your comments. We agree that the proposed standards would bring about substantial health benefits, including benefits to those who live near roads and to those who live in communities with EJ concerns. We also agree that the Agency can improve its methods to better estimate the health and environmental justice benefits associated with pollution reductions like those that would be achieved by the proposed and final rulemaking. There is considerable scientific evidence that specific populations and lifestages are at increased risk of $PM_{2.5}$- and ozone-related health effects. EPA is working to consider how to better reflect the overall distributional implications of future regulatory actions to improve air quality and public health. Nevertheless, we believe that our analysis for the proposed and final rulemaking is appropriate and informative in the context of the policy decisions being considered in this action

The commenter specifically requested that the Agency consider the disparate impacts of the rule through the analysis of race/ethnicity-stratified health benefits. In the proposal, the Agency provided an analysis that examined the racial and ethnic composition, as well as poverty status, of areas with the worst baseline air quality in 2045 and then considered whether those with the worst air quality were likely to benefit more from the proposed rule. We found that in the 2045 baseline, nearly double the number of people of color live within areas with the worst ozone and $PM_{2.5}$ air pollution compared to non-Hispanic Whites (NH-Whites). We also found that (in absolute terms) the largest predicted improvements in both ozone and $PM_{2.5}$ are estimated to occur in areas with the worst baseline air quality, where a substantially larger number of people of color are expected to reside. We did not expand this analysis to health benefits for a few reasons.

For our primary estimate of national-level PM and ozone-related health benefits, EPA systematically reviews the body of available epidemiological studies and risk estimates using explicit criteria to identify which studies and risk estimates are a best fit for use in a national analysis. These criteria include factors such as study design, geographic coverage, demographic populations, and health endpoints.[56] Using these criteria, the Agency selects risk estimates from epidemiologic studies that may be generalized to the population that is affected by the policy. Following this approach, EPA found that a risk estimate drawn from a national study of long-term exposure $PM_{2.5}$ mortality would more reliably estimate the number of $PM_{2.5}$-attributable deaths than would risk estimates stratified by individual race.

Furthermore, the Agency does not yet possess the race- or ethnicity-stratified baseline rates of death and disease for each endpoint it quantifies. Other data limitations include confidence in projections of population counts and population distribution (out to year 2045 for the proposal analysis) and the lack of race/ethnicity-stratified baseline health incidence projected into the future. Given the analytical limitations of the underlying literature and data to support a race/ethnicity stratified benefits analysis, we believe analyzing the distributional impacts of improvements in air quality is a fair surrogate for how benefits are distributed, while making the important observation that, qualitatively, there are specific populations and lifestages that may benefit more or less due to the distribution of pollution reductions projected to be achieved by the proposal. EPA will continue to work to improve how we characterize the distributional implications of future regulatory actions to improve air quality.

EPA is committed to taking decisive action to advance environmental justice and civil rights as part of its FY2022-2026 Strategic Plan. This rulemaking advances that strategic goal by setting stronger national emission standards for heavy duty engines and vehicles.

EPA acknowledges comments from many stakeholders on the impacts of COVID on underserved communities. While we were not able to incorporate COVID 19 into our modeling, we have evaluated the impacts we expect the rule to have on communities overburdened by pollution; this analysis is included in preamble Section IV.H, with additional discussion on environmental justice in preamble Sections II and XII.

23.2 General Comments About Environmental Justice

Comments by Organizations

Organization: *350Marin*

Air pollution from trucks to date is a major public health problem. According to EPA, more than 45 million people in the U.S. live within 300 feet of a major roadway or transportation facility, and 72 million people live within 200 meters of a truck freight route. People of color and those with lower income are most affected. [EPA-HQ-OAR-2019-0055-2474, p.1]

[56] U.S. Environmental Protection Agency (U.S. EPA). 2021. Estimating PM2.5- and Ozone-Attributable Health Benefits. Technical Support Document (TSD) for the Final Revised Cross-State Air Pollution Rule Update for the 2008 Ozone Season NAAQS. EPA-HQ-OAR-2020-0272. March. Available at: https://www.epa.gov/sites/default/files/2021-03/documents/estimating_pm2.5-_and_ozone-attributable_health_benefits_tsd_march_2021.pdf.

Organization: *Anne Mellinger-Birdsong*

In addition, many vulnerable populations including children, the elderly, and communities of color are both more exposed to air pollution, and more at risk of health problems caused by air pollution. [EPA-HQ-OAR-2019-0055-1244; see also Section 2.1]

> 6. Ozone causes asthma attacks, is as bad for progression of emphysema as 29 pack-years of cigarettes(https://doi.org/10.1001/jama.2019.10255). Ozone likely contributes to children developing asthma, and contributes to heart disease in adults. Ozone causes excess deaths in Medicare recipients, this effect is more pronounced in black people (https://doi.org/10.1056/NEJMoa1702747). [EPA-HQ-OAR-2019-0055-1244]
>
> 8. Demetillo and colleagues found that diesel traffic is the dominant source of NO2 disparities(https://doi.org/10.1029/2021GL094333). Lane and colleagues found that historical redlining maps from the 1930s still cause current day disparities in PM2.5 and NOx, with the placement of highways as one of the main contributing factors (https://doi.org/10.1021/acs.estlett.1c01012). Houston and colleagues found that Black and Asian-American/Pacific Island people were more exposed to diesel truck traffic near the Port of Los Angeles (https://doi.org/10.2105/AJPH.2012.301120). [EPA-HQ-OAR-2019-0055-1244]

Because air pollution from trucks and other heavy duty vehicles is so damaging to health, and especially to vulnerable populations such as children, the elderly, pregnant women, and communities of color, because of the structural inequities in our built environment placing more highways, ports, and railyards in communities of color, and because climate change is the biggest health threat we face, I support this rule. I encourage EPA to make it much stronger to fully protect the health of the most vulnerable populations. [EPA-HQ-OAR-2019-0055-1244]

Organization: *Carreras Tours, LLC (2033)*

Improving these standards will improve health outcomes for communities hardest hit by diesel pollution: communities near ports and freight corridors. [EPA-HQ-OAR-2019-0055-2033, p.1]

Organization: *Center for Climate and Energy Solutions (C2ES)*

Diesel-powered vehicles produce climate-polluting greenhouse gas emissions, as well as harmful air pollutants including PM2.5 particulate pollution and nitrous oxides (NOx), which produce smog and are hazardous to human health, especially to children, the elderly, pregnant people, and others with pre-existing respiratory conditions.3 Yet often the emissions from idling trucks, delivery vans, and other medium- and heavy-duty vehicles are concentrated in the very communities with populations most vulnerable to them. Delivery vans travel through neighborhoods, while highway and urban truck routes often pass through vulnerable communities and low-income communities. The burdens of pollution are often borne by communities disproportionately made up of people of color.4 [EPA-HQ-OAR-2019-0055-1165-A1, p.2]

3 *WHO global air quality guideline. Particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide* (Geneva: World Health Organization, 2021), https://www.who.int/publications/i/item/9789240034228.

4 Mary Angelique G. Demetillo et al., 'Space-Based Observational Constraints on NO2 Air Pollution Inequality from Diesel Traffic in Major US Cities,' *Geophysical Research Letters* 48 (August 2021): https://doi.org/10.1029/2021GL094333.

Air pollutants, including PM2.5 and NOx, are hazardous to human health; prolonged or excessive exposure can contribute to conditions like asthma, high blood pressure, chronic stress, and chronic respiratory diseases.12 Exposure to poor air quality is also correlated at the community level with significantly higher rates of COVID-19 infections and poorer health outcomes following infection.13 Burdens of air pollution and poor air quality are disproportionately borne by historically marginalized communities, including majority-Black communities, majority-immigrant communities, and low income communities, as well as children, the elderly, and other population with heightened health vulnerability.14 [EPA-HQ-OAR-2019-0055-1165-A1, p.4]

12 U.S. Environmental Protection Agency, *Integrated Science Assessment (ISA) for Oxides of Nitrogen – Health Criteria* (Washington, DC: U.S. Environmental Protection Agency, 2016): https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=310879; Paolo Giorgini et al., 'Air Pollution Exposure and Blood Pressure: An Updated Review of the Literature,' *Curr Pharm Des.* 22 (2016): 28-51, https://pubmed.ncbi.nlm.nih.gov/26548310; Hong Chen and Mark S. Goldberg, 'The effects of outdoor air pollution on chronic illnesses,' *McGill Journal of Medicine* 12 (2009): 58-64, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2687917.

13 X. Wu et al., 'Air pollution and COVID-19 mortality in the United States: Strengths and limitations of an ecological regression analysis,' *Science advances* 6: https://projects.iq.harvard.edu/covid-pm.

14 Mary Angelique G. Demetillo et al., 'Space-Based Observational Constraints on NO2 Air Pollution Inequality from Diesel Traffic in Major US Cities,' *Geophysical Research Letters* 48 (August 2021): https://doi.org/10.1029/2021GL094333.

Organization: *Ceres BICEP (Business for Innovative Climate and Energy Policy) Network*

Importantly, given that MHDVs are the largest source of nitrogen oxides (NOx) in the transportation sector, it is critical to strengthen the proposed NOx standards. Disadvantaged communities, located near highways, ports and distribution centers, have long borne the brunt of negative health and air quality impacts from truck pollution, and it is necessary to reduce this pollution as quickly as possible during the transition to electrification (which in turn, will have additional health benefits). Accordingly, EPA should adopt a strengthened Option 1, requiring a 90% reduction in NOx by 2027, and phase out advanced technology credit multipliers for NOx as soon as feasible. [EPA-HQ-OAR-2019-0055-2714-A1, p.2]

Further, given that medium- and heavy-duty vehicles are the largest source of nitrogen oxides (NOx) in the transportation sector, it is critical to strengthen the proposed NOx standards, which were last updated twenty years ago. Disadvantaged communities have long borne the brunt of negative health and air quality impacts from truck pollution, and we need to reduce these pollutants to the maximum extent possible. [EPA-HQ-OAR-2019-0055-2714-A2, p.1]

Further, given that MHDVs are the largest source of NOx in the transportation sector, it is critical to strengthen the standards to the maximum extent possible in order to reduce air pollution from MHDVs during the transition, which disproportionately increases health and air quality risks in disadvantaged communities located near truck routes, ports, and distribution centers. [EPA-HQ-OAR-2019-0055-2714-A3, p.2]

Organization: *Chesapeake Bay Foundation, Inc. (CBF)*

Emissions from heavy-duty trucks—including NOx and particulate matter—cause numerous, well-documented negative health impacts, including exacerbation of existing respiratory and cardiovascular conditions, increased asthma attacks and new cases of asthma, difficulty breathing, inflammation and irritation of the lungs, and decreased cardiac function, among many others.5 These negative health impacts are particularly damaging for communities and individuals who live, work, or attend school close to major roadways.6 Many of these communities are home to lower-income and/or minority populations who are already burdened by industrial air and water pollution sources located nearby.7 [EPA-HQ-OAR-2019-0055-1295-A1, p.3]

5 See U.S. EPA, Integrated Science Assessment (ISA) For Oxides of Nitrogen—Health Criteria (Final Report 2016), EPA/600/R-15/068; U.S. EPA Integrated Science Assessment (ISA) For Ozone and Related Photochemical Oxidants (Final Report 2013), EPA/600/R-10/076F; Integrated Science Assessment (ISA) For Particulate Matter (Final Report 2009), EPA/600/R-08/139F.

6 EPA, Office of Transportation and Air Quality, 'Near Roadway Air Pollution and Health: Frequently Asked Questions' EPA-420-F-14-044 (Aug. 2014), https://nepis.epa.gov/Exe/ZyPDF.cgi/P100NFFD.PDF?Dockey=P100NFFD.PDF.

7 See, e.g., Gregory C. Pratt et al., Traffic, Air Pollution, Minority and Socio-Economic Status: Addressing Inequities in Exposure and Risk, Int'l Journal of Env. Research and Public Health 12(5): 5355-5372 (May 2015), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4454972/.

One recent study found that communities of color and lower-income neighborhoods are disproportionately impacted by NOx emissions.8 Communities that are primarily composed of people of color and lower-income households experience, on average, 28 percent more nitrogen dioxide pollution than communities that are majority-white and higher income. Furthermore, millions of U.S. citizens live in areas burdened by high levels of ozone pollution fueled by NOx emissions,9 and lower-income and minority communities are disproportionately impacted by ozone pollution.10 [EPA-HQ-OAR-2019-0055-1295-A1, p.3]

8 Mary Angelique G. Demetillo, et al., Space-Based Observation Constraints on NO2 Air Pollution Inequality From Diesel Traffic in Major US Cities, Geophysical Research Letters Vol. 48, Issue 17 (Aug. 2021), https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2021GL094333.

9 See, e.g., Elizabeth Ridlington, et al., Trouble in the Air: Millions of Americans Breathed Polluted Air in 2018, at 21 (Winter 2020), available at https://uspirg.org/sites/pirg/files/reports/EnvironmentAmerica_TroubleintheAir_scrn.pdf ('Thirty-two large and small urban areas and six rural counties—home to more than 21 million people—experienced more than 100 days of ozone pollution in 2018'); see also American Lung Ass'n, State of the Air Report: 2022, https://www.lung.org/research/sota/key-findings.

10 See Miranda M. L. et al., Making the Environmental Justice Grade: The Relative Burden of Air Pollution Exposure in the United States. Int'l Journal of Envtl. Research and Public Health. 2011; 8(6):1755-1771, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3137995/.

These trends are seen in communities throughout the Chesapeake Bay watershed. The Chesapeake Bay watershed is traversed by major interstate highways running up the Eastern Seaboard on which heavy-duty trucks regularly operate. Many of these major roadways are located directly adjacent to or within residential communities. According to 2014 National Emissions Inventory data, in Maryland and Washington, D.C., 74 and 75 percent of NOx emissions are due to transportation, respectively.11 In Virginia, 67 percent of NOx emissions are due to transportation.12 The Bay watershed also hosts all or part of three nonattainment areas for the 2015 Ozone National Ambient Air Quality Standard: Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE (Marginal Nonattainment); Washington, DC-MD-VA (Marginal Nonattainment); and Baltimore, MD (Marginal Nonattainment).13 [EPA-HQ-OAR-2019-0055-1295-A1, pp.3-4]

11 Elizabeth Ridlington, Trouble in the Air, at 60-61.

12 Id.

13 EPA, Greenbook: '8-Hour Ozone (2015) Designated Area/State Information' (current as of Apr. 30, 2022), https://www3.epa.gov/airquality/greenbook/jbtc.html.

Figure 1 uses EJSCREEN, the 2017 National Air Toxics Screening Assessment, and the 2015-2019 American Community Survey to compare census block groups exposed to the highest amounts of diesel particulate matter, with those block groups that are largely comprised of minorities. The communities exposed to large amounts of diesel particulate matter are generally communities with large numbers of people of color. [EPA-HQ-OAR-2019-0055-1295-A1, p.4]

The same study that found communities of color and lower-income neighborhoods experience as much as 28 percent more NOx pollution also found, of the 52 cities examined, that diesel trucks contributed up to half the nitrogen oxide emissions despite comprising 5 percent or less of all traffic.14 Furthermore, a 60 percent reduction in diesel-related pollution would lead to a 40 percent decline in 'air pollution inequality'.15 Reducing diesel-related pollution is an incredibly effective way to ensure all communities, but particularly those that suffer the most, are able to breathe clean air. [EPA-HQ-OAR-2019-0055-1295-A1, p.5]

14 Pollution from Freight Traffic Disproportionately Impacts Communities of Color Across 52 U.S. Cities, American Geophysical Union (Oct. 7, 2021), https://news.agu.org/press-release/pollution-from-freight-traffic-disproportionately-impacts-communities-of-color-across-52-u-s-cities.

15 Id.

Since 1990, EPA has repeatedly asserted the objective of addressing environmental justice concerns through the reduction of air pollution that disproportionately harms or cumulatively impacts such communities.16 EPA's Office of General Counsel, the Environmental Law Institute, and the National Environmental Justice Advisory Council have all observed that the Clean Air Act gives EPA ample authority to address such concerns through rulemaking.17 We therefore urge EPA to swiftly fulfill its mission and reduce heavy duty truck emissions to decrease negative health impacts to historically disadvantaged communities. [EPA-HQ-OAR-2019-0055-1295-A1, p.5]

16 See J. Mueller, and T. Lilley, Forty Years of Environmental Justice: Where is the Justice?, Richmond Public Interest Law Review, Vol. 25, pg. 79- 87, May 5, 2022; Environmental Equity-Reducing Risk For All Communities, Vol. 1 (1992). Workgroup,

17 National Environmental Justice Advocacy Committee, Memorandum on Integrating Environmental Justice Authority (1996); Gary S. Guzy, EPA Statutory and Regulatory Authorities Under Which Environmental Justice Issues May Be Addressed in Permitting, 1 (2000).; Envtl. L. Inst., Opportunities For Advancing Environmental Justice: An Analysis of U.S. EPA Statutory Authorities, 67-68 (2001) Office of Environmental Justice, EPA Plan EJ 2014 (2011); EPA, Guidance on Considering Environmental Justice During the Development of Regulatory Actions (2015); Off. Of Envtl. Just., EPA, Technical Guidance for Assessing Environmental Justice in Regulatory Analysis in Regulatory Analysis, June 2016 1 (2016).

Organization: *Christopher Lish*

I am glad that, after 20 years of delay, the Environmental Protection Agency has finally proposed stronger tailpipe toxic pollution standards for heavy-duty diesel trucks.

However, while these rules are a good start, they don't go far enough. Now is the time to eliminate toxic tailpipe emissions from trucks. Black, Latino, Asian American, and other marginalized communities living in highly trafficked areas have suffered the health impacts of diesel trucks for far too long. To deliver on the Biden Administration's environmental justice, public health, and climate goals, the Environmental Protection Agency must make the rules stronger and finalize a strong heavy-duty vehicle rule this year that sets us on a rapid path to cleaning up and electrifying the most polluting vehicles on the roads—our trucks and buses—by 2035, if not sooner. [EPA-HQ-OAR-2019-1147; see also Section 1.2/2.4]

Diesel pollution kills. Smog and soot air pollution caused by trucks and buses are among the greatest threats to public health for the more than 45 million people in the U.S. living within 300 feet of a major roadway or transportation facility. Nearly 10,000 people in the United States die each year from exposure to diesel emissions from the transportation sector, and hundreds of thousands of others face heart attacks, asthma, and respiratory conditions that damage their wellbeing and quality of life. Diesel emissions most severely harm communities of color and working class communities, and cleaning up dirty diesel pollution helps to create a more just society. Improving these standards will improve health outcomes for communities hardest hit by diesel pollution. The Environmental Protection Agency should adopt requirements to address disproportionate health impacts so that those who are most harmed by diesel pollution can find relief quickly. Even with strong heavy-duty emissions standards in place, it will take years for the benefits to reach the people who need them most. That's why we also need a zero-emissions truck mandate. [EPA-HQ-OAR-2019-1147]

Organization: *City Council District 8, Pittsburgh, PA, Erika Strassburger*

We know that diesel pollution from heavy duty trucks and buses is a massive public health threat. Diesel pollution worsens asthma and is particularly dangerous to children’s developing lungs. Of course, dangerous nitrogen oxides and other pollution that heavy duty vehicles like trucks and buses spew into our air hurt communities of color and low wealth communities first and worst. With more than 13 million people (including 3.5 million children) living near major marine and inland ports or rail yards, an additional 45 million individuals living within 300 feet of a highway or close to large distribution centers where diesel emissions are particularly dangerous, and that these individuals are disproportionately low-income communities of color, this is truly an environmental justice issue. [EPA-HQ-OAR-2019-0055-2233, p.1]

We urgently need cleaner heavy-duty vehicles on the road, especially in underserved communities that are overburdened with truck pollution due to their proximity to highways and high-traffic corridors. [EPA-HQ-OAR-2019-0055-2233, p.1]

I urge the EPA to adopt these standards as soon as possible. Families in diesel death zones have suffered long enough. [EPA-HQ-OAR-2019-0055-2233, p.1]

Organization: *City of Seattle, Office of Sustainability & Environment*

The City of Seattle agrees with the EPA that the current EPA 2010 standards are inadequate to protect public health from dangerous pollutants like NOx emissions from Heavy Duty Vehicles. We encourage you to go further with the proposed rule to protect environmental justice and port-adjacent communities, like Seattle’s Beacon Hill and Duwamish Valley neighborhoods, which are continuously exposed to sources of pollution from diesel trucks and other transportation emissions. Specifically, Beacon Hill, Georgetown, and SouthPark rank higher in both air pollution levels and child asthma rates and on average have a life expectancy that is eight years lower than other neighborhoods in Seattle. [EPA-HQ-OAR-2019-0055-1287-A1, p.1]

Please use this opportunity to finalize a rule that puts communities first and aggressively pursues the targets necessary to address the climate crisis. The public health crisis across the country, particularly for communities near highways, warehouses, and ports cannot wait. Together, we can both tackle the climate and air-quality crisis and address the problem of the price-differential between a typical, used truck ($20-30k), and a new zero-emission electric vehicle ($300-400k) for those who will most struggle to adopt this critical new technology. By adopting firm standards that protect communities and incentivizing the transition, the U.S. can create a stronger, more efficient, and healthier economy. [EPA-HQ-OAR-2019-0055-1287-A1, p.2]

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

Environmental justice, energy justice, and equity considerations are central to the Proposal, given the vast history of disproportionate environmental and public-health burdens placed on communities of color and low-income communities.19 Communities that are overburdened with pollution from sources such as major roadways, industrial sites, and agriculture are predominantly low-income, and a large percentage of residents of these communities are people of color and non-English speakers.20 With the improvements described later in these comments, this rulemaking could bring about significant air-quality and health improvements in communities that are disproportionately burdened with air pollution from trucking and overburdened from pollution more broadly.21 [EPA-HQ-OAR-2019-0055-1302-A1, pp.14-15]

19 For more information on the history and definition of the environmental justice movement, see Initiative for Energy Justice, Section 1—Defining Energy Justice: Connections to Environmental Justice, Climate Justice, and the Just Transition (Dec. 23, 2019), https://iejusa.org/section-1-defining-energy-justice/.

20 See Gina M. Solomon et al., Cumulative Environmental Impacts: Science and Policy to Protect Communities, 37 Annual Review of Public Health (Jan. 6, 2016), https://pubmed.ncbi.nlm.nih.gov/26735429/.

21 See EPA, ISA for Particulate Matter at Ch. 12: Populations and Lifestages Potentially at Increased Risk of a Particulate Matter-Related Health Effect; Section 5: Sociodemographic Factors, https://www.epa.gov/isa/integrated-science-assessment-isa-particulate-matter.

EPA must set strong emissions standards to meet the obligations established by presidential directives on environmental justice. Under Executive Order 12,898, EPA 'shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.' 59 Fed. Reg. 7,629 (Feb. 11, 1994). And Executive Order 14,008 directs EPA to develop 'programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts.'' 86 Fed. Reg. 7,619, 7,629 (Jan. 27, 2021). It also establishes the Administration's policy ''to secure environmental justice and spur economic opportunity for disadvantaged communities that have been historically marginalized and overburdened by pollution.'' Id. [EPA-HQ-OAR-2019-0055-1302-A1, p.15]

This rulemaking presents a critical opportunity to mitigate the adverse health impacts plaguing communities that are overburdened by air pollution from HDVs and other sources. As noted by the ALA's 2022 State of the Air report, which grades counties on daily and long-term measures of particle pollution and daily measures of ozone, 'Close to 19.8 million people live in the 14 counties that failed all three measures. Of those, 14.1 million are people of color. People of color were 61% more likely than white people to live in a county with a failing grade for at least one pollutant, and 3.6 times as likely to live in a county with failing grades for all three pollutants.'22 As described in Section II.C.1 above, all 14 of these counties are located in the vicinity of at least one major highway that overburdens county residents with pollution from trucks. [EPA-HQ-OAR-2019-0055-1302-A1, p.15]

22 See ALA, State of the Air 2022 Key Findings, https://www.lung.org/research/sota/key-findings.

According to the ALA's report, more than 137 million Americans live in places that received failing grades for unhealthy levels of ozone or PM in their air. In addition to the disproportionate impact on people of color noted above, ALA outlines other 'high-risk' groups that are impacted by the pollution in these regions. For example, low-income communities are particularly vulnerable and at risk of health impacts from pollution. More than 15.9 million people whose incomes meet the federal definition for living in poverty reside in counties that received a failing grade on at least one of ALA's pollutant indicators, while over 2.6 million people living in poverty reside in counties that received failing grades on all three pollutant measures. In addition, around 31 million children (under age 18) and almost 21 million older adults (age 65 or older) live in counties that received a failing grade on at least one pollutant.23 [EPA-HQ-OAR-2019-0055-1302-A1, pp.15-16]

23 See ALA, State of the Air 2022 at 18.

A new paper, titled 'Pollution from Freight Trucks in the Contiguous United States: Public Health Damages and Implications for Environmental Justice' and currently undergoing peer review, explores the spatial implications of pollution from freight trucks in the United States.24 The authors find evidence that the negative health impacts of emissions from freight trucking are disproportionately distributed across the country and are disproportionately likely to impact certain racial and ethnic groups. In particular, they find that pollution from freight trucking is more likely to occur in counties and census tracts with higher proportions of Black and Hispanic residents. [EPA-HQ-OAR-2019-0055-1302-A1, p.16]

24 Priyank Lathwal et al., Pollution from Freight Trucks in the Contiguous United States: Public Health Damages and Implications for Environmental Justice, arXiv:2204.06588 (2022), https://arxiv.org/abs/2204.06588.

In fact, it is well established that communities of color and economically disadvantaged communities are disproportionately exposed to environmental burdens from a variety of sources.

The White House Council on Environmental Quality (CEQ) recently released a preliminary Climate and Economic Justice Screening Tool, which identifies communities around the country that are 'marginalized, underserved, and overburdened by pollution'25 and would therefore qualify for Justice4026 investments (President Biden's key environmental justice initiative). The Screening Tool identifies census tracts as 'disadvantaged' if they are above the threshold for one or more environmental or climate indicators (e.g., exposure to diesel PM or PM2.5, traffic proximity and volume, or proximity to hazardous waste sites) *and* above the threshold for socioeconomic indicators related to income and education.27 A recent analysis found that 64% of the population in census tracts the Screening Tool identifies as disadvantaged are Hispanic/Latino, Black or African American, or American Indian or Alaskan Native. Overall, 50% of Hispanic/Latino, Black or African American, and American Indian or Alaskan Native individuals in the country reside in disadvantaged communities, compared to just 17% of White, Non-Hispanic/Latino individuals.28 [EPA-HQ-OAR-2019-0055-1302-A1, p.16]

25 CEQ, Preliminary Climate and Economic Justice Screening Tool, https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5.

26 The White House, The Path to Achieving Justice40 (July 20, 2021), https://www.whitehouse.gov/omb/briefing-room/2021/07/20/the-path-to-achieving-justice40/.

27 CEQ, Climate and Economic Justice Screening Tool: Technical Support Document 4–8 (Apr. 2022), https://static-data-screeningtool.geoplatform.gov/data-pipeline/data/score/downloadable/cejst_technical_support_do
cument.pdf.

28 Emma Rutkowski et al., Justice40 Initiative: Mapping Race and Ethnicity, Rhodium Group (Feb. 24, 2022), https://rhg.com/research/justice40-initiative-mapping-race-and-ethnicity/.

These findings show the critical need for EPA to minimize the harmful emissions from the HDV sector. Doing so will not only improve a significant public-health and environmental issue, but will also decrease air pollution and improve well-being in overburdened communities. [EPA-HQ-OAR-2019-0055-1302-A1, p.16]

A 2019 study by ICCT found that, on average, trucks traveling at speeds below 25 miles per hour emitted NOx at more than five times EPA's certification limit.234 That study also found that, on average, trucks only achieved NOx emissions at or below the certification limit when traveling at highway speeds above 50 mph.235 For each mile of urban driving, a single 'line-haul' truck used in long-distance shipping can emit *one hundred times* the NOx pollution that a car would emit.236 Even when traveling on highways in populated urban areas, trucks will often be moving at lower speeds due to congestion. The Federal Highway Administration's 2020 list of 'major freight highway bottlenecks and congested corridors' shows that many of the most congested highways in the United States are near densely populated urban areas that are also ozone nonattainment areas, such as Chicago, New York City, Los Angeles, California's Bay Area, Dallas/Fort Worth, and Denver.237 As EPA's Proposal notes, 72 million Americans live within 200 meters of freight routes, and people of color and those with lower incomes are disproportionately likely to live near freight truck routes and to live in urban areas. 87 Fed.

Reg. at 17,451. Studies have consistently found that environmental hazards such as air pollution are more prevalent in areas where people of color and low income populations represent a higher fraction of the population compared with the general population, and a recent study found that PM2.5 pollution from HDVs disproportionately impacts people of color. 87 Fed. Reg. at 17,452. It is crucial that these overburdened near-road communities do not continue to experience disproportionate levels of air pollution due to high levels of emissions from HDVs traveling at lower speeds. See Section II.C, supra. [EPA-HQ-OAR-2019-0055-1302-A1, pp.55-56]

234 Id. at i.

235 Id.

236 Id.

237 FHWA, 2020 National List of Major Freight Highway Bottlenecks and Congested Corridors: FHWA Freight Mobility Trends: Truck Hours of Delay at 11, Map 1 (2020) https://ops.fhwa.dot.gov/freight/freight_analysis/mobility_trends/national_list_2020.pdf; EPA, 8-Hour Ozone (2015) Nonattainment Areas (Apr. 30, 2022), https://www3.epa.gov/airquality/greenbook/jnc.html.

Organization: *Clean Energy (CE)*

The benefits of accelerating adoption of near-zero vehicles will be most closely felt in environmental justice communities. These neighborhoods are commonly adjacent to industrial areas with heavy truck traffic and need relief now. Near-zero trucks provide tangible results whereas EV heavy-duty trucks are, at the present date, technological speculation. In a 2017 article, Jason Morgan of Fleet Equipment Magazine wrote, '*…Tesla unveiled its electric Class 8 truck, dubbed the Semi. Fully loaded, the Tesla Semi consumes less than two kilowatt-hours of energy per mile and is capable of 500 miles of range at GVW and highway speed…10*' But in 2022, five years later, orders for these trucks have not been filled. Conversely, earlier this year, Amazon deployed its 1,000th near-zero truck running on RNG. [EPA-HQ-OAR-2019-0055-1350-A1, p.3]

10 https://www.fleetequipmentmag.com/tesla-semi-electric-class-8-truck/

Therefore, in order to address the air quality issues in environmental justice communities today and in the foreseeable future near-zero trucks, deployable now, must be encouraged. They will provide the air quality benefits these communities deserve which include not only NOx reductions of 95 to 98 percent but also virtual elimination of particulate matter emissions. The new heavy-duty truck rule must support near-term solutions in addition to long-term strategies and aspirations. [EPA-HQ-OAR-2019-0055-1350-A1, pp.3-4]

Organization: *CleanAirNow (CANKC)*

CANKC believes the time for purposeful action is now, the Armourdale neighborhood in Kansas City Kansas is already experiencing a shorter life expectancy by 22 years as compared to other nearby neighborhoods. KCK is not siloed in this large and impactful discrepancy; our nation has overburdened environmental justice (EJ) communities by having them bear the brunt of systemic racism with a legacy of redlining, zoning and dumping practices that have left families without access to clean air, water, and land. We ask, how many more lives is this lack of ruling going to cost us? How many more preterm babies, developmental disorders, cognitive disorders, asthma attacks, heart disease, lung disease or cancer will occur in our communities as a result of poisonous diesel emissions? [EPA-HQ-OAR-2019-0055-1239-A1, p.1]

Environmental Justice communities and frontline workers are being buried day in and day out with a multitude of polluting sources from the transportation freight sector. This is NOT accounting for the coal plants, toxic release inventory sites, and scrap metal facilities all primarily located in BIPOC and low-income communities. EJ communities are at the fenceline and are inhaling the mixture of dirty air, compromising their immunity and resulting in higher risks for health problems. As we have seen firsthand during this pandemic, they are the same communities with higher hospitalizations and deaths from COVID-19. [EPA-HQ-OAR-2019-0055-1239-A1, pp.1-2]

In the creation of zero emission infrastructure and zero emission solution, we must prioritize environmental justice communities. The implementation of these regulations must take into account the lifecycle of pollution, from source to manufacturing to tailpipe to waste and all of the potential impacts throughout that system. We need innovative and comprehensive policy from the EPA that ensures a reduction in harms to EJ communities. [EPA-HQ-OAR-2019-0055-1239-A1, p.2]

The answer is zero actually meaning zero, it’s a win win for the climate and for the hardworking people of this nation. Because as we know, justice delayed is justice denied and haven’t we faced enough injustice? [EPA-HQ-OAR-2019-0055-1239-A1, p.2]

Organization: *CleanEarth4Kids*

Pollution from heavy-duty trucks is a racial justice issue as they mostly harm communities of color. [EPA-HQ-OAR-2019-0055-1208-A1, p.1]

Communities of color are paying a heavy price for this pollution and need a rapid transition to zero-emitting trucks and a clear path towards 100% electrification of big rigs, trucks, and buses. [EPA-HQ-OAR-2019-0055-1208-A1, p.1]

Frontline communities are being poisoned and they can not afford to wait for cleaner air. [EPA-HQ-OAR-2019-0055-1208-A1, p.1]

Organization: *Coalition for Clean Air*

Emissions from vehicle tailpipes are the greatest barrier to clean air in California. Fine particulate matter produced by diesel trucks is particularly health-threatening. It is responsible for about 95 percent of pollution-related health impacts in the world. In California, communities of color are most burdened by this diesel truck pollution. [EPA-HQ-OAR-2019-0055-1139-A1, p.1]

Organization: *Colorado Energy Office, et al.*

Of note, cleaner trucks on the roads are especially important for our residents who live in close proximity to freight routes and bear a disproportionate impact from truck emissions. These communities cannot be left behind in the transition to clean transportation. [EPA-HQ-OAR-2019-0055-1297-A1, p.2]

Organization: *Consumer Reports (CR)*

Long-term exposure to ozone and PM2.5 increase the risk of premature death from respiratory and cardiovascular diseases. Exposure to PM2.5 is also linked with increased incidences of childhood asthma.10 These health impacts more significantly affect the estimated 72 million people living within 200 meters of a truck freight route. Communities living near these routes are disproportionately people of color and those with lower incomes.11 A recent study conducted by the Union of Concerned Scientists showed that Asian-American, Black, and Latinx communities face, respectively, 34%, 24%, and 23% higher exposures to diesel pollution compared to their white counterparts.12 Stringent NOx emission standards are vital to reducing these adverse health impacts and to addressing historic environmental inequities. [EPA-HQ-OAR-2019-0055-1285-A1, p.3]

10 American Lung Association, Health Impact of Air Pollution, (2022. Available at: https://www.lung.org/research/sota/health-risks.

11 87 F.R. 17414, 17418.

12 Union of Concerned Scientists, Inequitable Exposure to Air Pollution from Vehicles in California, (January 28, 2019). Available at: https://www.ucsusa.org/resources/inequitable-exposure-air-pollution-vehicles-california-2019.

Organization: *Creation Justice Ministries*

Even though these trucks account for only 4 percent of vehicles on the road, they are responsible for 25 percent of total transportation sector greenhouse gas emissions. Those emissions are destroying our climate and communities, degrading God’s planet and God’s people, with a disproportionate and absolutely unjust impact on communities of color. [EPA-HQ-OAR-2019-0055-2482, p.1]

Organization: *Dave Arndt*

[*From Hearing Testimony, April 12, 2022*] Unfortunately, by plan, all of this injustice is burdened on Black, Brown and low- income areas. Let me repeat that – this was and is all done by design.

I sorry to say, just five years ago I did not know this. Sure, I knew that air pollution and environmental and social in justice was bad, but I never saw the design. My eyes have been opened; however, we need to open everyone's eyes. This hearing is a good start in doing that, thank you for your work and this opportunity.

Let's take a look at the Brooklyn, Cherry Hill, Curtis Bay neighborhoods of Baltimore. They have two incinerators within 5 miles. Now add a few more layers, 3 RMP facilities, a chemical factory which is a large emitter of carcinogens. That is just the start. There is a working port which drives heavy duty truck traffic through the neighborhoods. Plus, several very large distribution centers which amplifies the truck traffic. Next add in the diesel emission from trains and the large ships themselves. And for convenience several major interstates cutting through the neighborhoods transporting thousands of trucks through the I-95 corridor. This would be a good design if it was isolated, however it was all placed in a Black, brown and low-income neighborhood by design. All having a cumulative effect.

The Baltimore region ranks among the worst in the U.S. for air pollution. A study by the Chesapeake Bay Foundation in 2017 found air quality in the region was ranked moderate or worse one of every three days, according to the EPA's own Air Quality Index. Little wonder then that children in Baltimore City have asthma at twice the rate of the rest of the country.

I would recommend you go to your own EPA's Environmental Justice Screening and Mapping Tool and see how bad it is.

I would like to end with a quote from Richard Moore, the National Co-Coordinator of the Environmental Justice Health Alliance: "You can't separate health from environmental justice, because environmental justice is health. And you can't separate issues of climate change and global warming because environmental justice and economic justice is addressing global warming and climate change. And so those intersections are very crucial." [EPA-HQ-OAR-2019-0055-2867; see also EPA-HQ-OAR-2019-0055-0994]

Organization: *Delaware Department of Natural Resources and Environmental Control (DNREC)*

Cleaning up truck emissions is long overdue for the communities living adjacent to the I-95 Corridor, the Port of Wilmington, and freight hubs who disproportionately suffer from harmful air pollution. [EPA-HQ-OAR-2019-0055-1200-A1, p.2]

Air pollution from HD vehicles disproportionately harms underserved and lower income communities. To achieve environmental justice goals and provide equitable access to clean air across the state, Delaware needs options for reducing vehicle pollution. [EPA-HQ-OAR-2019-0055-1200-A1, p.3]

Organization: *District of Columbia Department of Energy and the Environment (DOEE)*

DOEE acknowledges that the District's urban and natural environments are constructed and managed in ways that have not benefitted the capital's communities equally. District residents that continue to suffer the effects of environmental hazards—and their compounding impacts—are disproportionately people of color and people experiencing poverty. These hazards manifest as air pollution, inequities in access to clean water and nutritious food, lack of proximate green space, proximity to industrial toxins, racial disparities in life expectancy, and increased vulnerability to extreme weather events and climate change. By addressing racial inequity in the systems we manage and influence, we create opportunities for more communities to benefit from and participate in the process of identifying and implementing environmental solutions. [EPA-HQ-OAR-2019-0055-1299-A1, p. 4]

Communities adjacent to congested highways in particular experience heavy truck traffic. These communities in the District, located near the highways that run through the Southeastern portion of the District experience the worst asthma rates in Washington. Data from the Centers for Disease Control and Prevention shows that, nationally, Black and indigenous people have statistically significant higher asthma rates than their counterparts in other races.5 In the District, children who live in predominately Black communities have 20 to 25 times more asthma-related emergency department visits than their counterparts in majority White communities.6 [EPA-HQ-OAR-2019-0055-1299-A1, p. 4]

5. Center for Disease Control. Most Recent National Asthma Data. https://www.cdc.gov/asthma/most_recent_national_asthma_data.htm. Accessed August 26, 2020.

6. Children's National Medical Hospital. 2017. "Asthma Surveillance in DC Emergency Departments and Hospitals." https://childrensnational.org/-/media/cnhs-site/files/departments/impactdc/impact-dc-surveillance.pdf?la=en&hash=4235C55A9C1DE9DE9725D8D5D99D30831FCA18CF

Recent evidence, especially research conducted during the Covid-19 health emergency, has shown the strong negative impact of NOx emissions on health, affecting environmental justice communities in particular. One such study conducted by researchers at George Washington University found the reduction in NOx pollution during the Covid-19 lockdown was twice as large in Black, indigenous, people of color, and Latinx communities as it was in White communities, providing further evidence that reducing NOx pollution is an environment justice issue.7 Another study conducted specifically to look at health discrepancies in the District found that communities of color in the Southeastern portion of the District had disproportionally higher rates of negative health outcomes related to air pollution exposure.8 Strong heavy-duty NOx standards are an important part of the solution to the health disparities that result from exposure to truck emissions. [EPA-HQ-OAR-2019-0055-1299-A1, p. 4]

7. G. Hunter Kerr, D.L. Goldberg, and S.C. Anenberg, COVID-19 Pandemic Reveals Persistent Disparities in Nitrogen Dioxide Pollution, PNAS July 27, 2021 118 (30) e2022409118; https://doi.org/10.1073/pnas.2022409118.

8. Maria Daniela Castillo et al., Estimating Intra-Urban Inequities in PM2.5-Attributable Health Impacts: A Case Study for Washington, DC, preprint, (Public Health, April 20, 2021), www.essoar.org/doi/10.1002.

Organization: *Edwin J. Ward*

It’s no secret that the health effects of air pollution from heavy-duty vehicles have disproportionately impacted historically marginalized communities over the last century and continue to do so.1 In Syracuse, NY, I lived for years in the shadow of the infamous I-81 viaduct, a highway constructed in the 1950s that destroyed the thriving black neighborhood of the 15th Ward. 2 As a result, black residents in Syracuse today face significantly higher rates of asthma than white residents.3 What happened in Syracuse is no anomaly; it is a microcosm of the United States as a whole. And while heavy- duty vehicle emissions standards might seem like an odd place to start ameliorating historical environmental injustices, heavy-duty vehicles are responsible for a disproportionate amount of air pollution impacts and GHG emissions. Despite accounting for only 5% of vehicles on the road, trucks generate over 25% of GHG emissions from the transportation sector.4 Even more concerning, a recent study by the University of Toronto found that someone living near a road that serves as a major trucking route experiences the same levels of air pollution as someone who lives near a highway with ten times as much traffic.5 If sufficiently stringent, EPA’s heavy-duty vehicle emissions standards have the opportunity to right historic wrongs, mitigate air pollution, and reduce greenhouse gas emissions. [EPA-HQ-OAR-2019-1050]

Organization: *Energy Innovation, LLC*

In addition, air pollution has an adverse impact on public health and quality of life for nearly all Americans, but communities of color, lower-income individuals, and frontline communities remain disproportionately impacted. [EPA-HQ-OAR-2019-0055-1310-A1, p.1]

We know that air pollution from transportation disproportionately impacts people of color, who are three times more likely than white people to live in the most polluted counties in the U.S.xxxix [EPA-HQ-OAR-2019-0055-1310-A1, pp.6-7]

xxxix American Lung Association, Fact Sheet: Medium and Heavy Duty Vehicles, https://www.lung.org/getmedia/bb0d60ba-eff2-4084-907b-916839ae985d/medium-and-heavy-duty-vehicles-fact-sheet.pdf.

Organization: *Environmental Community Advocates of Galena Park*

I live in the port community of Galena Park. The 18 wheelers rule our main street of Clinton Dr. Monday thru Friday we live in a world of dust and particulate matter. When will be free of these trucks? [EPA-HQ-OAR-2019-0055-2825,p.1]

Organization: *Environmental Defense Fund (EDF) (1265 and 2855)*

The health burden from truck and bus pollution is substantial, causing adverse health impacts in utero, in infants and children, and in adults and the elderly – with those who live closest to our nation’s roads and highways, ports, distribution centers, freight depots, and other well-known sources of truck pollution facing the greatest harms.6 EPA has estimated that 72 million people live within 200 meters of a truck freight route, and relative to the rest of the population, people of color and those with lower incomes are more likely to live near truck routes.7 [EPA-HQ-OAR-2019-0055-1265-A1, p.4]

6 See, e.g., Riley, S., Wallace, J., & Nair, P. 2012. Proximity to Major Roadways is a Risk Factor for Airway Hyper-Responsiveness in Adults. Can. Respir. J., 19(2):89-95. McConnell, R. et al. 2010. Childhood Incident Asthma and Traffic-Related Air Pollution at Home and School. Envtl. Health Perspect.,118(7):1021-6. Huynh, P. et al. 2010. Residential Proximity to Freeways is Associated with Uncontrolled Asthma in Inner-City Hispanic Children and Adolescents, J. Allergy (Cairo). Chang, J. et al. 2009. Repeated Respiratory Hospital Encounters Among Children with Asthma and Residential Proximity to Traffic. Occup. Envtl. Med., 66(2):90-8. Salam, M.T., Islam, T, & Gilliland, F.D. 2008. Recent Evidence for Adverse Effects of Residential Proximity to Traffic Sources on Asthma. Curr. Opin. Pulm. Med., 14(1):3-8.

7 87 Fed. Reg. 17451 (March 28, 2022).

Despite making up only about 4 percent of vehicles on the road,8 the buses, trucks, and tractor trailers that distribute our people and goods are the largest contributor to ozone-forming oxides of nitrogen (NOx) emissions from all highway vehicles and will be one of the largest mobile source contributors to ozone in 2025.9 They are also responsible for a significant amount of health-harming fine particulate matter (PM2.5) and more than 420 million tons of climate pollution – nearly a quarter of all transportation sector emissions and more than the entire country of Australia.10 [EPA-HQ-OAR-2019-0055-1265-A1, p.4]

8 H. Christopher Frey. 2018. Trends in onroad transportation energy and emissions. Journal of the Air & Waste Management Assoc. Vol. 68, No. 6, 514–563, Table 1. https://www.tandfonline.com/doi/full/10.1080/10962247.2018.1454357

9 https://www.epa.gov/sites/default/files/2019-08/documents/cti-sae-govt-ind-2019-04-04.pdf

10 EPA. 2020. Fast Facts: U.S. Transportation Sector Greenhouse Gas Emissions 1990-2019. https://www.epa.gov/ghgemissions/draft-inventory-us-greenhouse-gas-emissions-and-sinks-1990-2019 International Energy Agency, Atlas of Energy. 2020. http://energyatlas.iea.org/#!/tellmap/1378539487

It is estimated that more than 15,000 Americans die prematurely every year as a result of the motor vehicle pollution on our roads and highways.11 As a result of housing discrimination and other unjust policies, communities of color and low-income communities constitute a higher percentage of the population near our roads and highways and therefore suffer disproportionately from this harmful pollution.12 According to the American Lung Association’s 2022 State of the Air report, people of color are more than three and a half times more likely to breathe the most polluted air when compared to white people.13 A report by Moving Forward Network found that, on average, Asian and Black Americans are exposed to PM2.5 pollution that is 56 and 44 percent higher, respectively, than white Americans.14 And an EDF analysis of the Bay Area in California found that neighborhoods with higher percentages of residents of color experienced double the rate of asthma from nitrogen dioxide (NO2) –a pollutant often used as a marker for transportation-related pollution.15 [EPA-HQ-OAR-2019-0055-1265-A1, p.5]

11 Kenneth F Davidson et al. 2020. The recent and future health burden of the U.S. mobile sector apportioned by source. Environ. Res. Lett. 15 (7). https://iopscience.iop.org/article/10.1088/1748-9326/ab83a8/pdf Estimate of 'over 20,000' derived using the medians of the upper bound of Krewski and Lepeule’s 2011 and 2025 onroad health burden estimates in Table 3 and 4 and assuming a linear reduction over time.

12 Gregory M. Rowangould. 2013. A census of the US near-roadway population: Public health and environmental justice considerations. Transportation Research Part D 25, 59–67. https://www.sciencedirect.com/science/article/pii/S1361920913001107.

13 American Lung Association. 2022. State of the Air. https://www.lung.org/getmedia/74b3d3d3-88d1-4335-95d8-c4e47d0282c1/sota-2022.pdf

14 Jimmy O’dea. 2020. Zero-Emissions Technology for Freight: Heavy-Duty Trucks, Tools to Advocate for Zero-Emissions Technology. Moving Forward Network. http://www.movingforwardnetwork.com/wp-content/uploads/2020/10/MFN_ZeroEmissionToolkit-1.pdf

15 EDF. 2021. Air pollution’s unequal impacts in the Bay Area. https://www.edf.org/airqualitymaps/oakland/health-disparities

Heavy-duty diesel vehicle emissions are often identified as among the largest source of disparity, disproportionally affecting racial-ethnic minorities across geographies and demographics.16 A recent analysis by The Real Urban Emissions (TRUE) Initiative finds that people of color living in New York City are exposed to 5 percent more PM2.5 attributable to diesel trucks operating in the city than average, while non-Latino white residents are exposed to 10 percent less.17 TRUE concludes, '[t]hese inequities in air pollution exposure contribute to racial disparities in health outcomes.'18 [EPA-HQ-OAR-2019-0055-1265-A1, p.5]

16 Tessum, C. W., Paolella, D. A., Chambliss, S. E., Apte, J. S., Hill, J. D., Marhsall, J. D. PM2.5 polluters disproportionately and systemically affect people of color in the United States. Sci. Adv. 7, eabf4491 (2021).

17 Meyer, M. and Dallman, T., (April 2022). Air quality and health impacts of diesel truck emissions in New York City and policy implications. The Real Urban Emissions (TRUE) Initiative. https://www.trueinitiative.org/media/792240/true-nyc-report-fv.pdf 18 Id.

Recent work using satellite data to assess the health burdens from NO2 pollution in 52 cities found diesel traffic is the dominant source of disparities—across race, ethnicity, and income—and that a 62 percent reduction in on-road diesel traffic would decrease these inequalities by 37 percent, noting that heavy-duty diesel vehicle emissions, specifically, contribute to the majority of these NO2 inequalities.19 [EPA-HQ-OAR-2019-0055-1265-A1, pp.5-6]

19 Demetillo, M. A. G., Harkins, C., McDonald, B. C., Chodrow, P. S., Sun, K., & Pusede, S. E. (2021). Space-based observational constraints on NO2 air pollution inequality from diesel traffic

in major US cities. Geophysical Research Letters, 48, e2021GL09433. https://doi.org/10.1029/2021GL094333

Analysis by scientists at EDF, Harvard Chan School of Public Health and University of North Carolina, using state of the art fine scale air quality modeling and health impact assessment methods, found that electrification of medium- and heavy-duty diesel vehicles will have significant benefits in New York City at a census tract scale.20 Full electrification of the sector in New York area would **prevent $2.4 billion in health damages** every year by 2040 (248 deaths, 173 childhood asthma emergency department (ED) visits), much of it directly due to the nitrogen dioxide (NO2) reduction health benefits. Many minority and low-income neighborhoods with high baseline asthma ED visits also have elevated diesel truck and bus traffic and pollution and therefore face disproportionate impacts. Census tracts with 97 percent minority populations bear > 35 percent of total childhood asthma ED visits attributable to medium- and heavy-duty vehicles, despite being only 19 percent of the population. [EPA-HQ-OAR-2019-0055-1265-A1, p.6]

20 Presentation by Jonathan Buonocore, Chet France, Rick Rykowski, Brian Naess, Komal Shukla, Catherine Seppanen, Dylan Morgan, Frederica Perera, Katie Coomes, Ananya Roy, Sarav Arunachalam. 2022. 'Distribution of Air Quality Health Benefits of MHEV policies: New York,' University of North Carolina, Harvard Chan School of Public Health, Columbia University Mailman School of Public Health and Environmental Defense Fund.

This also means that these communities in New York City will potentially experience significant benefits of medium- and heavy-duty electrification. Up to 68 percent of childhood asthma ED visits reduced will be accrued in census tracts with >85 percent minority populations if full electrification takes place by 2040. (See Attachment D for full details of the analysis and results) [EPA-HQ-OAR-2019-0055-1265-A1, p.6]

Heavy-duty vehicles are also responsible for significant NOx, PM2.5, and black carbon emissions around ports, railyards, distribution centers, airports, and other places where trucks congregate and idle.21 Warehouses and distribution centers where trucks pull in and out, and often idle, are also concentrated sources of risk. Again, many discriminatory policies have led to the siting of these facilities near communities of color who face higher rates of underlying health conditions as a result of the cumulative burden from air pollution and other factors.22 In Houston's Fifth Ward, diesel trucks that come and go from the cluster of metal recyclers and concrete processing plants, drive up NO2 levels by 48 percent relative to the rest of the city. Residents are largely people of color (more than 90 percent), 40 percent live below the federal poverty line and life expectancy is almost a decade lower than the rest of the region (69 compared to 78 years).23 [EPA-HQ-OAR-2019-0055-1265-A1, p.6]

21 E.g., MJB Ports of Newark and Elizabeth.

22 Nardone A, Casey JA, Morello-Frosch R, Mujahid M, Balmes JR, Thakur N. 2020. Associations between historical residential redlining and current age-adjusted rates of emergency department visits due to asthma across eight cities in California: an ecological study. Lancet Planet Health. 4(1):e24-e31. Miranda ML, Edwards SE, Keating MH, Paul CJ. 2011. Making the

environmental justice grade: The relative burden of air pollution exposure in the United States. Int J Environ Res Public Health. 8: 1755-1771. Ihab Mikati, Adam F. Benson, Thomas J. Luben, Jason D. Sacks, Jennifer Richmond-Bryant. April 2018. Disparities in Distribution of Particulate Matter Emission Sources by Race and Poverty Status, American Journal of Public Health 108, no. 4: pp. 480-485. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5844406/

23 https://www.edf.org/airqualitymaps/houston/findings

Commercial diesel trucks also take an especially heavy toll on neighborhoods along their routes. A years-long study in Canada confirms large trucks to be the greatest contributors to black carbon emissions near major roadways.24 A study in Oakland, California found that transportation-related air pollution (e.g., black carbon and NOx) was much higher—in some cases double—on a freeway that is a designated truck route (I-880) compared to another freeway in the same city where trucks are prohibited (I-580).25 Another study near the Port of Oakland also found that black carbon levels measured along truck routes were higher compared to measurements at most other sites, including those near industrial facilities, other highways and on residential streets.26 Studies have combined these fine scale assessments with electronic health records in the health care systems serving the population in Oakland (Sutter Health and Kaiser Permanente) and find that these elevated levels of NO2 and black carbon are associated with higher rates of cardiovascular events,27 asthma emergency room visits and hospitalizations,28 as well as adverse pregnancy outcomes.29 Estimated effects of NO2 and black carbon on preeclampsia were highest among non-Latina Black mothers. [EPA-HQ-OAR-2019-0055-1265-A1, p.7]

24 Wang, J.M., Jeong, C-H., Hillker, N., Shairsingh, K. K., Healy, R. M., Sofowote, U., Debosz, J., Su, Y., McGaughey, M., Doerksen, G., Munoz, T., White, L., Herod, D., Evans, G. J. Near-road air pollution measurements: Accounting for inter-site variability using emission factors. Environmental Science & Technology, 2018; 52(16): 9495. DOI: 10.1021/acs.est.8b01914

25 Joshua S. Apte et. al. 2017. High-Resolution Air Pollution Mapping with Google Street View Cars: Exploiting Big Data. Environ. Sci. Technol. 51, 12, 6999-7008. https://pubs.acs.org/doi/10.1021/acs.est.7b00891

26 Julien J. Caubel et. at. 2019. A Distributed Network of 100 Black Carbon Sensors for 100 Days of Air Quality Monitoring in West Oakland, California. Environ. Sci. Technol. 53, 13, 7564-7573. https://pubs.acs.org/doi/10.1021/acs.est.9b00282 27 Alexeeff, Stacey E., et al. 'High-resolution mapping of traffic related air pollution with Google street view cars and incidence of cardiovascular events within neighborhoods in Oakland, CA.' Environmental Health 17.1 (2018): 1-13. 28 Alexeeff, S., et al. 'Google Street View car measurements of traffic related air pollution within neighborhoods and asthma-related emergency department visits and hospitalizations.' Environmental Epidemiology 3 (2019): 406-407. 29 Goin, Dana E., et al. 'Hyperlocalized Measures of Air Pollution and Preeclampsia in Oakland, California.' Environmental Science & Technology 55.21 (2021): 14710-14719.

The actual health burden from truck pollution may be larger still, as analyses often do not account for the potential impact from after-market defeat devices on medium- and heavy-duty trucks. The EPA believes the use of aftermarket defeat devices 'occurs within most or all categories of vehicles and engines, including commercial trucks...'30 A zero-emitting truck and bus fleet would avoid this problem of emission control tampering. Zero emitting vehicles would also protect against unanticipated excess in-use emissions deterioration not properly accounted for during EPA’s engine/vehicle certification process. [EPA-HQ-OAR-2019-0055-1265-A1, p.7]

30 https://int.nyt.com/data/documenttools/epa-on-tampered-diesel-pickups-11-20/6d70536b06182ad2/full.pdf

A shift to zero emitting medium- and heavy-duty vehicles – including rapid deployment in communities long overburdened by this pollution – is critically important to save lives and bring cleaner air to neighborhoods across the nation. [EPA-HQ-OAR-2019-0055-1265-A1, p.7]

California and other states around the nation are paving the way for ZEVs and creating a strong foundation for the federal government to move forward with protective emissions standards. In September 2020, California Governor Gavin Newsom announced a bold plan for the state to achieve 100 percent zero emitting passenger vehicle sales by 2035 and 100 percent zero emitting freight trucks and buses for all feasible operations by 2045, while accelerating mobilization of zero emitting vehicles in urban and community applications to address environmental injustice.53 [EPA-HQ-OAR-2019-0055-1265-A1, p.12]

53 State of California, Executive Order N-79-20 (September 23, 2020). https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf

Organization: *Evangelical Environmental Network (EEN)*

Almost 60% of NOx and PM exhaust emissions from the trucks and buses were in urban areas, 45 million people in the United States live, work, or attend school within 300 feet of a major road, airport, or railroad, and 45% of U.S. residents live in counties with unhealthy levels of smog or soot. Medical experts have labeled these areas diesel death zones, and link exposure to diesel exhaust to more than four dozen toxic air pollutants that cause birth defects, lung damage, dementia, and cancer.i [EPA-HQ-OAR-2019-0055-0993-A1, pp.1-2]

i Tessum CW, Apte JS, Goodkind AL, Muller NZ, Mullins KA, Paolella DA, Polasky S, Springer NP, Thakrar SK, Marshall JD, Hill JD. Inequity in consumption of goods and services adds to racial-ethnic disparities in air pollution exposure. Proc Natl Acad Sci U S A. 2019 Mar 26;116(13):6001-6006. doi: 10.1073/pnas.1818859116. Epub 2019 Mar 11. PMID: 30858319; PMCID: PMC6442600.

Organization: *Florida Council of Churches*

Florida is home now to nearly 22 million people and is growing by 1000 new residents a day. Almost half of Floridians live in the ten counties with the highest density of population and thus traffic congestion. Density can be determined in various ways. If one excludes land area with zero population, the ten most dense counties are respectively Broward, Pinellas, Miami-Dade, Palm Beach, Orange, Seminole, Hillsborough, Duval, Sarasota, and Lee. These counties also have significant, historic populations of African descent and Latine populations who live in urban neighborhoods ringed by inner-city interstates and expressways. It has been well-documented by scholars how the road systems were intentionally designed in conjunction with redlining to box these people in. They bear the brunt of exhaust pollution in Florida. Asthma is common across the state in these hemmed in communities and life-expectancy is lower. [EPA-HQ-OAR-2019-0055-1006, p.1]

Organization: Gardener Manjikian Consulting LLC

we demand a zero emissions future where all communities can thrive without breathing in toxic heavy duty truck pollution. EJ communities across the country are exposed to 28% more NOx pollution than other neighborhoods because warehouses, truck routes, and industrial areas are disproportionately built in frontline communities. The proposed HDT rule doesn't go nearly far enough to protect EJ communities. It ignores the long-standing demands for protective solutions from the folks experiencing the pollution of the freight transportation system firsthand. [EPA-HQ-OAR-2019-0055-2599, p.1]

Organization: *Great Rivers Environmental Law Center and Dutchtown South Community Corporation (DSCC)*

EPA should take action on the Proposed Regulation and enact the most stringent options available to it so as to protect the health of all Americans, but in particular, the low-income people of color who have been systematically overburdened by air pollution in this country and as a result, are most vulnerable to its continued impacts. Doing so would be of direct benefit to of DSCC and Great Rivers. [EPA-HQ-OAR-2019-0055-1323-A1, p.2]

It is well-established in the Proposed Regulation that Heavy Duty ('HD') vehicles are a significant source of NOx, contributing to high concentrations of ozone and PM2.5.1. The Proposed Regulation also points out that these impacts more severely impact low-income minority communities, already overburdened by air pollution.2. In particular, the Proposed Regulation demonstrates that HD vehicles are more often operated close to people of color.3 This is the case because people of color, as well as those with lower incomes, are more likely to live near truck routes.4 The St. Louis metropolitan area is no exception – many areas bordering major highways and traffic thoroughfares in the St. Louis area are populated by persons of color and other economically disadvantaged communities.5 [EPA-HQ-OAR-2019-0055-1323-A1, p.2]

1 Proposed Regulation at p. 17418.

2 Id. at pp.17418, 17452, 17584.

3 Id. at pp.17418, 17452.

4 Id.

5 Interdisciplinary Environmental Clinic at Washington University School of Law, Environmental Racism in St. Louis, located at https://7gxsl10eqdj9anba1k3swtoo-wpengine.netdna-ssl.com/wp-content/uploads/2020/08/2019-09-30_STL_Env_Racism_Report_REVISED_FINAL_Cropped.pdf. See also, US EPA, EJScreen, Map Comparisons for St. Louis, Missouri, Pct. People of Color and Traffic Proximity, located at https://ejscreen.epa.gov/mapper/comparemapper.html.

As is established in the Proposed Regulation, heightened exposure to HD vehicle traffic also contributes to a variety of adverse health impacts – in particular asthma and respiratory illness, as well as cardiovascular problems.6 Unfortunately, these heightened health risks bear out in St. Louis, especially in the low-income minority neighborhoods in St. Louis City and County. In St. Louis County and the City of St. Louis, the same zip code areas that have large low-income minority populations also have significantly higher rates of asthma-related emergency room visits than the Missouri and National averages.7 The City of St. Louis has the dubious honor of ranking first out of the 35 largest United States metropolitan areas in terms of asthma risk.8 This risk has increased over the last decade.9 Perhaps more startlingly, in a recent equity study compiled by the City of St. Louis, the City was awarded an equity score of 1 out of a possible 100 in the category of child asthma. The exceedingly low score was bestowed as a result of data showing that black children living in the City of St. Louis are more than 10 times as likely as white children to visit emergency rooms for asthma-related complications.10 [EPA-HQ-OAR-2019-0055-1323-A1, pp.2-3]

6 Proposed Regulation at p.17417.

7 Missouri Department of Health and Senior Services, EPHT Asthma Data by zip code, located at https://healthapps.dhss.mo.gov/MoPhims/QueryBuilder?qbc=EA&q=1&m=1; City of St. Louis Department of Health, Understanding Our Needs, Update (2016), page 15, located at https://www.stlouismo.gov/government/departments/health/documents/upload/UON-20160102.pdf.

8 East-West Gateway Council of Governments, Where We Stand: Twenty Years Later, located at: https://www.ewgateway.org/wp-content/uploads/2017/08/WWS6EdNo3.pdf.

9 Id.

10 City of St. Louis, Equity Indicators Toward a St. Louis Region that works for us all, Baseline Report (2018), at pp. 36-37, located at: https://www.stlouis-mo.gov/government/departments/mayor/initiatives/resilience/equity/documents/upload/Equity-Indicators-Baseline-2018-Report-Document.pdf.

The unique features of the St. Louis area highlight the pressing need for EPA to take immediate action to address transportation-related pollution. Focusing on pollution from HD vehicles offers a great start. As emissions modeling performed by EPA in connection with the Proposed Regulation reveals, 'heavy-duty engines will continue to be one of the largest contributors to mobile source NOx emissions nationwide in the future'.23 Unless and until EPA tackles this significant pollution source, the problem will not improve, but will instead continue to worsen.

Further, this is not a problem that can be put off to future generations - peoples' very lives are at risk. [EPA-HQ-OAR-2019-0055-1323-A1, p.5]

23 Proposed Regulation at p.17418.

At a minimum, EPA must include the above-described provisions in the Final Regulation. Doing so will begin the process of protecting the low-income minority people that have already shouldered to much of the pollution burden in urbanized communities such as St. Louis. [EPA-HQ-OAR-2019-0055-1323-A1, p.6]

Organization: *King County, Washington County Executive*

In King County, through the Washington State Environmental Health Disparities Map developed by the University of Washington Department of Environmental and Occupational Health Sciences, we know that communities of color, low-income communities, and road-proximate communities suffer from the highest rates of exposure to pollutants. This long-overdue rule must benefit our communities. The Clean Air Act is clear in requiring EPA to set a standard not just protective for healthy individuals, but also of these vulnerable populations. [EPA-HQ-OAR-2019-0055-1188-A2, p.1]

Organization: *Lydia Heye*

The Biden administration has made a public commitment to help protect environmental justice ("EJ") communities throughout the United States. However, EPA's heavy duty truck rule fails our EJ communities. This proposal ignores the longstanding demands from EJ communities to move the most protective solutions that will require air pollution reductions in EJ communities. EPA's proposed rule punts meaningful action into the uncertain future, yet again delaying justice for communities of color and frontline communities and perpetuating environmental racism.

Heavy Duty Trucks contribute to the worsening of the public health, environmental, and climate crisis. With this current rule the Biden Administration is falling short of their commitments to prioritize EJ and address the climate crisis. EJ communities cannot wait. We need strong regulations now, justice delayed is justice denied! Environmental justice communities are choking to death from the pollution from heavy duty trucks. The Biden Administration needs to prioritize community health over corporate wealth and at minimum require a just transition towards zero emission trucks.

We need to see a just transition towards zero emissions across the freight sector. Here in Southern California, we see this clearly in our port communities and communities near freeways. Through redlining and other racist land use practices, Black and Brown communities are forced to subject themselves and their families to deadly air when they decide to open their windows or walk outside. No one should be forced to experience that. Everyone should be entitled to breathe clean air.

EPA should be proposing solutions aimed at phasing out our dependency on deadly diesel. We will not accept partial solutions that leave us further burdened by pollution for decades to come.

Zero Emissions must mean zero – not near zero! EPA needs to do its part to end diesel-deaths in our communities. [EPA-HQ-OAR-2019-0055-1405]

Organization: *Maine Department of Environmental Protection (Department)*

Addressing heavy-duty NOx emission is particularly important for systemically disinvested communities, where low-income and people of color are disproportionately harmed by heavy-duty truck emissions because they are more likely to live, work, or go to school in areas with high truck activity, such as ports, highways, railyards, and distribution centers. [EPA-HQ-OAR-2019-0055-1288-A1,pp.1-2]

Organization: *Mass Comment Campaign sponsored by Climate Action Campaign (22,659)*

- Families in diesel death zones, particularly communities of color and low wealth communities, have suffered long enough and cannot wait extra model years for clean air, and drivers cannot wait extra model years for more efficient, pollution-free trucks. [EPA-HQ-OAR-2019-0055-1193, p.1]

Organization: *Mass Comment Campaign sponsored by Consumer Reports (CR) (17,499)*

These vehicles cause the majority of lung-damaging air pollutants, and disproportionately impact vulnerable communities located near trucking corridors. [EPA-HQ-OAR-2019-0055-1613-A1, p.1]

Organization: *Mass Comment Campaign sponsored by Evangelical Environmental Network (EEN) (67,755)*

Almost 60% of NOx and PM2.5 exhaust emissions from the trucks and buses were in urban areas, where 45 million people in the United States live, work, or attend school within 300 feet of a major road, airport, or railroad. 45% of U.S. residents live in counties with unhealthy levels of smog or soot. Medical experts have labeled these areas diesel death zones, and link exposure to diesel exhaust to more than four dozen toxic air pollutants that cause birth defects, lung damage, and cancer. [EPA-HQ-OAR-2019-0055-1610-A1,p .1]

Organization: *Mass Comment Campaign sponsored by Moms Clean Air Force and Arizona Climate Action Coalition (198)*

Moreover, this type of pollution is inequitably distributed and disproportionately harms Blacks and Latinos compared to whites. [EPA-HQ-OAR-2019-0055-1192-A1, p.2]

The residents of Arizona, especially those living in Maricopa County, have been plagued with the health impacts of both the climate crisis and Air Pollution. The American Lung Association has consistently graded the Maricopa County and Pinal County areas with failing grades on air quality. The latest report came out this month and again, the Phoenix area has received an F on the American Lung Association “State of the Air Report”. Out of over 220 metropolitan areas, the Phoenix area ranked 5th worst for high ozone days, 11th worst for 24-hour participle pollution and 8th worst for annual particle pollution. The air we breathe is harming all of us, but especially our children and elderly. [EPA-HQ-OAR-2019-0055-1192-A1,p.2]

Heavy duty vehicles are major contributors to the valley's air pollution. Diesel engines emit deadly particle pollution. And NOx combines with heat and sunlight in the atmosphere to form ground level ozone, or smog, a lung irritant and asthma trigger. Health officials tell us that the following groups are most at risk:

- Babies and children, whose bodies are rapidly developing.
- Pregnant women, whose risk of premature birth and low weight birth increases when exposed to air-pollution.
- Children and adults with asthma – as air pollution can both trigger asthma attacks and cause the development of the disease.
- People with COPD.
- People with lung cancer.
- People with cardiovascular disease.
- People with COVID-related lung problems or long-COVID, or people with active cases of COVID or other respiratory infections.
- People with any chronic disease such as cancer
- Older adults (over age 65), whose risk of premature death increases with exposure to air pollution. [EPA-HQ-OAR-2019-0055-1192-A1,p.2]

Organization: *Mass Comment Campaign sponsored by National Religious Partnership for the Environment (4,677)*

As Black Church leaders and congregants, we experience the tragedies of environmental justice on a regular basis. Communities of color face an undue, disproportionate and unjust burden of air pollution and climate impacts from the production of fossil fuels. Reducing emissions from the transportation sector offers an opportunity to reduce the pollution and climate impact burden in our communities. [EPA-HQ-OAR-2019-0055-1122-A1, p.1]

Exhaust from heavy duty vehicles is one of the main pollution sources in black communities. As our country moves a vast amount of goods from manufacturing plants to warehouse to businesses and homes, the distribution contributes to significant localized pollution in our communities, which are already suffering from pollution. This disproportional impact by truck pollution is a result of historical and ongoing systemic racism, which has placed interstates and heavily travelled roads through the heart of our communities and neighborhoods. [EPA-HQ-OAR-2019-0055-1122-A1, p.1]

Trucks, which only account for 10 percent of vehicles on the road, produce nearly 25 percent of the transportation sectors greenhouse gases. A 2021 report stated that a 62% reduction in diesel emissions would decrease race-ethnicity and income inequalities by 37%. [EPA-HQ-OAR-2019-0055-1122-A1, p.1]

President Biden’s in January 2021 that directed the Environmental Protection Agency (EPA) and other agencies to make environmental justice part of their mission. To help fulfill that mission, the EPA must make reducing air pollution from heavy duty trucks a priority. [EPA-HQ-OAR-2019-0055-1122-A1, p.1]

Organization: *Mass Comment Campaign sponsored by Neighbors for Clean Air and Elders Climate Action (43)*

Vehicle pollution inequitably harms Black and Latinx communities that are much more likely compared to whites to reside near heavy truck traffic on highways, and at truck terminals, ports and distribution centers. In fact, Multnomah County communities with larger black populations have three times higher diesel particulate matter pollution than neighborhood with majority white residents. [EPA-HQ-OAR-2019-0055-1619-A1,p.2]

Organization: *Mass Comment Campaign sponsored by Public Citizen (168)*

Diesel emissions most severely harm communities of color and working class communities, and cleaning up dirty diesel pollution helps to create a more just society. [EPA-HQ-OAR-2019-0055-1597-A2, p.1]

Improving these standards will improve health outcomes for communities hardest hit by diesel pollution. EPA should adopt requirements to address disproportionate health impacts so that those who are most harmed by diesel pollution can find relief quickly. [EPA-HQ-OAR-2019-0055-1597-A2, p.1]

I encourage the EPA to boldly pursue environmental justice as it reduces diesel emissions and improves the health of communities near ports and freight corridors. [EPA-HQ-OAR-2019-0055-1597-A2,p.1]

Organization: *Mass Comment Campaign sponsored by Union of Concerned Scientists - 1 (13,985)*

Marginalized communities living in highly trafficked areas have suffered the health impacts of diesel trucks for too long. And the science clearly shows that zero-emission trucks can be deployed now. [EPA-HQ-OAR-2019-0055-1194-A1, p.1]

Organization: *Mass Comment Campaign sponsored by Union of Concerned Scientists - 2 (959)*

The Environmental Protection Agency (EPA) has made explicit commitments to climate, clean air, and environmental justice under this administration. Environmental justice communities suffer a disproportionate burden of pollution from the goods movement sector writ large.1 Thus, we believe that this NOx rule should be strengthened to live up to these important stated commitments and to set us on a path to a zero-emission transportation future. [EPA-HQ-OAR-2019-0055-1608-A1, p.1]

1 https://www.movingforwardnetwork.com/zero-emissions/

Organization: *Mass Comment Campaign sponsoring organization unknown – 1 (2,443)*

This pollution is particularly dangerous for communities located close to high truck traffic areas, affecting millions of people that live near highways, warehouses, or ports. [EPA-HQ-OAR-2019-0055-1594-A1,p.1]

Organization: *Mass Comment Campaign sponsoring organization unknown – 3 (605)*

Truck pollution disproportionately impacts low-wealth communities and communities of color, leading to higher rates of asthma and other respiratory illness. With solid heavy-duty vehicle emission standards, we can cut deadly smog pollution for our children, families, and communities to breathe the clean air they deserve. [EPA-HQ-OAR-2019-0055-1606, p.1]

Organization: Mass Comment Campaign sponsoring organization unknown – 5 (52,051)

This makes it critical to ensure that heavy-duty vehicles are as efficient as possible and that we adopt and enforce strict emissions limits as we shift away from fleets powered by fossil fuels. Our communities cannot afford to wait for cleaner air. Black and Brown communities need a rapid transition to zero- emitting trucks and a clear path towards 100% electrification of polluting big rigs, trucks, and buses. [EPA-HQ-OAR-2019-0055-1600]

Organization: *Mass Comment Campaign sponsoring organization unknown – 8 (2,804)*

Diesel emissions most severely harm communities of color and working class communities, and cleaning up dirty diesel pollution helps to create a more just society. [EPA-HQ-OAR-2019-055-1605]

Organization: *Mass Comment Campaign sponsoring organization unknown – 13 (165)*

Because of discriminatory transportation practices, highways and transportation depots are often placed near and through communities of color, placing these communities in greater danger from vehicle pollution. Reducing diesel emissions would not only address climate change but significantly reduce pollution in communities of color. [EPA-HQ-OAR-2019-0055-1599]

Organization: *Mayor, City of Albuquerque, NM et al.*

As mayors, our cities are highly trafficked freight destinations for the movement of goods, and we are on the front lines of protecting the safety and well-being of our constituents. This long-overdue rule must benefit our communities. According to the American Lung Association's 2022 State of the Air report1, approximately 40% of Americans—over 137 million people—are living in areas that received a grade of "F" for their air pollution. This is especially problematic for vulnerable populations such as children, the elderly, low-income families and communities of color. The Clean Air Act is clear in requiring EPA to set a standard not just protective for healthy individuals, but also of these vulnerable populations. [EPA-HQ-OAR-2019-0055-1316-A1, p.1]

1 https://www.lung.org/research/sota/key-findings

Smog and soot air pollution caused by trucks and buses are among the greatest threats to public health for the more than 45 million people in the U.S. living within 300 feet of a major roadway or transportation facility.4 The pollution from diesel trucks disproportionately harms frontline communities near heavy vehicle traffic and trucking corridors - which by design tends to be low-income and communities of color - and leads to increased risk for cardiovascular disease, lung cancer, and other respiratory health illnesses. Recent studies show that diesel traffic is the largest source of nitrogen oxide disparity by race in the United States. Transitioning from combustion to zero-emission trucks is therefore one of our greatest opportunities to tackle both the climate crisis and environmental injustice. [EPA-HQ-OAR-2019-0055-1316-A1, p.2]

4 https://www.epa.gov/air-research/research-near-roadway-and-other-near-source-air-pollution

Organization: *Metropolitan Washington Air Quality Committee (MWAQC) et al.*

As noted in the Metropolitan Washington 2030 Climate and Energy Action Plan,2 underserved communities have been disproportionately affected by harmful environmental exposures, such as ambient air pollution and climate-change-related health impacts. Therefore, more stringent controls on air pollution from heavy-duty vehicles and subsequent emissions reductions have the potential to help the most vulnerable populations. [EPA-HQ-OAR-2019-0055-0996-A1, pp. 1 - 2]

2. “Metropolitan Washington 2030 Climate and Energy Action Plan” (Washington, D.C.: Metropolitan Washington Council of Governments, November 18, 2020), https://www.mwcog.org/documents/2020/11/18/metropolitanwashington-2030-climate-and-energy-action-plan/.

Organization: *Mid-America Regional Council (MARC) Air Quality Forum*

Emissions from heavy duty trucks concentrate near freight corridors and hubs where they impact overburdened and underserved communities from surrounding neighborhoods. In the Kansas City region, like many other metropolitan areas, these communities are where many low-income individuals and people of color call home. These communities face a prevalence of asthma that is higher than the national average and are medically underserved. Without further reductions, heavy-duty vehicles will continue to be one of the largest contributors to mobile source emissions of NOx, which react in the atmosphere to form ozone and particulate matter. These pollutants create or exacerbate respiratory and cardiovascular problems and other adverse health impacts that lead to hospital admissions, emergency room visits, and premature deaths. For the health of our vulnerable communities, we urge the EPA to enact the strongest possible limits on emissions from heavy-duty trucks possible to transition to zero-emissions vehicles more quickly in the heavy-duty fleet. [EPA-HQ-OAR-2019-0055-1131-A1, p. 1]

Organization: *Midwest Ozone Group (MOG)*

The modeling data provided in these comments illustrates the need for measurable improvements to environmental conditions in communities that are heavily impacted by dense traffic. Ambient improvements to PM, PM2.5, and ozone represented by this proposed rule will serve to facilitate the development of implementation outcomes of local environmental benefits attributable to controls on mobile sources like heavy duty trucks. EPA's burden is to effectively implement this rule per Executive Order 12898, 'Federal agencies must identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations.' This comment is also found in Section 20.1. [EPA-HQ-OAR-2019-0055-1272-A1, p.11]

Organization: *Minnesota Pollution Control Agency (MPCA)*

It is the MPCA's responsibility to protect Minnesotans' health and environment in collaboration with the federal government, through cooperative federalism. Although Minnesota is currently in attainment for the National Ambient Air Quality Standards for NOx and ozone, MPCA research demonstrates that environmental justice communities are disproportionately exposed to air pollution from transportation. People in these communities are also more vulnerable to air pollution health impacts due to underlying issues, like their socioeconomic status and access to health care. National studies have identified significant disparities in NOx exposure based on race; researchers at the University of Minnesota estimate that people of color in America experience 38% more NOx pollution where they live than white Americans. Further, previous EPA research, as demonstrated in the proposed rulemaking, shows that there are significant, known co-benefits to health outcomes related to NOx emissions reductions. [EPA-HQ-OAR-2019-0055-1044-A1, p. 1]

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

MEMA urges EPA to consider the impacts of NOx emissions on underserved and inner-city communities. While all communities are impacted by climate change and air quality, the effects on communities of differing socioeconomic statuses are not proportionate. Historically, environmental policies, including but not limited to electric vehicles, engine emissions standards, carbon emissions trading or taxation, chemical bans or restrictions and other industrial regulations, may have caused disproportionate harm to disadvantaged communities. It is critical that EPA finalize NOx standards that will ensure all commercial vehicles, not just electric vehicles, are equipped with best-in-class technology to ensure that every community is afforded cleaner air. [EPA-HQ-OAR-2019-0055-1322-A1, pp. 8 - 9]

Organization: *National Parks Conservation Association (NPCA)*

Sadly, the brunt of the air pollution burden is felt in communities outside of our parks, where residents who live near high freight traffic areas, such as highways, warehouse districts, or ports, are forced to breathe in dangerous pollutants from heavy duty trucks. As highlighted in the proposed rule, 72 million Americans live within 200 meters of freight routes with high levels or HD truck traffic.21 Of those 72 million, people of color make up a disproportionate number of the individuals harmed by pollution from freight traffic, greatly exacerbating the health and environmental justice impacts felt by nonwhite populations across the nation. [EPA-HQ-OAR-2019-0055-1314-A1, p.4]

21 87 Fed. Reg. at 17,451

Overall, when researchers isolate race, nonwhite people have a 28 percent higher health burden, and Black people had a 54 percent higher than the population at large.22 Emission source types, in particular, disproportionately affect racial-ethnic minorities and make the air that people of color breathe dirtier than it is for White people.23 This relationship between emissions and race is systemic and statistically significant for all major sectors, and heavy-duty vehicles is one of the larges sources of disparity.24 Further, even when social class is held constant, the relationship between race and the distribution of air pollution remains, independent of socioeconomic status.25 This clear example of environmental justice must be rectified in every way possible, including through the adoption of this EPA rule. This would begin the climb to racial and environmental justice, and it would allow the national parks to provide cleaner air to its visitors and the residents of its gateway communities. [EPA-HQ-OAR-2019-0055-1314-A1, p.4]

22 Nancy Leong, Enjoyed by White Citizens, 109 GEO. L.J. 1421, 1465–66 (2021).

23 Christopher W. Tessum et al., PM2.5 Polluters Disproportionately and Systemically Affect People of Color in the United States, SCIENCE ADVANCES (2021), https://doi.org/10.1126/sciadv.abf4491.

24 Id.

25 Robert D. Bullard, Building Just, Safe, and Healthy Communities, 12 TUL. ENVTL. L.J. 373, 382–83 (1999).

Heavy-duty vehicles are a key contributor to ozone and PM National Ambient Air Quality Standards (NAAQS) nonattainment in air basins across the country. This is of particular concern in states like California, where NOx pollution from HD vehicles is an outsized source of ozone and PM2.5 in regions such as the San Joaquin Valley and South Coast Air Basins. When it comes to meeting the CAA's NAAQS, The San Joaquin Valley is now in extreme nonattainment with the 1997, 2008, and 2015 ozone standards, serious nonattainment with the 1997 annual and 24-hour and 2006 24-hour PM2.5 standards, and moderate nonattainment with the 2012 annual PM2.5 standard. The San Joaquin Valley is also home to the environmental justice communities of Fresno, Visalia, and Bakersfield, which are ranked by American Lung Association (ALA) as being three of the most polluted cities in the country for ozone, annual PM2.5, and short-term PM2.5 pollution.26 In terms of the economic impact, one study found that '[i]n the San Joaquin Valley overall, the cost of air pollution is more than $1,600 per person per year, which translates into a total of nearly $6 billion in savings if federal ozone and PM2.5 standards were met.'27 [EPA-HQ-OAR-2019-0055-1314-A1, pp.4-5]

26 ALA, 2019 State of the Air Report: Most Polluted Cities. Available at, https://www.lung.org/our-initiatives/healthy-air/sota/city-rankings/most-polluted-cities.html.

27 Jane V. Hall, et. al., The Benefits of Meeting Federal Clean Air Standards in the South Coast and San Joaquin Valley Air Basins 2008), at 5. Available at http://publichealth.lacounty.gov/mch/AsthmaCoalition/docs/BenefitsofMeetingCleanAirStandards_11_06_08.pdf.

When viewed alongside other heavily impacted areas, like West Oakland or communities in the South Coast Air Basin, the total impact to vulnerable populations in the state is enormous, both from an economic and public health standpoint. Attaining statewide standards for PM and ozone just in California would annually prevent 9,000 premature deaths—more than the total number of deaths from second-hand smoke and motor vehicle crashes combined—and avoid the annual $2.3 billion price tag in the State's economy associated with hospitalizations and treatment related to air pollution.28 The uneven distribution of health, social, and livelihood costs of the freight sector is one of California's deepest forms of environmental injustice, where freight hubs and corridors disproportionately poison the State's low-income communities and communities of color.29 In West Oakland, where CARB attributes 71% air pollution risk to truck traffic,30 residents have life expectancies as much as 24 years shorter than their neighbors in the Oakland Hills.31 This story will sound familiar to communities in Wilmington, Roseville, Shafter, Fresno, Commerce, North Richmond, rural Riverside, and many other predominantly low-income communities and communities of color that live near freight hubs and truck corridors.32 [EPA-HQ-OAR-2019-0055-1314-A1, p.5]

28 CARB, Quantification of the Health Impacts and Economic Valuation of Air Pollution from Ports and Goods Movement in California, (Mar. 21, 2006) https://www.arb.ca.gov/planning/gmerp/plan/appendix_a.pdf

29 See, e.g. Pacific Institute, Paying with Our Health: The Real Cost of Freight Transport in California, (Nov. 2006). Available at https://pacinst.org/wp-content/uploads/2013/02/paying-with-our-health-full-report.pdf.

30 CARB, Diesel Particulate Matter Health Risk Assessment for the West Oakland Community, (Dec. 2008) at 3. Available at https://www.arb.ca.gov/ch/communities/ra/westoakland/documents/westoaklandreport.pdf.

31 Virgina Commonwealth University, Neighborhood-Level Determinants of Life Expectancy in Oakland, CA, (Sept. 2012) at 20. Available at https://societyhealth.vcu.edu/media/society-health/pdf/PMReport_Alameda.pdf.

32 Pacific Institute, Paying with Our Health: The Real Cost of Freight Transport in California, (Nov. 2006). https://pacinst.org/wp-content/uploads/2013/02/paying-with-our-health-full-report.pdf.

Organization: *National Religious Partnership for the Environment*

The pollution generated by heavy duty vehicles is not an equal burden. Black, Indigenous, Latinx and Asian-American communities disproportionately bear the brunt of air pollution from our national transportation priorities. Reducing diesel emissions would not only address climate change, which is felt first and worst in communities of color, but significantly reduce pollution in black, brown and Asian-American neighborhoods. [EPA-HQ-OAR-2019-0055-1221-A1, p.1]

Organization: *Northeast States for Coordinated Air Use Management (NESCAUM)*

Low load cycles and excess NOx emissions are of particular concern in Overburdened Communities located near busy truck routes and where trucks operate in stop and go conditions where exhaust temperatures are potentially too low to enable selective catalytic reduction (SCR) emissions control function. [EPA-HQ-OAR-2019-0055-1249-A1, p. 11] [Also in Section 3.3]

Organization: *Ozone Transport Commission (OTC) and Mid-Atlantic/Northeast Visibility Union (MANE-VU)*

In addition, urban residents can be exposed to higher levels of health-damaging PM2.5 and toxic air pollutants concentrated at 'hot-spots' near high-density traffic arteries. Freight transportation relies on trucks, trains, and ships operating within communities in the Northeast and mid-Atlantic to move goods. This activity generates a significant amount of localized air pollution in communities already overburdened by diesel exhaust pollution. Local emissions contribute to an ongoing health crisis in these communities. [EPA-HQ-OAR-2019-0055-1250-A1, p.4]

Low load cycles and excess NOx emissions are of particular concern in Overburdened Communities located near busy truck routes and where trucks operate in stop and go conditions. [EPA-HQ-OAR-2019-0055-1250-A1, p.14] [Also in Section 3.3]

Organization: *Public Citizen and Healthy Port Communities Coalition (HPCC)*

Cleaner technology results in tangible health benefits that will protect public health in communities of color and low-income communities. [EPA-HQ-OAR-2019-0055-1417-A2, p. 1]

These recommendations will further improve health outcomes in the communities of color and low-income communities most burdened by diesel pollution. We encourage the EPA to boldly pursue environmental justice as it reduces diesel emissions and improves the health of communities near ports and freight corridors. [EPA-HQ-OAR-2019-0055-1417-A2, p. 5]

Organization: *San Joaquin Valley Air Pollution Control District (District)*

The challenges faced by the San Joaquin Valley with respect to air quality are unmatched by any other region in the nation. The Valley’s topography, climate, geography, and the presence of two major transportation corridors connecting Northern and Southern California all contribute to the region’s air quality challenges. Additionally, a number of Valley communities are highly impacted by environmental and socioeconomic challenges. Since its adoption, the Clean Air Act has led to significant improvements in air quality and public health benefits throughout the San Joaquin Valley. Through a comprehensive regulatory program, the District has adopted over 650 rules since 1992. With an investment of over $40 billion, air pollution from San Joaquin Valley businesses has been reduced by over 80%. The pollution released by industrial facilities, agricultural operations, and cars and trucks is at a historical low for all pollutants. As a result, San Joaquin Valley residents’ exposure to high smog levels has been reduced by over 90%. [EPA-HQ-OAR-2019-0055-1291-A1, p.1]

Organization: *South Coast Air Quality Management District (SCAQMD)*

We further applaud the analytical effort in the RIA to study whether communities saddled with the worst air quality will stand to particularly benefit from more stringent standards. We concur in the assessment that areas with worse air quality, including swaths of the Los Angeles area, may stand to benefit from reductions in ozone. Similarly, the assessment that '[t] hose in areas with the worst air quality would experience a greater reduction in PM2.5 than those in the remaining 95 percent of grid cells' is an important one.25 Putting aside the potential for further and future refinements in this mode of analysis, as is generally known, persons living in proximity to freeways and heavily trafficked areas do suffer worse air quality on average. Those who live in significant proximity to sources of heavy truck or other transportation emissions can experience negative health outcomes, and those population areas can correlate with other negative socioeconomic indicators. Providing environmental health benefits and relief to burdened communities is rightfully at the core of EPA's responsibility to exercise its Title II rulemaking duties. Thus, while securing emission reductions from trucks is needed for NAAQS attainment throughout the entirety of South Coast AQMD's jurisdiction of 10,700 miles, it should not be overlooked that having cleaner heavy truck traffic also helps assure significant benefits for certain, highly impacted communities. We urge EPA to consider the most stringent standards in favor of those communities. [EPA-HQ-OAR-2019-0055-1201-A1, p.7]

25 RIA at pg. 308.

Organization: *Southern Environmental Law Center (SELC)*

Exposure to this type of pollution is also an environmental justice issue; '[r]elative to the rest of the population, people of color and those with lower incomes are more likely to live near truck routes.'11 This is in part due to zoning practices and land use decisions, including in the South, that have consistently sited highways and commercial and industrial facilities that often rely on frequent truck deliveries in communities of color and low-income communities.12 [EPA-HQ-OAR-2019-0055-1247-A1, pp.2-3]

11 Id.

12 See e.g., Kaveh Waddell, When Amazon Expands, These Communities Pay the Price, CONSUMER REPS. (Dec. 9, 2021), https://www.consumerreports.org/corporate-accountability/when-amazon-expands-these-communities-paythe-price-a2554249208/; INST. FOR TRANSP. & DEV. POL'Y, Highways and Zoning: Tools of Racist Policy (Mar. 10, 2021), https://www.itdp.org/2021/03/10/highways-and-zoning-tools-of-racist-policy/; Ashish Valentine, 'The Wrong Complexion for Protection.' How Race Shaped America's Roadways and Cities, NAT'L PUB. RADIO (July 5, 2020), https://www.npr.org/2020/07/05/887386869/how-transportation-racism-shaped-america; Johnny Miller, Roads to Nowhere: How Infrastructure Build on American Inequality, THE GUARDIAN (Feb. 21, 2018), https://www.theguardian.com/cities/2018/feb/21/roads-nowhere-infrastructure-american-inequality.

Organization: *States of California, et al. (The States)*

Impoverished communities and communities of color are disproportionately harmed by heavy-duty truck emissions because they are more likely to live, work, or go to school in areas with high truck activity, such as ports, highways, railyards, and distribution centers. [EPA-HQ-OAR-2019-0055-1255-A1, p. 2]

Emissions from heavy-duty trucks disproportionately endanger residents of environmental justice communities by exposing them to harmful air pollution that causes significant health impacts. Heavy-duty trucks concentrate their emissions along transportation corridors and near ports and warehouses.12 Communities located near this infrastructure are disproportionately lower-income and communities of color and typically face industrial pollution cumulatively with truck emissions.13 For example, EPA modeling has shown that race and income are significantly associated with living near truck routes nationally, even when controlling for other factors.14 EPA research has also indicated that people of color are more likely to live within 300 feet of major transportation facilities and go to school within 200 meters of the largest roadways.15 Likewise, a comprehensive study by the South Coast Air Quality Management District—which covers Los Angeles and the Inland Empire, the largest logistics hub nationwide—found that communities located near large warehouses scored far higher on California's environmental justice screening tool, which measures overall pollution and demographic vulnerability.16 That study concluded that, compared to the South Coast basin averages, communities in the South Coast basin near large warehouses had a substantially higher proportion of people of color; were exposed to more diesel particulate matter; had higher rates of asthma, cardiovascular disease, and low birth weights; and had higher poverty and unemployment rates.17 [EPA-HQ-OAR-2019-0055-1255-A1, pp. 4 - 5]

12. 87 Fed. Reg. at 17,452.

13. EPA Memorandum, Estimation of Population Size and Demographic Characteristics among People Living Near Truck Routes in the Coterminous United States, at 11-12, Fig. 3, 17-19, Fig. 9 (Feb. 16, 2022) (finding that individuals living near major truck routes are more likely to be people of color and lower-income), EPA-HQ-OAR-2019-0055-0982; see also Michelle Meyer & Tim Dallmann, The Real Urban Emissions Initiative, Air quality and health impacts of diesel truck emissions in New York City and policy implications, at 7, Fig. 5 (2022) (concluding that Black and Latino individuals in New York City are disproportionately exposed to PM2.5 along freight corridors), attached as Exhibit 1; South Coast Air Qual. Mgmt. Dist., Final Socioeconomic Assessment for Proposed Rule 2305 – Warehouse Indirect Source Rule – Warehouse Actions and Investments to Reduce Emissions (WAIRE) Program and Proposed Rule 316 – Fees for Rule 2305, at 3-7 (May 2021) (determining that individuals living near warehouses in the logistics-heavy South Coast Air Quality Management District are more likely to be people of color, lower-income, and exposed to high pollution levels), attached as Exhibit 2.

14. EPA Memorandum, "Estimation of Population Size and Demographic Characteristics among People Living Near Truck Routes in the Coterminous United States" (Feb. 16, 2022), EPA-HQ-OAR-2019-0055-0982, at 20-24.

15. Chad Bailey, “Demographic and Social Patterns in Housing Units Near Large Highways and other Transportation Sources,” at 3 (2011), EPA-HQ-OAR-2019-0055-0126.

16. South Coast Air Qual. Mgmt. Dist., Final Socioeconomic Assessment, supra note 13, at 4-5.

17. Id. at 5-7.

As the South Coast Air Quality Management District study demonstrates, and as many others corroborate,18 residents of environmental justice communities near logistics infrastructure suffer from health effects due to exposure to NOx and associated heavy-duty truck emissions. These issues are particularly acute in our States, which proudly generate a majority of the nation’s economic activity associated with the logistics industry, yet also bear its detrimental environmental impacts. Major ports in some of our States handled 61 percent of all container traffic nationwide in 2020, including the three megaports of Los Angeles, Long Beach, and New York and New Jersey, which together accounted for 43 percent of all container traffic.19 Additionally, Chicago’s central location makes it a national leader in intermodal transit.20 Reflecting historical redlining,21 the communities near these ports are overwhelmingly comprised of residents with lower-incomes and people of color who disproportionately suffer exposures and health impacts from pollution from heavy-duty truck engine emissions. Data from the census tracts surrounding the Ports of Los Angeles and Long Beach exemplify these inequalities: [[See docket number EPA-HQ-OAR-2019-0055-1255-A1, pp. 7-8 for data tables.]] [EPA-HQ-OAR-2019-0055-1255-A1, pp. 5 - 7]

18. See, e.g., Gaige Hunter Kerr, et al., COVID-19 Pandemic Reveals Persistent Disparities in Nitrogen Dioxide Pollution, 118 Proc. Nat’l Acad. Sciences 30 (2021), attached as Exhibit 3; Mary Angelique G. Demetillo, et al., Space-Based Observational Constraints on NO2 Air Pollution Inequality from Diesel Traffic in Major US Cities, Geophysical Research Letters 48 (2021), attached as Exhibit 4; Paul Allen, et al., Newark Community Impacts of Mobile Source Emissions: A Community-Based Participatory Research Analysis (2020), attached as Exhibit 5; Maria Cecilia Pinto de Moura, et al., Union of Concerned Scientists, Inequitable Exposure to Air Pollution from Vehicles in Massachusetts (2019), attached as Exhibit 6; Iyad Kheirbek, et al., The Contribution of Motor Vehicle Emissions to Ambient Fine Particulate Matter Public Health Impacts in New York City: a Health Burden Assessment, 15 Env’t Health 89 (2016), attached as Exhibit 7.

19. Data from the Bureau of Transportation Statistics, Container TEUs (Twenty-foot Equivalent Units) (2020), https://data.bts.gov/stories/s/Container-TEU/x3fb-aeda/ (ports of Baltimore, Boston, Honolulu, Long Beach, Los Angeles, New York and New Jersey, Oakland, Seattle, South Jersey, Tacoma, and Wilmington combined for 24.956 million TEUs, 61% of 41.24 million TEUs total nationwide; ports of Long Beach, Los Angeles, and New York and New Jersey combined for 17.62 million TEUs, 43% of 41.24 million TEUs) (last accessed May 16, 2022).

20. Chicago Metropolitan Agency for Planning, The Freight System: Leading the Way, at 16 (2017), attached as Exhibit 8.

21. Beginning in the 1930s, federal housing policy directed investment away from "risky" communities of color. Nearly all of the communities adjacent to the three megaports (the Ports of Los Angeles, Long Beach, and New York and New Jersey) and the intermodal terminals in Chicago were coded red, signifying the least desirable areas where investment was to be avoided. See Univ. of Richmond Digital Scholarship Lab, Mapping Inequality, https://dsl.richmond.edu/panorama/redlining/#loc=12/33.748/-118.272&city=los-angeles-ca (Los Angeles, CA), https://dsl.richmond.edu/panorama/redlining/#loc=14/40.678/-74.004&city=brooklyn-ny (Brooklyn, NY), https://dsl.richmond.edu/panorama/redlining/#loc=13/40.704/-74.068&city=hudson-co.-nj (Hudson County, NJ), https://dsl.richmond.edu/panorama/redlining/#loc=13/40.627/-74.233&city=union-co.-nj (Union County, NJ), https://dsl.richmond.edu/panorama/redlining/#loc=12/41.854/-87.772&city=chicago-il (Chicago, IL) (last accessed May 16, 2022).

Logistics hubs demand extensive networks of highways and warehouses to move and store cargo via millions of truck trips annually. Southern California was home to nearly 1.2 billion square feet of warehouse space as of 2014,24 the South Coast Air Basin now contains approximately 3,000 warehouses over 100,000 square feet,25 and the Ports of Los Angeles and Long Beach alone generate about 35,000 container truck trips every day.26 Aggravating historical injustices, decision makers disproportionately site highways and warehouses in environmental justice communities whose residents, like those of port communities, suffer higher levels of pollution exposure from heavy-duty trucks than do whiter and higher-income communities. Data demonstrate that the census tracts in California with the highest levels of ozone, PM2.5, and DPM exposure are communities of color bordering such logistics thoroughfares—Highway 99 in the San Joaquin Valley and Highways 10 and 60 in the Inland Empire: [[See docket number EPA-HQ-OAR-2019-0055-1255-A1, p. 9 for data table.]] [EPA-HQ-OAR-2019-0055-1255-A1, p. 8]

24. South Coast Air Qual. Mgmt. Dist., Final Socioeconomic Assessment, supra note 13, at 7-8.

25. Southern California Association of Governments, Industrial Warehousing in the SCAG Region: Task 2. Inventory of Warehousing Facilities, at 2-11 (2018), available at https://scag.ca.gov/sites/main/files/file-attachments/task2_facilityinventory.pdf (last accessed May 16, 2022).

26. U.S. Dept. of Transportation, Federal Highway Administration, FHWA Operations Support – Port Peak Pricing Program Evaluation (2020), available at https://ops.fhwa.dot.gov/publications/fhwahop09014/sect2.htm (last accessed May 16, 2022).

Accordingly, achieving emissions reductions from heavy-duty trucks is a critical step to begin dismantling historical patterns of environmental injustice burdening communities near ports, highways, and warehouses. [EPA-HQ-OAR-2019-0055-1255-A1, p. 9]

Organization: *Sustainable Solar Systems*

Diesel pollution from heavy duty trucks and buses is a massive public health threat. Even without considering climate change, the air pollution caused by heavy duty trucks is a environmental justice issue that causes more health issues in frontline and marginalized communities. Diesel pollution worsens asthma and is particularly dangerous to children's developing lungs. Here in Philadelphia, 21% of children have asthma, which is more than double the national rate. Indoor and outdoor air pollution are major contributors to the high prevalence of asthma in Philadelphia. The air pollution doesn't only affect childrens' health. It increases costs for LMI families, increases absentee rates in school and days missed from work for their parents. It affects childrens ability to learn in school, affecting lifetime income levels for those children. [EPA-HQ-OAR-2019-0055-2737, p.1]

We urgently need cleaner heavy-duty vehicles on the road, especially in underserved communities that are overburdened with truck pollution due to their proximity to highways and high-traffic corridors. [EPA-HQ-OAR-2019-0055-2737, p.1]

This is more than a financial issue. It's a justice and equity issue. But soon, these cleaner vehicles will actually be cheaper to own and operate than diesel vehicles anyway - making it the smart financial choice to invest in these vehicles now. The EPA must not delay in the adoption of these standards or the next round starting in 2030. Families in diesel death zones have suffered long enough. [EPA-HQ-OAR-2019-0055-2737, p.1]

Organization: *United Methodist Church - General Board of Church and Society*

The United Methodist Church further states that 'clean air is a basic right and necessity for all life' (2016 Book of Resolutions, #1033). Communities of color face an undue, disproportionate, and unjust burden of air pollution and climate impacts from the production of fossil fuels. Most significantly, these new regulations would safeguard communities of color from continued, disproportionate impacts of vehicular pollution and the health effects of greenhouse gas emissions. [EPA-HQ-OAR-2019-0055-1042-A1, p.1]

Organization: *Various Academic Researchers*

Strengthening HDV NOx emissions standards is necessary to reduce air pollution injustice

NOx emissions are not distributed equally throughout the urban landscape, resulting in disproportionately higher NO2 concentrations in marginalized and minoritized communities of the U.S. These disparities have persisted despite overall reductions in ambient NO2. Our research in progress indicates that in 2019, NO2 levels in communities with the largest shares of non-white residents were 2.1 times higher and rates of NO2-attributable pediatric asthma were 7.6 times higher than levels and rates in communities with the largest shares of white residents [Kerr et al., in prep]. [EPA-HQ-OAR-2019-0055-1220-A1, p. 2]

HDV NOx emissions are a leading source of NOx in urban areas of the U.S. On average across the U.S., HDV NOx accounts for 16% of total NOx emissions, but in some cities this proportion can be as high as 30%.5 Marginalized and minoritized communities are located closer to a higher density of interstates, highways, and other major roads. For example, the number of major roads within a kilometer of the least white communities in the U.S. was about 4.5 times higher than the number in the most white communities.5 [EPA-HQ-OAR-2019-0055-1220-A1, p. 2]

5. Kerr, G. H.; Goldberg, D. L.; Anenberg, S. C. COVID-19 Pandemic Reveals Persistent Disparities in Nitrogen Dioxide Pollution. Proc Natl Acad Sci USA 2021, 118 (30), e2022409118. https://doi.org/10.1073/pnas.2022409118.

The unique natural experiment provided by the COVID-19 pandemic allowed us to better understand NO2 disparities and the source of these disparities. Despite an approximately 50% decrease in passenger vehicle activity during the early phase of the pandemic, we found that NO2 levels in marginalized and minoritized communities of the U.S. during the pandemic still exceeded levels in non-marginalized and minoritized communities prior to the pandemic.5 The modest impact that removing ~50% of passenger vehicles from roadways had on NO2 disparities during the pandemic, the important contribution of HDVs to NOx emissions, and the colocation of heavily trafficked roadways with marginalized and minoritized communities point to the importance of HDV NOx emissions in creating and maintaining NO2 inequality. Given their impact, strengthening HDV NOx emissions standards is necessary to advance environmental justice in the nation’s most vulnerable communities. [EPA-HQ-OAR-2019-0055-1220-A1, p. 2]

5. Kerr, G. H.; Goldberg, D. L.; Anenberg, S. C. COVID-19 Pandemic Reveals Persistent Disparities in Nitrogen Dioxide Pollution. Proc Natl Acad Sci USA 2021, 118 (30), e2022409118. https://doi.org/10.1073/pnas.2022409118.

Organization: *WE ACT for Environmental Justice*

These adverse impacts are a preventable reality for people living in low-income areas and communities of color because of their close proximity to high-traffic roadways and trucking routes, bus depots, and goods movement facilities.4,5 These are the areas that scientists have deemed 'diesel death zones' due to adverse environmental and health impacts linked to exposure to toxic air pollutants in diesel exhaust.6 A recent study that utilized space-based observations of NOx air pollution across 52 U.S. cities revealed the striking inequities in exposure for low-income Black, Hispanic, Asian, and Indigenous people compared to white residents.7 [EPA-HQ-OAR-2019-0055-1347-A1, p.1]

4 https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1014874.pdf

5 https://www.lung.org/research/sota/key-findings/people-at-risk

6 https://grist.org/Array/seeking-environmental-justice-in-californias-diesel-death-zones/

7 https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2021GL094333

Our legacy of discriminatory transportation and land use planning has placed people of color on the frontlines of the climate crisis8,9 and in segregated communities that are overburdened by the health damaging effects of exhaust from trucks and buses, power plants, construction sites, and heavy industrial and manufacturing sites.10 We have seen that chronic exposure to high levels of air pollution in communities of color placed residents at higher risk of hospitalization and death from global health crises such as the COVID-19 pandemic.11, 12 [EPA-HQ-OAR-2019-0055-1347-A1, p.2]

8 https://www.bbc.com/future/article/20220125-why-climate-change-is-inherently-racist

9 https://www.epa.gov/system/files/documents/2021-09/climate-vulnerability_september-2021_508.pdf.

10 https://www.propublica.org/events/sacrifice-zones-communities-in-the-path-of-industrial-pollution

11 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7204717/

10 https://www.propublica.org/events/sacrifice-zones-communities

12 https://www.researchgate.net/profile/Gonzalo-Bacigalupe/publication/342496424_COVID-19_Interconnectedness_Health_Inequity_the_Climate_Crisis_and_Collective_Trauma/links/5f426f5b92851cd3021f56e7/COVID-19-Interconnectedness-Health-Inequity-the-Climate-Crisis-and-Collective-Trauma.pdf

Organization: *Wisconsin Department of Natural Resources (WDNR)*

Finally, low-income communities and communities of color represent a higher fraction of populations living along high heavy-duty vehicle traffic corridors and bear a disproportionately high pollution burden from mobile sources. Reducing the ozone and particulate matter pollution from heavy-duty trucks will improve health outcomes throughout Wisconsin. Most importantly, it will take a critical step toward attainment of the 2015 ozone NAAQS, improving air quality in areas overburdened by pollution. [EPA-HQ-OAR-2019-0055-1162-A1, p. 2]

Organization: *World Resources Institute (WRI)*

Pollution from trucks, buses, and other medium- and heavy-duty vehicles directly affects the health of people who live near highways, ports, and depots. EPA’s own analysis estimates that 72 million people in this country live within 200 meters of a truck freight route, and relative to the rest of the population, people of color and those with lower incomes are more likely to live near these transportation corridors. [EPA-HQ-OAR-2019-0055-1298-A1, p.1]

In addition to these ambient conditions, also of concern are the on-board emissions from the diesel school buses that represent more than 90 percent of the 480,000 school buses on the road today, transporting over 20 million students daily and driving 3.3 billion miles annually. Children are particularly susceptible to the negative health effects of diesel exhaust from school buses, a known carcinogen linked to reduced lung development and increased risk for asthma and pneumonia in children, among other risks. In addition, there is evidence that reducing diesel exhaust exposure can improve not only students' respiratory health, but also their academic outcomes. [EPA-HQ-OAR-2019-0055-1298-A1, p.2]

Electric school buses, which produce zero tailpipe emissions, are the healthiest solution for all students, bus drivers, and the communities they travel through. Because students from low-income communities are more likely to ride a school bus - 60% of students from low-income families ride the bus to school, compared to 45% of students from families with higher incomes - a more stringent rule will advance the transition to an electric school bus fleet and simultaneously help address this transportation inequity. [EPA-HQ-OAR-2019-0055-1298-A1, p.2]

Organization: *Yellowstone Integrated Architecture and Construction*

Dangerous nitrogen oxides and other pollution that heavy duty vehicles like trucks and buses spew into our air hurt communities of color and low wealth communities first and worst, but affect all of us, especially our children. [EPA-HQ-OAR-2019-0055-2816, p.1]

EPA Summary and Response

Summary:

Commenters pointed out the need to control emissions from heavy-duty vehicles to improve public health and welfare, especially to those who live, work, or attend school close to major roadways and in communities with EJ concerns.

Response:

Thank you for your comments. EPA agrees that actions to control emissions from heavy-duty vehicles are necessary to improve public health and welfare. The standards in this rule will bring about significant health benefits in the U.S., including to those who live, work, or attend school close to major roadways and in communities with EJ concerns. EPA notes that, as explained in preamble Sections I and III, EPA is promulgating these standards under our authority in CAA section 202(a)(3)(A) and has appropriately assessed the statutory factors specified in that section.

Please refer to Section 1 of this document for responses to comments regarding concerns that the proposal does not go far enough to reduce emissions from heavy-duty vehicles. Please refer to Section 3 for responses to comments about the stringency of the proposed standards.

EPA is committed to taking decisive action to advance environmental justice and civil rights as part of its FY2022-2026 Strategic Plan. This rulemaking advances that strategic goal by setting stronger national emission standards for heavy duty engines and vehicles.

EPA acknowledges comments from many stakeholders on the impacts of COVID on underserved communities. While we were not able to incorporate COVID 19 into our modeling, we have evaluated the impacts we expect the rule to have on communities overburdened by pollution; this analysis is included in preamble Section IV.H, with additional discussion on environmental justice in preamble Sections II and XII.

24 Comparison of Benefits and Costs

Comments by Organizations

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

Cost-benefit analysis also supports establishing stringent standards in this rulemaking. EPA's cost-benefit analysis should quantify the rule's climate benefits based on the social cost of greenhouse gases (SC-GHG), and EPA should consider these benefits—as well as the additional benefits from Commenters' proposed improvements—in finalizing the standards.

Organization: *Great Rivers Environmental Law Center and Dutchtown South Community Corporation (DSCC)*

It is not without meaning that EPA's own cost analysis demonstrates more stringent emissions controls will actually cost less money and save more lives.25 [EPA-HQ-OAR-2019-0055-1323-A1, p.6]

25 Proposed Regulation at p.17589, Table IX-1.

Organization: *Manufacturers of Emission Controls Association (MECA)*

MECA estimated that the proposed NOx reductions could be achieved with an approximate cost-effectiveness from $1,000 to $5,000 per ton of NOx reduced. We used a cost-effectiveness methodology that is based on both certification emission levels as well as in-use emissions reported by CARB [40] following the 2017 Carl Moyer Guidelines [41], and assuming typical heavy-duty engine power, load and annual use. Benefits were calculated for a vehicle's current full useful life of 435,000 miles. The resulting range of cost-effectiveness values is due to variability in vehicle and engine characteristics. For example, replacing a higher-emitting vehicle that operates more frequently and lasts longer on the road will be more cost-effective than replacing a lower-emitting vehicle that operates for less time. EPA's estimate of $2,000 per ton NOx reduced for the 2010 heavy-duty NOx standards is within this range [42], and both are significantly below the average cost of controls on stationary power plants and industrial NOx sources, which have been reported to range from $2,000-$21,000 per ton [43]. Similarly, CARB estimated the cost-effectiveness for future low-NOx requirements to be approximately $6,000 per ton [44]. [EPA-HQ-OAR-2019-0055-1320-A1, p.27]

[40] S. Hu, C. Howard, D. Quiros, R. Ianni, W. Sobieralski, W. Ham, H. Sun, B. Yang, C. Fehrenbacher, A. Vanzant, V. Sales, D. Chernich and T. Huai, 'Overview of CARB's Truck and Bus Surveillance Program (TBSP): Findings and Implications,' in 29th CRC Real World Emissions Workshop, Long Beach, 2019.

[41] CARB, ‘Carl Moyer Program Guidelines,’ 20 June 2017. [Online]. Available: https://www.arb.ca.gov/msprog/moyer/guidelines/current.htm.

[42] 40 CFR Parts 69, 80, and 86, ‘Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements,’ Federal Register, pp. 5002-5193, 2001.

[43] U.S. EPA, ‘Menu of Control Measures for NAAQS Implementation,’ 20 October 2017. [Online]. Available: https://www.epa.gov/sites/production/files/2016-02/documents/menuofcontrolmeasures.pdf.

[44] CARB, ‘California Air Resources Board Staff Current Assessment of the Technical Feasibility of Lower NOx Standards and Associated Test Procedures for 2022 and Subsequent Model Year Medium-Duty and Heavy-Duty Diesel Engines,’ 2019.

Organization: *Institute for Policy Integrity at New York University School of Law (Policy Integrity)*

It is well established that agencies should consider a range of regulatory alternatives in order to properly evaluate the costs and benefits of a regulatory proposal. Executive Order 12,866 explains that “agencies should select those approaches that maximize net benefits” when “choosing among alternative regulatory approaches.”21 Accomplishing such a goal of maximizing net benefits is impossible without first considering a broad range of alternatives at different levels of stringency.22 The Office of Management and Budget (“OMB”) Circular A-4 directs agencies to “describe the alternatives available to [the agency] and the reasons for choosing one alternative over another.”23 When, as here, there is a continuum of possible alternatives based on the level of stringency, agencies “generally should analyze at least three options: the preferred option; a more stringent option that achieves additional benefits (and presumably costs more) beyond those realized by the preferred option; and a less stringent option that costs less (and presumably generates fewer benefits) than the preferred option.”24 Circular A-4 makes clear that an analysis that, as here, does not discuss the incremental costs and benefits of alternatives is not adequate.25 [EPA-HQ-OAR-2019-0055-1256-A1, pp. 5 - 6]

21. 58 Fed. Reg. 51,735 §1(a) (Oct. 4, 1993).

22. See Richard L. Revesz & Samantha P. Yi, Distributional Consequences and Regulatory Analysis, 52 ENV’T L. 53, 91–92.

23. OFFICE OF MGMT. & BUDGET, CIRCULAR A-4: REGULATORY ANALYSIS 16 (2003).

24. Id.

25. Id.

Organization: *Our Children's Trust*

What is at stake in this proposed rule are lives of children—their health and safety. Nonetheless, EPA's RIA applies discount rates of 3% and 7% to the benefits of reducing pollution. Even in the context of 'valuing PM2.5-related premature **mortality, we discount the value of premature mortality occurring in future years using rates of 3 percent and 7 percent.'3** At the same time EPA discounts the benefits of eliminating pollution substantially devaluing those benefits for children today who will become adults in 20 years, or children born in 20 years and beyond, EPA has also ignored 'future changes to climate [that] may create conditions more conducive to forming ozone' and 'the potential for climate-induced changes in temperature to modify the relationship between ozone and the risk of premature death.'4 [EPA-HQ-OAR-2019-0055-1317-A1, p.2]

3 U.S. EPA, Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards: Draft Regulatory Impact Analysis, EPA-420-D-22-001, at 388 (Mar. 2022).

4 Id.

The RIA does not include any valuation for the social cost of carbon ('SCC'). As we have written in other comments, given the catastrophic harms to young people and future generations posed by ongoing GHG pollution and the intergenerational injustice and lack of political power of these generations, EPA should not be discounting the benefits accruing to those generations when it makes decisions today that will profoundly affect their health and welfare and indeed their ability to sustain life in their communities and in their homes. Please stop using this discounting practice that is unjustified from any ethical, legal or economic perspective, and use a zero percent discount rate and a meaningful valuation of the SCC. Discounting as conducted in this RIA is not required by any law of Congress and it is unconstitutional. It has real-life implications. EPA does not even evaluate alternative regulations that could 'cost' more in dollars today to implement because it does not fully value the benefit of doing so. Every one of the RIAs EPA has prepared in the past thirty years has systematically undervalued the benefit of stringent pollution control to protect air quality, and human health and welfare, and discriminates against children and future generations. [EPA-HQ-OAR-2019-0055-1317-A1, pp.2-3]

5 U.S. EPA, Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards: Draft Regulatory Impact Analysis, EPA-420-D-22-001, at 3 (Mar. 2022).

EPA has in the past performed a sensitivity analysis with zero % discounting and discounting as low as 2%. Please explain why EPA refuses for the past three decades to engage in that analysis to provide a more accurate picture of the benefit cost analysis to children of today and tomorrow. [EPA-HQ-OAR-2019-0055-1317-A1, p.3]

The RIA acknowledges that: 'The benefits associated with the standards presented here do not include the full complement of health, environmental, and climate-related benefits that, if quantified and monetized, would increase the total monetized benefits.'5 By monetizing all costs and only a margin of the economic benefits (then substantially discounted) gives a very imbalanced and inaccurate picture of the enormous benefits of stopping GHG pollution. The totality of health and climate harms from these GHGs are well-documented and relevant to the burdens imposed by the proposed rule on youth and future generations. EPA should provide a very clear explanation up front that the monetized benefits are so undervalued that they outweigh costs by an order of magnitude and provide some tangible explanation for the American public, judges and policymakers to understand how substantially the benefits outweigh any costs. EPA should also explain how the discounting process, which is not lawful, not authorized by Congress, nor allowed constitutionally also gives a skewed view of the benefits of these proposed regulations and has foreclosed EPA from evaluating even more protective regulations that would care for the health of the youngest citizens and the voiceless future generations who will live with the consequences of these rules. [EPA-HQ-OAR-2019-0055-1317-A1, p.3]

Organization: *Truck and Engine Manufacturers Association (EMA)*

Using the foregoing numbers, on a per-vehicle basis, the proposed Option 1 low-NOx regulations likely would have a costs-to-benefits ratio (or a negative benefits-to-costs ratio) on a per-HHD-vehicle basis of approximately 10:1. As a result, Option 1 is not implementable. In addition, EPA will need to revise Option 2 in a manner consistent with EMA's recommendations to enhance the cost-effectiveness of the Agency's final low-NOx regulations. [EPA-HQ-OAR-2019-0055-1203-A1, p. 144]

In light of the foregoing, the Agency will need to revise its RIA and benefits estimates, and make the necessary changes to the resultant cost-benefit calculations before finalizing this rulemaking. As it stands, it remains clear that the Agency's Option 1 proposal is cost-prohibitive. [EPA-HQ-OAR-2019-0055-1203-A1, p. 165]

EPA Summary and Response

Summary:

The commenters made several observations about the comparison of costs and benefits associated with the proposal, including that EPA's cost-benefit analysis should quantify the rule's climate benefits based on the social cost of greenhouse gases (SC-GHG), that costs and benefits should be compared across alternatives, that there are unquantified benefits that, when accounted for, would further increase net benefits, and that the Agency needs to revise its cost-benefit calculations.

Response:

EPA acknowledges the commenters' input and observations about the comparison of benefits and costs in the proposal. EPA's benefit-cost analysis is consistent with applicable guidance and best practices for conducting such analyses, including OMB Circular A-4 and EPA's Guidelines for Preparing Economic Analyses, including guidance on which discount rate estimates to apply, and how to apply them, when monetizing benefits and costs. We consider our analysis consistent with the guidance, methodologically rigorous, and a best estimate of the projected societal benefits and costs associated with the proposed and final program. In the proposal, we found that the benefits of both scenarios we analyzed, Option 1 and Option 2, far outweighed the costs associated with those same scenarios (RIA Chapter 8 describes EPA's benefits methodology and assumptions). See also our response in sections 18 and 21 of this document for further detailed response about the appropriateness of EPA's cost and benefits methods.

We note that EPA is not taking final action at this time on the proposed revisions to certain Heavy-Duty GHG Phase 2 standards. As a result, the benefits analysis for this final rulemaking does not monetize the Social Cost of GHGs associated with reductions in GHG emissions related to any changes to the Heavy-Duty GHG Phase 2 standards.

In setting the final emission standards, EPA appropriately assessed the statutory factors specified in CAA section 202(a)(3)(A). EPA's assessment of the relevant statutory factors in CAA section 202(a)(3)(A) justify the final emission standards. We also evaluated additional factors, including factors to comply with E.O. 12866; our assessment of these factors lends further support to the final rule. For additional discussion on our assessment in setting the final standards, see sections 3.1 and 3.2 of this Response to Comments document and preamble Sections III, IV, and V.

EPA also acknowledges that the benefits associated with the proposed program do not include the full complement of health and environmental benefits that, if quantified and monetized, would increase the total monetized benefits. However, EPA demonstrated that the benefits it did monetize would provide society with a substantial net gain in welfare. Unquantified benefits generally scale with the emissions impacts of the proposed standards and benefits far outweighed costs under each regulatory option. The omission of unquantified benefits did not impact the Agency's evaluation of the proposed regulatory options.

25 Impact on vehicles sales, mode shift, fleet turnover

25.1 Commenters who Agree with the Conclusions of EPA's Sales Analysis

Comments by Organizations

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

And while EPA has previously found that sales impacts from heavy-duty emissions standards were too uncertain to quantify—a position with which Commenters continue to agree—Commenters generally endorse the Agency's conclusions regarding the potential sales impacts of this rulemaking. Despite uncertainties, Commenters agree with EPA that the adverse sales impacts, if any, from proposed Option 1 (including pre-buy and low-buy effects) are likely to be minimal and short lived. [EPA-HQ-OAR-2019-0055-1302-A1, p.8]

EPA has previously declined to quantify the sales impacts of heavy-duty regulations, determining that adverse impacts were not certain to occur, and that it was not possible to isolate the effects of the standards from other, potentially stronger, factors, such as broader macroeconomic conditions. In the 2011 Phase 1 GHG standards, EPA and NHTSA noted that 'whether pre-buy or delayed purchase is likely to play a significant role in the truck market depends on the specific behaviors of purchasers in that market,' and explained that the Agencies would not project fleet turnover effects '[w]ithout additional information' about the likelihood of future market conditions. EPA & NHTSA, Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles, 76 Fed. Reg. 57,106, 57,332 (Sept. 15, 2011). Similarly, in the 2014 Tier 3 standards, EPA explained that it had 'not attempted to estimate explicitly the effects of the rule on scrappage of older vehicles and the turnover of the vehicle fleet,' because it did not 'have a good estimate of the effect of new vehicle price changes on vehicle turnover.' EPA, Control of Air Pollution from Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards, 79 Fed. Reg. 23,414, 23,617 (Apr. 28, 2014). And most recently, in the 2016 Phase 2 GHG standards, EPA and NHTSA again declined to project sales and turnover effects, explaining that while the standards might affect sales to some degree, 'the size of that effect is likely to be swamped' by macroeconomic conditions, and that it was 'unlikely to be possible to separate the effects of the existing standards from other confounding factors.' 81 Fed. Reg. at 73,875.255 [EPA-HQ-OAR-2019-0055-1302-A1, pp.69-70]

> 255 CARB similarly declined to attempt to estimate sales impacts from the Omnibus, observing that while some studies had explored the relationship between general cost increases and purchasing behavior, they resulted in a 'very wide range' of 'highly uncertain' estimates, which CARB cautioned 'may change markedly in the span of only several years due to the dynamics of industry, and modern global economics.' CARB, Attachment B to Resolution 20-23, Response to Comments on the Environmental Analysis for the Proposed Heavy-Duty Engine and Vehicle Omnibus Regulation and Associated Amendments 14 (Aug. 26, 2020). https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hdomnibuslownox/res20-23attbrtc.pdf.

We recognize that EPA has now developed a peer-reviewed methodology to estimate the sales impacts of heavy-duty regulations, which it suggests could be applied in the final rule. While we do not think EPA should quantify sales effects in the final rule, for the reasons noted above in the previous rulemakings, we do concur in the Agency's ultimate conclusion that any such effects are likely to be minimal and short-lived. According to the Agency's example results, proposed Option 1 is unlikely to cause extensive or long-lasting adverse sales impacts, with potential pre- and low-buy for Class 8 trucks ranging 'from zero to approximately two percent increase in sales over a period of up to 8 months before the 2031 standards begin (pre-buy), and a decrease in sales from zero to approximately two percent over a period of up to 12 months after the 2031 standards begin (low-buy).' 87 Fed. Reg. at 17,429. [EPA-HQ-OAR-2019-0055-1302-A1, p.70]

As EPA's analysis of previous, comparable heavy-duty regulations determined, historical pre-buy/low-buy effects have been limited—where there is evidence that they have even occurred at all.256 Specifically, these effects have been shown to be limited by *vehicle type* (with 'some evidence for Class 8 vehicles' but no such evidence for Classes 6 or 7257), limited in *magnitude* (with '[s]mall' pre-buy effects for Class 8 vehicles prior to the 2010 and 2014 regulations258), and limited in *duration* (with ‘some evidence for Class 8 vehicles of short-term pre-buy and low-buy’ lasting ‘typically less than 8 months’259).260 And on the limited occasions when both pre-buy and low-buy effects have occurred in the past, they often cancel each other out in a matter of months, with a net sales impact of zero.261 [EPA-HQ-OAR-2019-0055-1302-A1, pp.70-71]

256 EPA, Analysis of Heavy-Duty Vehicle Sales Impacts Due to New Regulation at 8–16 , EPA-420-R-21-013 (2021), https://cfpub.epa.gov/si/si_public_pra_view.cfm?dirEntryID=349838&Lab=OTAQ.

257 Id. at 8.

258 Id.

259 Id.

260 See id. at 9 ('Pre-buy and low-buy effects, where they occur, are short lived, with the period of significance not extending beyond 8 months pre and post regulation.').

261 See id. at 20 (citing Rittenhouse and Zaragoza-Watkins’s (2018) finding that pre-buy prior to the 2007 regulation was 'followed by a near-symmetrical reduction in sales in the months immediately after the regulation went into effect—for an overall near zero net sales impact'); National Academies of Sciences Engineering and Medicine, Reducing Fuel Consumption and Greenhouse Gas Emissions of Medium- and Heavy-Duty Vehicles, Phase Two: Final Report 329 (2020), https://doi.org/10.17226/25542 ('The pre-buy and low-buy impacts [of the 2007 standards] were short-lived and small in volume…and they roughly canceled out, leaving an insignificant net impact on sales.').

Moreover, while there is mixed evidence of limited pre-buy and low-buy behaviors surrounding some prior heavy-duty vehicle regulations, the evidence is neither definitive nor predictably consistent across regulations or vehicles. As EPA concluded from its literature review, ‘pre-buy and low-buy do not occur universally. These effects do not appear to show up in all rules, or for Class 7 vehicles.’262 In fact, in the case of the 2010 regulations, Class 7 vehicles actually showed some evidence of reduced sales before the implementation of the regulations, and increased sales after the implementation of the regulations—the opposite of pre-buy/low-buy and contrary to a simplistic assumption that higher expected regulatory costs necessarily result in greater adverse sales impacts, given that the 2007–2010 regulations ‘are largely seen as the most extensive (and expensive) HDV emissions standards.’263 [EPA-HQ-OAR-2019-0055-1302-A1, p.71]

262 EPA, Analysis of Heavy-Duty Vehicle Sales Impacts Due to New Regulation at 99.

263 Id. at 39.

Similarly, not all purchasers can be expected to engage in the same kind of behavior in response to regulations. For example, smaller firms, which make up a plurality of trucking companies, 'typically have lower pricing power, and as such are less likely to engage in pre-buy, low-buy, or class-shifting behavior.'264 Likewise, contrary to claims regularly advanced by industry advocates, trucking firms' responses to increased costs 'may not always follow what would be expected by theory.'265 Studies 'suggest that trucking companies may pass on, and recoup (or more than recoup) certain costs, and that economic responses to HDV emissions regulations may be more complex than anticipated and may be counterintuitive in certain respects.'266 [EPA-HQ-OAR-2019-0055-1302-A1, p.71]

264 Id. at 16.

265 Id. at 43.

266 Id.

Further, as EPA noted in its 2021 analysis, '[g]iven the high relative costs of [HDVs], we also do not expect much of a pre-buy effect, as any advantage associated with increasing early purchases because of anticipated HDV price increases are offset by the costs of managing excess vehicle capacity, which can be expensive, or selling or scrapping older stock.'267 Commenters agree with this assessment. [EPA-HQ-OAR-2019-0055-1302-A1, p.71]

267 Id. at 54.

Commenters also strongly support EPA's view that the extended useful life and warranty periods of proposed Option 1—in addition to ensuring critical real-world emissions reductions—are likely to reduce the potential for adverse sales impacts. As EPA explains, '[t]his is because longer useful life periods are expected to make emission control technology components more durable, and more durable components, combined with manufacturers paying for repairs during the proposed longer warranty periods, would in turn reduce repair costs for vehicle owners.' 87 Fed. Reg. at 17,590. The reduced repair costs can be expected to alleviate some of the effect of increased vehicle purchase costs, and '[a]s a result, they may reduce incentives for pre- and low-buy and mitigate adverse sales impacts.' Id. at n.785. [EPA-HQ-OAR-2019-0055-1302-A1, pp.71-72]

The Proposal's reliance on familiar technology, combined with the enhanced durability and warranty provisions, means that purchasers can be expected to face reduced incentives to engage in pre-buy behavior in response to these standards. See Comments of MFN, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022. [EPA-HQ-OAR-2019-0055-1302-A1, p.72]

Finally, Commenters' proposed improvements to the GHG standards can also be expected to reduce the potential for adverse sales impacts of the standards. Manufacturers often improve the fuel efficiency of their vehicles as part of their strategy for complying with GHG standards, which are less likely to cause adverse sales impacts because the benefits of fuel savings accrue to the vehicle purchaser, thereby lowering transport costs and stimulating the economy.270 Fuel efficiency and GHG standards also reduce the impact of fuel price volatility on new vehicle demand, and insulate manufacturers and workers from fuel price shocks, leading to more stable sales and employment numbers.271 [EPA-HQ-OAR-2019-0055-1302-A1, p.72]

> 270 See Katherine Rittenhouse & Matthew Zaragoza-Watkins, Anticipation and Environmental Regulation, 89 J. Envtl. Econ. & Mgmt. 255, 267 (2018).
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> 271 See id.; Matthew Zaragoza-Watkins, Analysis of Market Impacts of GHG and Fuel-Economy Standards for Heavy-Duty Vehicles (May 11, 2015), attachment to Comment of EDF on EPA's Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles—Phase 2 (Docket No. EPA-HQ-OAR-2014-0827) (Aug. 16, 2016).

Organization: *Environmental Defense Fund (EDF) (1265 and 2855)*

Certain companies continue to inaccurately make the argument that protective pollution standards disrupt the market for new trucks because of a pre-buy/low buy phenomenon. These arguments are based almost entirely on inflated cost projections for compliance with EPA Option 1, which aligns with the California Heavy-Duty Omnibus rule, including assumed substantial additional costs for replacing diesel NOx controls based on warranty and extended useful life provisions. [EPA-HQ-OAR-2019-0055-1265-A1, pp.25-26]

However, CARB's cost projections are reasonable and indeed, similar claims related to past standards have proven incorrect. For instance, some companies often incorrectly cite the 2006/2007 emissions standards as an example of standards that caused a pre-buy/low-buy effect. A prior analysis by EDF has shown that standards, including the 2007 standards, did not meaningfully result in 'pre-buy' or 'low-buy.'108 The study found that the net impact of the 2007 criteria standards on sales, and likely employment, was quite small.109 Instead, GDP, the price of diesel fuel, and controls for annual and month-of-year differences described the vast majority of the variation in sales and employment,110 Failing to control for these underlying economic trends biases analysis of the impact of regulation.111 The study found that other previous criteria pollutant standards, in 1998, 2002, 2004, and 2010, also had no impact on new-vehicle sales.112 The study concluded that the empirical evidence suggests that compliance with criteria pollutant standards has not generally caused a demand shift or net impact on new-vehicle sales.113 [EPA-HQ-OAR-2019-0055-1265-A1, p.26]

> 108 Analysis of Market Impacts of GHG and Fuel-Economy Standards for Heavy Duty Vehicles by Dr. Matthew Zaragoza-Watkins in comments of Environmental Defense Fund on Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles—Phase 2; Proposed Rule, 80 Fed. Reg. 40138 (July 13, 2015), EPA-HQ-OAR-2014-0827-1971, https://www.regulations.gov/comment/EPA-HQ-OAR-2014-0827-1971; See also Katherine Rittenhouse and Matthew Zaragoza-Watkins, Anticipation and Environmental Regulation, Journal of Environmental Economics and Management 89, 255-277 (2018), https://doi.org/10.1016/j.jeem.2018.03.005.
>
> 109 Id.

110 Id.

111 Id.

112 Id.

113 Id.

Organization: *Moving Forward Network (MFN)*

A frequent industry claim that EPA should forcefully reject in response to comments is that new emission standards cause a “pre-buy/no-buy” phenomenon. The theory goes that complying with new standards comes at an exorbitant cost, causing fleets to stock up on older truck models before the new standard comes into effect (“pre-buy”) resulting in a sharp decrease in sales after the standard begins (“no-buy”). Because of this wild oscillation in demand, manufacturers claim standards will result in job cuts—something they claim happened with previous heavy-duty vehicle emission standards. Any scrutiny of the impact of past emission standards on purchasing behavior shows that manufacturers are superimposing trendlines and erroneously calling that a causal relationship. [EPA-HQ-OAR-2019-0055-1277-A1, p. 38]

A more rigorous econometric approach was conducted to evaluate the 2007 federal truck emission update impact on truck sales. The analysis found that regulatory “anticipation” caused a spike in truck sales before the rule began, followed by a slump once it came into effect.154 But, critically, the spike and slump were extremely short-lived (only seven months before and after), and caused by other macroeconomic factors (GDP and oil price changes). Moreover, the number of vehicle sales impacted was small, roughly 30,000 nationally, and almost 30 percent of these sales were attributable to GDP and oil price changes. In fact, further examination of historical Class 3-8 sales data shows a clear correlation between decreased truck sales and periods of economic downturn (Figure 6). [EPA-HQ-OAR-2019-0055-1277-A1, pp. 38 - 39]

154. https://www.sciencedirect.com/science/article/abs/pii/S0095069617306848?via%3Dihub

Further, the 2007 standard required an entirely new emission control technology. In comparison, the 2010 federal truck standard, which the report also evaluated, only required minor improvements to existing technology and did not experience any pre-buy/no-buy behavior. This is vital because an enhanced version of EPA’s Option 1 that aligns with the Heavy-Duty Omnibus rule only necessitates improvements to existing technology, not entirely new technologies, and is much more similar to the 2010 update. [EPA-HQ-OAR-2019-0055-1277-A1, p. 39]

Additionally, the only cost data that manufacturers can point to comes from an unverifiable survey conducted on their members with wildly inflated projections. In contrast, numerous third parties, including the California Air Resources Board156 and the manufacturers of emission control systems,157 have published extensive cost projections that are orders of magnitude less than the industry survey. Many of these studies are backed by actual lab testing and all results are publicly available. [EPA-HQ-OAR-2019-0055-1277-A1, pp. 39 - 40]

> 156. California Air Resources Board Staff Report on the Warranty Cost Study for 2022 and Subsequent Model Year Heavy-duty Diesel Engines. https://ww2.arb.ca.gov/sites/default/files/2022-01/warranty_cost_study_final_report.pdf.
>
> 157. https://www.meca.org/wp-content/uploads/resources/MECA_2027_Low_NOx_White_Paper_FINAL.pdf, pp. 24-25.

EPA Summary and Response

Summary:

Some commenters, including a comment from Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association and Sierra Club (CATF, et. al), agreed with EPA's analysis of the proposed rule, specifically stating that pre- and low-buy sales effects will be limited and short-lived. CATF, et, al also stated that, though they agree that any sales effects are likely to be minimal and short-lived, EPA should not quantify the sales effects in the final rule, highlighting uncertainties EPA noted in previous HD rulemakings with respect to estimating sales and fleet turnover effects. EDF and MFN further commented that pre- and low-buy sales effects analyses by some manufacturers rely on inflated cost projections and "an unverifiable survey," as opposed to published, public cost projections which are often backed by lab testing.

Commenters, including CATF, et. al, EDF and MFN pointed out that there is evidence of limited pre- and low-buy from previous HD standards, with EDF and MFN stating that the sales effects around the 2007 standards can be largely explained by changes in factors such as GDP and the price of oil or diesel. CATF, et.al commented that the familiar technology available to meet this proposed regulation's standards, as well as the increased durability and warranty provisions proposed, would lead to reduced incentive for pre-buy. Similarly, MFN commented that the proposed standards could be met with mostly existing technology, "similar to the 2010 update," which the commenter stated resulted in minimal pre- and low-buy.

Response:

EPA maintains our assessment that any possible sales effects of the final rule are likely to be minimal and short lived, see RIA Chapter 10 for more detail. EPA agrees that there are many uncertainties associated with estimating pre-buy and low-buy, including those discussed in past rules. For this reason, we have presented the sales analysis for this rule as an illustrative example. EPA agrees that the costs used by some manufacturers to analyze possible pre- and low-buy effects from the proposed rule were larger than the publicly available cost estimates EPA used in the proposed analysis, as well as the cost estimates used in the final rule analyses. See RIA Chapter 7 for more information on the cost estimates used in the final rule analyses, and section 18 of this document for EPA's response to commenters' cost estimates submitted to the docket on the proposed rule.

EPA agrees that macroeconomic factors are the main driver of changes in HD vehicle sales, as shown in the peer reviewed EPA report "Analysis of Heavy-Duty Vehicle Sales Impacts Due to New Regulation" (EPA sales impacts report).[57] Though EPA disagrees with MFN's characterization of the 2010 standards as an update to the 2007 Heavy-Duty Engine and Vehicle Rule, noting that the "2010 update" refers to the full phase-in of that rule, we agree that the standards in this final rule can be met with technologies that are an evolution of today's emissions control technologies.

25.2 Commenters who Disagree With our Analysis and Provide Supporting Data from ACT Research, Ricardo or Ramboll

Comments by Organizations

Organization: *Allison Transmission, Inc. (Allison)*

- EPA has also underestimated the potential impact of "pre-buy" and "low-buy" behavior. Based on data submitted with these comments, Allison believes that these periods will be both more extensive and of greater impact to vehicle sales, particularly with respect to the two-phased approach adopted in Option 1. [EPA-HQ-OAR-2019-0055-1231-A1, p.6]

EPA has proposed two-different options with regard to the stringency of new standards to control emissions of nitrogen oxides ("NOx") from heavy-duty vehicles ("HDVs"). EPA is also taking comments on the range of alternative standards that lie between the two options.5 On the whole, Allison supports the single-phase regulatory structure of Option 2, rather than imposing two different sets of standards in Model Years ("MYs) 2027 and 2031 under Option 1. As indicated in more detail below, the imposition of new standards for heavy-duty commercial vehicles has historically been preceded by a "pre-buy" period where trucking companies and other fleet and individual purchasers seek to avoid a step-up in price and change in emissions architecture for vehicles that will be used in their business. This is followed by a downturn in business after the new standards take effect (the "low-buy" period). Thus, rather than smoothing out any pre-buy period by phasing-in two sets of standards taking effect within four years of each other, Allison believes that EPA's Option 1 would likely exacerbate the turmoil that normally attaches to the imposition of new standards. [EPA-HQ-OAR-2019-0055-1231-A1, p.7]

5 87 Fed. Reg. at 17,421.

Under Option 1, it is likely that pre-buys would start before 2027, followed by decreases in demand that would extend well into the 2030s. Many vehicle buyers, when confronting new requirements in the second phase of Option 1, would seek to avoid a step-up in costs, changes in proven technology, and the costs of new maintenance procedures. These potential buyers --

[57] The full document can be found on EPA's Science Inventory website: https://cfpub.epa.gov/si/si_public_pra_view.cfm?dirEntryID=349838&Lab=OTAQ and in the docket on this rule

having purchased during the “pre-buy” period or during the first phase of Option 1 --would likely not re-enter the market for some time after the MY 2031 standards were implemented. As provided below, Allison’s data indicates that EPA may have underestimated this “pre-buy” effect by orders of magnitude in the vocational vehicle market. Overall, Allison believes that Option 1 has the potential to extend economic dislocation and, with it, create market inefficiencies that will raise the ultimate cost of a transition to cleaner HDV technology. [EPA-HQ-OAR-2019-0055-1231-A1, p.7]

EPA has projected that Option 1 would result in a pre-buy of approximately zero to 2 percent and a corresponding decrease in sales of the same magnitude for up to 12 months following implementation of the 2031 Option 1 standards.44 EPA bases this estimate, in part, on a study of previous transitions in regulatory standards in 2004, 2007, 2010 and 2014.45 [EPA-HQ-OAR-2019-0055-1231-A1, p.19]

44 87 Fed. Reg. at 17,429.

45 Id. at 17,590. See also: RIA Chapter 10.1

As the RIA notes, however, the results of EPA’s study vary by regulation. In the month prior to the implementation of the 2014 regulations, pre-buy activity reached 13.2 percent.46 In other months prior to implementation of the same standard, particularly those further away from the implementation date, the percentages of pre-buy were generally lower and included months where no change was detected.47 Thus, assuming an averaged zero to 2 percent effect as across all vehicles may not be justified or fully reveal the actual real-world effects (including volatility in sales) that may be experienced in different segments of the market. While the RIA notes that there are several limitations to EPA’s analysis, including the observation that other effects of the proposed rule apart from price could have an impact on buying behavior, neither EPA or the outside study attempted to further quantify how different vocational vehicle or Class 7-8 tractors could be affected by pre-buy and low-buy behavior. [EPA-HQ-OAR-2019-0055-1231-A1, p.19]

46 Table 10-2, RIA at 410.

47 Id.

In general, Allison believes that a more significant pre-buy and low-buy than EPA analysis has projected should be expected. As reflected in Table 4 below, Allison has conducted an analysis using ACT Research’s historical North America build data pulled in April. This data represents the CL6/7/8 North American On-Highway portfolio over previous fifteen-year period, i.e., for 2006-2021 sales, and shows that there are substantial differences in how new EPA criteria and GHG regulations have affected vehicle sales.48 In many cases, the pre-buy and low-buy effects are substantially more than projected by EPA. [EPA-HQ-OAR-2019-0055-1231-A1, p.19]

48 In reviewing Table 4, it should be noted that most of Allison’s fully automatic transmission sales during this fifteen-year period were attributable to vocational truck and bus sales in classes 4 through 8. In the

chart above, the 2000 series was used in Class 4/5 walk-in vans and class 6/7 pickup & delivery vehicles as well as school buses. The 3000 series was utilized in Class 6/7 and 8 vocational trucks as well as Class 8 transit and school buses. The 4000 series was used in Class 8 vocational vehicles.

Allison Transmission performed an analysis using ACT Research data pulled from April 2021, supporting finalization of Option 2 to moderate anticipated pre-buy and low-buy effects. See Appendix 3. Specifically, based on a review of our analysis, we would note that:

- Allison analysis of ACT Research historical build data reflects a more significant pre-buy/low-buy effect from the EPA 2007 Heavy-Duty Engine and Vehicle Rule than EPA projects for the current rulemaking. Across weight classes CL6/7/8, pre-buy activity ranged up to 47-56%, far exceeding EPA assumption of 0-2% pre-buy resulting from the proposed emission standards. While Allison data regarding EPA's Phase 1 and Phase 2 GHG rules show lower relative effects, they are still above EPA projections.
- In addition, based on the same data for the 2007 rule, EPA's estimate of low-buy impacts is almost certainly underestimated. As reflected above, both the extent and duration of the low buy period exceeds what EPA estimates for this rulemaking. In comparison with EPA 0-2% twelve-month estimate, one-year impacts during 2006-2007 ranged from 28 to 44%. And these effects persisted beyond twelve months duration. Allison analysis using a smoothed average based off of ACT Research data reflects approximately six years of lower-than-average sales from 2007-2013. (based on fifteen-year build average 2006-2021).
- Pre-buy and low-buy effects were not limited to Class 8, rather sales data shows substantial prebuy and low-buy activity in medium- and heavy-duty Class 6/7 vehicles. Our analysis of data showed evidence of stronger pre-buy effects for Class 6/7 (56% above fifteen-year average) compared to Class 8 in 2007 (47% above fifteen-year average)
- Pre-buy and low-buy effects showed similar patterns across all CL6/7/8 vocations industry-wide Additional detail by vocation is provided in Appendix 2. 49 [EPA-HQ-OAR-2019-0055-1231-A1, p.20]

  49 One possible explanation is that the Heavy Heavy-Duty Class 8 engine design capability allowing rebuild may lead to stronger low-buy affects without as much related pre-buy activity, compared to Medium Heavy-Duty engines which showed stronger pre-buy activity.

EPA also requested comment on impact from events external to industry. A high level of year over year volatility is common in commercial vehicle markets due to replacement cycles and multi-year capital planning at the fleet level. Allison's analysis in Table 4 above smooths averages during multi-year periods to better understand sustained impacts over a longer period of time. At EPA's request we included some one-year impacts in Table 5. In general, Allison believes that external events can create significant volatility. However, unlike regulatory impacts which are more easily factored into replacement cycles and capital planning by fleets, external events can be more challenging to anticipate and therefore can have sharp one-year impacts and rebounds as industry and customers recover (as in 2019-2020 COVID-19 and 2021 recovery as GHG Phase 2 began). [EPA-HQ-OAR-2019-0055-1231-A1, p.20]

External events can also exacerbate a period of pre-buy / low-buy, e.g., as was experienced during the Great Recession of 2008 that took place before full phase in of 2010 NOx standards. Specifically:

- As the previous NOx standards began to be partially phased in during 2006 to 2007, on-highway sales and industry builds dropped 28% to 44% across Class 6/7/8. These effects also persisted in subsequent years.
- Builds dropped 34% to 42% from 2008 to 2009. In this period of time, a reasonable assumption could be made that external factors like the Great Recession of 2008 contributed to the decline. But the market stayed lower than the fifteen-year average for an extended period (2007-2013) even during a time period when the U.S. economy could be viewed as being in full recovery. Thus, it is reasonable to conclude that other factors, such as the impact of stricter NOx regulations combined with external factors to cause a decrease in builds. In our analysis within Table 4, Allison chose to smooth the average across multiple years to show short term and sustained regulatory effects of the previous NOx rulemaking and avoid relying on any particular year, such as 2009, when there were unclear reasons for low sales apart from prevailing economic conditions.
- Builds also dropped 30% to 38% over 2019 to 2020 which one could assume may be attributed, in large part, to the economic impacts flowing from COVID. In contrast however, these, this unexpected setback could not be factored into end-user buy cycles ahead of time, and builds rebounded 5% to 23% in 2021 despite continuing supply-chain headwinds. [EPA-HQ-OAR-2019-0055-1231-A1, p.21]

North America Commercial Vehicle Production forecasts from ACT Research's Charging Forward 1st Edition CEV study in Q1 2021 project a nearly 26% drop in Class 4-8 vehicle sales from 2026-2027 that may be attributed to pre-buy in 2026 and the costs that would flow from regulations to be implemented in 2027. (For further detail, see Appendix 2). When Allison sought permission from ACT Research to share our analysis based on ACT Research, we understood that ACT Research is engaging in further study of pre-buy and low-buy of 2027 regulations in a forthcoming report, and there may be minor differences in the developing report compared to Allison analysis of ACT Research data. However, ACT Research reviewed and agreed with the general trends Allison Transmission analysis reflects within this comment. [EPA-HQ-OAR-2019-0055-1231-A1, p.21]

Overall, Allison believes that this pre-buy and low-buy analysis is an important consideration for determining the level of control required by the final rule. Given this importance, EPA should conduct a sensitivity analysis of different levels of economic impact this rule may have prior to finalizing the final rule, particularly considering that initial cost of equipment and lower compliance margin may drive more severe effects for Option 1 compared to Option 2. 50 [EPA-HQ-OAR-2019-0055-1231-A1, pp.21-22]

50 EPA should make such analysis available in the docket for this rulemaking.

Allison also believes Option 1 benefits are overcounted in Proposed Rule due to an expectation that higher indirect costs, greater compliance risks from insufficient margin, and a two-step phase-in rule structure could undermine EPA goals through pre-buy and low-buy effects. Allison believes that EPA analysis of 8-month pre-buy and 12- month low buy only to CL8 at 0-2% is a severe underestimation and that EPA should engage in further sensitivity analysis modeling a moderate pre-buy with Option 2 and a more severe and protracted pre-buy with Option 1 prior to finalization of rule.[EPA-HQ-OAR-2019-0055-1231-A1, p.22]

Comparing sales during periods transitioning in EPA/NHTSA Phase 1 GHG and fuel efficiency program and Heavy-Duty Phase 2, one can note that GHG rulemakings have less apparent pre-buy, low-buy affects compared to the 2007 NOx rulemaking. There could of course be many reasons for this variability, but one aspect could be that the technology to reduce GHG emissions may positively impact total operating costs for the buyer and/or lead to the perception that such technology will have a lesser impact on vehicle maintenance and related uptime that could affect the mission of affected vehicles. Based on our review of the proposed rule, the associated draft RIA and our own data, Allison would encourage the following actions: [EPA-HQ-OAR-2019-0055-1231-A1, p.22]

- EPA should further consider historical data from 2007 HD Engine and Vehicle Rule to check assumptions regarding the impact of additional NOx regulation on commercial vehicles during this timeframe on sales. Allison's analysis based on ACT Research data exceeds the estimated impacts that EPA has relied on in this rulemaking. [EPA-HQ-OAR-2019-0055-1231-A1, p.22]

Allison would also encourage EPA to carefully consider the potential impacts of increased prices for engines/vehicles that could result from extended emission warranty and useful life provisions and how these impacts could affect pre-buy and low-buy periods. As noted above, warranty and useful life periods are proposed to undergo a substantial increase in length, up to 6 times for some vehicle categories. This level of increase also follows an extended period during which warranty periods have not changed, potentially increasing the level of uncertainty for those manufacturers who will need to price-in the extended periods into an engine/vehicle sales price. In terms of relevant data, EPA should consider the price impacts flowing from the California Air Resources Board's Step 1 increase that took effect with MY 2022.[EPA-HQ-OAR-2019-0055-1231-A1, pp.22-23]

Organization: *American Truck Dealers (ATD)*

ATD has long supported continuous emission improvements for HDEs. At the same time, ATD has suggested consistently that any new emissions mandates must not compromise the affordability, reliability, fuel economy, and/or serviceability of HDEs and CMVs. This position reflects the fact that prospective customers will avoid purchasing or leasing new CMVs which cost too much, offer performance compromises, or pose risks of unacceptable downtime. CMV customers purchase or lease new equipment only when necessary to meet the needs of their private or for-profit business models and use cases. New medium- and heavy-duty CMVs are expensive, but unlike high-priced light-duty vehicles, they are not luxuries but specially built to do a wide variety of jobs in a reliable and cost-effective manner. [EPA-HQ-OAR-2019-0055-1321-A1, p. 1]

Appropriately structured HDE NOx standards must involve a national, wholistic approach to reducing the impact of CMVs on air quality. Specifically, EPA must only adopt new HDE emission standards that will enhance (and not delay) fleet turnover. If EPA instead moves too far, too fast, as the California Air Resources Board (CARB) and other states have done, the cost of new CMVs will increase dramatically even as their performance degrades, resulting in a decline in the otherwise applicable rate of fleet turnover and environmental improvement.3 [EPA-HQ-OAR-2019-0055-1321-A1, p. 2]

> 3. In October 2021, several states urged EPA to adopt CARB's newly adopted HDE NOx Omnibus mandates. ATD categorically opposes EPA's adoption of those mandates.

Together, the higher CMV prices and operating costs that directly stemmed from EPA's 2002-10 HDE NOx standards led to a significant disruption of the new CMV marketplace, leading to lost employment, lost profits, and even the shuttering of some businesses. New CMV customers acted rationally and predictably to avoid higher new CMV prices and performance compromises. Many opted to pre-buy new CMVs equipped with older HDEs. Others opted to hold onto their existing equipment for longer than they otherwise planned to. Still others met their business needs by seeking out late model used CMVs. Employees suffered, the industry suffered, and the environment suffered as fleet turnover ground to a halt. [EPA-HQ-OAR-2019-0055-1321-A1, p. 2]

This history must not be repeated. EPA must ensure that the new NOx mandates for MY 2027 and later will be technologically feasible and cost effective, both up front and over the useful life of the HDEs they will apply to. Otherwise, if faced with products that are too costly up front, too expensive to operate, or too unreliable, prospective new CMV buyers will once again opt to pre-buy CMVs equipped with older HDEs, opt to hold onto older CMVs longer, or opt for the used truck market. In addition to disrupting CMV suppliers, manufacturers, dealers, and the employees who work for them, the resulting delay in fleet turnover will undermine the continuous environmental improvements we all seek. [EPA-HQ-OAR-2019-0055-1321-A1, p. 2]

Based on industry cost analyses and data related to the marketplace reactions to EPA's MY 2002-2010 HDE NOx standards, ATD is concerned that EPA's proposed NOx standards, assuming that they are even achievable, will cause CMV prices to skyrocket, resulting in reduced fleet turnover and an increase in the average age of the on-road CMV fleet. The most effective near term option for reducing CMV NOx emissions is to accelerate the turnover of the on-road CMV fleet. Currently, the average age of CMVs on the road in the U.S. is over 14 years.7 Consequently, almost 50% of the in-use CMV fleet is equipped with pre-MY 2010 HDEs. [EPA-HQ-OAR-2019-0055-1321-A1, p. 4]

> 7. Association for the Work Truck Industry, Aging Trucks Create More Service Opportunities, (Nov. 2019).

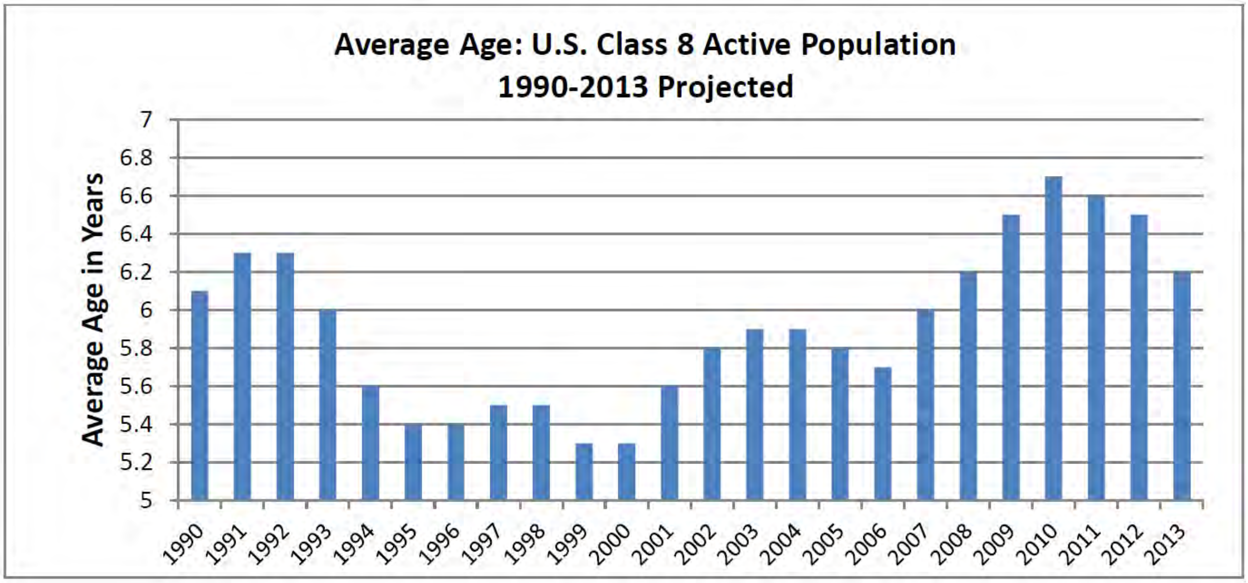
Given RSC's projected average CMV price increase, ATD concludes that EPA's proposed Option 1 NOx standards could have a major disruptive impact on new CMV sales resulting from a major pre-buy/no buy, a significant deferral of new CMV sales, and a spike in later model used CMV purchases prior to 2031. This conclusion runs counter to EPA's suggestion that a pre- and low-buy for Class 8 trucks may range from zero to an approximately two percent increase in sales over a period of up to 8 months before the 2031 standards begin (pre-buy), and a decrease in sales from zero to approximately two percent over a period of up to 12 months after the 2031 standards begin (low-buy).10 [EPA-HQ-OAR-2019-0055-1321-A1, p. 4]

10. 87 Fed. Reg. 17414, 17590.

Figure 1 below, which graphs annual retail Class 4-8 CMV sales between 2000 and 2010, shows how prospective new truck purchasers rushed to "pre-buy" trucks equipped with pre-compliant technologies to avoid the cost and performance impacts of EPA's NOx mandates. A surge of orders began in 2002 for the pre-MY 2004 equipment, after which orders slumped significantly. In 2006, orders surged for pre-MY 2007 equipment, and then fell off precipitously. Lastly, in the 2009 timeframe, orders increased for pre-MY 2010 equipped trucks. In each instance, the new CMV marketplace recognized, anticipated, and sought to avoid the higher prices and poorer performance of the phased-in NOx mandate-compliant equipment. [EPA-HQ-OAR-2019-0055-1321-A1, p. 5]

It would be unconscionable for EPA to adopt new NOx mandates that would result in a similar scenario given the negative economic and employment impacts that would result and, as importantly, the lost emissions reduction benefits associated with a slowdown in fleet turnover. [EPA-HQ-OAR-2019-0055-1321-A1, p. 5]

In addition to undermining anticipated environmental benefits, delays in CMV fleet turnover caused by new EPA NOx reduction mandates, by increasing the average age of trucks and tractors on the road, will exacerbate reliability and safety concerns. Simply put, older CMVs are, on average, not as clean, green, safe, and reliable as newer vehicles. As noted above and detailed in Appendix B, when faced with higher truck pricing and lower truck performance, prospective new CMV truck customers acted rationally and held on to their older equipment longer. This delayed turnover resulted in an aging fleet largely made up of CMVs built prior to 2004. Figure 2 below indicates that the age of the class 8 fleet increased to 6.6 years, about 11 months older than the historical average dating back to 1979. [EPA-HQ-OAR-2019-0055-1321-A1, p. 5]



Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

EPA's proposed standards would impose inordinate costs upon manufacturers and vehicle owners alike and thus present a significant possibility of market-disrupting pre-buy and no-buy scenarios.9 As acknowledged in the draft Regulatory Impact Analysis (RIA), EPA's regulatory program must be premised upon the availability of 'technically feasible, cost-effective technologies to achieve the [desired emission] reductions in the 2027-2031 timeframe at reasonable cost per vehicle, with no compromise to vehicle or safety.'10 EPA has not, however, proposed standards and requirements with 'reasonable' per-vehicle costs. Both the Proposed Rule and accompanying draft RIA dramatically underestimate the increased costs to achieve compliance with the proposal, which ultimately would be borne at every level of the heavy-duty transportation industry. As discussed in more detail in Section II.B.2 of these comments, the anticipated manufacturing cost increases will have ripple effects across the United States and world economies—potentially disincentivizing the production of certain classes of vehicles, which in turn may constrain the options available for affordable domestic freight transportation. To fulfill its statutory obligation to give 'appropriate consideration' to costs, EPA must fully account for these impacts in its cost analysis. [EPA-HQ-OAR-2019-0055-1168-A1, p.11]

> 9 While Daimler Truck focuses primarily here on increased incremental technology, warranty, and other direct/indirect compliance costs, we also note that paperwork burdens would increase under EPA's proposal. The Proposed Rule implicates a number of information collection activities, all of which will significantly increase compliance burdens and costs for manufacturers. Daimler Truck has reviewed EPA's 'Supporting Statement for Information Collection Request' (EPA ICR Number 2621.01) (April 19,

2022) and notes that EPA's summary—in particular the respondent burden and cost estimates in Table 3 of the 'Supporting Statement'—captures some but perhaps not all of the information collection burdens and costs accompanying implementation of the Proposed Rule. These costs should not only be factored in to OMB's consideration of the Proposed Rule under the Paperwork Reduction Act, but should also be accounted for in evaluating whether EPA's proposal reflects adequate consideration of costs as required under CAA Section 202.

10 See EPA, Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, Draft Regulatory Impact Analysis (March 2022) ('Draft RIA').

EPA's conclusions regarding anticipated effects of the Proposed Rule on HD vehicles (e.g., sales, mode shift, fleet turnover) similarly undermine the lessons of past industry experience, including the Agency's projections that the market would likely see a modest 'pre-buy' scenario for Class 8 trucks under proposed Option 1 (around a 0-2% increase over a period of up to 8 months before the 2031 standards begin) and a similarly modest 'low-buy' scenario (namely a 0-2% decrease in sales over a period up to 12 months after the 2013 standards begin).53 EPA opines that the expected dramatic increases in vehicle purchase price will be offset by reduced operating costs, reasoning that longer useful life periods will make emission control technology components more durable, and more durable components—combined with manufacturers paying for repairs during the proposed longer warranty periods—would in turn reduce repair costs for vehicle owners. Through this reasoning, EPA reaches the conclusion that these combined effects may <u>*increase sales of new HD vehicles*</u> 'if fleets and independent owner-operators prefer to purchase more durable vehicles with overall lower repair costs.'54 Yet EPA has not, nor can it, provide empirical or historic support for this assertion. [EPA-HQ-OAR-2019-0055-1168-A1, p.20]

53 Id. (noting that if pre-buy and low-buy behaviors occur, then the initially projected emission reductions are likely to be smaller than expected).

54 Id. (noting, however, that EPA is unable to quantify these effects because existing literature does not provide clear guidance on the relationship between warranty changes, price increases due to increased warranty periods, and sales impacts).

Further, it is notable that EPA anticipates no change in the price or mode of freight transportation associated with the regulatory proposal, concluding simply that 'the Proposed Rule is not expected to have a large impact on truck freight rates given that the price of the truck is only a small part of the cost per mile of a ton of goods' and, for this reason, 'the Agency expects little mode shift due to the proposed standards.'55 [EPA-HQ-OAR-2019-0055-1168-A1, p.21]

55 Id. at 17,590.

The suppositions underlying EPA's economic impact analysis lead the Agency to overlook market impacts that are widely expected to follow from the Proposed Rule. To assemble a more accurate picture of anticipated impacts, EMA engaged third party market expert ACT Research to study the likely economic effects of implementing EPA's proposal.56 The ACT Research

Impacts Study, submitted with the EMA comments on the Proposed Rule, examines three different scenarios to help predict vehicle market and labor impacts related to the anticipated increases in operating costs for Class 8 vehicles, working off of both the incremental cost estimates provided in the Ricardo Cost Study and EPA's cost estimates in the Proposed Rule. Specifically, the ACT Research Impacts Study considers the pre-buy effects of three different cost scenarios: Scenario 1, which uses the Ricardo Cost Study estimates discussed above; Scenario 2, which uses EPA's significantly lower cost estimates in the Proposed Rule and draft RIA; and Scenario 3, which uses the Ricardo Cost Study estimates but removes the proactive aftertreatment system replacement system cost that was included in the Ricardo study. ACT Research then analyzes anticipated heavy-duty manufacturing sector employment impacts of projected pre-buy and low-buy under each of these three scenarios. [EPA-HQ-OAR-2019-0055-1168-A1, p.21]

> 56 See ACT Research, 'Pre-Buy/Low-Buy Analysis of Heavy-Duty Sector Impacts from Emissions Regulations' (April 29, 2022) (the 'ACT Research Impacts Study') (submitted with Truck and Engine Manufacturers Association comments on EPA-HQ-OAR-2019-0055).

ACT Research's analysis arrives at pre-buy estimates ranging from **94,428 units** total (for the years leading up to both MY 2027 and MY 2031 standards implementation) under the conservative EPA cost scenario (Scenario 2) to **211,900 units** total under the Ricardo cost scenario (Scenario 1). These estimates lead to a projection of employment impacts in 2027 and 2031 from **98,335 jobs lost** in EPA's lower cost scenario, to **220,666 jobs lost** in the Ricardo cost scenario. [EPA-HQ-OAR-2019-0055-1168-A1, p.21]

Aside from these numerical projections, a number of key observations emerged from the ACT Research Impacts Study:

• **EPA Significantly Underestimates the Magnitude of Expected Pre-Buy.** ACT Research projects, based upon the history of previous standards implementation, that implementation of the Proposed Rule will result in two large pre-buys in the years immediately preceding MY 2027 (i.e., MY 2025 and 2026) and MY 2031 (i.e., MY 2029 and MY 2030). Even under the most conservative Scenario 2, which builds off of EPA cost estimates in the Proposed Rule, ACT Research estimates that pre-buy could be around **14%** of market share for new MY 2025-2026 Class 8 vehicles and **8%** of market share for new MY 2029-2030 Class 8 vehicles.57 Under Scenario 1, using the higher cost estimates of the Ricardo Cost Study, ACT Research estimates that pre-buy could be the 'largest ever,' around **34%** of market share for new MY 2025-2026 Class 8 vehicles and **19%** of market share for new MY 2029-2030 Class 8 vehicles.58 EPA's **0-2%** pre-buy estimates in the Proposed Rule are off by a factor of at least 8 using the Agency's own conservative cost estimates; and, applying the more realistic cost estimates from the Ricardo Cost Study, are off by a factor of around 35. These pre-buy estimates are based upon ACT Research's assessment of operating cost increases for Class 8 tractors and vocational trucks, which (under the study's Scenario 1) could be as high as 14% and 12% for these categories of vehicles, respectively, in MY 2027 and 9% and 7%, respectively, in MY 2031.59 [EPA-HQ-OAR-2019-0055-1168-A1, pp.21-22]

57 Id. at 10-11, Tables 4 and 5.

58 Id. at 8, Tables 2 and 3.

59 Id.

• **EPA's Analysis Fails to Account for the Labor Effects of Pre-Buys**. Based upon the ACT Research analysis, it is clear that EPA's economic impact analysis fails to appreciate, and therefore assess, each link of the causal chain triggered by more stringent emission regulation, namely (1) price and operating cost increases, (2) prebuy/ low-buy scenarios, and (3) job losses in the commercial vehicle manufacturing sector. The ACT Research Impacts Study evaluates the low-buy effects anticipated to flow from the pre-buy scenarios described above, applying Newton's Third Law that 'every action has an equal and opposite reaction.'60 In other words, every pre-bought unit is pulled forward from the future and will not recur, meaning that pre-buy volumes in the years immediately preceding new standard implementation correlate directly with a reduction in units that would otherwise be sold in the years following the new standards taking effect. Thus, pre-buys can be expected to have adverse impacts on the truck manufacturing supply chain by proportionately reducing demand for future model year vehicles. [EPA-HQ-OAR-2019-0055-1168-A1, p.22]

60 Id. at 23.

• **EPA Erroneously Concludes That There Will Be No Freight Rate Impacts.** ACT Research also considers a significant downside of a pre-buy scenario, namely the inevitable rebalancing of excess trucking capacity that results from a pre-buy, which in turn causes lower freight rates and reduced earnings in the trucking industry during the pre-buy/low-buy period. The ACT Research analysis concludes, for instance, that prebuy in the Class 8 tractor market ahead of the MY 2027 standards (using Scenario 1 cost figures) could have as much as a 2.9% negative impact on truckload freight rates, which would mean about $10.4 billion in lost earnings, which is discounted to $8.4 billion in 2021 dollars. ACT Research estimates a similar earnings impact in 2031, with a total of $17.9 billion (2021$) combined impact from implementation of the Proposed Rule standards. Adding to the further adverse impacts in the freight transportation industry, it is widely expected that, as increased costs associated with more stringent regulation are realized and fleets are required to purchase more expensive trucks, there will ultimately be a long-term freight rate increase above today's rates. This will consequently increase the price of every good that is shipped domestically by truck, increasing the price of consumer goods and exacerbating rapidly-rising inflation. [EPA-HQ-OAR-2019-0055-1168-A1, p.22]

EPA should also consider the strong potential for its proposal (and attendant pre-buy and no-buy effects) to encourage older commercial fleets to remain on the road longer, thereby significantly delaying the anticipated emission reductions under the Proposed Rule. As observed by Diesel Technology Forum in testimony given during EPA's April 2022 public hearings on the Proposed Rule, market research reflects that nearly half of the vehicles currently on the road are pre-2011 model years, suggesting that a significant portion of fleet owners would prefer to maintain and operate older vehicles rather than invest in more costly, new-technology vehicles.61 This phenomenon of continued and widespread use of legacy vehicles—many of which do not have particulate traps and/or selective catalytic reduction technology to help reduce emissions—defeats the emission reduction aims of the Proposed Rule and begs the question of whether government resources are better spent incentivizing turnover of these older fleets rather than mandating costly reductions from the vehicles of the future. [EPA-HQ-OAR-2019-0055-1168-A1, pp.23-24]

> 61 See Testimony of the Diesel Technology Forum before the U.S. Environmental Protection Agency (April 12, 2022), available at https://www.dieselforum.org/news/testimony-of-the-diesel-technology-forum-before-the-u-senvironmental-protection-agency-april-12-2022 (stating that 'According to our most recent analysis of vehicles in operation (VIO) data from IHSMarkit as of the end of 2021, 53 percent are 2011 and newer model year vehicles and 47 percent are an older generation. These are pre-2011 model year vehicles with relatively higher emissions.').

Organization: *International Union, United Automobile, Aerospace and Agricultural Implement Workers of America (UAW)*

We urge the EPA to avoid creating economic insecurity for the hardworking men and women who build heavy duty vehicles and parts. It is important to note that the customers for medium and heavy-duty vehicles are often commercial customers capable of in-depth cost analysis and fleet planning. If these customers believe that new regulations will increase the cost of future trucks and operations, they will pull truck purchases forward to avoid those costs. In an industry that is already highly cyclical, this can create a 'pre-buy/no-buy' cycle in which there is a surge of purchases for older vehicles prior to the regulations and a steep decline in the purchase of new vehicles following the regulations. Overly aggressive regulations could also result in truck makers delaying or reducing new product offerings. This type of market disruption can result in layoffs or job losses for American workers. This concern is not just theoretical. For many UAW workers in the heavy truck industry, they will still remember the wave of layoffs in 2007 that came out of a pre-buy/no-buy cycle. [EPA-HQ-OAR-2019-0055-1138-A1, p.3]

We recognize that economic projections always come with uncertainty and are strongly shaped by modeling assumptions. However, it is important to recognize there are studies from credible organizations that suggest there is a real possibility the regulations will create a major 'pre-buy/no-buy' cycle. For example, [Figure can be found on p.4 in EPA-HQ-OAR-2019-0055-1138-A1] analysis by the Americas Commercial Transportation (ACT) Research, an industry leading research firm, raises concerns that the proposed regulations will create a major market disruption resulting in significant job impacts.1 [EPA-HQ-OAR-2019-0055-1138-A1, p.4]

> 1 ACT Research. April 2022. 'Pre-Buy/Low-Buy: Analysis of Heavy-Duty Sales Effects from Emissions Regulations': https://static1.squarespace.com/static/624ddf53a2360b6600755b47/t/625cbf7329b4af630a080311/1650245492139/ACT.pdf; See also Ricardo. January 14, 2022, 'Cost Impact Study for Potential Next-Tier EPA HDOH Emission Regulations': https://static1.squarespace.com/static/624ddf53a2360b6600755b47/t/625cbec8f7aef559cbc4c9a7/1650245321849/Ricardo.pdf

Importantly, market disruption that hurts vehicle sales can also hinder the environmental goals the regulations are hoping to achieve. Well-crafted regulations must also consider market responses that could lead to unintended consequences. If overly aggressive regulations significantly reduce truck sales or create a pre-buy cycle, it will take longer to turn over the U.S. truck fleet with new vehicles using the latest technologies. This does not just have economic and employment impacts, it also results in customers purchasing and holding onto older, less efficient, and higher emitting trucks that will be on the road longer.2 Without sufficient fleet turnover, regulations could result in delaying the deployment of cleaner and more efficient trucks they are meant to promote. [EPA-HQ-OAR-2019-0055-1138-A1, p.4]

> 2 Ramboll. February 10, 2022. 'Alternative Regulatory Scenarios for Heavy-Duty Diesel Trucks: NOx Emissions Effects': https://static1.squarespace.com/static/624ddf53a2360b6600755b47/t/624f66f9ccfff63904f2a967/1649370873280/Ramboll_EMA_Scenarios_10Feb2022.pdf

Organization: *Truck and Engine Manufacturers Association (EMA)*

In order to ensure the adoption of fully achievable and cost-effective HDOH low-NOx regulations, and notwithstanding our broader agreement, the Agency should revise the proposed standards in the following manner: The pending rulemaking — arguably the last rulemaking for HD diesel engines — needs to be truly cost-effective to ensure that the market is fully receptive to the new low-NOx trucks. Otherwise fleet turnover will be stalled or delayed, which will diminish the envisioned benefits of the low-NOx regulations. Fashioning a final rule that will not impede fleet turnover will help to ensure that the reasonably estimated benefits from this rulemaking can be achieved. [EPA-HQ-OAR-2019-0055-1203-A1, p. 6]

Significantly, EPA's cost-benefit analysis also does not adequately account for the significant pre-buy/no-buy impacts that the proposed low-NOx regulations will cause. To the contrary, EPA downplays the potential impacts of any pre-buy/no-buy market response, claiming that "our results for proposed Option 1 suggest pre- and low-buy for Class 8 trucks may range from zero to approximately two percent increase in sales over a period of up to 8 months before the 2031 standards begin (pre-buy), and a decrease in sales from zero to approximately two percent over a period of up to 12 months after the 2031 standards begin (low-buy)." (87 FR at p. 17429.) As detailed below, that is a fundamentally unrealistic assessment of how the HD vehicle market is likely to respond to Option 1. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 155 - 156]

The HD commercial vehicle truck market is very sensitive to the introduction of new technology-forcing emissions regulations. The most recent example of that is when EPA and CARB implemented a 90% reduction in the PM standard for 2007 MY and later heavy-duty engines, which required the introduction of diesel particulate filters into the HD marketplace. In parallel, NOx standards were reduced by 50%. HD vehicle purchasers, wary of the cost and reliability implications of the major new HDOH technology launches, significantly accelerated their vehicle-replacement purchasing cycles in 2005 and 2006 to avoid purchases of the new technology vehicles in 2007 – the classic manifestation of a pre-buy/no-buy response to new aggressive emissions regulation. More specifically, in the Class 8 market, vehicle purchases ramped-up significantly in 2005 and 2006, with the result that 40% more vehicles were sold in

2006 (284,000 units) than in 2004 (203,000). In 2007, the market then dropped by a full 47%, to just 151,000 units. Among the other adverse consequence of that pre-buy/no-buy response, air quality benefits were delayed, and very significant layoffs ensued at vehicle assembly plants and powertrain production facilities, with similar cascading unemployment effects and other dislocations throughout the HDOH supply chain. See Polk Automotive Services Data; ATD's Report, "Look Back at EPA's Cost and Other Impact Projections for 2004-2010 HDOH Standards" (Feb. 13, 2012); UAW Comments (Oct. 15, 2015; RIN 2060-A816). See also ERG Report, "Analysis of Heavy-Duty Vehicle Sales Impacts Due to new Regulations" (May 2021, EPA-420- R-21-013). [EPA-HQ-OAR-2019-0055-1203-A1, p. 156]

With respect to this rulemaking, Ricardo and ACT Research Group (ACT) have conducted a detailed analysis of the pre-buy/no-buy vehicle-purchasing practices that HD vehicle fleet operators likely would engage in to try to avoid the cost and other impacts of the proposed low-NOx regulations, with specific reference to Option 1. As set forth in Tables 32 and Figure 8 of the Ricardo Report (reproduced below), EPA's Option 1 low-NOx regulations likely would result in an initial "pre-buy" of approximately 93,000 Class 8 vehicles, followed by a second two-year prebuy in advance of the 2031MY that would amount to approximately $53,000 Class 8 vehicles — for a total of approximately 146,000 "pre-bought" HHD vehicles. A pre-buy of that magnitude would eliminate a correspondingly large percentage of EPA's assumed emission-reduction benefits from the low-NOx regulations, and would cause an additional increase in the per-vehicle costs resulting from the proposed regulations, given the reduced number of new vehicles that would be sold and therefore available to recoup the costs of the regulations. [EPA-HQ-OAR-2019-0055-1203-A1, p. 156]

In addition to Ricardo's analysis, ACT has conducted its own detailed assessment of the pre-buy/no-buy response that likely would occur in the heavy-duty vehicle market in response to the per-vehicle cost increases associated with EPA's Option 1 proposal. A copy of ACT's report is attached hereto as Exhibit D. ACT has concluded that proposed Option 1 regulations would lead to the "largest ever" pre-buy/no-buy market response. The specific results of ACT's analysis are summarized in the following tables: [EPA-HQ-OAR-2019-0055-1203-A1, p. 157]

Similar to what Ricardo has estimated, and by way of example, ACT estimates that the anticipated pre-buys of HHD vehicles in response to the implementation of Option 1 regulations and costs would impact more than 37% of the market in advance of the MY 2027, and an additional 19% of the market in advance of the MY 2031. The impact on the overall HD market would be an aggregate pre-buy of approximately 211,900 trucks. Thus, when factoring-in the likely actual prebuy/ no-buy impacts at issue, it is evident that EPA has understated the per-vehicle cost impacts of its proposed low-NOx regulations, in part, due to the fact that the Agency has over-estimated the number of low-NOx-compliant trucks that will be acquired in the years starting in 2027, and extending out through 2031 and beyond. [EPA-HQ-OAR-2019-0055-1203-A1, p. 158]

In addition, the reasonably anticipated pre-buy/no-buy response will substantially diminish the potential environmental benefits from a nationwide program centered around a 0.02 g/bhp-hr standard, as opposed to Option 2-like standards. In that regard, Ramboll has compared the relative efficacy, from a national NOx emissions-inventory perspective, of a low-NOx program based on a 0.02 g/bhp-hr standard, including the expected associated pre-buy/no-buy response, with a low- NOx program based on a 0.05 g/bhp-hr standard, which Ramboll assumes would result in a 50% lower pre-buy/no-buy response and greater availability of new emissions-compliant HD vehicles. A copy of Ramboll's report is attached hereto as Exhibit E. The overall results of Ramboll's comparative inventory analysis are set forth below. [EPA-HQ-OAR-2019-0055-1203-A1, p. 158]

Ramboll's emissions-inventory analysis shows that an Option 2-like low-NOx program targeting a 0.05 g/bhp-hr FTP/RMC NOx standard would reduce baseline-projection NOx emissions by approximately 23% as of 2035, while a program centered around a 0.02 g/bhp-hr NOx standard could actually increase NOx emissions from current baseline projections by as much as 11% as of 2035 due to the "largest-ever" pre-buy/no-buy response, and due to the projected unavailability of new HDOH diesel vehicles and engines that would be fully-compliant with the associated Option 1 low- NOx requirements. Thus, Ramboll's analysis helps to confirm the enhanced efficacy of EMA's more feasible alternative proposal. [EPA-HQ-OAR-2019-0055-1203-A1, p. 159]

Organization: *PACCAR, Inc (PACCAR)*

In particular, PACCAR agrees with the following aspects of EMA's comments: A nationwide program centered around Option 2-like requirements, and including higher interim in-use standards, would be more cost-effective, and would reduce the prospects for further delaying fleet turnover or creating disruptive pre-buy/no-buy responses from the market. [EPA-HQ-OAR-2019-0055-1346-A1, p.2]

Organization: *Truckload Carriers Association (TCA)*

A workable solution is needed to help bridge gaps on emissions, not widen them. Under the proposed standards, due to compliance-driven demand, the price is expected to steeply increase for newer model engines, further delaying fleet turnover for many motor carriers. [EPA-HQ-OAR-2019-0055-1160-A1, p. 2]

An incremental cost would also reflect manufacturers' added stringency for emissions and an increase in useful life and warranties for emission-related components. One report found that if the proposed standards go into effect, the price of heavy-duty diesel engines would increase between $18,000 to $35,000 per vehicle, depending on the level of requirement4. [EPA-HQ-OAR-2019-0055-1160-A1, p. 2]

> 4. Ricardo Strategic Consulting, "Cost Impact Study for Potential Next-Tier EPA HDOH Emission Regulations", January 14, 2022, 360b6600755b47/t/625cbec8f7aef559cbc4c9a7/1650245321849/Ricardo.pdf

If motor carriers, due to the proposed standards, are unable to find available, reliable, and affordable technology and parts, they will be incentivized to keep their older, higher-emission vehicles and engines longer – leading to worse environmental consequences than intended. TCA argues that a more practical standard would better lay the groundwork for timely and affordable fleet transition. According to a 2022 study, which forecasted market response, a 0.02g/bhp-hr FTP standard scenario would increase NOx emissions between 2.2 to 11.6 percent, while a more-feasible 0.05 g/bhp-hr FTP standard would decrease NOx emissions between 0.7 to 23 percent8. [EPA-HQ-OAR-2019-0055-1160-A1, p. 2.]

> 8. Ramboll, “NOx Emission Effects”, February 10, 2022, https://static1.squarespace.com/static/624ddf53a2360b6600755b47/t/624f66f9ccfff63904f2a967/1649370873280/Ramboll_EMA_Scenarios_10Feb2022.pdf

Organization: *U.S. Chamber of Commerce*

While our comments tend to focus primarily on potential impacts to long haul freight trailers and the traditional trucking sector, similar concerns exist with respect to potential impacts on all vehicle classes covered by the rule, including transit buses, commercial delivery vehicles, and vehicles designed for waste removal, construction, agriculture, and more. [EPA-HQ-OAR-2019-0055-1245-A1, p. 3]

First, it should be recognized that trucking is enormously important to the economy—it moves 72 percent of goods in America and is the foundation of a well-functioning supply chain.6 When trucking costs go up, the costs of nearly all goods go up along with them. [EPA-HQ-OAR-2019-0055-1245-A1, p. 3]

> 6. Economics and Industry Data, American Trucking Association, https://www.trucking.org/economics-and-industry-data

Moreover, long-haul trucking in particular is overwhelmingly comprised of small businesses that are disproportionately vulnerable to changing economic circumstances. According to the Truck and Engine Manufacturers Association, 98 percent of U.S. fleet owners are small businesses operating 20 or fewer commercial vehicles. These small businesses operate on tight margins and typically do not have the financial resources necessary to absorb significant regulatory cost increases, which therefore must be passed on to American consumers in the form of higher costs for shipped goods. [EPA-HQ-OAR-2019-0055-1245-A1, pp. 3 - 4]

As the White House pointed out at an event in April, trucking costs grew more than 20 percent last year as a surge in demand for goods combined with a decline in trucking employment that preceded the pandemic.7 In 2022, sharply increased fuel costs have added to economic burdens on the industry, which also faces major challenges due to supply chain disruptions and labor shortages. [EPA-HQ-OAR-2019-0055-1245-A1, p. 4]

> 7. April 4, 2022 White House event: The Biden Administration’s Unprecedented Actions to Expand and Improve Trucking Jobs. Available at https://www.whitehouse.gov/briefing-room/statements-releases/2022/04/04/fact-sheet-the-biden-administrations-unprecedented-actions-to-expand-and-improve-trucking-jobs/

As indicated above, steady fleet turnover is arguably the most important factor relevant to ensuring continuing NOx emissions reductions from the trucking sector. A regulation that adds significant cost for new vehicles, or other significant uncertainties, could delay this progress. [EPA-HQ-OAR-2019-0055-1245-A1, p. 7]

We are particularly concerned that EPA's proposal underestimates the likely negative consequences associated with large scale "pre-buys" prior to compliance deadlines. While EPA's proposal dedicates attention to this issue, stating that "if pre-buy and low-buy behaviors occur, then the initial emission reductions are likely to be smaller than expected." [EPA-HQ-OAR-2019-0055-1245-A1, p .7]

However, the agency ultimately projects nearly negligible pre- and post-compliance impacts of between zero and two percent of sales. These projections appear low based on recent history—a recent detailed analysis by industry sales consultancy ACT Research details the significantly higher pre-buy/low-buy phenomenon that resulted from prior medium- and heavy-duty rules.14 Moreover, EPA admits that these projections are guesswork, noting that "existing literature does not provide clear guidance on the relationship between warranty changes, increases in prices due to increased warranty periods, and sales impacts." [EPA-HQ-OAR-2019-0055-1245-A1, p .7]

14. Pre-Buy/Low-Buy Analysis of Heavy-Duty Sales Effects From Emissions Regulations. Available at https://static1.squarespace.com/static/624ddf53a2360b6600755b47/t/625cbf7329b4af630a080311/1650245492139/ACT.pdf

If technology and warranty costs exceed EPA's estimates as many industry experts expect, pre-buy behavior will be further incentivized beyond EPA's already low estimates. This could significantly delay emissions reductions benefits that are the central purpose of the rule. Accordingly, prior to finalization of the rule, it should be a top priority for EPA to perform further careful analysis to resolve discrepancies in pre-buy projections. Indeed, a 2022 study by Ramboll finds that under a scenario similar to EPA's proposed Option 1, emissions of nitrogen oxides would actually increase between 2.2% and 11.6% due to pre-buy/low-buy effects.15 [EPA-HQ-OAR-2019-0055-1245-A1, p. 7]

15. Alternative Regulatory Scenarios for Heavy-Duty Diesel Trucks. Available at https://static1.squarespace.com/static/624ddf53a2360b6600755b47/t/624f66f9ccfff63904f2a967/1649370873280/Ramboll_EMA_Scenarios_10Feb2022.pdf

Delayed adoption of safety features. Delayed fleet turnover can have impacts beyond just emissions. Slowed fleet turnover delays adoption and use of enhanced automated safety features that are common on newer trucks. [EPA-HQ-OAR-2019-0055-1245-A1, p. 7]

Organization: *Institute for Policy Integrity at New York University School of Law (Policy Integrity)*

EPA should consider revising its estimation of sales impacts and fleet turnover. EPA should consider discussing sales impacts and fleet turnover qualitatively, or, in the alternative, identifying and discussing the assumptions baked into its quantitative model that may result in an overestimate of sales impacts. [EPA-HQ-OAR-2019-0055-1256-A1, p. 2]

EPA lays out three effects of regulation on heavy trucks in its fleet turnover analysis. First, there is a pre-buy effect, whereby the Proposed Rule encourages companies and individuals to buy vehicles before the implementation date to avoid the (potential) increased (net) cost of their vehicle. Second, there is a low-buy effect whereby the (potential) pre-buy behavior displaces purchases that would have occurred in the absence of regulation from after the implementation date to before the implementation date and out of the new truck market altogether (either through not buying a truck or shifting to purchase a used truck). The net effect of this pre-buy and low-buy effect on overall demand for new heavy-duty vehicles captures the elasticity of demand to the regulation.107 Finally the Gruenspecht effect, also known as the scrappage effect, whereby substitution from new vehicles to used vehicles increases used vehicle price and the longevity of these vehicles by making it more economical to fix them. These three impacts jointly determine the impact of the regulation on fleet size and thereby emissions, as vehicles sold before the implementation date emit relatively more air pollutants than those sold after the regulations take effect. [EPA-HQ-OAR-2019-0055-1256-A1, p. 19]

> 107. We use “net” here to note that there are also improvements in the quality of the vehicle, including a longer warranty and improved durability, which has the opposing effect on pre-buy behavior than price. Theoretically, these quality improvements could reverse the impact of an increase in price leading to an elasticity of zero or even a shift in sales from before to after the rule implementation. In the final SAFE rule (see “Equation 3 – Calculation of Change in Sales”), NHTSA and EPA folded fuel efficiency savings into the vehicle price to construct a measurement of the net price change. In this context, this is also possible with decreased maintenance and repair costs.

EPA uses a new methodology to forecast the sales impacts of the proposed regulation. Specifically, EPA estimates changes in truck sales across the months before and after the compliance deadline of previous EPA standards. It then calculates the demand elasticities based on the estimated sales effects of the 2007 and 2010 standards. Based on its estimated compliance costs, EPA further uses the elasticities to forecast changes in truck sales due to the proposed regulation. As we explain in detail below, this methodology could be improved by strengthening the key assumption of 100% cost pass-through and correcting the econometric errors that could bias the forecast. [EPA-HQ-OAR-2019-0055-1256-A1, p. 19]

EPA fails to recognize that the reduced-form identification effects capture both the increased price due to the regulation and the improved vehicle quality such as longer warranties and improved durability. The pre-buy effects estimated by the agencies capture the anticipation effects, i.e., the increased pre-regulation purchases in anticipation of higher new-truck prices along with improved vehicle attributes (i.e., the cross-price elasticity over time), whereas the low-buy effects capture both systematic post-regulation sales slump due to this shift in demand over time and the direct effects of policy (i.e., the own-price elasticity of demand).108 In particular, the own-price elasticity implied by EPA captures the net change in sales due to higher purchase vehicle prices, which are passed through to buyers from sellers with higher compliance costs, and improved vehicle attributes. EPA is thus essentially jointly estimating the two elasticities without isolating the direct effects of policy, which are the most relevant estimates for the forecast of the sales impacts of the new rule in its methodology. [EPA-HQ-OAR-2019-0055-1256-A1, pp. 19 - 20]

108. The anticipation effects led to 31,164 more truck sales before the implementation of the 2007 heavy-duty emission standards. See Katherine Rittenhouse & Matthew Zaragoza-Watkins, Anticipation and Environmental Regulation, 89 J. ENV'T ECON. & MGMT. 255–77, 266 (2018).

In the sales effects estimation, the agencies have omitted and/or failed to address a number of confounding factors that may bias the effects of the proposed regulation on truck sales, including:

• The adverse fuel consumption effects, i.e., excessive fuel consumption due to improved fuel efficiency with the new emission standards, and buyers' concerns about the reliability of untested control technology;109

• Rule stringency, e.g., the required emission reductions level, technology requirement, and compliance costs;

• Vehicle attributes, e.g., improved efficiency, increased longevity and warranty, and decreased repair costs;110

• Endogenous vehicle purchase prices;111 and

• Previous truck sales.112 [EPA-HQ-OAR-2019-0055-1256-A1, p. 20]

109. DRIA, supra note 41, at 412.

110. Id. at 226.

111. The pre-buy effects may be confounded by higher pre-regulation vehicle prices due to sellers' anticipation of an increased demand shock. The endogenous vehicle price is particularly the case in a non-competitive freight market. An instrumental variable approach is called for to address this supply-side confounder if the vehicle purchase price is to be controlled for in the model. See Rittenhouse & Zaragoza-Watkins (2018), supra note 108, at 262; see also Terence Lam & Charles Bausell, Strategic Behaviors Toward Environmental Regulation: A Case of Trucking Industry, 25 CONTEMP. ECON. POL'Y 3–13, 11 (2007).

112. See Lam & Bausell (2007), supra note 111 at 10-11.

These omissions are critical because they may be effects from these elements that EPA is observing, rather than effects from the factors EPA is explicitly considering. Unlike the two papers that EPA cites,113 EPA uses these estimates to make forecasts about the impact of the proposed regulation on future vehicle sales over time. Failure to address the omission of the above unobservable time-varying variables raises serious questions about the accuracy of the agencies' forecast of the sales impacts of the proposed regulation. [EPA-HQ-OAR-2019-0055-1256-A1, pp. 20 - 21]

These forecasting issues are unsurprising, as the published studies upon which the agency relies were not peer reviewed for the express purpose of forecasting the future impact of a proposed regulation. Instead, these studies focused solely on identifying the existence of pre-buy and low-buy effects. With this more limited goal in mind, these papers only have limited success, as their estimates of these effects were only statistically significant for a subset of the truck regulations only providing mixed evidence of their existence; EPA has similarly mixed results with respect to statistical significance.114 Policy Integrity has previously commented on similar identification and forecasting problems in the light-duty context when EPA and NHTSA advanced their modeling of the scrappage effect beyond the peer-reviewed literature.115 [EPA-HQ-OAR-2019-0055-1256-A1, p. 21]

114. DRIA, supra note 41, at 410, tbl. 10-1.

115. See, e.g., Inst. for Pol'y Integrity, Comments on The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks at 56–78 (Oct. 26, 2018).

EPA has three options to address the potential forecasting errors. First, EPA could improve its current reduced-form estimation by exploiting available data to account for the impact of these confounding changes on truck sales and testing the sensitivity of the estimation to alternative model specifications. Alternatively, EPA could consider estimating a structural model, as it has indicated it may do for future regulations in the light-duty context.116 As a final alternative—that Policy Integrity recommends—EPA could qualitatively discuss the potential impact of the pre-buy and low-buy effect in a similar manner as its current discussion of the Gruenspecht effect.117 In this discussion, the agency could discuss the identification problems above as limiting factors on their analysis, along with the non-existence of literature using these estimates to forecast sales effects. [EPA-HQ-OAR-2019-0055-1256-A1, p. 21]

116. See Jacobsen et al., The Effects of New-Vehicle Price Changes on New- and Used-Vehicle Markets and Scrappage (EPA, Aug. 2021), https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=352754&Lab=OTAQ.

117. DRIA, supra note 41, at 416.

In response to the rule, EPA assumes that the required extended warranties and increased truck durability will reduce repair costs, which will be a benefit for the trucking industry that partially or fully offsets increased sale prices.118 The impact on repair costs for the trucking industry is to extend the period of low maintenance costs—which are covered by the manufacturer under the Proposed Rule's longer warranties—thereby lowering their repair costs in the medium run until increased technology costs result in higher long-run per-mile maintenance costs after roughly 7 years of operation.119 These benefits should in turn increase demand for trucks holding price constant. Therefore, the overall impact of the regulation on sales could theoretically be positive or negative, just as the sign of the pre-buy effect is theoretically unclear.120 At a minimum, this improvement in truck quality will lower the overall impact of the regulation on fleet-turnover, including pre-buy and no-buy behavior. However, EPA's current methodology for estimating fleet size impacts is unable to capture the opposing price and quality effects separately, and so is unable to determine if trucking companies will be better off after the Proposed Rule. [EPA-HQ-OAR-2019-0055-1256-A1, pp. 21 - 22]

118. Id. at 342 & n.370.

119. Id. at 348, fig. 7-4.

120. Assuming perfect information and no information shocks after the implementation date (a potentially reasonable assumption for trucking companies making long-run fleet size decisions), a trucking company would only move up their planned purchase of a new truck if the expected post-implementation increase in sales price exceeds the decrease in maintenance and repair costs.

Currently, the EPA implicitly captures quality changes, including longer warranties and increased durability, along with other "unobserved factors, such as concerns over vehicle reliability and control technology uncertainty," in the price coefficient of their pre-buy and no-buy analyses. However, it is unclear if truck manufacturers and trucking companies will respond to the Proposed Rule in the same manner as they did to the past rules. In fact, based on the mixed results with respect to statistical significance and coefficient magnitudes in RIA Table 10-1 of the pre-buy and low-buy effects, it is even unclear if truck manufacturers and truck companies responded to past regulations in 2002, 2007, 2010, and 2014 in the same manner. Moreover, as the price increases stem from the cost of implementing a specific set of production processes and technology changes in the truck manufacturing assumed by EPA, it is unclear if the past estimates are consistent with the assumed quality changes that EPA forecasts. Therefore, it is unclear the extent to which EPA captures the offsetting effect of lower repair costs on fleet turnover in its analysis of the pre-buy and low-buy effects. To accurately capture the impact of EPA's projected quality changes, consistent with its assumed price increases, EPA needs to identify the price and quality effects on sales separately. [EPA-HQ-OAR-2019-0055-1256-A1, p. 22]

There may be long-run impacts not captured in EPA's simple short-run estimates comparison. Specifically, as the demand for capital goods, like heavy-duty trucks, becomes more inelastic over time, we should expect any negative sales effect to be small and temporary (as discussed above). This is particularly true given that EPA predicts minimal to no fleet turnover, transportation mode shifting, or changes in site locations. [EPA-HQ-OAR-2019-0055-1256-A1, p. 22]

The result of EPA's analysis is strongly dependent on the assumption that manufacturers can fully pass along the additional compliance cost to consumers (i.e., the trucking companies purchasing heavy-duty vehicles) through higher prices for new vehicles. However, EPA does not adequately discuss its reasoning for this assumption. Theoretically,121 in a perfectly competitive market, increased marginal costs are expected to be passed onto consumers as price equals the marginal cost of production. However, the degree to which the costs would be borne by producers and consumers depends on the sensitivity of consumers to prices. Consumers would not fully bear the costs unless they were completely insensitive to price changes. In other words, if consumers choose not to buy or buy fewer units because of price increases, then manufacturers are not able to pass on 100% of the additional costs. Moreover, the pass-through rate varies with the share of fixed costs within total compliance costs, i.e., costs that would occur regardless of the quantity of the product sold and do not affect the price in competitive markets. In an imperfectly competitive market, the validity of the 100% pass-through assumption also relies on producers' market power. Empirically, the agencies' estimates of the demand elasticities indicate some change in overall demand, which is not consistent with perfectly inelastic demand and thus does not support the 100% cost pass-through assumption.122 [EPA-HQ-OAR-2019-0055-1256-A1, pp. 22 - 23]

121. See SYLWIA BIALEK & MAX SARINSKY, INST. FOR POL'Y INTEGRITY, OVERINFLATED: THE SAFE RULE'S OVERSTATED ESTIMATES OF VEHICLE-PRICE IMPACTS 9-12 (2020).

122. DRIA, supra note 41, at 412.

EPA implicitly discusses the scrappage effect in the context of pre-buy and low-buy impacts. Specifically, EPA states that "potential buyers decid[e] not to purchase at all. In this case, the vehicle miles traveled (VMT) of older vehicles may increase to make up for the VMT otherwise expected of the newer ('missing') vehicles. To the extent that the older vehicles emit more than the missing vehicles, emissions may increase. However, because the VMT is likely to be shifted to the newer [heavy-duty] vehicles among the existing fleet, and most of those vehicles are expected to be in compliance with the existing [heavy-duty] vehicle standards, this effect is expected to be small."123 EPA then goes on to argue against the scrappage effect due to the absence of a robust methodology.124 [EPA-HQ-OAR-2019-0055-1256-A1, p. 23]

123. DRIA, supra note 41, at 416.

124. Id. EPA explicitly states that "Quantifying these effects would require a robust method to estimate the effects of the standards on pre-buy and low-buy, as well as a method to estimate shifts in VMT among vehicle vintages in the case of an expected change in the net sales of newer vehicles. In the absence of robust methods to estimate these effects, EPA is not quantifying the fleet turnover or emissions impacts in this proposed rule, though, as with pre-buy and low-buy, we acknowledge these potential impacts."

We agree that modeling the scrappage effect is potentially unnecessary in this instance, but recommend that EPA provide a fuller explanation of why this is the case. EPA cannot simply claim it lacks the methodology given the use of such methodology by NHTSA and EPA in the light-duty vehicle context. In the 2020 SAFE rulemaking, EPA and NHTSA estimated the scrappage effect using a reduced-form model. More recently, EPA issued a report outlining a structural-form methodology for estimating the scrappage effect.125 While Policy Integrity has previously submitted comments critical of EPA and NHTSA's methods of estimating the scrappage effect for light-duty vehicles,126 EPA cannot now ignore its prior methodologies without a fuller explanation. [EPA-HQ-OAR-2019-0055-1256-A1, p. 23]

125. See generally Jacobsen et al, supra note 116.

126. See, e.g., Inst. for Pol'y Integrity Comments, supra note 115.

We recommend that EPA briefly discuss the scrappage estimates in the light-duty vehicle context. The agency should explain why this estimate lacks robustness (i.e., is challenging or flawed) in the heavy-duty vehicle context relative to the light-duty vehicle context. Alternatively, EPA could discuss why NHTSA and EPA's current estimation strategies are weak more generally (i.e., in both light and heavy-duty contexts). Part of this justification should also include EPA's expectation that the scrappage effect will be "small" in the heavy truck context. [EPA-HQ-OAR-2019-0055-1256-A1, p. 23]

This suggestion should not be read as a recommendation to include the scrappage effect. Instead, we recommend that EPA provide a more comprehensive explanation for its modeling decisions, particularly where it is inconsistent with past EPA modeling practices in the vehicle market more generally. If EPA now believes its prior methodologies for estimating scrappage are flawed more generally—even in the light-duty vehicle context—this should be explained. We believe a similar consideration and discussion may be warranted for EPA's estimates of the pre-buy elasticities. [EPA-HQ-OAR-2019-0055-1256-A1, p. 24]

EPA makes clear that the sales effect of the regulation should be small due to the competing effects of increased capital costs and decreased operating costs. However, as EPA notes, the evidence is unclear and mixed as to whether the net effect of sales is zero127 or negative.128 In fact, this is consistent with EPA's finding that the sales impacts of regulations in 2002 and 2014 are insignificant, while it finds significant low-buy effect in 2007 and 2010.129 But even in 2007 and 2010, EPA notes that the "observed effects are short-lived, on the order of months rather than years."130 [EPA-HQ-OAR-2019-0055-1256-A1, p. 24]

127. Rittenhouse & Zaragoza-Watkins (2018), supra note 108.

128. D. Harrison, Jr., & M. LeBel, Customer Behavior in Response to the 2007 Heavy-Duty Engine Emission Standards: Implications for the 2010 NOx Standard, NERA Economic Consulting (2008) [Docket ID EPA-HQ-OAR-2019-0055-0576].

129. DRIA, supra note 41, at 410.

130. Id.

The net effect of the proposed regulation on sales is unclear based on EPA's illustrative examples using the 2007 and 2010 estimates.131 Despite the estimation problems discussed above, it is clear that EPA's analysis indicates that the net sales effect should be interpreted as zero based on the above evidence, including the likely small and temporary effect on sales. This interpretation is consistent with EPA's prediction of low turnover effects and no mode shifting due to the Proposed Rule. EPA should be explicit about the near-zero impact on sales based on previous studies and their own estimates. [EPA-HQ-OAR-2019-0055-1256-A1, p. 24]

131. Id. at 412–15 (showing pre-buy effects that are statistically insignificant using the 2007 estimates and slightly positive effects using the 2010 estimates and small, negative low-buy effects using both the 2007 and 2010 estimates).

Organization: *National Association of Chemical Distributors (NACD)*

Lastly, the pre-buy effects of this rule will likely be smaller under option 2 than option 1. Pre-buy effects are likely to follow this rulemaking as owners of these fleets are operating under slim margins and must think of long-term viability when purchasing trucks. This was seen during the implementation of EPA's MY2004-2010 emission standards, as there was a spike in truck purchases before stringent emission standards went into effect for MY2007-2010 and then a subsequent slowing of fleet turnover to avoid purchasing new trucks with harsher standards. The annual retail sales in 2005 was over 250,000 higher than 2010 and the average fleet age was nearly one year higher in 2010 compared to 2005.4 Since option 2's requirements are less severe, fleet owners will not bear as high a cost and can have more confidence in reliability, creating a smaller pre-buy effect than option 1. The EPA should also consider creating incentives for fleet owners to transition to new trucks versus more stringent NOx requirements - requirements that will only serve to keep older trucks on the road longer. [EPA-HQ-OAR-2019-0055-1279-A1, p. 4]

4. American Truck Dealers, 'A Look Back at EPA's Cost and Other Impact Projections for MY 2004-2010 Heavy-Duty Truck Emissions Standards,' nada.org, NADA, https://www.nada.org/WorkArea/DownloadAsset.aspx?id=21474839308

EPA Summary and Response:

Summary:

Commenters stated that EPA overestimated costs, underestimated pre- and low-buy effects and fleet turnover effects, and failed to account for additional market disruptions. Some commenters compared EPA results to an analysis completed by ACT Research. Some commenters made suggestions on changes to EPA's sales effects methodology.

Response:

Commenters expressed their concern about potential market disruptions and employment effects associated with standards that commenters asserted are not feasible or cost-effective (particularly proposed Option 1). Some commenters stated that the pre- and low-buy analysis should be an important consideration for determining the level of control in the final rule. Some commenters stated that EPA underestimated costs of the proposed regulation, as well as pre- and low-buy, and failed to account for some of the effects of market disruptions (such as employment effects, changes to freight rates, and delayed fleet turnover). One commenter (Daimler) commented that EPA did not propose standards "with 'reasonable' per-vehicle costs.'" One commenter (ATD) stated that if EPA moves too far, too fast, new vehicle costs will increase dramatically and performance will decline, resulting in a decline in fleet turnover and environmental improvements. Commenters cited external studies and data that yield higher estimates of costs, as well as pre- and low-buy, including ACT Research, Ricardo, and Ramboll studies and data.

Commenters stated that EPA overestimated fleet turnover, as well as the emissions reductions achievable by the proposed regulation, and underestimated the effect of the proposed rule on trucking capacity and freight rates. One commenter, Institute for Policy Integrity (IPI), stated that EPA overestimated pre-buy and low-buy, and that EPA should discuss these impacts qualitatively due to limitations of the methodology.

The final NO_X standards will be implemented with a single step in MY 2027 (which was the type of approach used in proposed Option 2) and reflect the greatest emission reductions achievable starting in MY 2027, giving appropriate consideration to costs and other statutory factors. Regarding commenters' statements that the new emission standards must be cost-effective, EPA notes that CAA section 202(a)(3) neither requires that EPA consider all the statutory factors equally nor mandates a specific method of cost analysis; rather EPA has discretion in determining the appropriate consideration to give such factors. See, e.g., Sierra Club v. EPA, 325 F.3d 374, 378 (D.C. Cir. 2003) (explaining that similar technology forcing language in CAA section 202(l)(2) ‘‘does not resolve how the Administrator should weigh all [the statutory] factors in the process of finding the ‘greatest emission reduction achievable' ''); Husqvarna AB v. EPA, 254 F.3d 195, 200 (D.C. Cir. 2001) (explaining that under CAA section 213's similar technology-forcing authority that ‘‘EPA did not deviate from its statutory mandate or frustrate congressional will by placing primary significance on the ‘greatest degree of emission reduction achievable' '' or by considering cost and other statutory factors as important but secondary). As explained in the final rule preamble Sections III and V, and sections 3 and 18 of this document, in setting the final emission standards EPA appropriately assessed the statutory factors specified in CAA section 202(a)(3)(A), including giving appropriate consideration to the cost associated with the application of technology EPA determined will be available for the model year the final standards apply (i.e., cost of compliance for the manufacturer associated with the application of such technology). EPA's assessment of the relevant statutory factors in CAA section 202(a)(3)(A) justify the final emission standards.

We also undertook additional analyses, including a sales analysis; however, since there are many uncertainties associated with estimating pre-buy and low-buy, including those discussed in past rules,[58] we have presented the sales analysis for this rule as an illustrative example. Our evaluation suggests that if pre-buy or low-buy occur, they will be small in magnitude (~2%) and short in duration (8 to 12 months) (see preamble section X and RIA Chapter 10 for more information). EPA has also provided a cost analysis for the final rule and disagrees that our final regulation will lead to dramatic cost increases (see preamble Section V, RIA Chapter 7, and section 18 of this document for more information). In addition, EPA has carefully and appropriately assessed sales and other economic impacts, and we continue to believe that our peer-reviewed methodology is appropriate, even considering the uncertainties we acknowledge in the RIA and in the EPA sales impacts report.[59] The EPA sales impact report and the method used to estimate illustrative results in Chapter 10 of the RIA, which stemmed from that report, is

[58] For example, see Chapter 8.4 of the Regulatory Impact Analysis for the Phase 2 Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles, found at https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-phase-2-greenhouse-gas-emissions-standards, or the EPA sales impact resort found at https://cfpub.epa.gov/si/si_public_pra_view.cfm?dirEntryID=349838&Lab=OTAQ

[59] The study can be found at https://cfpub.epa.gov/si/si_public_pra_view.cfm?dirEntryID=349838&Lab=OTAQ an in the docket for this rule.

transparent, reproducible, and "is based on the best reasonably obtainable scientific, technical, and economic information available," in compliance with OMB Circular A-4.[60]

Many commenters stated that EPA underestimated the costs due to the proposed regulation. In addition, some commenters stated that EPA cost estimates should include taxes and additional insurance and financing costs as outlined in the ACT Research Impacts Study (submitted with Truck and Engine Manufacturers Association comments). Allison commented that EPA should consider the price impacts flowing from the California Air Resources Board's Step 1 increase that took effect with MY 2022. Daimler commented that paperwork burden costs should be accounted for in regulatory costs. Many commenters, including Daimler, UAW, and TCA, referred to cost estimates from Ricardo Strategic Consulting. The ACT Research study referred to by commenters also relies on costs estimated from Ricardo.

EPA believes that the estimates and methodologies presented in the RIA are appropriate, even considering the uncertainties we acknowledge in RIA. As explained above in this response, in Preamble Sections III IV, and V, EPA explains that the final standards are appropriate and technologically feasible for MY 2027 based on EPA's consideration of the statutory factors. The sales analysis for this rule is an illustrative example, using the technology costs as estimated and discussed in Chapter 7 of the RIA as a proxy for the change in price due to this rule. In the context of the sales analysis, EPA does not have data to estimate additional insurance or financing costs for purchasers of HD engines and vehicles as a function of this regulation. In the context of the cost analyses, because such taxes, insurance, and financing costs are paid by purchasers of vehicles, those costs are not part of the manufacturers' costs of compliance. Also, EPA does not agree that we should include transfer payments such as taxes in the cost analysis for the total program. See Section 18.3 of this document for responses to similar comments about transfer payments.

Regarding Allison's comment, EPA has considered the price information from California Air Resources Board along with data from the Truck and Engine Manufacturers Association in developing the warranty-related costs for the final standards. EPA has provided a cost analysis and estimate for the final rule and disagrees that our final regulation will lead to dramatic cost increases. Regarding Daimler's comment, EPA includes paperwork burden costs in the "Other" category of indirect costs. Regarding commenters' reference to cost estimates from Ricardo, EPA has provided a cost analysis and estimate for the final rule and disagrees that our final regulation will lead to dramatic cost increases. For more information on EPA's response to comments regarding estimated costs of this EPA regulation, including to the cost estimates in Ricardo Strategic Consulting's report, please refer to section 18 of this document, Section V of the Preamble, and RIA chapter 7.

Several commenters stated concerns that the proposed NOx standards, particularly proposed Option 1, may lead to increasing truck prices, and therefore result in pre- and low-buy sales effects. Commenters also stated that the phase-in approach of Option 1 would lead to larger sales effects than the single-step implementation time frame of Option 2. NACD commented that proposed Option 2 would be less costly and be associated with more confidence in reliability

[60] OMB Circular A-4 (found at https://obamawhitehouse.archives.gov/omb/circulars_a004_a-4/#d) provides guidance to Federal Agencies on the development of regulatory analyses as required under Executive Order 12866.

than proposed Option 1, leading to a smaller pre-buy effect compared to proposed Option 1. PACCAR commented that a program with Option 2-like requirements would be more cost-effective, and less likely to lead to delays in fleet turnover or pre-buy/no-buy responses from the market. Allison Transmission stated that EPA does not attempt to quantify how different vocational vehicles or Class 7-8 tractors could be affected by pre- and low-buy, and assuming an average effect across all vehicles may not fully reveal real-world effect in different segments of the market. Commenters including Allison, Daimler, UAW, EMA, and U.S. Chamber of Commerce stated that pre- and low-buy effects will be larger in magnitude and duration than EPA estimates. Daimler, ACT, EMA, and Allison all referred directly to estimates made in the ACT Research study. ACT estimated two years of pre-buy, with low-buy being an opposite but equal effect, using cost estimates outlined in the Ricardo study. In addition, ACT estimated effects across Classes 4-8. ATD pointed out that Ricardo also estimated larger pre- and low-buy than EPA as a result of the Proposed Option 1, as well as reduced turnover and increased used vehicle sales.

EPA disagrees that pre- and low-buy estimates are underestimated in the RIA. Our estimates rely on peer-reviewed methodology and EPA cost estimates for the final program presented in the RIA. We believe our estimates and methodology are appropriate even considering the uncertainties we acknowledge in the RIA and in the EPA sales impacts report. EPA also notes that the final rule includes a single step approach in MY 2027, which was the approach proposed until Option 2. See also our response further below regarding possible emission effects from pre-buy and low-buy of the final standards. EPA also notes that the pre- and low-buy analysis in the RIA is an illustrative example of how this methodology could be used to estimate sales impacts of a HD regulation and does not impact cost and benefit estimates of this final rule. EPA believes that effects on fleet turnover due to pre- and low-buy will be minimal and short-lived, as discussed in Chapter 10.1 of the RIA. In the EPA sales impacts report supporting the pre- and low-buy methodology introduced in the proposed rule, the sales effects for Classes 6-8 were each examined separately. The data and estimated results for Classes 6 and 7 were economically insignificant or inconsistent with market expectations; therefore, we are unable to estimate effects on those two HDV classes at this time. In addition, we do not have data to separate out different HD applications within a class.

The analysis estimated by ACT Research uses much higher cost estimates from Ricardo as opposed to those estimated by EPA. Even for the cost scenario ACT Research states is based on EPA cost estimates, the final costs used by ACT Research are adjusted upward compared to EPA cost estimates for the proposed rule. In addition, the significantly larger results from ACT Research mentioned by commenters are estimated assuming a strong economic outlook. ACT Research pointed out that if a neutral economic outlook is assumed, results would be smaller. In addition, though ACT Research explained their methodology in broad strokes (they use measures of both willingness and ability to buy to estimate pre-buy), they did not provide enough detail on the model or assumptions for EPA to further respond to their specific estimation method and results. Without sufficient information, EPA cannot fully evaluate the study or results.

ACT Research assumed low-buy estimates were equal in magnitude and opposite in direction to the estimated pre-buy. In other words, pre-buy effects in the ACT Research study were entirely due to planned purchases shifting forward in time to before the standards are in place. Published literature on pre- and low-buy in the HD vehicle market is mixed on whether pre- and low-buy are equal and opposite. See Chapter 10 of the RIA for this rule for more information on HD sales effects literature. The results from the EPA sales impacts report are also unclear on this issue, with economic significance and magnitude varying across the pre-buy and low-buy sales effects for the different standards. Assuming equal and opposite reactions assumes all pre-bought vehicles are purchases pulled forward in time and are vehicles that would have been purchased after the regulation if the regulation had not been finalized. This ignores alternative reasons pre- or low-buy may happen, including HD vehicle owners that do not pre-buy, but instead delay a purchase for some period after a regulation is finalized.

Some commenters raised specific points on what should be additionally included or assessed differently in EPA's estimates and analyses. Allison Transmission commented that EPA should carefully consider potential impacts of increased prices due to extended warranty and useful life provisions. In their comments, Daimler partially quoted EPA with respect to the discussion on the effect of extended warranties and longer useful provisions, stating that EPA cannot provide support for the assertion that "the conclusion that these combined effects may *increase sales of new HD vehicles* 'if fleets and independent owner-operators prefer to purchase more durable vehicles with overall lower repair costs.'" IPI commented that the method EPA used to estimate pre- and low-buy effects does not separate out the improved quality effects from the effect of increasing costs, and that EPA must identify price and quality effect separately. IPI commented that improvements in truck quality will reduce the impact of the regulation on fleet turnover, including pre- and low-buy. IPI also commented that failing to address the omission of unobservable time-varying variables (including adverse fuel consumption effects, rule stringency, vehicle attributes, endogenous vehicle purchase price and previous truck sales) leads to serious questions about the accuracy of EPA's forecast of sales effects. IPI suggested three options for addressing the potential errors they point out in their comment. IPI first suggested EPA exploit available data to account for the impact of these factors, and test the sensitivity of the estimation to alternative model specification. The second suggestion made by IPI was to estimate a structural model. IPI's third recommendation was to qualitatively discuss potential pre- and low-buy effects. In addition to discussing sales impacts qualitatively, IPI commented that EPA should consider discussing fleet turnover qualitatively, or identify assumptions within the quantitative model that may lead to overestimation. IPI also stated that EPA should be explicit about the near-zero impacts on sales based on previous studies and on the EPA estimates.

In the analyses for the final rule, as in the proposed rule, EPA estimated pre- and low-buy effects using total per-vehicle direct and indirect EPA cost estimates for the final program, which include the estimated cost of longer warranty and useful life. For information on EPA's approach to estimating warranty and useful life costs, see RIA Chapter 7. In the final RIA, the full sentence Daimler is referring to states "More durable components coupled with manufacturers paying for repairs during a longer warranty period would in turn reduce repair costs, which may increase (or reduce the decrease in) sales of new HD vehicles due to fleets and independent owner-operators being inclined to purchase vehicles with lower repair costs." EPA points out that the effect of longer warranties and useful life provisions may increase, or reduce the incentive for, pre- and low-buy, mitigating adverse sales impacts. Longer useful life and longer warranty may also lead to reduced perception of risk (for example, that quality of post-regulation implementation vehicles will be lower compared to pre-regulation implementation vehicles), as well as lower overall repair costs, which may mitigate downward pressure on sales through pre- and/or low-buy. In addition, this may lead to increased sales of new HD vehicles compared to a counterfactual where these regulations are not in place, especially in the long term, when uncertainty of the effect of the rule on vehicle performance decreases. In the nearer term, the effect depends on the magnitude of 1) purchaser preferences for any or all of the following: durability, lower repair costs, and decreased emissions; and 2) purchaser aversion to either, or both, increased costs and perceived risk. EPA does not have the data to estimate the direct effect of longer useful life and longer warranty on sales impacts for this rule. EPA considered multiple sensitivities in our inputs and assumptions in the course of estimating effects for the proposed and final rules. In the pre- and low-buy effects analysis, we estimated pre- and low-buy using multiple estimated elasticities to get a range of possible sales effects.

EPA states in Chapter 10.1 of the RIA and in the EPA sales impacts report that the sales impacts estimates likely capture unobserved aspects of the regulation, which includes quality changes. Therefore, we assume the pre- and low-buy results are an upper-bound estimate for sales effects due to the cost of the rule. EPA agrees that the expected quality improvements, and possible fuel or other operating cost savings due to the rule, may reduce those effects to below the upper-bound estimates.

With respect to IPI's suggestion that EPA exploit available data to account for unobservable variables, the EPA sales impacts report containing the HD sales effects literature review and methodology for the EPA sales effects estimates explains the data the researchers considered, as well as the reasoning behind including or excluding it from the analysis. In section 2.4 of the EPA sales impacts report, we discuss how the model specification was chosen, and the considerations made in choosing it. In addition, the data and method used in EPA's estimates were informed by published literature examining the effect of HD regulations on pre- and low-buy, and included multiple tests on the validity of the data, as described in section 3 of the EPA report. In section 3 of the EPA sales impacts report, we also discuss the econometric framework used, including testing on different forms of the month of year indicator variables, and determining the appropriate leads and lags, if any, that should be included. EPA believes we appropriately identified and used available, relevant data. With respect to IPI's second suggestion, that EPA estimate a structural model, "structural model" is a broad term, but generally requires assumptions on the relationship of the variables used in the analysis. Reduced-form methods, like the one used in the sales effects analysis in the RIA, identify the relationship between the variables. EPA believes the reduced-form method applied, without assumptions regarding the relationship between variables, is useful for this illustrative analysis, and moves the sparse HD sales effects literature forward. With respect to IPI's third suggestion that EPA discuss sales effects and fleet turnover qualitatively, EPA points out that sales impacts and fleet turnover effects are discussed qualitatively in RIA Chapter 10.1. Quantitative estimates of sales impacts are introduced as an illustrative example of how EPA may estimate pre- and low-buy in RIA Chapter 10.1.2.2. In addition, the RIA cites the EPA sales impacts report where the method EPA illustrates is identified and explained. In fact, EPA clearly states in the RIA and in sections 2 and 4 of the cited EPA sales impacts report that estimated effects found in the literature are mixed, and that the lower-bound for all pre- and low-buy results in the EPA study is zero, or no effect.

IPI asserted that there are likely long-run impacts that are not captured by EPA's short-run sales effects estimates, and that like other capital goods, the demand for HD trucks is more inelastic, leading to temporary and small long-term sales effects.

EPA agrees with the assertion that long-term sales effects of this regulation are likely to be small. EPA clearly states that the sales effects estimated and illustrated in the RIA are short-term effects and cover a range of possible outcomes, including no effect.

IPI commented that EPA could improve our methodology by strengthening the assumption of 100% cost pass-through, and states that EPA does not adequately discuss its reasoning for this assumption. IPI stated that in a perfectly competitive world, consumers would not fully bear the costs unless they were completely insensitive to prices (perfectly inelastic demand – demand would not change with a change in price), and in an imperfectly competitive world, cost pass-through relies on producers' market power. IPI stated that because EPA's estimated demand elasticities indicate some change in overall demand, the assumption of 100% cost pass-through is not supported.

EPA does not have data to support a lower level of cost pass-through. The assumption of 100% cost pass-through is consistent with EPA's characterization of the sales effects as range between upper-bound (under full cost pass-through) and lower-bound (or no effect) estimates. Full cost pass-through is associated with upper-bound estimates because it will lead to the greatest increase in estimated costs as a function of the rule for consumers, which will lead to the largest estimated impacts on sales. Assuming partial cost pass-through, without changing other assumptions, will lead to smaller estimated impacts of the rule.

Allison Transmission stated the EPA should conduct a sensitivity analysis of different levels of economic impacts the regulation might have, and that this analysis should be available in the docket. The pre- and low-buy analysis method EPA outlined and illustrated in Chapter 10 of the RIA includes estimating multiple elasticities, as well as the effects of those multiple elasticities. Our analyses, both for the proposal and final rule, are available in the docket for this rule.

Commenters stated that EPA-estimated historical effects of previous EPA regulation are underestimated in both magnitude and direction. Allison, EMA, UAW, and the U.S. Chamber of Commerce comments reflect estimates and conclusions ACT Research made in its study on sales effects of previous EPA HD regulations in comparison to sales effects estimated in EPA's report. Allison Transmission stated that EPA should consider further historical data from the 2007 rule to check assumptions regarding the impact of NOx regulations on commercial vehicles during that timeframe. ATD included figures showing annual retail sales of Class 4-8 vehicles from 2000 through 2010. ATD commented that these sales show pre-buy starting in 2002 ahead of the 2004 HD rule, as well as in 2006 ahead of the initial implementation of the 2007/2010 HD rule with sales falling after the rules were implemented. ATD also stated that sales increased before 2010, when the 2007/2010 HD rule was fully phased in. Allison Transmission stated that there were about six years of lower-than-average sales from 2007-2013 based on the 15-year build average over 2006 to 2021. NACD stated that there was a spike in truck purchases ahead of the start of the 2007/2010 HD rule, followed by a slow-down in fleet turnover, which they attribute to consumer avoiding purchasing new trucks with "harsher standards." IPI commented that it is unclear if truck manufacturers and trucking companies will respond to the Proposed Rule in the same manner as they did to the past rules.

In building a method to estimate sales impacts, EPA considered the effect of four previous EPA HD rule implementations, including data surrounding the 2004 HD rule, the 2007/2010 HD rule and the 2014 HD rule. In response to ATD stating that sales increased starting in 2002, ahead of the 2004 HD rule, EPA points out that the Department of Justice and EPA completed consent decrees with seven of the largest heavy-duty diesel engine manufacturers in the U.S., under which six of the manufacturers were required, among other things, to meet a 2.5 g/bhphr limit on NMHC+NOX no later than October 1, 2002, thus pulling much of the regulatory implementation timeline ahead to October 2002.[61] Because of this, much of the pre-buy for that rule, if there was any, would have been felt in the time frame preceding the end of 2002. In the EPA study, we find no evidence for pre-buy in Class 8 vehicles ahead of the 2002 implementation. In response to comments stating that EPA underestimated the effect of the 2007/2010 HD rule, specifically citing the fall in retail sales starting around 2005, EPA points out that there were external factors affecting the market, and economy as a whole, at that time, including the Great Recession, which officially began at the end of 2007.[62] In addition, for the 3 years prior, starting in 2004, the Federal Reserve steadily increased interest rates. This made it costlier to purchase expensive goods, especially those purchased through the use of credit, like HD vehicles. This ultimately led to reduced purchases of those expensive goods. Attributing all, or even most, of the decline between 2005 and 2009 to the 2007 HD regulation is not appropriate. The EPA sales impacts report does find evidence of pre-buy in Class 8 vehicles before the final phase-in of the 2007/2010 HD rule implementation in 2010, though results are smaller than those cited by commenters. EPA agrees with IPI that the results in the EPA sales impacts report were mixed with respect to statistical significance and magnitude for the previous EPA regulations, which indicates that is it not clear that truck manufacturers and truck companies responded to past regulations in a similar manner.

Allison Transmissions chose to smooth vehicle sales averages across multiple years to better understand sustained impacts over a longer period of time, pointing out that there is a lot of year-over-year volatility due to replacement cycles and multi-year capital planning. Impacts of year-over-year volatility are mitigated in EPA's estimation methodology, as the effect of each historical regulation were estimated separately and built upon previous literature, extending our analysis from accounting for only 8 months of data to including data from the 12 months preceding and following implementation of the rule. This is consistent with annual cycles in vehicle purchasing and model year updates. Also, with the exception of the sales effects for low-buy surrounding the 2007 implementation date, our results show no effects after 8 months, and the results for low-buy using the effects estimated for the 2007 implementation date decrease from 7 to 12 months. In addition, EPA accounts for macroeconomic events through the inclusion of monthly GDP, oil prices, imports and exports, and a measure of consumer sentiment. Within-

[61] More information on these consent decrees can be found on EPA's Civil Cases and Settlements by Statute webpage:
https://cfpub.epa.gov/compliance/cases/index.cfm?templatePage=12&ID=1&sortby=RELEASE_DATE,RELEASE_DATE&stat=Clean%20Air%20Act

[62] https://www.nber.org/news/business-cycle-dating-committee-announcement-december-1-2008

year volatility is also accounted for in EPA's estimation through the use of controls for month-of-year seasonality.

Many commenters stated that because EPA underestimated pre-buy and low-buy, we overestimated the number of low-NOx compliant trucks that will be purchased starting in 2027 through 2031, and this reduced turnover, and associated increase in the average age of the fleet, will reduce the emissions impacts from the rule. In addition, commenters stated that EPA should estimate emissions effects due to pre- and low-buy. Some of these commenters cited a study by Ramboll stating that the proposed Option 1 can result in increased NOx emissions due to a large pre-buy, while the proposed Option 2 could result in a smaller sales effect and more emissions compliant trucks on the road.

In section 10 of the RIA, we qualitatively discuss possible emission effects from pre-buy and low-buy. As discussed in preamble Section III.A, in setting the final standards we gave appropriate consideration to costs associated with the application of technology to achieve the greatest emissions reductions in MY 2027 (i.e., cost of compliance for manufacturers associated with the standards[63]) and other statutory factors, including energy and safety. In preamble Section III.A, and throughout Sections III and IV more broadly, we detail our determination that the combination of elements in the final standards are appropriate, feasible, and consistent with our authority under the CAA to set technology-forcing criteria pollutant standards for heavy-duty engines for their useful life.[64] In turn, it is our assessment that the final standards, including when combined with the final useful life and warranty requirements, will lead to a minimal effect on the duration or magnitude of any possible pre- or low-buy (see preamble Section X for additional discussion). Since we expect minimal effects on duration or magnitude of pre- and low-buy, and since there are many uncertainties associated with estimating pre-buy and low-buy (including those discussed in past rules), we have chosen a qualitative approach to evaluate potential emissions impacts of pre- and low-buy, as provided in RIA Chapter 10.

Some commenters pointed out the ACT Research estimates of employment effects due to low-buy. EPA has added an illustrative method to estimate a sales effect on employment. For more information on EPA's response to the ACT Research employment impact estimates, and on

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[63] More specifically, for this rule in setting the final standards and consistent with CAA section 202(a)(3)(A), the cost of compliance for manufacturers associated with the standards that EPA gave appropriate consideration to includes the direct manufacturing costs and indirect costs incurred by manufacturers associated with meeting the final standards over the corresponding final useful life values, given that this rule sets new more stringent standards through both the numeric level of the standard and the length of the useful life period.

[64] CAA section 202(a)(3)(A) is a technology-forcing provision and reflects Congress' intent that standards be based on projections of future advances in pollution control capability, considering costs and other statutory factors. See National Petrochemical & Refiners Association v. EPA, 287 F.3d 1130, 1136 (D.C. Cir. 2002) (explaining that EPA is authorized to adopt ''technology-forcing'' regulations under CAA section 202(a)(3)); NRDC v. Thomas, 805 F.2d 410, 428 n.30 (D.C. Cir. 1986) (explaining that such statutory language that ''seek[s] to promote technological advances while also accounting for cost does not detract from their categorization as technology-forcing standards''); see also Husqvarna AB v. EPA, 254 F.3d 195 (D.C. Cir. 2001) (explaining that CAA sections 202 and 213 have similar language and are technology-forcing standards). In this context, the term ''technology-forcing'' has a specific legal meaning and is used to distinguish standards that may require manufacturers to develop new technologies (or significantly improve existing technologies) from standards that can be met using existing off-the-shelf technology alone. Technology-forcing standards such as those in this final rule do not require manufacturers to use specific technologies.

EPA's illustrative sales effect on employment estimation, see section 26 of this document and Chapter 10.2 of the RIA.

Commenters stated that pre-buy would lead to excess capacity, and excess low-buy (beyond the estimated pre-buy level) would lead to tight capacity. In addition, Daimler and other commenters reported ACT Research conclusions that, due to excess trucking capacity due to pre-buy, freight rates would be lower, which would lead to reduced earnings in the trucking industry during the pre-buy/low-buy period. Daimler also commented that increased costs due to the proposed rule would lead to long-term freight rate increases above today's rates. EPA acknowledges that pre-buy may lead to excess trucking capacity, and low-buy may lead to tight capacity in the short run, but such impacts would be small. Results in the EPA sales impacts report indicate that if pre- and low-buy occur, they would be short-run effects, and therefore, in the event that excess or tight capacity exists due to pre- or low-buy, those effects would also be short-term as the market reverts to expected levels. Also, as EPA estimates indicate that any pre- or low-buy effects would be small in magnitude, possible resulting capacity effects would be small as well. In addition, the assumptions by these commenters ignore planned replacement, scrappage, and delayed scrappage in a fleet. If a pre-bought truck is a truck that would have been purchased later in absence of the regulation, this indicates there were plans to either purchase an additional truck for a fleet, or to replace a truck in a fleet. Excess capacity would not exist unless the fleet owner(s) retained the vehicle they otherwise would have sold or scrapped when they pre-bought their new truck. In addition, if there is tight capacity after a regulation due to excess low-buy, this indicates that not only were new trucks not purchased, but truck/fleet owners scrapped or sold trucks they currently owned without replacing them. Alternatively, excess low-buy due to delayed purchase could be associated with delayed scrappage, again leading to minimal effects on capacity.

The U.S. Chamber of Commerce pointed out that long-haul trucking is mainly comprised of small businesses, and that 98% of U.S. fleet owners are categorized as small businesses; they are disproportionately vulnerable to changing economic circumstances and typically do not have the financial resources to absorb significant regulatory cost increases, and therefore pass those increases on to the consumer. As explained in preamble Section V, EPA's cost analysis for the final program includes "technology costs," that represent the costs incurred by manufacturers--i.e., regulated entities--to comply with the final program, and "operating" costs, that represent the costs of using the technology in the field and which accrue to the owner/operator of MY 2027 and later heavy-duty vehicles. EPA notes that U.S. fleet owners are owner/operators, not manufacturers, and are not regulated entities under the final program's requirements.[65] As previously noted above in this response, EPA's assessment of the relevant statutory factors in CAA section 202(a)(3)(A) justify the final emission standards. EPA recognizes that the costs of our rules are often ultimately passed on to the consumer through increased upfront prices; however, we also expect that the longer useful life and warranty periods in the rule will result in lower emission repair costs for many vehicle types and fewer emission control failures, which we anticipate could be particularly impactful for small businesses. We further expect that several provisions in the final rule will improve the operating experience of small fleet owners; for

[65] See Chapter 11 of the RIA for EPA's discussion of the impacts of the final program on directly regulated entities that are small businesses and section 17.1 of this document for responses to additional comments regarding impacts on small businesses.

instance, we expect the serviceability provisions in the final rule will result in better service experiences for owners who repair their own equipment, as is typical of small fleets (see preamble Section IV and sections 3, 4, and 5 of this document for additional details on warranty, useful life, and serviceability provisions in the final rule). Our assessment of the total program costs (i.e., both technology and operating costs) lend further support to the final rule.

IPI recommended that EPA provide a fuller explanation of why modelling scrappage is potentially unnecessary, including a discussion of scrappage in the light-duty context. IPI cited the scrappage effects estimated in prior NHTSA and EPA light-duty vehicle rulemakings, as well as the recent EPA issues report outlining a structural-form methodology for estimating the scrappage effect.

The scrappage models EPA has used to estimate responses in the light-duty market to vehicle regulations, and the effects that have been estimated using them, were all built using data exclusively from the light-duty vehicle market. Purchase and use decisions are made differently in heavy and light-duty contexts, and assumptions about inputs that affect scrappage decisions in the light-duty market are not the same as those that would be made in the heavy-duty market. Though we do not have data or a methodology to estimate dynamic scrappage in the HD vehicle context, or the changing of scrappage decisions due to the cost of the rule, the EPA MOVES model includes an estimate of static scrappage rates. EPA has added further discussion on modeling scrappage in the HD context to Chapter 10.1.3 of the RIA, including a reference to the static scrappage modeling in the MOVES model.

Some commenters, including ATD and NACD, stated that EPA emission standards should focus on increasing fleet turnover as opposed to disincentivizing purchases of new HD vehicles through dramatic increases in costs and decreased performance.

As explained in the final rule preamble, sections 3 and 18 of this document, and above in this response, the final standards are promulgated under and consistent with our authority in CAA section 202(a), which includes EPA giving appropriate consideration to cost associated with the application of technology EPA determines will be available for the model year the final standards apply. EPA also provides a cost analysis and estimate for the final rule and disagrees that our final program will lead to dramatic cost increases or decreased performance. See Chapters 3 and 7 of the RIA for this rule for more information on our feasibility and cost analyses. Finally, while we agree with the importance of encouraging fleet turnover, state or other federal programs are best positioned to offer incentives for retiring older heavy-duty trucks and purchasing new, lower emitting trucks or zero-emissions vehicles and such programs are outside the scope of this rulemaking (see Section 12.1.1 of this document for additional discussion on fleet turnover).[66] For example, the recently passed Inflation Reduction Act (IRA)

[66] For example, other Federal programs that are well positioned to help encourage fleet turnover include the Diesel Emissions Reduction Act funding, which grants and rebates that protect human health and improve air quality by reducing harmful emissions from diesel engines.

has many incentives for promoting zero-emission vehicles that are anticipated to assist in fleet turnover.[67]

25.3 Commenters who Disagree With our Analysis

Comments by Organizations

Organization: *American Truck Dealers (ATD)*

To illustrate the importance of fleet turnover and safety, it was not until 2018 that all major CMV manufacturers began including such advanced driver assistance systems (ADAS) as forward collision avoidance and lane departure warning to standard package offerings. ADAS features have led to a reduction in accidents involving CMVs, along with a reduction in related injuries and deaths. Bottom line: to the extent EPA's new NOx mandates serve to inhibit fleet turnover, they also will inhibit the roll-out of important new accident-reducing features and systems such as ADAS, by no means yet prevalent on the road today.12 [EPA-HQ-OAR-2019-0055-1321-A1, p. 6]

> 12. According to a Fleet Advantage survey, as of 2020, over 50% of the CMV fleet was MY 2017 and older.

Organization: *American Farm Bureau Federation (Farm Bureau)*

Specifically, we are concerned that the agency's projection of extremely modest technology and warranty costs associated with the rule will result in a significant overestimation of future fleet turnover and underestimation of the negative emissions consequences associated with large-scale 'pre-buys' prior to compliance deadlines. To its credit, EPA openly admits that its projections are guesswork, but it does not quantitatively explore how underestimating costs could drive higher pre-buy behavior that could significantly delay and undermine emissions reductions benefits that are the central purpose of the rule. So, before finalizing this rule, we urge EPA to work collaboratively with industry, states, and other affected stakeholders to resolve discrepancies related to technology costs and achievability, warranty impacts, corresponding fleet turnover and environmental impacts of the proposal. [EPA-HQ-OAR-2019-0055-1163-A1, p.2]

Organization: *Autocar, LLC (Autocar)*

Autocar is proud to say that it has a strong, longstanding relationship with Cummins. As partners, the two companies consistently communicate and work collaboratively to address challenges and explore potential solutions to enable both companies to comply with and honor the spirit of CARB's and EPA's greenhouse gas and NOx rules. [EPA-HQ-OAR-2019-0055-1292-A1, p. 4]

[67] For example, see Sections 13403 (Qualified Clean Vehicles), 13404 (Alternative Refueling Property Credit), 60101 (Clean Heavy-Duty Vehicles), 60102 (Grants to Reduce Air Pollution at Ports), and 70002 (United States Postal Service Clean Fleets) of H. R. 5376.

Through that regular dialogue, Cummins has informed Autocar that production of Autocar's top-selling diesel engines will be modified significantly in 2024-2026 as a result of CARB's Low NOx rule and now in 2027 and after under the Proposed Rule. Under the CARB rule, Cummins' sales volume of these engines is limited to 45% in 2024 and 25% in 2025, and it is not yet known what portion of those restricted sales will be to Autocar. Further, sales of those engines will create credit deficits for Cummins. In order to take the actions necessary to offset the deficits, the cost of these engines are anticipated to increase by $4,000-$5,000 per engine. Although Cummins understands the problems this causes for Autocar and its customers that rely on diesel trucks, including municipalities purchasing trucks with taxpayer dollars, they can't bear all of the cost to meet the new standards. They anticipate similar issues with other engines when more stringent standards are implemented over time, particularly for small-volume product lines. [EPA-HQ-OAR-2019-0055-1292-A1, p .4]

In addition, the California NOx standards, and now the EPA NOx standards in the Proposed Rule, present ongoing development demand for Cummins. Engine fuel maps and emissions levels are a constantly-moving target. This complicates Autocar's efforts toward compliance for the vehicle, making it impossible to predict performance against 2027 standards. By contrast, large vertically-integrated manufacturers develop their engines and vehicles simultaneously and in a complementary manner, without the many challenges of a third-party engine-vehicle relationship. [EPA-HQ-OAR-2019-0055-1292-A1, p. 4]

Organization: *Engine and Truck Organizations*

Based on our assessment, EPA's "Option 1" rule as proposed will be:

- Cost prohibitive. The additional technology required for diesel engines will drive new and used vehicle prices higher, reducing or delaying fleet turnover to newer, cleaner, safer trucks. Higher operating costs will also deter the attractiveness of those trucks. [EPA-HQ-OAR-2019-0055-1177-A1, p.1]
- Counter to environmental goals. When new truck prices rise and their costs of operation increase, customers will hold onto older, higher emitting trucks longer, undermining the continuous improvements in air quality we all seek. [EPA-HQ-OAR-2019-0055-1177-A1, p.1]

Organization: *American Bus Association (ABA) (1070 and 1308)*

In addition to the extremely burdensome potential costs associated with the Proposal, both in terms of direct and indirect costs to manufacture and maintain new emissions control technology, which may not even be feasible, the Notice also mentions EPA's review of the Proposal's potential impact on the sale of new vehicles and fleet turnover. Here, again, ABA believes EPA's estimates are insufficient because the underlying cost estimates in the analysis do not fully capture the costs and economic impact on motorcoach operators, or other property-carrying stakeholders. With the potential cost to purchase a new vehicle under the Proposal increasing by $42,000 or more, along with additional costs associated with maintaining the system, and likelihood of increased repair costs and other operational costs resulting from the likelihood of increased derate situations, motorcoach operators will take every measure possible to avoid the need to purchase a new vehicle for as long as possible. This outcome will not only affect air quality, it will also affect safety, with older vehicles remaining on the road. Alternatively, the cost to purchase a new vehicle will force more motorcoach companies out of business. [EPA-HQ-OAR-2019-0055-1308-A1, p.7]

Organization: *American Trucking Associations (ATA)*

ATA has established 12 fleet Guiding Principles that should be considered in the development of HD2027 including:

• Implementation must not result in pre-buys/low-buys/no-buys of new equipment. [EPA-HQ-OAR-2019-0055-1326-A1, p. 5]

If pre-buy and low-buy behaviors occur, the initial emission reductions will be smaller than expected. In other words, if new truck buyers anticipate adverse technological and/or financial impacts, changes in purchase patterns could reduce the anticipated benefits. This highlights the importance of correctly assessing the potential impacts of the rule. [EPA-HQ-OAR-2019-0055-1326-A1, p. 15]

Fleets that purchase new trucks typically to do so on a consistent basis which supports a steady manufacturing schedule, including the labor and supplies needed to produce new vehicles. According to a recent sampling of fleets, 30% of respondents indicated they would not consider pre-buying ahead of a new standard while a majority (54%) indicated they would consider a prebuy depending upon the additional price of a new truck.12 [EPA-HQ-OAR-2019-0055-1326-A1, p. 15]

12. See Appendix A.

Similarly, low-buying after a new standard takes effect was slightly less appealing with 27% of respondents indicating they would not consider a low-buy while 44% would depending upon the additional price. Finally, a no-buy scenario where purchases shift to the used truck market was the least considered approach with 42% of respondents indicating they would not consider this approach. As these results indicate, a large percentage of fleet respondents that purchase new trucks would consider pre-buys or low-buys depending upon the anticipated purchase price increase resulting from the new standard. This highlights the importance of accurately quantifying and minimizing the cost impacts of the proposed rulemaking in order to avoid these adverse impacts. [EPA-HQ-OAR-2019-0055-1326-A1, pp. 15 - 16]

Organization: *Coach USA, Inc. (Coach USA)*

Given the economic challenges still facing the motorcoach industry, any rules that will increase the cost of a new bus by over $40,000, as proposed here (and that will likely also increase vehicle maintenance and repair costs) will counterproductively encourage the continued use of older, less emissions-efficient motorcoaches. Such rules could also have the perverse effect of forcing some motorcoach operators to abandon the business altogether, as many have already done in recent years. The impact could well be more personal cars on the highway, and higher emissions. To prevent these results, EPA needs to be more mindful of the role of motorcoaches in the nation's transportation system and develop emissions rules that balance reasonable emissions goals with the constraints facing our industry. [EPA-HQ-OAR-2019-0055-1307-A1, p. 3.]

Organization: *International Union, United Automobile, Aerospace & International Union, United Automobile, Aerospace & Agricultural Implement Workers of America - UAW Region 1A*

To be effective, the final rule must be: Customer-acceptable. If truck owners and operators choose not to purchase new trucks due to cost or reliability concerns that result from a bad federal rule, older trucks will stay on the roads longer and environment goals will not be achieved. [EPA-HQ-OAR-2019-0055-1062-A1, pp.1-2]

Organization: *National Association of Small Trucking Companies (NASTC)*

The rule applies to manufacturers of heavy-duty vehicles; still, it directly affects the motor carriers that must purchase the vehicles and the drivers who must operate them on the job. As Bloomberg reports, "whether the rule succeeds will be determined by how quickly trucks with the new technologies are sold."3 NASTC has served our sector of the trucking industry for more than 30 years, providing a range of services that facilitate our members' business operations and help them remain competitive. In our estimation based on three decades of experience, the outcome of such dramatic emissions standards is fairly predictable. [EPA-HQ-OAR-2019-0055-1130-A1, p. 5]

> 3. Bloomberg, "Truckers Say This Is the Worst Time for Biden's Plan to Cut Emissions," March 1, 2022. https://www.supplychainbrain.com/articles/34662-truckers-say-this-is-the-worst-timefor- bidens-plan-to-cut-emissions

If the proposed rule, either option, is adopted, many if not most carriers and truckers will opt to keep the vehicle(s) they have for longer than they otherwise would have. Small-business truckers in general cannot afford to buy brand-new power units, which today cost around $140,000. New vehicles complying with the proposed rule as of MY '27 will cost significantly more—reflecting the sophisticated new technologies that enable their engines to meet the new standards and requirements, a period of inflation-fed cost increases, and new technologically complex systems still working out the bugs. So, for the large percentage of carriers having 20 or fewer trucks, the new vehicles will be even less of an option; these carriers will remain in the used heavy-duty truck market. [EPA-HQ-OAR-2019-0055-1130-A1, p. 5]

Organization: *NC Commerce*

History has shown that dramatic changes in emissions standards materially drive costs up. That creates an economic "perfect storm" whereby customers either pre-buy trucks or defer the purchase of new vehicles entirely. Both effectively circumvent the objective of getting new technology on the road. More important, both are highly detrimental to efforts to preserve and grow employment in North Carolina. In other words, there will be a dramatic loss of jobs in

North Carolina (and in America) if the proposed rule by EPA is adopted as written. [EPA-HQ-OAR-2019-0055-1434]

Organization: *North Carolina Assembly House of Representatives, John Faircloth*

We need to avoid an economic “perfect storm” whereby customers either pre-buy trucks or defer the purchase of new vehicles entirely. Both effectively circumvent the objective of getting new technology on the road. More important, both are highly detrimental to efforts to preserve and grow employment. In other words, there will be a dramatic loss of jobs in North Carolina (and in America) if the proposed rule by EPA is adopted as written. [EPA-HQ-OAR-2019-0055-2446, p. 2]

Organization: *North Carolina General Assembly, Philip E. Berger*

History has shown that dramatic changes in emissions standards materially drive costs up. That creates an economic "perfect storm" whereby customers either pre-buy trucks or defer the purchase of new vehicles entirely. Both effectively circumvent the objective of getting new technology on the road. More important, both are highly detrimental to efforts to preserve and grow employment. In other words, there will be a dramatic loss of jobs in North Carolina (and in America) if the proposed rule by EPA is adopted as written. [EPA-HQ-OAR-2019-0055-1105-A1, p. 2]

Organization: *North Carolina House of Representatives, Office of the Speaker, Tim Moore*

History has shown that dramatic changes in emissions standards materially drive costs up. That creates an economic "perfect storm" whereby customers either pre-buy trucks or defer the purchase of new vehicles entirely. Both effectively circumvent the objective of getting new technology on the road. More important, both are highly detrimental to effo1ts to preserve and grow employment. In other words, there will be a dramatic loss of jobs in North Carolina (and in America) if the proposed rule by EPA is adopted as written. [EPA-HQ-OAR-2019-0055-1146-A1, p. 2]

Organization: *North Carolina State House of Representatives, Larry W. Potts*

We need to avoid an economic "perfect storm" whereby customers either pre-buy trucks or defer the purchase of new vehicles entirely. Both effectively circumvent the objective of getting new technology on the road. More important, both are highly detrimental to efforts to preserve and grow employment. In other words, there will be a dramatic loss of jobs in North Carolina (and in America) if the proposed rule by EPA is adopted as written. [EPA-HQ-OAR-2019-0055-1061-A1, p. 2]

Organization: *NTEA - The Association for the Work Truck Industry*

In response to the Environmental Protection Agency’s (EPA) proposed rule (Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards) published in the March 28, 2022 Federal Register, NTEA – The Association for the Work Truck Industry submits the following comments expressing our concern that the costs associated with these proposed changes would delay the introduction of newer and cleaner trucks and be counterproductive to the goal of decreasing truck emissions. [EPA-HQ-OAR-2019-0055-1164-A1, p. 1]

The EPA proposal would significantly increase the purchase price of a new truck. As indicated, today's trucks that are already 98% cleaner than older trucks. Currently, more than 50% of the trucks operating are pre-2010. An old (pre-2010) truck emits some 30 times more NOx than today's engines. EPA should be incentivizing the sale of current trucks not making them more expensive and creating a disincentive to the replacement of old trucks. [EPA-HQ-OAR-2019-0055-1164-A1, p. 3]

The federal government levies a 12% excise tax on the retail sale of new heavy-duty trucks. This tax would apply to any additional costs associated with compliance to the proposed EPA rules. Placing an additional tax burden on what are primarily domestically manufactured trucks will only serve to disincentivize their sale. The best way to reduce emissions is to incentivize the replacement of the oldest trucks on the road. Making new trucks more expensive – possibly by $40,000 – will guarantee keeping old trucks on the road longer than is healthy for both the environment and the economy. [EPA-HQ-OAR-2019-0055-1164-A1, p. 3]

EPA's proposal would require manufacturers to develop new technology for further NOx reduction at the same time as these manufacturers are trying to develop zero emission advanced fuel trucks like EV's. [EPA-HQ-OAR-2019-0055-1164-A1, p. 3]

Promulgating regulations that would significantly increase the cost of replacing older, less environmentally friendly trucks while forcing manufacturers to divert critical R&D resources away from further development of zero-emissions technology trucks seems counterproductive. [EPA-HQ-OAR-2019-0055-1164-A1, p. 3]

Many localities that face significant air quality concerns are in and around areas of heavy truck traffic, such as ports, warehouses, terminals and urban areas. Because of the economic challenges in many of these places the trucks operating locally are often older. As mentioned, pre-2010 trucks emit significantly more tailpipe emissions than newer trucks. The best and fastest way to improve air quality in these areas is to replace the numerous older trucks with newer and cleaner ones. Unfortunately, regulations that make trucks marginally cleaner but dramatically more expensive than post 2010 trucks will only serve to keep those older trucks in operation longer. [EPA-HQ-OAR-2019-0055-1164-A1, pp. 3 - 4]

What is needed from these regulations are trucks that are affordable, durable and meet the customer's vocational needs. The regulations must not act as a financial barrier to cleaner trucks and ultimately ZEV's. Rather, federal regulations should focus on reducing the current high costs associated with ZEV's and building the infrastructure needed to operate the next generation of work trucks. [EPA-HQ-OAR-2019-0055-1164-A1, p. 4]

EPA has the opportunity to issue a single, nationwide rule that is both reasonable and reduces emissions while allowing manufacturers to continue developing the future of ZEV's. Issuing a rule that is technologically infeasible and increases acquisition costs such that it forces fleets to delay the turnover of their oldest trucks will not help the environment. [EPA-HQ-OAR-2019-0055-1164-A1, p. 4]

Organization: *State Trucker Associations (2)*

As EPA develops the final rule on tailpipe emissions from heavy-duty trucks as part of the "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards", we file these comments in support of a single national low-NOx rule that is technologically feasible, protects American jobs, and is not disruptive to the nation's economy or supply chains. An approach such as Option 1 that cannot be achieved by all classes of trucks under widely varied business models will cause significant uncertainty among fleets and will result in purchasing new trucks before new standards are implemented. This pre-buy/low-buy/no-buy scenario would jeopardize thousands of good paying jobs and slow environmental success. To be effective, the final rule must result in new trucks that are:

Affordable - If trucking companies choose not to purchase new trucks due to cost or reliability concerns, older trucks will stay on the road longer and environmental goals will not be achieved; [EPA-HQ-OAR-2019-0055-1039-A1, p.2]

Durable - New, more expensive trucks are not purchased to sit in repair bays. Trucks are unproductive pieces of equipment unless they are moving freight; [EPA-HQ-OAR-2019-0055-1039-A1, p.2]

Safe - Safety is a top priority in every trucking operation. Putting off the purchase of the newest equipment will delay the use of the latest safety technologies; and [EPA-HQ-OAR-2019-0055-1039-A1, p.2]

Cleaner - An unworkable rule will delay fleet turnover and impede environmental progress. [EPA-HQ-OAR-2019-0055-1039-A1, p.2]

Fleets don't make trucks - they are consumers that buy trucks. While this rule is directed at manufacturers, it is trucking companies buying new technologies that determine the success or failure in the implementation of every trucking emission regulation. Fleets remain extremely sensitive to the many difficulties involved in running a trucking company - a matter that is especially significant to the 97% of fleets classified as small businesses. [EPA-HQ-OAR-2019-0055-1039-A1, p.2]

[Additional comment by one commenter who joined this mail campaign]: We believe it is equally important to look for solutions that will not jeopardize American jobs too. … Running a trucking operation is extremely difficult and challenging, but trucks are the backbone of our economy and impact every American every single day. Now more than ever, it is incumbent that all the stakeholders work together to find solutions that can and will work for everyone. [EPA-HQ-OAR-2019-0055-1089]

[Additional comment by one commenter who joined this mail campaign]: RITA [Rhode Island Trucking Association, Inc.], whose members move roughly 90% of the state's fright (sic), is comprised primarily of small businesses who operate trucks to perpetuate their businesses. The aforementioned factors are critical to their sustainability and survival, [EPA-HQ-OAR-2019-0025-2051]

Organization: *Truck Renting and Leasing Association (TRALA)*

As we have seen in years past, significant environmental rules tied to a specific model year have led to large pre-buys in the years preceding the adoption of new rules. Pre-buys have led to a boom-and-bust market, as customers do not want to pay for the increased cost and new maintenance requirements associated with the newer environmental regulations. Given the significant increases in purchase costs and operating costs expected from Option 1, TRALA believes that Option 1 will trigger significant pre-buys that could strain the new truck market. This could dramatically hinder the ability of its members to acquire new trucks in the years preceding the new rule, harming small businesses who need new trucks to operate or expand their business. For these reasons TRALA urges the EPA to reject Option 1. [EPA-HQ-OAR-2019-0055-1180-A1, p. 3]

Organization: *United Motorcoach Association (UMA)*

Additionally, buses and motorcoaches significantly reduce emissions by removing private passenger automobiles. Consumers that cannot afford the inevitable fare and charter cost increases will select less efficient means of travel, counterproductive to EPA's goals of reducing overall emissions. [EPA-HQ-OAR-2019-0055-1311-A1, p.2]

Another consideration is the general havoc mandated by the earlier rounds of NOx emissions reductions. [EPA-HQ-OAR-2019-0055-1311-A1, p.2]

Organization: *Worldwide Equipment Enterprises, Inc.*

Secondly, this regulation, like most others, burdens both small businesses and small trucking operations with much higher costs. That additional burden and cost will, therefore, simply keep fleet and individual truck owners from upgrading their existing heavy-duty trucks to the newer, more efficient and environmentally friendly engines and systems that were mandated back in 2014. In fact, this regulation, regardless of which Option is implemented, would have a negative environmental impact because those cost increases would effectively incentivize a truck owner to keep a dirty pre-2014 truck on the road for much longer than would otherwise be the case. [EPA-HQ-OAR-2019-0055-1275-A1, pp.1-2]

Organization: *Retail Industry Leaders Association (RILA)*

EPA should therefore build consensus with market participants in identifying a balance that maintains strong emissions standards over a reasonable length of time for these engines without inducing an overly burdensome cost-increase to owners and operators of vehicles that use heavy-duty engines. Such increases in vehicle price could be especially challenging to owners of smaller fleets, whose operations might be less resilient to significant unanticipated rises in vehicle prices. Furthermore, although EPA acknowledges the potential issues related to reduced fleet-turnover counteracting the intended reduction of pollutants in Section 10.1.3 of its regulatory impact analysis (RIA) for this proposed rule, the Agency also admits that it has not performed analyses to quantify the impacts of such issues. EPA is therefore encouraged to investigate such impacts and incorporate updated findings into its economic impact analysis. [EPA-HQ-OAR-2019-0055-1189-A2, p.4]

EPA Summary and Response

Summary:

Commenters stated EPA underestimated costs and that the technology needed might not be feasible. Commenters stated that the rule will lead to slower reductions in emissions than estimated, and lead to additional tax burden. Some commenters state that we do not fully capture effects on the motorcoach industry.

Response:

Commenters stated that EPA's estimated costs in the proposed rule were too low, and that the price of HD trucks would increase significantly under the proposed regulation. ABA stated that costs to make and maintain the technology needed might not be feasible. AFBF and RILA stated that EPA does not qualitatively explore the sales and emissions effects of potentially underestimating costs. Commenters stated that the increased cost due to the regulation would lead to pre- and low-buy, reduced fleet turnover and associated slower reductions in emissions. NTEA stated that that the proposed rule would lead to higher purchase price of a new truck, which disincentivizes replacement of older, less environmentally friendly trucks, and the increased costs will lead to additional tax burden. NTEA also states that the proposal would require the development of new technology, diverting critical R&D resources away from further development of zero-emission technology. Some commenters, including TRALA, RILA and State Trucker Associations, stated that small business fleets are particularly sensitive to increased prices, with RILA stating that small fleets are less resilient to increases in vehicle prices and ABA stating that the increased costs could force companies out of business. Some commenters stated that pre- and low-buy, and associated reduced fleet turnover, will affect safety due to older vehicles remaining on the road longer.

See our responses to similar comments in section 25.2 of this document. We note that, besides the survey information responded to below, the commenters in this subsection additionally did not provide data or other information to support their assertions. With respect to NTEA's comments about additional tax burden, see our response to similar comments in section 25.2 of this document. With respect to comments about fleet turnover and the impact on zero-emission vehicles, see our response to similar comments in section 25.2 of this document. We note that the safety concerns related to fleet turnover raised by commenters were not safety concerns related to the technology that may be applied beginning in MY 2027 to meet the new emission standards, but rather concerns related to older vehicles remaining on the road longer. We estimate little to no pre-buy and low-buy due to this rule, as further explained in section 25.2 of this document and other documents referenced in our responses there; therefore, we do not expect fleet turnover to impact HD vehicle safety.

TRALA stated that previous rules led to large pre-buy, and, along with Engine and Truck Organizations, that proposed Option 1 will lead to significant uncertainty and pre-buy.

In the EPA study, we find no evidence for pre-buy in Class 8 vehicles ahead of the 2002 implementation. The EPA sales impacts report does find evidence of pre-buy in Class 8 vehicles before the phase in of the 2007/2010 HD rule implementation in 2007 and 2010, though we disagree that there is evidence of "large" pre-buy. There were external factors affecting the market, and economy as a whole, in the lead up to the 2007, especially, and attributing all, or even most, of the decline between 2005 and 2009 to the 2007 HD regulation is not appropriate. See our responses in section 25.2 of this document as well.

ABA, Coach, and UMA stated that EPA costs do not fully capture the cost and economic impact on the motorcoach industry, and these costs will lead to motorcoach operators delaying purchases of new vehicles as long as possible. Commenters also stated that increased costs will lead to increased fares which will lead consumers to choose less efficient means of personal travel, like personal vehicles.

EPA has not conducted an analysis in this rule of the effects on individual sectors such as the bus or motorcoach industry, instead analyzing this rule by heavy-duty vehicle groups. See our response to comments in sections 18.6 and 18.9 for more information.

ATA commented on results of a survey of fleet members, stating that 30% of truck buyers would not consider pre-buying, while 54% say that would, depending on the additional price of a new truck. The survey ATA discussed in their comments consisted of 26 responses, the largest group of which (8 responses) reported not being price sensitive. 5 respondents indicated they would consider pre-buying at an additional price of $5,000 or more, and an additional 4 respondents indicated they would start considering pre-buying at an additional price of $10,000 or more. Similar responses to low-buy were seen in the survey results, where the largest group would not consider it. In the final rule, EPA estimates costs of this rule for Class 8 vehicles to be under $5,000. If the survey results ATA provided are representative of national heavy-duty vehicle buyers, they support our estimates of little to no pre- and low-buy as a function of this rule.

AFBF stated that EPA should collaborate with industry, states, and other affected stakeholders to resolve discrepancies related to technology costs and achievability, warranty impacts, fleet turnover, and environmental impacts. EPA conducted extensive stakeholder outreach in this rulemaking. See Preamble Section I and the introduction of this Response to Comments document for information on the extensive stakeholder input EPA received on the proposed rule. Details on meetings with stakeholders and materials shared with EPA post-proposal can be found in the docket for this rulemaking.[68]

[68] For a complete list of stakeholder meetings post-proposal see "U.S. EPA. Stakeholder Meeting Log. November, 2022.", located at docket EPA-HQ-OAR-2019-0055,

Autocar expressed their concern that the combination of the new NOx standards and the sales volume limitations due to the CARB rule will lead to uncertainty in the volume of engines they will be able to purchase from their supplier, Cummins. Autocar commented that this will also adversely affect their business and customers because Cummins will increase the cost of their engines by as much as $4,000 to $5,000 because Cummins cannot bear all of the cost of meeting the new standards. In addition, Autocar stated that, not being vertically integrated, it is at a disadvantage with respect to development and compliance costs.

We acknowledge Autocar’s concerns regarding potential impacts on their company. EPA is acting on our authority under Clean Air Act section 202(a)(3)(A) for this final rule (see our response in section 25.2 for more information). After considering comments on the proposed rule, we have updated our technology costs per vehicle estimates in the final RIA (see RIA Chapter 7).

26 Employment impacts

26.1 Commenters Supporting our Analysis

<u>Comments by Organizations</u>

Organization: *International Union, United Automobile, Aerospace and Agricultural Implement Workers of America (UAW)*

We appreciate the EPA’s willingness to engage with the UAW on heavy-duty and light-duty regulations. It is refreshing that Administrator Regan and his team have made it clear at by their actions that workers have a seat at the table on regulatory matters that have a direct impact on their jobs both now and in the future. The final regulations could have a direct impact on the over 40,000 UAW members working at manufacturing plants building medium and heavy-duty trucks, vocational trucks, commercial vans, school buses and medium and heavy-duty pickup vehicles and parts. Our heavy truck members work in communities throughout the country for major truck manufacturers at assembly, engine, and component manufacturing facilities. UAW members are proud to meet our economy’s diverse trucking needs while incorporating technologies to aid in fuel economy and reduce harmful emissions. [EPA-HQ-OAR-2019-0055-1138-A1, p.2]

Whether the heavy truck industry can achieve such ambitious standards and remain globally competitive will depend in large part on additional policies that promote domestic manufacturing and support quality jobs. The Biden Administration has supported consumer incentives that simultaneously encourage manufacturers to build vehicles in the United States that support great union jobs as well as investing in infrastructure and retooling factories for a successful transition. We agreed with the Biden Administration and are disappointed that the Senate has thus far failed to pass legislation that is needed for a successful transition. Whether it is government support for manufacturing investments, production volumes, government procurement, consumer purchases, or workforce development, all policies should be crafted to promote and strengthen the domestic supply chain for traditional and electrified vehicles that are a source of quality union jobs for American workers now and in the future. [EPA-HQ-OAR-2019-0055-1138-A1, p.2]

Balanced regulations should set a feasible path to address the impact of pollutants and position the U.S. truck manufacturing industry to innovate and lead with clean technologies that improve fuel efficiency, reduce emissions, and advance emerging powertrain technologies like battery electric or fuel cells. This, in turn, would strengthen U.S. competitiveness and ensure stability for the thousands of workers and communities benefiting from quality manufacturing jobs. [EPA-HQ-OAR-2019-0055-1138-A1, p.3]

A significant market disruption can have a devastating impact on workers and the economy. Surrounding communities are also negatively impacted by layoffs as families suddenly have less to spend on housing, car payments, groceries, clothes, and other essential and discretionary items. The potential for layoffs is not limited to worker assembly trucks and buses, the impacts would ripple through the network of manufacturing communities that produce components and materials for the medium and heavy-duty truck industry. [EPA-HQ-OAR-2019-0055-1138-A1, p.4]

EPA Summary and Response

Summary:

The commenter above (UAW) stated that the final regulation could have an impact on many UAW workers at manufacturing plants, and that significant market disruption can be devastating for workers. UAW also stated that significant market disruption can lead to potential layoffs that span from those working in assembly plants and rippling through the community. UAW commented that the regulation should feasibly reduce pollution, lead to innovation, improve fuel efficiency, strengthen US competitiveness, and ensure job stability.

Response:

EPA agrees that this regulation might impact employment at vehicle manufacturing plants, and discusses possible impacts qualitatively and quantitatively in Chapter 10 of the RIA. EPA is unable to estimate effects of this regulation on industries outside of the directly regulated HD engine and vehicle manufacturing industries due to lack of data and appropriate methods. As required by CAA 202(a)(3)(A) for the standards in this final rule, we are setting standards that will result in the greatest emissions reductions achievable through the application of technology beginning in model year 2027 after giving appropriate consideration to costs and other statutory factors associated with the application of such technology. See preamble Sections III and V for additional discussion on feasibility and costs of the final standards, and our assessment of the cost impacts of the final program.

26.2 Commenters who Disagree with our Analysis and Provide Data

<u>Comments by Organizations</u>

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

EPA's economic impact analysis is not informed by real world data and, due to fundamental analytical flaws, reflects the Agency's failure to give informed consideration to the likely impacts its Proposed Rule will have on jobs, the cost of goods transportation, the HD transportation market, and the economy more generally. The Agency's analysis of the impacts of the proposed standards on vehicle sales and employment treats these considerations as entirely separate and overlooks the links between the two. Indeed, EPA acknowledges that its employment analysis is divorced from any consideration of how 'demand-effect' impacts of the Proposed Rule will affect firm-level employment, 'due to data limitations.'51 This omission leads EPA to conclude that more costly vehicles and parts will in fact lead to an ***<u>increase</u>*** in manufacturing sector employment, an assertion that ignores how price increases are likely to affect sales and, in turn, the labor market.52 [EPA-HQ-OAR-2019-0055-1168-A1, p.20]

> 51 Proposed Rule, 87 Fed. Reg. at 17,592 (noting that EPA's employment impact analysis is not based upon any projected changes in vehicle sales; rather that EPA's analysis assumes that output would be held 'constant').
>
> 52 Id. (reflecting EPA's projections that increased vehicle and parts costs would be expected to increase employment by 400 to 2,200 job years in 2027 and 300 to 1,800 job years in 2032 under proposed Option 1, and that—for similar reasons—employment would be expected to increase under proposed Option 2 by 400 to 2,200 job years in 2027 and 300 to 1,500 job years in 2032).

Not surprisingly, low-buy years cause the loss of manufacturing jobs. ACT Research reviews the pre-buys that took place in MY 2005 and 2006 ahead of the MY 2007 standards, which precipitated a loss of about 10,000 truck assembly jobs from low-buy in 2007. The 10,000 jobs lost represented a labor decrease of approximately 26% from the previous year, which ACT Research points out is a conservative estimate when compared to the 48% decline in Class 6-8 unit production that took place in 2007. Thus, the 26% reduction in commercial manufacturing jobs may be used to benchmark potential job losses associated with the current Proposed Rule. [EPA-HQ-OAR-2019-0055-1168-A1, p.22]

Organization: *Truck and Engine Manufacturers Association (EMA)*

The market impacts from the expected pre-buy go beyond the number of impacted HD vehicles. Pre-buys also trigger subsequent low-buys or no-buys, which in turn can result in significant layoffs in the vehicle-manufacturing industry and in related market sectors as well. ACT's report analyses and quantifies those reasonably anticipated employment impacts, which, if the Option 1 standards are finalized, would be dramatic. More specifically, and as detailed in the ACT report, the likely layoffs resulting from the pre-buy/low-buy that the costs of the Option 1 requirements will trigger would amount to approximately 220,700 jobs in the aggregate. (See ACT Report, pp. 14-17.) [EPA-HQ-OAR-2019-0055-1203-A1, p. 158]

Organization: *National Association of Chemical Distributors (NACD)*

However, continually adding more aggressive, yet unproven emission requirements to heavy-duty trucks will significantly burden the chemical distribution industry and the American economy as a whole. This is supported by an analysis conducted by NACD economist John Dunham & Associates (JDA), which used the EPA's regulatory impact analysis estimate that calculated the cost of this rule would be between $1.9 and $2.1 billion per year to implement. JDA's economic analysis found that chemical distributors would bear a cost of $429.6 million with a loss of 716 full time equivalent (FTE) jobs in the chemical distribution industry and a loss of over $208 million of economic output if this rule is implemented. When applied to the total economy, this would force a loss of over 3,000 FTE jobs and negative impact of over $675 million of economic output. [EPA-HQ-OAR-2019-0055-1279-A1, p. 2]

EPA Summary and Response

Summary:

Daimler and EMA commented that pre-buy will trigger low-buy, which will lead to significant layoffs in the HD truck industry, pointing out that EPA did not estimate sales effects on employment. These commenters referred to the ACT Research report and the employment analysis discussed within it.

Response:

In response to commenters, EPA has added an illustrative method to estimate a sales effect on employment due to pre- and low-buy in the RIA for the final rule. This method uses an average estimate of job-years per truck produced in the U.S. and focuses on employees in the sectors identified as directly affected by the regulation. Our results indicate that employment effects due to sales effects would be small in magnitude. For more information on methodology and results, see chapter 10 of the RIA.

The ACT Research method referred to by commenters assumes low-buy is an equal but opposite counter to pre-buy. For EPA's response to the assumption that low-buy is equal but opposite to pre-buy, see our responses to the comments in section 25.2. To estimate the effect of low-buy on employment, ACT Research found the change in employment between 2006 and 2007 and divided that by their estimate of pre-buy in 2006 to get an estimate of jobs lost per low-bought truck in 2007. The method used by ACT attributes all changes in employment to low-buy and does not account for any changes that may have occurred in this time frame separate from the 2007/2010 HD rule. This approach by ACT Research thus does not account for factors mentioned in section 25.2 above, like the Federal Reserve increasing interest rates or the official beginning of the Great Recession.

Daimler commented that EPA's analyses are not informed by real world data. For the sales and employment effects estimated in Chapter 10 of the RIA, EPA uses data from many sources, including the Census Bureau, Bureau of Labor Statistics, Wards Automotive Group, Energy Information Administration, Bureau of Economic Analyses and more. In addition, the analyses performed by EPA are informed by peer-reviewed and published literature.

NACD commented that the rule will lead to millions of dollars in cost and economic output to the chemical distribution industry, as well as hundreds of job-years reduced, stating that aggressive, unproven requirements for HD trucks will lead to significant burdens for the chemical distribution industry and the American Economy as a whole. They also commented that there will be thousands of job-years lost to the total economy along with a negative impact of millions of dollars to economic output. In setting the final emission standards, EPA appropriately assessed the statutory factors specified in CAA section 202(a)(3)(A), including giving appropriate consideration to the cost associated with the application of technology EPA determined will be available for the model year the final standards apply (i.e., cost of compliance for the manufacturer associated with the application of such technology). EPA's assessment of the relevant statutory factors in CAA section 202(a)(3)(A) justify the final emission standards.[69] We also evaluated additional factors, including factors to comply with E.O. 12866; our assessment of these factors lends further support to the final rule. EPA acknowledges there are costs to society associated with this final rule; our evaluation of the costs and benefits of the final program concludes that the benefits to society far exceed the costs, as explained in Chapter 9 of the RIA. EPA is unable to estimate the effects of this regulation on industries outside of the directly regulated HD engine and vehicle manufacturing industries due to lack of data and appropriate methods, and we cannot evaluate the NACD estimates because the analysis and data was not provided in the comment.

26.3 Commenters who Disagree with our Analysis

Comments by Organizations

Organization: *Charter Township of Redford*

I have recently learned that your agency has proposed new regulations regarding commercial vehicles emission standards in the U.S. that are intended to reduce emissions by 90%, increase the useful life period by 84%, and increase the emissions warranty period by 500% in 8 ½ years. [EPA-HQ-OAR-2019-0055-1099-A1, p. 1]

While I appreciate your concern for air quality, and your goals to reduce the carbon footprint and safeguard our environment, I fear that such aggressive measures could cripple the commercial vehicle industry, that account for thousands of jobs in my community and many more than that nationwide. [EPA-HQ-OAR-2019-0055-1099-A1, p. 1]

Still suffering the impact of the Covid-19 pandemic, our community has witnessed the closing of many local businesses, an increase in unemployment, a growing number of delinquent tax accounts and water bills, and more and more residents in need of government assistance. This is all too reminiscent of the most recent recession that will already take us another 20 years to fully recover from. The last thing we need right now, is another impediment to employment. [EPA-HQ-OAR-2019-0055-1099-A1, p. 1]

[69] For information on the numeric level and feasibility of standards of the final rule see preamble Section III.

I am NOT writing you today to suggest that you abandon your mission to protect the environment, as I respect and appreciate those efforts very much. I encourage you only to take a more balanced approach in doing so. Give industry the time it needs to retool and adjust, so more jobs aren't lost and more families and communities aren't decimated in the process. [EPA-HQ-OAR-2019-0055-1099-A1, p. 1]

Organization: *American Trucking Associations (ATA)*

ATA has established 12 fleet Guiding Principles that should be considered in the development of HD2027 including:

• Standards should be based upon sound science and account for economic and employment impacts on fleet operators, manufacturers, and suppliers. [EPA-HQ-OAR-2019-0055-1326-A1, p. 5]

Organization: *Engine and Truck Organizations*

Based on our assessment, EPA's "Option 1" rule as proposed will be:

- Bad for jobs. As was caused by previous EPA NOx rules, we anticipate a pre-buy/no buy scenario, that could result in dramatic job losses for our employees. [EPA-HQ-OAR-2019-0055-1177-A1, p.1]

Organization: *Institute for Policy Integrity at New York University School of Law (Policy Integrity)*

EPA should clarify that any employment impacts from the Proposed Rule are likely small and short-lived. EPA should quantify upstream and downstream employment effects, and if it cannot, the agency should at a minimum identify the direction and magnitude of total net employment effects. [EPA-HQ-OAR-2019-0055-1256-A1, p. 2]

Ideally, EPA should quantitatively measure employment effects. Currently, EPA addresses employment effects qualitatively except for the cost effect, as discussed below. If EPA continues to address employment qualitatively, it should at least attempt to give an idea of the direction of the employment impacts and its relative size. [EPA-HQ-OAR-2019-0055-1256-A1, p. 24]

EPA discusses total employment impacts in the manufacturing sector qualitatively, indicating that the impact of the regulation on employment could be positive or negative.132 [EPA-HQ-OAR-2019-0055-1256-A1, p. 25]

> 132. Id. at 420.
>
> But EPA does conduct a quantitative analysis of the cost effect, i.e., the increased employment analysis necessary to adopt technologies needed for trucks to meet the standards.133 For these employment effects, it uses the ratio of workers to production cost for all vehicle manufacturing to imprecisely infer the specific ratio for production

processes related to emission reductions compliance activities in the heavy-duty sector.134 [EPA-HQ-OAR-2019-0055-1256-A1, p. 25]

133. Id. at 425.

134. Id. at 421-22.

Qualitatively, EPA accounts for two additional impacts on employment in the manufacturing sector: the demand effect, i.e., changes in demand for labor in the manufacturing sector due to changes in sales, and the factor-shift effects, i.e., the employment changes due to changes in labor intensity of production resulting from changes in the production process and compliance activities.135 EPA predicts the demand effect to be negative, but since EPA also predicts that the sales impact will be small and indistinguishable from zero,136 this employment effect should also be small and indistinguishable from zero.137 In contrast, EPA cannot even determine the direction of the factor-shift effect on manufacturing employment.138 [EPA-HQ-OAR-2019-0055-1256-A1, p. 25]

135. Id. at 420.

136. See section V.C, supra.

137. EPA misleadingly states that “a demand effect caused by higher production costs raising market prices. Higher prices reduce consumption (and production) reducing demand for labor within the regulated industry.” DRIA at 419. However, this statement ignores the opposing effect of quality improvements later recognized in Section 10.2.2.1. In fact, based on EPA’s own analysis, the net impact on sales is unclear and currently indistinguishable from zero.

138. DRIA, supra note 41, at 420.

Overall, the direction of overall employment effect on manufacturing is unclear. Even so, EPA should attempt to qualitatively determine whether the overall net effect on employment is likely to be small or large, as the former seems more likely due to the small sales effect and the overall unclear direction on manufacturing employment. [EPA-HQ-OAR-2019-0055-1256-A1, p. 25]

In addition, EPA also needs to qualitatively assess the impact of the Proposed Rule on downstream employment. For consumers of heavy-duty trucks (i.e., truckers and trucking companies), the impact is again unclear due to the opposing effects of the cost increase and the presumptive improvement in vehicle quality that leads to the small and essentially zero sales effect.139 A similar logic applies to middlemen, such as dealers and service providers, because the sales effect is likely to be small and indistinguishable from zero. Furthermore, the counter-veiling impacts on competing sources of transportation such as rail and air that would result from any negative impact is a further reason that employment impacts downstream should be small and indistinguishable from zero. We again recommend that EPA discuss the potential magnitude of this impact, particularly given its statement that the agency does not expect transportation mode shifts, again clarifying that the evidence does not support an impact different than zero.140 [EPA-HQ-OAR-2019-0055-1256-A1, pp. 25 - 26]

139. Id. at 426.

140. Id. at 416.

Finally, EPA's analysis fails to discuss the upstream employment impacts of the Proposed Rule. Specifically, it should discuss the impact on the upstream sectors, such as steel or electronic producers.141 As with downstream employment impacts, because the overall impact of vehicle sales is potentially small and close to zero, the impact on upstream employment is again likely small. [EPA-HQ-OAR-2019-0055-1256-A1, p. 26]

141. Id. at 421.

Given the interest in employment effects, EPA should attempt to measure the employment effects quantitively. However, if this is not possible, EPA should at least attempt to qualitatively assess the direction and magnitude of the employment effects. Based on the above assessment, the direction of the employment effect is unclear and likely to be relatively small, though the existing evidence points to a small impact that is either zero or slightly positive. [EPA-HQ-OAR-2019-0055-1256-A1, p. 26]

Organization: *International Union, United Automobile, Aerospace & International Union, United Automobile, Aerospace & Agricultural Implement Workers of America - UAW Region 1A*

To be effective, the final rule must be: Economically viable. If the final rule results in higher costs for manufacturers and fleet owners, manufacturers and small business owners may have no choice but to lay off workers and eliminate jobs. [EPA-HQ-OAR-2019-0055-1062-A1, pp.1-2]

History has shown that dramatic changes in emissions standards materially drive costs up. That creates an economic perfect storm whereby customers either pre-buy trucks or defer the purchase of new vehicles entirely. Both effectively circumvent the objective of getting new technology on the road. More important, both are highly detrimental to efforts to preserve and grow employment. Bottom line: **there will be a dramatic loss of jobs in Michigan (and in America) if the proposed rule by EPA is adopted as written.** [EPA-HQ-OAR-2019-0055-1062-A1, p.2]

Organization: *NC Commerce*

History has shown that dramatic changes in emissions standards materially drive costs up. That creates an economic "perfect storm" whereby customers either pre-buy trucks or defer the purchase of new vehicles entirely. Both effectively circumvent the objective of getting new technology on the road. More important, both are highly detrimental to efforts to preserve and grow employment in North Carolina. In other words, there will be a dramatic loss of jobs in North Carolina (and in America) if the proposed rule by EPA is adopted as written. [EPA-HQ-OAR-2019-0055-1434]

Organization: *U.S. Chamber of Commerce*

The Chamber's America Works Data Center has documented the ongoing worker shortage crisis in detail.8 More than 3 million people have left the workforce since the beginning of the COVID pandemic, and we now have nearly 11.5 million job openings with only 5.9 million unemployed workers. Truck drivers are no exception; the American Trucking Association estimates that the driver shortage has reached an all-time high of 80,000 unfilled jobs.9 These circumstances, combined with EPA's proposal, led United Auto Workers Regional Director Laura Dickerson to warn that the rule will create an economic "perfect storm" resulting in "a dramatic loss of jobs in Michigan and in America if the proposed rule by EPA is adopted as written."10 [EPA-HQ-OAR-2019-0055-1245-A1, p. 4]

> 8. America Works Data Center: https://www.uschamber.com/workforce/america-works-data-center
>
> 9. ATA Driver Shortage Update. Available at https://www.trucking.org/sites/default/files/2021-10/ATA%20Driver%20Shortage%20Report%202021%20Executive%20Summary.FINAL_.pdf
>
> 10. UAW Region 1a comments. Available at https://www.regulations.gov/comment/EPA-HQ-OAR-2019-0055-1062

Accordingly, in light of the ongoing worker shortage crisis, EPA should take extra caution to avoid exacerbating the historic inflation, labor, and supply chain disruptions facing the industry. [EPA-HQ-OAR-2019-0055-1245-A1, p. 4]

Exacerbation of labor shortages. In addition to delayed adoption of safety features, other technological features and amenities found on newer trucks tend to aid in driver recruitment—an important priority due to aforementioned labor shortages. The impact of delayed fleet turnover could therefore become a factor negatively impacting driver recruitment efforts. [EPA-HQ-OAR-2019-0055-1245-A1, pp. 7 - 8]

Organization: *Volvo Group*

Truck sales plummeted in 2007 and 2008 because of the regulation and this behavior led to a reduction in force for Volvo Group UAW-represented production workers in our three truck and engine plants from more than 4600 jobs in 2006 down to only 2300 jobs in June 2008 (before the great recession began) representing a 50% loss of good paying union jobs. These production job losses were not fully recouped until seven years later (i.e., 2014). [EPA-HQ-OAR-2019-0055-1324-A1, p. 4.]

<u>EPA Summary and Response</u>

<u>Summary</u>:

The Engine and Truck Organizations, UAW, NC Commerce and U.S. Chamber of Commerce stated that the proposed rule will lead to a dramatic loss of jobs and reduced fleet turnover. The UAW commented that if the final rule results in higher costs for manufacturers and fleet owners, manufacturers and small business owners may have to lay off workers. The US Chamber of Commerce stated that the EPA should avoid exacerbating historical inflation and the labor and supply chain disruptions facing the industry. The U.S. Chamber of Commerce also stated delayed fleet turnover could negatively impact driver recruitment efforts because the new trucks, and the draw of the technological features and amenities found on them, would not be available to help attract new drivers. Volvo commented that reduced truck sales in 2007 and 2008 were due to EPA regulation, and that they led to job losses in Volvo's UAW-represented production workforce that were not recouped until about 7 years later. Charter Township of Redford stated that the aggressive proposal could lead to many job losses. The commenter pointed out similarities in the effect Covid-19 and the most recent recession had on their community, and stated their hope to avoid another impediment to employment. The commenter asked EPA to take a more balanced approach to the proposed regulation and give the industry time to retool and adjust to prevent job loss. The US Chamber of Commerce stated that the EPA should avoid exacerbating historical inflation and the labor and supply chain disruptions facing the industry. ATA stated that "standards should be based upon sound science and account for economic and employment impacts on fleet operators, manufacturers, and suppliers."

Response:

As required by CAA section 202(a)(3)(A) for the emission standards in this final rule, we are setting technology-forcing standards. In setting the final emission standards, EPA appropriately assessed the statutory factors specified in CAA section 202(a)(3)(A), including giving appropriate consideration to the cost associated with the application of technology EPA determined will be available for the model year the final standards apply (i.e., cost of compliance for the manufacturer associated with the application of such technology). EPA's assessment of the relevant statutory factors in CAA section 202(a)(3)(A) justify the final emission standards. See preamble Sections III and V for additional discussion.

EPA's analyses of the cost effects of this final rule on employment indicate that employment effects are expected to be small, as explained in Chapter 10.2 of the RIA. In the final RIA, we also include an illustrative analysis of the demand effect on employment.[70] These illustrative results also indicate that employment effects are expected to be small. EPA analyses of employment and other economic impacts are transparent, reproducible, and are "based on the best reasonably obtainable scientific, technical, and economic information available," in compliance with OMB Circular A-4.[71] With respect to the commenter's statement that delayed fleet turnover will lead to new negative impacts on driver recruitment efforts, to the extent that this might happen, EPA does not expect significant impacts on fleet turnover. EPA estimates pre- and low-buy would be small in magnitude and short lived, and therefore effects on fleet turnover would be small and short-lived as well. See Chapter 10.1.3 of the RIA for EPA's discussion of

[70] The demand effect on employment analysis added to the final RIA is presented as illustrative because it is based on the illustrative sales analysis discussed in section 25 of this document, as well as in Chapter 10.1 of the RIA.
[71] OMB Circular A-4 (found at https://obamawhitehouse.archives.gov/omb/circulars_a004_a-4/#d) provides guidance to Federal Agencies on the development of regulatory analyses as required under Executive Order 12866.

fleet turnover. In addition, there are factors outside the scope of this rulemaking that could impact driver retention, including job quality, driver pay and driver benefits, and EPA does not have data, and the commenter did not provide data, to support that fleet turnover is a predominant factor in driver retention.

In response to Volvo's assertion of the decrease in sales and associated employment effects in 2007 and 2008, EPA points out that there were external factors affecting the market and the economy as a whole at that time, including the Great Recession which officially began at the end of 2007.[72] Attributing all, or even most, of the decline in sales, and associated employment losses, in those years to the 2007 HD regulation is not appropriate. See also our response regarding similar comments in section 25.2 of this document.

The Institute for Policy Integrity at New York University School of Law (IPI) commented that EPA should clarify that employment impacts are likely small and short lived, as well as quantify, or at least identify the direction and magnitude on total net employment of, the upstream and downstream employment effects. IPI also commented that the statement in the proposal "a demand effect caused by higher production costs raising market prices. Higher prices reduce consumption (and production) reducing demand for labor within the regulated industry" is misleading. The commenter stated that this statement ignores the opposing effect of quality improvements recognized later in the draft RIA, and that the net impact on sales in unclear and indistinguishable from zero. IPI requested that EPA attempt to qualitatively determine if the net employment effect will be small or large. IPI stated that the direction of employment effects is unclear, and likely to be relatively small, pointing out that existing evidence indicates a small impact, ranging from zero to slightly positive.

In RIA Chapter 10.2, we are clear that our employment estimates are only partial employment effects, and that we are uncertain as to the magnitude or direction of full employment effects. In addition, we are unable to estimate upstream or downstream impacts due to data and methodology being unavailable. EPA does not agree with IPI that the draft RIA discussion about how higher prices can lead to reduced labor demand is misleading and ignores the effect of quality improvements. We are clear in the RIA that the demand effect is a result of the change in cost, ignoring other effects, which includes changes in quality. Later in Chapter 10.2 of the RIA, we qualitatively discuss how quality changes might impact employment effects.

26.4 Commenters Providing Information on Employment Effects due to Electrification

Comments by Organizations

Organization: *CALSTART*

CARB's macroeconomic analysis of the ACT found the policy would result in a net increase of over 7,000 jobs in California through 2040 (CARB, 2019a). In an examination of labor requirements associated with manufacturing combustion passenger vehicles compared to a

[72] https://www.nber.org/news/business-cycle-dating-committee-announcement-december-1-2008

similar battery electric vehicle, one study found nearly identical per vehicle labor hours associated with battery electric vehicle manufacturing as combustion vehicles. This finding indicates the commonly held belief that battery electric vehicles are less labor intensive is inaccurate (Küpper, 2020). [EPA-HQ-OAR-2019-0055-1313-A1, p.8]

Organization: *Lion Electric Co. USA Inc. (Lion)*

Lion supports the expected job growth associated with the proposed Options 1 and 2. As Lion grows, we continue to expand our team of change-makers dedicated to transforming the future of transportation. Our Joliet factory will initially provide over 750 clean energy jobs in a field that is in high demand, as states across the U.S. introduce laws to deploy more zero-emission vehicles in the next decade. In the next four years, we expect that this plant will add over 1,400 jobs that will create an abundance of economic opportunities in clean manufacturing for local communities. Lion will directly contribute to reducing unemployment in Joliet, thereby strengthening the local economy. In addition, Lion will continue to create jobs in our nationwide Experience Centers with a focus on hiring locally and training technicians to provide service and support to a variety of clients. These are stable, well-paying positions in a growing industry that will have long-term sustainability as the electric vehicle sector continues to expand. By implementing programs that facilitate the switch to ZEVs, the EPA can help boost projected job growth across OEMs in the field of electrification, while meeting its primary goal of reducing air pollution in the United States. [EPA-HQ-OAR-2019-0055-1151-A2, pp. 3 - 4]

Organization: *Moving Forward Network (MFN)*

Labor and those working in the freight sector (including truckers, equipment operators, warehouse and logistics workers, and others) are essential constituents in the quest for a just transition to a cleaner energy economy, air quality improvements, zero emissions, and climate mitigations. Many workers not only work in industries (such as trucking) that expose them to toxics and impact their health, but they also live in communities disproportionately bearing the burdens of pollution. Regulations to strengthen emission standards as well as further zero emission trucks need to account for more than just the effects of the policy on job growth. Standards should include an economic analysis of the proposed regulation and alternatives as well as include provisions to ensure that these increases in jobs are coupled with labor standards to ensure that workers are benefiting by more than just access but quality of job. [EPA-HQ-OAR-2019-0055-1277-A1, p. 37]

MFN provided a detailed analysis in our Making the Case for Zero-Emission Solutions in Freight151 report on the economic benefits of zero emissions for different labor sectors through the freight transportation system, including manufacturing, maintenance, etc. MFN found that if money and resources were prioritized for the commercial fleet infracture, the job creation alone from direct and indirect work would be at around 30,000 additional jobs by 2037 (Figure 4). This estimate far outweighs the claims that under the current structures of the rule EPA could be affecting jobs. [EPA-HQ-OAR-2019-0055-1277-A1, p. 37]

151. https://www.movingforwardnetwork.com/wp-content/uploads/2021/10/MFN_Making-the-Case_Report_May2021.pdf

A strong ZEV sales requirement coupled with the emission standard has the potential to achieve one of the goals of the Biden administration to develop domestic manufacturing jobs. A new report from SAFE highlights the potential for more than 270,000 jobs “through investment in transportation manufacturing grants and tax incentives” and nearly 154,000 jobs through “incentives that make it cheaper to buy medium and heavy-duty electric vehicles, like trucks and buses.” [EPA-HQ-OAR-2019-0055-1277-A1, p. 37]

Many of the components that make up an MHD internal combustion engine (ICE) vehicle are the same as a ZEV. However, there are key electric drive components that differentiate a ZEV, such as battery packs, electric motor, inverters and converters, along with other electrical parts. These various components, from materials sourcing, to design, to assembly, all make up the long list of sub-segments within the ZEV manufacturing segment of the supply chain. [EPA-HQ-OAR-2019-0055-1277-A1, p. 38]

ERM’s analysis found that a national ACT-style rule combined with a federal NOx standard that aligns with the Heavy-Duty Omnibus rule would generate a 63,000 net increase in jobs and net GDP growth of over $10 billion by 2035.153 Importantly, the average wages for the new jobs created are roughly double the average wages of those replaced. [EPA-HQ-OAR-2019-0055-1277-A1, p. 38]

153. Robo et al. 2022, p. 4.

Organization: *National Coalition for Advanced Transportation (NCAT)*

The growth in the electric vehicle industry has created jobs and will continue to do so. About 10% of the employees in the motor vehicles and component parts sector (including manufacturing, repair and maintenance, and professional services) work on alternative fuel vehicles.40 Component parts manufacturing employs nearly half a million people in jobs that work on increasing fuel economy in the United States.41 The domestic manufacturing of alternative fuels vehicles and hybrids grew from 2018 to 2019 in most technologies, with electric vehicles adding 6,200 manufacturing jobs.42 The jump was even greater in 2020: electric and hybrid electric vehicle employment grew more than 6% from 2019, adding over 12,000 new jobs.43 This was the largest jobs increase of any clean energy category.44 One study found that the electric vehicle industry (defined broadly to include professional services, management, personal services, etc.) in California employed 275,600 people in 2018, and these jobs grew an average of 2.9% per year (2010-2018).45 Securing America’s Future Energy estimates that updating fuel economy standards and sustaining emission reductions over five years will lead to the creation of 60,378 new jobs nationwide.46 [EPA-HQ-OAR-2019-0055-1290-A1, pp. 8 - 9]

40. National Association of State Energy Officials & Energy Futures Initiative, 2020 U.S. Energy & Employment Report (2021) at 148-49, 154, available at https://static1.squarespace.com/static/5a98cf80ec4eb7c5cd928c61/t/5e78b3c756e8367abbd47ab0/1584968660321/USEER+2020+0323.pdf.

41. Id. at 154.

42. Id. at 149.

43. Environmental Entrepreneurs, Clean Jobs America 2021 (2021) at 4, available at https://www.powermag.com/wp-content/uploads/2021/04/e2-2021-clean-jobs-america-report-04-19-2021.pdf.

44. Id.

45. Los Angeles County Economic Development Corporation, Energizing an Ecosystem: The Electric Mobility Revolution in Southern California (Mar. 2020) at 36-37, available at https://laedc.org/2020/03/01/laedc-ev-industry-report/.

46. Securing America's Future Energy, The Commanding Heights of Global Transportation (Mar. 2021) at 6, available at https://2uj256fs8px404p3p2l7nvkd-wpengine.netdna-ssl.com/wpcontent/uploads/2021/03/The-Commanding-Heights-Of-Global-Transportation-Quantifying-The-Employment-Effects.pdf.

Organization: *WE ACT for Environmental Justice*

Moreover, the transition supports employment opportunities economy-wide. The current workforce and communities most affected by disinvestment, climate change and generations of environmental degradation must and deserve to benefit, accessing potential jobs across the electric vehicle supply chain and opportunities to build community wealth. An analysis found that electrifying cars and trucks by 2035 would produce over 2 million jobs.29 Again, this emphasizes the importance of the EPA to create the regulatory conditions to transition to 100% zero-emission medium- and heavy-duty vehicle sales by 2035. As outlined in our Green Jobs Report,30strategic interventions such as workforce development and STEM training are necessary to help displaced workers, people of color, and under- and unemployed residents in disadvantaged communities earn the relevant technical skills to access and retain family-sustaining jobs in the clean energy and electric transportation industry. [EPA-HQ-OAR-2019-0055-1347-A1, p.6]

29 http://www.2035report.com/transportation/wp-content/uploads/2020/05/2035Report2.0-1.pdf?hsCtaTracking=544e8e73-752a-40eeb3a5-90e28d5f2e18%7C81c0077a-d01d-45b9-a338-fcaef78a20e7

30 https://www.weact.org/wp-content/uploads/2020/12/FINAL-2_Green-Jobs-Report_Full-Report-Full-View.pdf

Organization: *Zero Emission Transportation Association (ZETA)*

HDV electrification is also precipitating tremendous job creation. A 2019 study found that in California alone, policies designed to electrify HDVs could generate 1.31 million more job-years than the status-quo policies.10 The charging infrastructure necessary to accommodate this transaction could alone create more than 29,000 jobs across the country.11 [EPA-HQ-OAR-2019-0055-1283-A1, p.3]

10 https://calstart.org/wp-content/uploads/2022/02/ZIO-ZETs-Report_Updated-Final-II.pdf

11 https://secureenergy.org/the-commanding-heights-ofglobal-transportation-quantifying-the-employment-effects/

Relatedly, the transportation industry is also experiencing considerable shortages of available truck drivers, and HDV electrification could ameliorate this crisis. The trucking industry is an estimated 80,000 drivers short, with many long-term employees citing stress as a reason for quitting.12 This trend is expected to worsen by 2030 as the industry struggles to meet the growth in freight demand.13 Drivers consistently report higher satisfaction with the EV driving experience compared to fossil fuel-powered vehicles, however, and trucking is expected to benefit from the same trend. EVs provide a smoother ride with minimal vibrations, less noise pollution, and a high-tech driving experience free from the fumes of diesel exhaust.14 As a result, the health benefits associated with eliminating diesel fume inhalation and improved experience from a quieter drivetrain may reduce healthcare costs and increase driver retention.15 [EPA-HQ-OAR-2019-0055-1283-A1, p.3]

12 https://www.nytimes. com/2021/11/09/us/politics/trucker-shortage-supply-chain.html

13 https://www.trucking.org/news-insights/ata-chiefeconomist-pegs-driver-shortage-historic-high

14 https://www.trucks.com/2021/07/26/electric-trucks-cost-driver-benefits/

15 https://www.c2es.org/wp-content/uploads/2020/02/Insights-On-Electric-Trucks-ForRetailers-And-Trucking-Companies.pdf

EPA Summary and Response

Summary:

Commenters including CALSTART, MFN, NCAT, WE ACT, and ZETA cited published studies indicating that there could be job growth with increasing electric vehicle production. ZETA went on to say that electrification can help reduce truck driver shortages due to the improved experience of driving a HD electric vehicle over driving the ICE counterpart, as well as leading to reduced healthcare costs and increased driver retention. In their comment, Lion supported the expected job growth under the proposed Options 1 and 2, and discussed the clean energy jobs they are planning on introducing over the next decade. Lion stated that by implementing programs that facilitate the switch to ZEVs, EPA can help job growth in the field of electrification, and reduce air pollution. MFN stated that regulations that further zero emission trucks need to account for more than the effects of the policy on job growth, but should include provisions that ensure that growth is paired with labor standards to lead to improvements in both job access and quality. They also stated that many of workers, including those in trucking, work in industries that expose them to pollutants that impact their health, but also live in communities that disproportionately bear the burden of pollution.

Response:

EPA appreciates the information provided on the possible effect that increasing the penetration of electrified vehicles in the heavy-duty market might have on jobs. Since the final standards are not based on projected utilization of ZEV technology, we have not incorporated additional production of ZEV technologies into our assessments of the impacts of the final rule; therefore, these comments are outside the scope of this final rule.[73]

27 This Section is Blank

28 Proposed changes to HD Phase 2 GHG program

28.1 Zero Emission Vehicle (ZEV) Penetration rates for MY 2027, 2028, and 2029

28.1.1 Support Proposed Standards or More Stringent

Comments by Organizations

Organization: *Advanced Engine Systems Institute (AESI)*

AESI supports EPA's decision to revisit the Phase II GHG standards and propose that they be tightened to reflect the pace of electrification. [EPA-HQ-OAR-2019-0055-1281-A1, p. 2]

Organization: *Air Products and Chemicals, Inc. (Air Products)*

While Air Products applauds EPA's regulatory effort to reduce NOx and greenhouse gas emissions from heavy-duty vehicles, we do not believe the proposed regulation goes far enough with respect to zero-emission vehicle (ZEV) technologies in light of truck manufacturer developments and the number of states adopting the California Advanced Clean Truck (ACT) regulations, which stipulate an implementation schedule for the introduction of ZEV trucks – including both hydrogen fuel cell electric vehicles (FCEV) and battery electric vehicles (BEV) – into the commercial market. [EPA-HQ-OAR-2019-0055-1166-A1, p. 1]

[73] See preamble Section III for discussion on the technology pathway we evaluated for complying with the final standards. Manufacturers may choose to comply with the standards through using other technologies, including ZEV technologies.

The scientific community agrees that hydrogen must play an important role in decarbonizing heavy-duty transportation, because of its unique ability to deliver the performance characteristics needed for this class of vehicles. Heavy-duty FCEVs are exceeding heavy-duty battery electric vehicle performance, including faster refuel times, longer range, and larger payloads, while performing better in extreme climate conditions. Without hydrogen powered fuel cell drive trains, the supply logistics of many of these markets will have to change considerably. Hydrogen as a transportation fuel most closely mirrors the traditional transportation fuel experience and when deployed at scale, hydrogen FCEVs provide cost savings on a total cost of ownership basis for most single vehicles and fleet applications. [EPA-HQ-OAR-2019-0055-1166-A1, p. 2]

The last few years have seen considerable commercial development in fuel cell transportation and hydrogen fueling. Today, over 13,000 light-duty fuel cell electric consumer vehicles have been sold in California, accompanied by dozens of fuel cell electric buses in revenue service across the country, and a growing deployment of medium- and heavy-duty vehicles for long-haul transport and delivery services, including customers like DHL, UPS, and FedEx. [EPA-HQ-OAR-2019-0055-1166-A1, p. 2]

The Biden Administration in 2021 established significant goals to reduce greenhouse gas emissions from the transportation sector to address global warming. These include the January 2021 Executive Order which initiated a Federal Clean Vehicle Procurement Strategy that directed federal officials to develop plans to convert all federal fleets to zero emission vehicles, including Postal Service vehicles. President Biden's American Jobs Plan includes $15 billion to fund deployment of a national network of 500,000 public chargers for electric vehicles by 2030. In further support of the deployment of zero emission vehicles nationwide, US DOT announced in April 2021 its latest round of Alternative Fuel Corridor designations established by the FAST Act of 2015. This program recognizes highway segments that have infrastructure plans to enable travel on alternative fuels, including hydrogen. Cumulative designations for all fuel types (electric, hydrogen, propane, natural gas) include 134 Interstates and 125 US highways/State roads, covering almost 166,000 miles of the NHS in 49 States plus DC. [EPA-HQ-OAR-2019-0055-1166-A1, p. 2]

The initiatives above are in addition to the bold initiatives of California and New York to eliminate sales of internal combustion engine vehicles starting in 2035 for all classes of on-road vehicles. California's light-duty ZEV program is also currently being implemented in 15 other states. In addition, the Advanced Clean Truck (ACT) regulations adopted by California and several other states focus on requiring manufacturers to supply increasing numbers of M/HD ZEVs to the market, including hydrogen FCEVs. Moreover, President Biden signed an executive order in August 2021 setting the goal of 50 percent of all new vehicle sales for light, medium and heavy-duty vehicles be zero emission vehicles in 2030. This action was supported by announcements from GM and Ford of their plans to sell 40 percent to 50 percent zero-emissions vehicles by 2030. GM has said it will sell only electric vehicles by 2035. [EPA-HQ-OAR-2019-0055-1166-A1, p. 2]

As the White House American Jobs Plan May 2021 statement urged, "now is the…time for long-term transformative investments." Instead, the proposed update to the EPA heavy-duty engine standards regulation supports a slow walk to zero-emission vehicles, allowing new low emission, internal combustion engine vehicles to remain acceptable through 2030. Zero emission vehicles simplify or eliminate many of the current and proposed EPA regulations related to controlling emissions under a broad range of engine operating conditions and maintaining emission control over a greater portion of an engine's operational life. With zero emission vehicles, the EPA no longer needs to police vehicle exemptions and deterioration of vehicle life-time performance, and non-compliance resulting from non-certified engines that are introduced into the market can be eliminated. [EPA-HQ-OAR-2019-0055-1166-A1, pp. 2 - 3]

In recognition of the rapidly expanding adoption of zero-emission vehicle requirements across the country and the potential regulatory program enforcement benefits associated with their introduction, Air Products strongly recommends that the US EPA accelerate the deployment of zero emission vehicles, including fuel cell electric vehicles, and more closely align its proposed regulation with the ZEV goals initiated by the Biden Administration and heavy-duty ZEV regulations being adopted by California and other individual states across the country. [EPA-HQ-OAR-2019-0055-1166-A1, p. 3]

Given our global experience in these areas, Air Products been a resource for policy development in many leading jurisdictions. We look forward to greater coordination and collaboration with US EPA and other federal agencies on hydrogen fuel cell vehicle infrastructure deployment going forward. [EPA-HQ-OAR-2019-0055-1166-A1, p. 3]

Organization: *American Council for an Energy Efficient Economy (ACEEE)*

In the original Phase 2 rulemaking EPA projected no EV sales and noted that the model year (MY) 2027 standards were achievable with improvements in internal combustion vehicle (ICV) technology alone. However, EV sales and developments in EV technology have grown rapidly since the rule was adopted and these changes have the potential to significantly decrease the GHG benefit of the rule, by allowing ICVs to lag in performance, or even backslide. Thus, EPA should increase rule stringency to deliver at least the same improvements in ICVs as the original rule expected to deliver, while considering the emissions reduction benefits of an increase in EV market share. Increasing the stringency of the proposed rule by the expected EV market share will not only prevent unnecessary losses in GHG reductions but also preserve manufacturer freedom to choose between ICV improvements or even faster electrification to comply with the rules. [EPA-HQ-OAR-2019-0055-2852-A1, p.2]

In the proposed rulemaking EPA projects that EVs will reach 1.5% of the combined vocational and day cab markets in 2027 (p.17601)1. This projection is based upon heavy-duty sales data that shows that California accounts for 3.1% of the national HDV market2 (p17600-17601), Advanced Clean Truck (ACT) rule requirements and assumptions on California's share of the total EV market ix (p.17601). [EPA-HQ-OAR-2019-0055-2852-A1, p.3]

1 All page numbers refer to this rules NPRM, unless otherwise noted.
2 As discussed further below, however, we find this to be an implausibly low market share for California.

ix Ben Sharpe and Claire Buysse, 'Zero-Emission Bus and Truck Market in the United States and Canada: A 2020 Update' (ICCT, May 21, 2021), https://theicct.org/publication/zero-emission-bus-and-truck-market-in-the-united-states-and-canada-a-2020-update/.

The adoption of the ACT rule in additional states will have a significant effect on the heavy-duty EV market. To date this rule has been adopted by 6 states *x* and is in the process of being adopted in Connecticut *xi*. Based on EPA's California sales projection and these states' own analyses of the ACT rule, ACEEE estimates that the states that have already adopted the ACT represent at least 6% of the HDV sales market (see Appendix A). [EPA-HQ-OAR-2019-0055-2852-A1, p.3]

> x State of Oregon, 'DQC Approves Clean Trucks Rule, a Significant Move toward Fighting Climate Change and Protecting Human Health,' State of Oregon Newsroom, November 17, 2021, https://www.oregon.gov/newsroom/Pages/NewsDetail.aspx?newsid=64571; Department of Ecology, 'WAC 173-423-400,' Washington State Department of Ecology, November 29, 2021, https://ecology.wa.gov/Regulations-Permits/Laws-rules-rulemaking/Rulemaking/WAC-173-423-400; Edmund Coletta, 'MassDEP Files New Regulations to Reduce Emissions, Advance Market for Clean Trucks in the Commonwealth | Mass.Gov,' December 30, 2021, https://www.mass.gov/news/massdep-files-new-regulations-to-reduce-emissions-advance-market-for-clean-trucks-in-the-commonwealth; Lawrence Hajna and Caryn Shinske, 'NJDEP - News Release 21/P043 - DEP Commissioner LaTourette Announces Adoption of Clean Truck Rules, Setting New Jersey on Path for Zero-Emission Vehicle Future,' Department of Environmental Protection, accessed May 4, 2022, https://www.nj.gov/dep/newsrel/2021/21_0043.htm; NY Press Office, 'Governor Hochul Announces Adoption of Regulation to Transition to Zero-Emission Trucks,' New York State, December 30, 2021, https://www.governor.ny.gov/news/governor-hochul-announces-adoption-regulation-transition-zero-emission-trucks.
>
> xi 'AN ACT CONCERNING EMISSIONS STANDARDS FOR MEDIUM AND HEAVY-DUTY VEHICLES,' Pub. L. No. Bill No. 931 (2021), https://www.cga.ct.gov/2021/fc/pdf/2021SB-00931-R000218-FC.PDF.

Given these market shares, ACEEE estimates that required EV sales in the states that have already adopted the ACT will account for at least 1% of all HDV sales nationally in MY 2027. Additionally, as the NPRM analysis rightly anticipates (p.17601), the ACT rule will also spur EV sales outside of ACT adopting states, albeit at a slower rate. Assuming that EV sales share in non-ACT states is at least 15% of that of ACT states, EV sales will be 3.5% nationally at a bare minimum in MY 2027. The 1.5% EV sales share in the NPRM underestimates the EV market share by more than a factor of 2 and, therefore, fails to take advantage of the emissions reductions made possible by growing EV sales, potentially allowing ICVs to improve at a slower rate than intended under the Phase 2 standards. [EPA-HQ-OAR-2019-0055-2852-A1, p.3]

EPA requests comment on additional increases in stringency for 2028 and 2029, correctly noting (17419) that there is information to support higher HDV EV share in those years. ACT requirements will increase to 40% for class 4-6 vocational vehicles, and 25% for class 2b-3 and all class 7-8 vehicles, in MY 2029 *xii*, and consequently the EV share in ACT states will account for 3% of the HDV market by MY 2029. Continuing to increase stringency through MY 2029 is vital to setting the stage for the next round of rule making, especially given the rapid growth in EVs that is expected in these years. Neglecting to increase stringency during these years would lower the baseline for standards in MY 2030 and lead to a growth in credits that would hinder the adoption of appropriately stringent standards. ACEEE projects national EV sales in MY 2029 of no less than 6.5%. Estimated nationwide EV sales are summarized in Table 1. [EPA-HQ-OAR-2019-0055-2852-A1, p.4]

> xii CARB, 'Advanced Clean Trucks Fact Sheet',' California Air Resources Board, June 25, 2020, https://ww2.arb.ca.gov/resources/fact-sheets/advanced-clean-trucks-fact-sheet.

Importantly, California's projected 3.1% share of national heavy-duty sales in 2027 shown in the EPA proposal (p. 17600) is surprisingly small. California HDV registrations accounted for 10% of national tractor registrations in 2020 *xiii*. We understand that California's share of HDV sales does in fact trail registration share, but the disparity shown in the NPRM figures is very large. Furthermore, the dollar value of medium- and heavy-duty vehicle sales in California was 6.9% of the national total in 2021 *xiv*. Given that California EV sales were calculated as a fixed (ACT-mandated) percentage of all heavy-duty sales in California, low heavy-duty sales projections would result in an underestimate of EV sales. This concern is compounded by the fact that several ACT states scaled their sales to California's reported sales based on truck VMT. Using the states' calculations from their rule adoptions as discussed above leads to the conclusion that the non-California ACT states account for about 3.5% of the HD market, when one would expect them instead to account for 12% based on statistics such as registrations *xv*. Given that the NPRM's own analysis of EV sales is based upon scaling California's projected sales to its share of EV registrations (p.17601), it is worth noting that only looking at registrations would instead lead to nationwide EV sales of 5% in MY 2027. [EPA-HQ-OAR-2019-0055-2852-A1, p.4]

> xiii US DOT, 'Table MV-9 - Highway Statistics 2019 - Policy | Federal Highway Administration,' Federal Highway Administration, November 2020, 9, https://www.fhwa.dot.gov/policyinformation/statistics/2019/mv9.cfm.
>
> xiv ATD, 'ATD Data 2021' (American Truck Dealers, 2022), https://www.nada.org/WorkArea/DownloadAsset.aspx?id=21474861283.
>
> xv US DOT, 'Table MV-9 - Highway Statistics 2019 - Policy | Federal Highway Administration,' 9.

California is also in the process of adopting the Advanced Clean Fleets (ACF) rule, which will enforce a Zero-Emission Vehicle (ZEV) mandate on fleets operating in the state *xvi*. This rule will create a ZEV mandate for many new vehicle registrations, preventing non-compliant out of state vehicles from being registered in California. This will likely bring California's share of sales closer to its share of registrations and affect the projection of EVs as a percentage of the national heavy-duty market in 2027. Thus, it is crucial that EPA base its EV projections for the final rule on consistent, up-to-date data on state heavy-duty vehicle markets. [EPA-HQ-OAR-2019-0055-2852-A1, p.4]

> xvi CARB, 'Advanced Clean Fleets,' California Air Resources Board, 2022, https://ww2.arb.ca.gov/our-work/programs/advanced-clean-fleets

EPA proposes to increase GHG emissions stringency by 1.5% for MY 2027 vocational vehicles and day cab tractors based on its projection of 1.5% EV sales share among these vehicles in MY 2027. EPA, however, proposes an exclusion that carveout that reduces this stringency by half. EPA excludes spark ignition (SI) vocational vehicles from the increase in stringency, proposing that all vocational EVs be certified under the compression ignition (CI) standard, while noting that SI and CI vocational vehicles belong to the same averaging set. However, strengthening standards by 1.5% for only a subset of vehicle types fails to reflect the emissions benefits gained by the 1.5% EV sales share that EPA projects across all vocational vehicles and day cabs. SI vehicles account for 60% of class 4 vocational vehicles, and more than 30% of class 5 and 6 vehicles *xvii*. As a result, applying the proposed improvements to just the CI vehicles effectively halves the stringency increase for vocational vehicles to under 1% on average. [EPA-HQ-OAR-2019-0055-2852-A1, p.5]

> xvii Dana Lowell and Jane Culkin, 'Medium- & Heavy-Duty Vehicles: Market Structure, Environmental Impact, and EV Readiness' (EDF, n.d.), https://www.edf.org/sites/default/files/documents/EDFMHDVEVFeasibilityReport22jul21.pdf.

If EPA excludes SI vehicles from stringency increases in the final rule, the standards for CI vehicles must be strengthened further to account for the SI market share of each vehicle class. This requires projecting the CI/SI sales split into the future and considering how electrification may change this split. ACEEE recommends that EPA instead increase emission stringency for both SI and CI vehicles, which avoids the need to correct for SI market share. This stringency increase should also be tailored to expected EV sales, which we have already noted is currently underestimated in the proposal. The stringency increase for both CI and SI vehicles, therefore, should not be under 3.5%. [EPA-HQ-OAR-2019-0055-2852-A1, p.5]

EPA does not propose any changes in Class 2b-3 vehicle emission standards, nor do they provide evidence that these vehicles are less likely to be electrified over the life of the rule. As of this point in time GHG emissions from Class 2b-3 pickup trucks and vans are regulated under the heavy-duty standards alone. EPA has discussed potentially regulating these vehicles as light-duty vehicles (P. 17417), however there are no proposals on the table to do so yet. EPA should include them in any and all rule updates. Excluding them without reason misses the opportunity and the need to hold them to more appropriate standards. Should EPA decide to include these vehicles in future LD regulations, they can then amend the HDV regulations accordingly. [EPA-HQ-OAR-2019-0055-2852-A1, p.5]

Until this point, our comments have focused on improving EV sales projections and the corresponding stringency increases, and ensuring that the rule does not allow ICV performance to degrade. The Phase 2 GHG emission program, however, is meant not merely to reflect real-world technological trends, but to push them further to achieve greater GHG reduction. Simply updating EV sales estimates and rule stringency to recognize current state commitments to vehicle electrification, will not push developments in ICV technology or EV sales as far as feasible or as fast as needed to meet broader climate goals. [EPA-HQ-OAR-2019-0055-2852-A1, p.6]

In addition to the states that have already adopted the ACT rule, 10 other states are parties to a Memorandum of Understanding committing to rapid electrification of heavy-duty vehicles. Strong federal standards would help encourage these states to adopt the ACT, which would push the market further and set the stage for stronger standards in MY 2030 and beyond. [EPA-HQ-OAR-2019-0055-2852-A1, p.6]

Likewise, many manufacturers have announced accelerated schedules for heavy-duty EV production, with several companies announcing targets of 50% worldwide electrification by 2030, including Volvo and Scania *xviii*. Vehicle standards of comparable ambition would provide crucial support for these leading companies and ensure that their targets can be met in the U.S. market. [EPA-HQ-OAR-2019-0055-2852-A1, p.6]

> xviii Scania, 'Scania's Electrification Roadmap,' Scania Group, November 24, 2021, https://www.scania.com/group/en/home/newsroom/news/2021/Scanias-electrification-roadmap.html; AB Volvo, 'Volvo Trucks Launches Electric Truck with Longer Range,' Volvo Group, January 14, 2022, https://www.volvogroup.com/en/news-and-media/news/2022/jan/news-4158927.html.

Historically, EPA has developed proposals for vehicle standard stringency using analysis of technology cost-effectiveness, among other considerations. Yet no up-to-date analysis of heavy-duty EV ownership cost parity appears in the proposal. A recent National Renewable Energy Laboratory (NREL) study found that EVs will make up 42% of the medium-duty (MDV) and HDV market share by calendar year 2030, based on a lower total cost of ownership for more EV types *xix*. This finding suggests that EPA could feasibly set standards that decrease emissions in new vehicles by 20% in MY 2027 and linearly increase to 40% in MY 2029, compared to the current standards; either by increased EV sales or even greater improvement to ICV performance. This is supported by the NREL study, which predicts that many EVs will become cost competitive by MY 2027 *xx*. The NREL study additionally suggests that EVs could rapidly grow in cost performance and market share even as ICVs continue to improve efficiency, undercutting arguments that one must come at the expense of the other *xxi*. This rate of electrification is also roughly consistent with the ACT requirements, supporting EPA standards consistent with the year-by-year EV sales shares required by the ACT on a nationwide basis. [EPA-HQ-OAR-2019-0055-2852-A1, p.6]

> xix Catherine Ledna et al., 'Decarbonizing Medium-& Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis' (NREL, March 2022), https://www.nrel.gov/docs/fy22osti/82081.pdf.

xx Catherine Ledna et al., ‘Decarbonizing Medium-& Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis’ (NREL, March 2022), https://www.nrel.gov/docs/fy22osti/82081.pdf.

xxi Catherine Ledna et al., ‘Decarbonizing Medium-& Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis’ (NREL, March 2022), https://www.nrel.gov/docs/fy22osti/82081.pdf.

Such ambitious actions are necessary to deliver the progress on ICV efficiency and EV adoption to meet broader climate goals. Global warming is a critical threat to our nation and we need to limit the increase in global average temperatures to less than 2°C. Research from the International Council for Clean Transportation (ICCT) suggests that mild increases in rule strigency are not enough to have an impact. Accounting for the fact that vehicles sold today will remain on the roads for over a decade, and their GHG emissions much longer, HD ZEV sales must reach at least 20% in MY 2027 and 50% in 2030% *xxii*. ICCT’s estimates are summarized by vehicle class and type in Table 2. These sales numbers are excedingly close to levels that NREL and industry actions suggest are possible. For this reason ACEEE suggests that EPA increase average strigency by 19% in MY2027 and increase this linearly to 40% in MY 2029. [EPA-HQ-OAR-2019-0055-2852-A1, p.7]

xxii Claire Buysse, Sara Kelly, and Ray Minjares, ‘Racing to Zero: The Ambition We Need for Zero-Emission Heavy-Duty Vehicles in the United States,’ *International Council on Clean Transportation* (blog), April 8, 2022, https://theicct.org/racing-to-zero-hdv-us-apr22/; Arijit Sen and Josh Miller, ‘Emissions Reduction Benefits of a Faster, Global Transition to Zero-Emission Vehicles’ (ICCT, March 8, 2022), https://theicct.org/publication/zevs-global-transition-benefits-mar22/.

EPA has rightly proposed to strengthen MY 2027-2029 GHG and NOx emissions regulations. However, the rule needs improvements. As discussed, the rule does not follow the historical standard of using technology cost-effectiveness analysis to set stringency and instead simply attempts to follow market trends. In doing so it also significantly underestimates the pace of technological development. The proposed rule is also weakened by counterproductive credit provision and vehicle exclusions. Even without these credits and exclusions the proposed rule is not stringent enough to ensure the predicted improvements in ICV efficiency. Moreover, a much stronger rule is needed to support an EV adoption trajectory consistent with the cost-effectiveness of electrification in a rapidly growing number of heavy-duty vehicle segments and the urgent need to curtail transportation greenhouse gas emissions. While our comments are focused on the GHG portion of the NPRM, ACEEE also recognizes the value and pressing need to reduce NOx and other criteria pollutant emissions as much as possible. ACEEE encourages EPA to ensure that the final rule protects the health of our nation by ensuring that the final rule pushes NOx standards and technology further than what the current market can support and drives innovation. [EPA-HQ-OAR-2019-0055-2852-A1, pp.9-10]

EPA should improve its EV sales estimates to reflect consistent, up-to-date data on state heavy-duty vehicle markets. Reference case EV sales estimates of at least 3.5%, 5%, and 6.5% in MYs 2027, 2028, and 2029, respectively, are warranted. GHG stringency increases of these same percentages would be required just to ensure that the ICV improvements in the original rule are preserved. [EPA-HQ-OAR-2019-0055-2852-A1, p.10]

EPA should not exclude vehicles that will see significant electrification, such as class 2b-3 pickup trucks and vans, from stringency increases and should, likewise, not exclude SI vehicles. [EPA-HQ-OAR-2019-0055-2852-A1, p.10]

EPA should set standards that reflect an EV share of 19% by MY 2027, 30% in MY 2028, and 40% in MY 2029. This is also in line with the pressing need to prevent global temperatures from rising more than 2°C. [EPA-HQ-OAR-2019-0055-2852-A1, p.10]

Organization: *American Lung Association et al.*

Support stronger climate pollution reductions and boost the transition to zero-emission trucks. We support a widespread and rapid transition to zero-emission trucks, noting that the proposed Option 1 assumes extremely limited growth in the zero-emission truck market and may work at cross purposes to both emission reductions and more rapid electrification. Six states have now adopted zero-emission truck standards, and more are in the process of adopting standards and other agreements that will further accelerate the zero-emission truck market. To truly spur the transition to zero emissions, the final rule must account for greater growth in the zero-emission truck market and establish more stringent greenhouse gas standards that account for this growth. Failing to account for the growth in the zero-emission vehicle market may reduce the overall benefits of the rule if higher emitting trucks are balanced against advanced technology credits. Conversely, establishing a stronger signal via Phase 2 is essential to setting the stage for accelerating to zero-emission technologies throughout the trucking sector. [EPA-HQ-OAR-2019-0055-1271-A1, p.3]

Organization: *AMPLY Power et al.*

We, the undersigned businesses, write to support the US Environmental Protection Agency (EPA) in finalizing a Clean Trucks Plan that accelerates the transition to zero-emission medium- and heavy-duty vehicles. [EPA-HQ-OAR-2019-0055-1236-A1, p. 1]

The Clean Trucks Plan represents a critical opportunity for the US to transition to widespread electrification of trucks and buses. The emissions and economic benefits of the transition to zero-emission medium- and heavy-duty vehicles are well documented and the urgency to reduce global warming and criteria emissions is paramount to human health and the economy.1 [EPA-HQ-OAR-2019-0055-1236-A1, p. 1]

> 1. For example see, Sen, A., R. Minjares, J. Miller, and C. Braun. 2022. “Benefits of the 2020 Multi-State Medium- and Heavy-Duty Zero-Emission Vehicle Memorandum of Understanding,” Washington, DC: International Council on Clean Transportation. Online at: https://theicct.org/publication/md-hd-mou-benefits-apr22/ and Ledna, C., M. Muratori, A. Yip, P. Jadun, and C. Hoehne. 2022. “Decarbonizing Medium- and Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis,” Golden, CO: National Renewable Energy Laboratory. Online at: https://www.nrel.gov/docs/fy22osti/82081.pdf

We are concerned with the level of zero-emission vehicles expected to be deployed through the proposed Clean Trucks Plan. To avoid the most severe impacts of climate change and attain clean air in communities impacted by vehicle emissions, **we need federal standards that at a minimum, achieve zero-emission truck and bus deployments on par with the Advanced Clean Trucks standard in model years 2027-2029.** [EPA-HQ-OAR-2019-0055-1236-A1, p. 1]

Six states, representing 20 percent of national medium- and heavy-duty vehicle registrations, have adopted the Advanced Clean Trucks standard, which sets a minimum level of zero-emission vehicle sales in these states. Through this policy, zero-emission vehicles in these states will comprise nearly 20 percent of Class 4-8 sales in model year 2027, nearly 30 percent in model year 2028, and nearly 40 percent in model year 2029.2 Several other states are actively considering adoption of the Advanced Clean Trucks standard. [EPA-HQ-OAR-2019-0055-1236-A1, p. 1]

> 2. Based on sales-weighted averages of zero-emission vehicle sales requirements in the Advanced Clean Trucks standard for Class 4-8 straight trucks and Class 7-8 tractors.

There are many policy mechanisms that EPA can use to achieve this transition. No matter the path chosen, the results should be the same: accelerating national zero-emission vehicle deployments in model years 2027-2029 at least to levels in the Advanced Clean Trucks standard. Federal policy supporting zero-emission vehicle deployments in these years is critical to achieving even greater deployments of zero-emission vehicles in subsequent policies, such as a Phase 3 GHG standard, that would apply to vehicles in model year 2030 and later. [EPA-HQ-OAR-2019-0055-1236-A1, p. 2]

EPA's assessment of the zero-emission truck and bus market in its proposed updates to the Phase 2 GHG standards—that zero-emission trucks and buses will comprise just 1.5 percent of Class 4-8 vehicle national vehicle sales in model year 2027—greatly underestimates the number of zero-emission trucks and buses needed and possible to be deployed. [EPA-HQ-OAR-2019-0055-1236-A1, p. 2]

Parallel to our support of regulatory action at EPA is our support of federal policies for incentives and investments in zero-emission vehicles and infrastructure. Such policies include the Infrastructure Investment and Jobs Act and tax incentives proposed in Congress for zero-emission vehicles and infrastructure. [EPA-HQ-OAR-2019-0055-1236-A1, p. 2]

Our businesses are building the vehicles, infrastructure, and business models to support the zero-emission vehicle market. We stand by ready to work with EPA to enable and encourage this market. [EPA-HQ-OAR-2019-0055-1236-A1, p. 2]

Organization: *BorgWarner*

We strongly urge EPA to avoid tailpipe-specific ZEV definitions that exclude technologies that could make a timely real-world difference in CO2 emissions. For example, hydrogen combustion is an advanced technology that is under development and more ready to be rapidly deployed in high volumes to make an impact on the environment. This technology can be readily adapted from existing systems and therefore, could be used as a bridging strategy to significantly decrease CO2 during the transition to electric and fuel cell vehicles. [EPA-HQ-OAR-2019-0055-1234-A1, p. 3]

We recommend EPA look to future Commercial Vehicle (CV) Battery Electric Vehicle (BEV) growth forecasts when considering the new standard. While BorgWarner supports adjustments to the Phase II standards, we recognize that CV BEV forecasts are rapidly shifting. Industry forecasts increasingly expect more CV BEVs and consequently we believe that, even with adjustments, EPA is underestimating the level of CV ZEV penetration. [EPA-HQ-OAR-2019-0055-1234-A1, p. 4]

Organization: *BYD Motors, LLC (BYD)*

As the global leader in the manufacture of zero-emission vehicles, BYD is uniquely positioned to assess the feasibility of significant long-term deployment of ZEVs. [EPA-HQ-OAR-2019-0055-1207-A1, p. 1]

Our own data shows that globally BYD Motors has delivered and sold 72,222 battery electric buses; 17,974 battery electric trucks and 1,898,219 New Energy Passenger Vehicles (including pure electric and hybrids). We expect that number to continue to rise, indicating that the capacity is there and will continue to grow. [EPA-HQ-OAR-2019-0055-1207-A1, p. 1]

This same U.S. factory, operating as BYD Bus & Coach in Lancaster, California, has begun producing zero-emission battery electric school buses that will transport school children to and from their schools and provide emerging Vehicle-to-Grid technologies that will transform communities reliance on the grid. [EPA-HQ-OAR-2019-0055-1207-A1, pp. 1 - 2]

In support of EDF, we urge EPA to ensure its standards help achieve 80 percent ZEVs for new school and transit buses by MY2029. We also support EDF's encouragement of EPA to ensure its standards help achieve 40% ZEV sales by 2029 for new Classes 4-7 Vehicles and Class 8 Short-Haul Trucks. [EPA-HQ-OAR-2019-0055-1207-A1, p. 2]

A 2022 study done for EDF by Rousch supports the case that a significant near-term deployment of ZEVs is, in fact, feasible. [EPA-HQ-OAR-2019-0055-1207-A1, p. 2]

As the Official Sponsor of Mother Nature, BYD is committed to manufacturing products, including buses, school buses, trucks, forklifts and passenger vehicles that are emission-free and safe. BYD announced in April it has ceased manufacturing internal combustion engines to focus on hybrid and battery electric vehicles including its full line of passenger vehicles. [EPA-HQ-OAR-2019-0055-1207-A1, p. 2]

Organization: *California Air Resources Board (CARB)*

The NPRM requests comment on all aspects of the proposed targeted updates to the 2027 MY HD GHG Phase 2 program, including the projections of the four vehicle types affected and if additional vehicle types should be considered. CARB staff supports U.S. EPA's proposed adjustment of the 2027 MY CO_2 emission standards to account for higher HD ZEVs penetration in the HD vehicle market than originally expected in the existing U.S. EPA's HD Phase 2 GHG standards. As also mentioned in the NPRM, in March 2021, CARB adopted the ACT regulation which requires manufactures to produce a certain percentage of HD ZEV for sale in California. CARB's ACT HD ZEV requirement will start with the 2024 MY (5 to 9 percent of total HD vehicle sales) and ramp up significantly through 2035 MY and beyond (40 to 75 percent of total HD vehicle sales).138 Furthermore, some section 177 states such as Washington, Massachusetts, Oregon, New Jersey, and New York have followed California and adopted the ACT regulation, and other states are in the process of adopting the regulation. This will significantly increase HD ZEV production starting in 2024 MY, not only in California, but also in the whole nation. [EPA-HQ-OAR-2019-0055-1186-A2, p.79]

> 138 California Air Resources Board, Final Regulation Order, Advanced Clean Truck Regulation, effective date March 15, 2021. https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/fro2.pdf

While CARB staff supports U.S. EPA's proposed adjustment of CO_2 emission standards for 2027 and later MY vehicles, we have significant concerns on the proposed CO_2 emission standard adjustment values as well as the U.S. EPA's targeted subcategories and respectfully urge U.S. EPA to consider the two following recommendations. [EPA-HQ-OAR-2019-0055-1186-A2, p.79]

CARB staff has significant concerns regarding the methodology used for calculating the percentage of national 2027 MY HD ZEVs in the NPRM. One key assumption in the U.S. EPA's calculation is that 42 percent of HD ZEVs sold in the U.S. would be sold in California. This 42 percent estimate is based on an International Council on Clean Transportation report showing that in 2020, almost 1,100 of the 2,600 zero-emission commercial vehicles in the U.S. were in California. The report noted in its introduction that the market for zero-emission buses and trucks is still in its early stages and provided an overview of the 2020 market. However, that report neither projects HD ZEV sales beyond 2020 nor considers that zero-emission technology continues to advance nor accounts for the fact that other states adopt CARB's ACT regulation. Consequently, both that report, and U.S. EPA's estimates of HD ZEVs in the nation improperly failed to consider an important aspect of the problem, State Farm, 463 U.S. at 43; specifically, factors that, as discussed below, indicate that as a number of other states implement HD ZEV requirements and encourage electrification of commercial vehicles, the number of HD ZEVs will increase in the nation. [EPA-HQ-OAR-2019-0055-1186-A2, pp.79-80]

In the NPRM, U.S. EPA used CARB's ACT rulemaking's estimates of 2027 MY California sales of 3,938 HD ZEVs and divided it by 42 percent, to arrive at the national sales of 9,376 HD ZEVs, as shown in Section XI.C.1. of the NPRM. However, this method of estimating the quantities of HD ZEVs throughout the nation is highly inaccurate and therefore projects inappropriately low numbers of HD ZEVs in the 2027 MY, less than 10,000 HD ZEVs sold in the U.S. compared to total national sales of all heavy-duty vehicles of almost 600,000 vehicles. [EPA-HQ-OAR-2019-0055-1186-A2, p.80]

In Table XI-3 of the NPRM, the total number (conventional and HD ZEV) of California vehicle sales was taken from CARB's ACT projections for the 2027 MY, which was 20,938 vehicles. For the national sales, the sales projection was from the Phase 2 Final Rule (Table XI-5). If CARB's ACT California sales were divided by the Phase 2 national sales, the California sales constitute a little over 3 percent of national sales, which is low compared to the typical California sales of about 7 to 10 percent of national sales. The effect of this lower number of California sales compared to national sales would also result in an inaccurate lower fraction of calculated national HD ZEVs in 2027 MY. [EPA-HQ-OAR-2019-0055-1186-A2, p.80]

As U.S. EPA mentioned in the NPRM, California's HD vehicle population is approximately 10 percent of the U.S. HD population. Based on CARB's HD certification data in the 2019 and 2020 MYs, California's HD vehicle sales are about 7 percent of the national sales. Based on these facts, CARB staff estimates about 7 to 10 percent of national sales are California sales in 2027 MY. With the required HD ZEV sales of 15 to 20 percent of total California HD vehicle sale in 2027 under CARB's ACT regulation, the California ZEV sales alone are already about 1 to 2 percent of the total U.S. HD sales. It is also worth noting that CARB staff is currently working on developing the proposed Advanced Clean Fleet regulation that would accelerate the market for zero-emission trucks and buses by requiring California fleets that are well suited for electrification to transition to ZEVs where feasible.139 In the NPRM, U.S. EPA assumed only 1.5 percent national HD ZEV penetration in their proposed 2027 MY CO2 emission standards, which seems to only account for California's adoption of the ACT. However, as noted earlier, in addition to California, several section 177 states have already adopted CARB's ACT regulation, which will definitely result in national ZEV penetration much greater than 1.5 percent as proposed in the NPRM. [EPA-HQ-OAR-2019-0055-1186-A2, p.80]

139 California Air Resources Board, Advanced Clean Fleets, March 3, 2022. Advanced Clean Fleets Fact Sheet (ca.gov)

HD ZEV sales will likely increase beyond CARB's ACT regulatory push in 2027. As mentioned in the NPRM, an MOU organized by Northeast States for Coordinated Air Use Management, sets a target of an interim goal of 30 percent of all new medium-duty and HD vehicles sales being HD ZEVs no later than 2030.140 Currently, 18 signatories, including California and the section 177 states noted above, are part of this agreement. In order to achieve this interim goal, a significant number of vehicles sales in 2027 must be HD ZEVs. [EPA-HQ-OAR-2019-0055-1186-A2, p.81]

140 https://www.nescaum.org/documents/medium-and-heavy-duty-zero-emission-vehicles-action-plan-development-process/. Accessed March 21, 2022.

A report by the ACT Research shows projections of HD ZEV sales to be 21 percent in 2027.141 The report predicts that in the early years, regulatory requirements will drive HD ZEV sales; however, past 2030, technology gains will far exceed regulatory influences due to increasingly favorable total cost of ownership of ZEVs over conventional vehicles. A recent report by Roush projects that by 2027 to 2030, the total cost of ownership for a HD ZEV will be less for a conventional commercial vehicle in certain vehicle types.142 NREL conducted a study that projected HD ZEV sales would account for 42 percent of all new HD sales by 2030 based solely on economics, assuming the charging and refueling infrastructure is established (a very conservative scenario showed 7 percent of HD ZEV sales by 2030.143) Furthermore, recent federal, state,144,145 and private146 programs and agreements are being implemented in the near-term to build infrastructure for HD ZEVs. [EPA-HQ-OAR-2019-0055-1186-A2, p.81]

141 ACT Research. https://www.actresearch.net/electric-vehicles-charge/ .

142 http://blogs.edf.org/climate411/files/2022/02/EDF-MDHD-Electrification-v1.6_20220209.pdf. Accessed March 21, 2022.

143 https://www.nrel.gov/docs/fy22osti/82081.pdf

144 https://www.michigan.gov/-/media/Project/Websites/leo/REV_Midwest_MOU_master.pdf?rev=6dd781b5a4eb4551b3b3a5b875d67fb9. Accessed March 21, 2022.

145 https://www.governor.state.nm.us/2022/02/24/new-mexico-coalition-of-mountain-west-states-sign-mou-to-develop-a-regional-clean-hydrogen-hub/ Accessed March 21, 2022.

146 https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/daimler-nextera-blackrock-to-invest-650m-in-us-charging-sites-for-trucks-68665504. Accessed March 21, 2022.

CARB staff accordingly urges U.S. EPA to account for the aforementioned factors that individually and collectively indicate there will be significantly greater quantities of HD ZEVs in the nation than as estimated in the NPRM and that the proposal will consequently result in the generation of more credits than U.S. EPA is anticipating, which will likely not fulfill U.S. EPA's objective of maintaining the stringency of the Phase 2 GHG program. State Farm, 463 U.S. at 43. [EPA-HQ-OAR-2019-0055-1186-A2, p.81]

CARB staff believes that more accurate and realistic national HD ZEV penetration projection rates will likely be at least 20 percent of all nationwide HD sales per year for 2027 and beyond, in adjusting the 2027 and subsequent MY CO2 emission standards. If U.S. EPA moves forward with a proposal that is based on the NPRM's projection of weak HD ZEV sales like the 1.5 percent proposed in the NPRM, then the Phase 2 GHG standards need to be adjusted to ensure higher HD ZEV sales do not destroy the efficacy of the Phase 2 GHG standards. The standards must be amended with some backstop in allowable credits for HD ZEVs to prevent higher HD ZEV sales resulting in substantial delays or the elimination of needed and cost effected vehicle and engine technologies initially identified during the adoption of Phase 2 GHG program. Applying HD ZEV emission credit caps or significantly reducing HD ZEV credits after a threshold volume is reached would be necessary to assure that the projected vehicle and engine technologies identified as feasible and cost effective are realized in the implementation of the Phase 2 GHG program. [EPA-HQ-OAR-2019-0055-1186-A2, pp.81-82]

In addition to the four vehicle types most likely to be electrified through 2030, U.S. EPA should also consider the refuse hauler vehicle type. As part of CARB's ACT rulemaking package, CARB staff conducted an assessment of the ZEV market and the suitability of ZEVs in the MD and HD commercial space.147 The ZEV suitability was assessed based on four factors: weight, route/range, charging/fueling infrastructure, and battery/vehicle space constraints. Each of these factors for each market segment (i.e., vehicle category) was assigned a number value of 1, 3, or 10 (with 1 representing a highly suitable characteristic, 3 representing a challenging suitability characteristic, and 10 representing a poorly suitable characteristic). These values were then averaged for each market segment to assign each segment a value between 1 and 10, where the lowest values would suggest the highest suitability for electrification. The market segment with an average suitability score that is above 5 has at least two characteristics identified with poor suitability factors. This indicates that electrification with today's technology is not likely to be feasible for most of that market segment. According to the assessment, refuse haulers have a ZEV suitability score of 1 to 2, indicating that they are the most suitable segments to transition to ZEP due to their typical operation on predictable routes with frequent stop-and-go. Hence, CARB staff recommends U.S. EPA to consider refuse haulers in their targeted vehicle types that are subject to the proposed adjustment of the 2027 MY CO2 emission standards. [EPA-HQ-OAR-2019-0055-1186-A2, p.82]

> 147 California Air Resources Board. Appendix E: Zero Emission Truck Market Assessment, to the Staff Report: Initial Statement of Reasons, 'Public Hearing to Consider the Proposed ACT Regulation,' October 22, 2019. https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/appe.pdf

In addition, CARB staff urges U.S. EPA to also include HD vehicles subjected to SI GHG standards (or HD gasoline vehicles) as part of the targeted subcategories for adjusting 2027 and newer MY CO2 emission standards. The projected higher ZEV penetration in 2027+ timeframe, which had necessitated the proposed 2027 and newer MY GHG standards adjustment for HD diesel vehicles, should be accounted for all HD internal combustion vehicle standards regardless of their powered fuel types. HD gasoline vehicles still make up a significant portion in HD transportation sector, especially in light and medium HD vehicle categories. It can also be argued that all gasoline-fueled HD vehicles have targeted applications that do not require high engine torque (i.e., less vehicle payload) or high fuel efficiency (i.e., shorter operating routes), thereby making this segment highly feasible for electrification. Therefore, CARB staff recommends U.S. EPA to adjust 2027 and newer MY CO2 emission standards for HD vehicles certified to SI GHG standards following the same approach that U.S. EPA proposed in the NPRM, incorporating CARB staff's suggested revised HD ZEV penetration projection discussed in the comment above, for diesel vehicles. [EPA-HQ-OAR-2019-0055-1186-A2, pp. 82-83]

Organization: *CALSTART*

As significant as the benefits of the ACT were estimated to be in California, CARB's emissions analysis also illustrates the need for even greater emission reductions. The 2.9 million metric tons of global warming emissions estimated to be reduced in California by the ACT in 2040 is small compared to the baseline of roughly 33 million metric tons per year in 2040. The 5,301 tons of NOx reduced per year in 2040 is also small compared to an annual estimate of nearly

60,000 tons in 2040. Adoption of the ACT is a significant step in deploying zero-emission medium- and heavy-duty vehicles, but it alone will not reduce emissions of criteria pollutants or GHGs enough to achieve air quality or climate goals. [EPA-HQ-OAR-2019-0055-1313-A1, p.7]

Similar NOx and GHG emission benefits of adopting the ACT result from multi-state analyses. Adoption of ACT in 12 states and the District of Columbia, assuming implementation in 2025, will reduce GHG emissions an estimated 15 percent below business as usual in 2050 (Figure 3). ACT adoption in these states would similarly reduce NOx emissions by 15 percent in 2050 compared to business as usual (ICCT, 2022). [EPA-HQ-OAR-2019-0055-1313-A1, p.7]

While the widespread transition to zero-emission vehicles will require large scale production of vehicles, small businesses have enabled the early stages of the medium- and heavy-duty zero-emission market (CARB, 2021). Zero-emission vehicles produced by small businesses have helped demonstrate the suitability of zero-emission technologies, while generating new jobs and economic growth in the process. Such companies manufacture buses and shuttles (e.g, Greenpower Motor, Motiv Power Systems, and Lion Electric), on-road trucks and vans (e.g., Phoenix Motorcars and Lightning Systems), and off-road yard trucks (e.g., Orange EV) and have combined to manufacture over 560 vehicles for California fleets alone as of May 2021. As larger manufacturers enter the marketplace, small business will continue to provide critical innovations and products in the transition to zero-emission vehicles. The US Department of Energy recognizes how critical small-business contributions are to the development of clean energy technological solutions—in June 2021, 235 small businesses were awarded $54 million in seed funding for projects ranging from electric vehicle batteries to advanced grid technologies (DOE, 2021). [EPA-HQ-OAR-2019-0055-1313-A1, pp.7-8]

Regulatory actions to accelerate the deployment of zero-emission medium- and heavyduty vehicles have taken place at the state level in the US to-date. In June 2020, California became the first state to adopt the ACT standard, a regulation requiring an increasing fraction of zero-emission Class 2b-8 sales beginning in model year 2024, according to Table 1. Five more states—Oregon, Washington, New Jersey, New York, and Massachusetts—adopted the ACT in 2021, with implementation beginning in model year 2025. Based on Class 2b-8 vehicle registrations in 2019, these six states represent 20 percent of the national truck and bus market and 17 percent of Class 4-8 sales.6 Three other states are actively considering adoption of the ACT including Colorado, Maine, and Connecticut (CDPHE, 2022; Maine Department of Environmental Protection, 2021; State of Connecticut, 2022). [EPA-HQ-OAR-2019-0055-1313-A1, p.8]

> 6 Class 2b-8 vehicle registrations are based on Atlas' evaluation of 2019 IHS Markit registration data, available at: https://www.atlasevhub.com/materials/medium-and-heavy-duty-vehicleregistrations- dashboard/. Sales are based on an unpublished CALSTART analysis of 2019 IHS Markit data that uses a 1 percent growth in total annual sales for all vehicle classes (Al-Alawi, 2022).

In 2020, state governors, under a memorandum of understanding (MOU), committed to accelerating deployments of zero-emission medium- and heavy-duty vehicles in their states with at least 30 percent of sales being zero-emission vehicles in 2030 and 100 percent no later than

2050. As of May 2022, 17 states, Washington, DC, and Quebec have adopted this Multi-state MOU (O'Dea, 2022). Note, these commitments apply to Class 2b-8 vehicles. A summary of states adopting the ACT, Heavy-Duty Omnibus, and Multi-state MOU are shown in Figure 4. [EPA-HQ-OAR-2019-0055-1313-A1, p.9]

At the international level, CALSTART's Global Drive to Zero program is a strategic, international initiative designed to catalyze the growth of the zero-emission medium and heavy-duty vehicle sector, focused on key vehicle segments, from transit buses to semi-trucks (Global Drive to Zero, n.d.). More than 100 Drive to Zero pledge partners promise to collaboratively put in place supporting mechanisms to speed the early market for these vehicles and equipment.7 Similar to the Multi-state MOU, fifteen countries have signed the Global MOU committing to zero-emission vehicles comprising 30 percent of medium- and heavy-duty sales and 100 percent of sales no later than 2040. The 100 percent sales target signed by countries is ten years earlier than that in the Multistate MOU. An additional 42 sub-national governments, businesses, and other organizations in the freight and bus industry and road transport, have fully endorsed the ambition of the Global MOU. [EPA-HQ-OAR-2019-0055-1313-A1, pp.9-10]

7 A current listing of Drive to Zero Pledge Partners is available at https://globaldrivetozero.org/about/pledge-partners/

CALSTART urges EPA to increase the number of zero-emission vehicles deployed through the final rule. There are many mechanisms that EPA can use to achieve this outcome, including increasing the stringency of the Phase 2 GHG standards or crediting of zero-emission vehicles for compliance with NOx emission standards while achieving net 90 percent NOx reductions compared to current engines. No matter the path chosen, CALSTART recommends the final rule set the regulatory framework on a path to accelerate national zero-emission vehicle deployments in model years 2027-2029 at least to levels achieved by the ACT for Class 4-8 vehicles. In model years 2027-2029, the ACT achieves Class 4-8 zero-emission sales of 18 percent, 26 percent, and 34 percent based on analysis by CALSTART (weighted for national sales of Class 4-8 straight vehicles and Class 7-8 tractors) (Table 2 and Figure 5). [EPA-HQ-OAR-2019-0055-1313-A1, p.10]

A final rule supporting zero-emission vehicle deployments in model years 2027-2029 is critical to building a ramp to even greater deployments of zero-emission vehicles in subsequent policies, namely the Phase 3 GHG standard, that would apply to vehicles in model year 2030 and later. The world is already behind the pace of reductions needed for addressing climate change and air quality. The Clean Trucks Plan must move the path to zero-emission vehicles upward. Otherwise, Phase 3 GHG standards will never push industry to the levels of zero-emission trucks that are achievable and needed. As discussed and shown below, EPA's assessment of the zero-emission truck and bus market in its proposed updates to the Phase 2 GHG standards—that zero-emission trucks and buses will comprise just 1.5 percent of Class 4-8 vehicle national vehicle sales in model year 2027—greatly underestimates the number of zero-emission trucks and buses expected and possible. [EPA-HQ-OAR-2019-0055-1313-A1, pp.10-11]

As shown in our market adoption analysis below, zero-emission vehicles can be deployed at levels similar to the ACT standard in segments ready for electrification today, i.e., in urban regions where the duty cycles and distances best match with technology capabilities and production capacity. These applications, some of which are already called out by EPA in the proposed rule (transit, school bus, delivery and regional tractors) could be mapped to EPA's existing matrix bin structure created for EPA's Phase 2 GHG standard. Each bin would be assigned a discrete emission reduction target based on segment-based projections of zero-emission sales. The total GHG emissions reductions from such a scheme would adjust the 1.5 percent GHG reduction called for in the proposed rule to at least match emission reductions achieved by the ACT standard. [EPA-HQ-OAR-2019-0055-1313-A1, p.11]

More stringent GHG emission standards could work in parallel to flexibility given to manufacturers to comply with NOx emission standards through the accelerated deployment of zero-emission vehicles. The NOx reductions from these deployments would meet or exceed a net 90 percent NOx reduction. [EPA-HQ-OAR-2019-0055-1313-A1, p.11]

CALSTART analyzed IHS Markit sales data by state and vehicle class to estimate sales of zero-emission Class 4-8 vehicles in the six states that have adopted the ACT standard (Al- Alawi, 2022). Compared to the 9,376 zero-emission vehicles estimated will be sold in model year 2027, CALSTART's analysis indicates 16,347 vehicles will be sold across the six states that have adopted the ACT (Table 3). This represents 3.3 percent of total Class 4-8 sales in model year 2027 (estimated at 297,574 Class 4-8 straight vehicles and 189,117 Class 7-8 tractors), compared to the 1.5 percent estimated in the proposed rule. In model years 2028 and 2029, CALSTART estimates zero-emission vehicles from the six ACT states will comprise 4.8 percent and 6.3 percent of total Class 4-8 sales in the US, respectively. While annual sales of all vehicles have decreased since 2019 as a result of the pandemic, the fraction of zero-emission vehicles from the six ACT states will remain similar no matter the basis for annual sales. For example, in CALSTART's estimate of zero-emission Class 4-8 vehicle sales using both 2019 and 2021 sales as baselines, the number of zero-emission vehicle sales in the six ACT states doubles from model year 2027 to 2029 from roughly 3 percent to 6 percent. [EPA-HQ-OAR-2019-0055-1313-A1, p.12]

While six states have currently adopted the ACT standard, another 11 states and Washington, DC have committed to achieving 30 percent zero-emission Class 2b-8 vehicle sales by 2030. Three of these states are actively considering adoption of the ACT, including Colorado, Maine, and Connecticut, and it is likely that more than six states will be implementing the ACT in model years 2027-2029. Modifications to the Phase 2 GHG standards and crediting in the NOx standard should account for states that adopt the ACT in the future and whose implementation begins sometime between model years 2026 and 2029. If all of the 18 jurisdictions in the US that have adopted the Multi-state MOU were to achieve ACT-like sales in line with the MOU's 2030 commitment, CALSTART estimates 32,470 zero-emission Class 4-8 vehicles would be sold nationally in model year 2027 corresponding to 6.5 percent of national Class 4-8 sales and increasing to 12.4 percent of sales in model year 2029 (Table 4).8 [EPA-HQ-OAR-2019-0055-1313-A1, p.12]

8 In MOU jurisdictions that have not adopted the ACT, implementation was assumed to begin in model year 2026. In the six states that have adopted the ACT, implementation

was consistent with regulatory actions in these states, i.e., 2024 in California and 2025 in the other five states.

The Clean Trucks Plan should also account for zero-emission vehicles deployed through states' adoption of the ACF standard, which sets requirements for fleets to purchase zero-emission medium- and heavy-duty vehicles. This policy has been in development at CARB since 2019 and is expected to be adopted by the CARB Board in 2023, with implementation beginning in 2024. Other states will have the ability to adopt this policy (CARB, n.d.). The ACF will result in three times the number of Class 4-8 zero-emission vehicles (straight vehicles and tractors) than the ACT in model years 2027-2029, as shown in the Table 5 (CARB, 2021a). Unaccounted for, credits from zero-emission vehicles in the ACF could overwhelm the Clean Trucks Plan and greatly compromise its intended reductions in emissions. [EPA-HQ-OAR-2019-0055-1313-A1, p.13]

EPA's projection of zero-emission vehicle sales should also take into account state and local requirements for the deployment of zero-emission transit buses, which are excluded from ACT sales requirements but are included in EPA's projection of zero-emission vehicle sales and affect Phase 2 GHG standards. California's Innovative Clean Transit (ICT) standard, adopted in December 2018, is one such policy that EPA should consider. The ICT requires an increasing fraction of transit bus purchases to be zero-emission vehicles beginning at 25 percent in 2023 for large transit agencies and 25 percent in 2026 for small transit agencies. Under this policy, all transit bus purchases in the state must be zero-emission vehicles from 2029 and onward (CARB, 2019b). From purchase plans submitted to CARB by 19 large transit agencies across the state, an estimated 5,000 zero-emission buses (Class 4 and above) will be deployed in California through 2030 (Figure 6) (Paddon, 2021). Additional zero-emission transit buses will be deployed by small transit agencies. [EPA-HQ-OAR-2019-0055-1313-A1, pp.13-14]

Outside of state policies requiring the deployment of zero-emission vehicles, there are other important market drivers that EPA should consider in its projection of zero-emission vehicle sales, including vehicles deployed with known incentive funding and public commitments by fleets and vehicle manufacturers to produce and adopt zero-emission vehicles. [EPA-HQ-OAR-2019-0055-1313-A1, p.14]

Funding in the recently adopted Infrastructure Investment and Jobs Act (IIJA) will provide roughly $3.5 billion for zero-emission transit buses and up to $5 billion for zero-emission school buses. In a rough estimate that considers the price of a battery electric transit bus at $850,000 and a school bus at $375,000, the IIJA could fund approximately 4,000 transit buses and 13,000 school buses over the five-year life of these programs. While no targets have been set to date, incentives for the purchase of zero-emission trucks are also eligible expenditures under several, billion-dollar IIJA programs, including but not limited to the Carbon Reduction Program ($6.4 billion), the Congestion Mitigation and Air Quality Improvement Program ($13 billion), and the National Highway Freight Program ($7.1 billion). [EPA-HQ-OAR-2019-0055-1313-A1, pp.14-15]

Nationally, over 1,200 zero-emission trucks have been deployed across the US (Figure 7), with at least that many more expected to be deployed through existing vouchers awarded in

California's HVIP incentive program.9 Through 2021, an additional 1,700 zero-emission school buses and 3,500 zero-emission transit buses have been awarded, ordered, or delivered (see maps in Figure 8 below showing state distribution of these vehicles).10 [EPA-HQ-OAR-2019-0055-1313-A1, p.15]

> 9 Deployments of zero-emission trucks can be found at: https://calstart.org/zeroing-in-on-zero-emission- trucks/.Vehicles ordered through HVIP can be found at: https://californiahvip.org/impact

> 10 Adoption of zero-emission school buses and transit buses can be found at: https://calstart.org/zeroing-in-on-esbs-2022/ and https://calstart.org/zeroing-in-on-zebs/.

Fleets are committing to zero-emission vehicle transitions, ordering these vehicles, and deploying them. Nationwide, an estimated 81 fleets are currently operating zero-emission trucks. An additional 76 fleets have zero-emission vehicles on order. Twenty fleets have publicly set goals for adopting zero-emission vehicles.11 Last December, President Biden issued an Executive Order committing all Federal vehicle purchases to zero-emission technologies by 2035 (White House, 2021). [EPA-HQ-OAR-2019-0055-1313-A1, p.16]

> 11 EDF has catalogued fleets' deployments, orders, and commitments to zero-emission trucks, see: https://docs.google.com/spreadsheets/d/1l0m2Do1mjSemrb_DT40YNGou4o2m2Ee-KLSvHC- 5vAc/edit#gid=1021779951

Fleets in the US have "ordered" – inclusive of legally binding and non-binding commitments – 146,000 zero-emission trucks to be delivered over the next ten years. The largest order is from Amazon for 100,000 Rivian delivery vans. Rivian aims to have the first 10,000 delivery vans delivered to Amazon by 2022 and all 100,000 delivered by 2030. The United Parcel Service's order of 10,000 Arrival delivery vans is expected to be completed by 2024.12 [EPA-HQ-OAR-2019-0055-1313-A1, p.16]

> 12 See CALSTART's report "Zeroing in on Zero-Emission Trucks" for more information at: https://calstart.org/zeroing-in-on-zero-emission-trucks/

Twenty-one manufacturers of combustion cars, trucks, and equipment have made public commitments around zero-emission, electric, "carbon neutral," or "fossil free" vehicles (Table 6).13 Notable commitments include those by two large, legacy manufacturers of heavy-duty vehicles that have committed to 50 percent of their sales being electric or zero-emission vehicles by 2030, which match the Class 4-8 sales requirements and exceed the Class 7-8 tractor sales requirements under the ACT.14 [EPA-HQ-OAR-2019-0055-1313-A1, pp.16-17]

> 13 Information on vehicle manufacturers' commitments to clean technologies can be found in Table 2 at: https://globaldrivetozero.org/publication/country-policy-targets-briefing/

14 Information on Volvo Trucks and Scania's commitments can be found at: https://www.volvogroup.com/en/news-and-media/news/2022/jan/news-4158927.html and https://www.scania.com/group/en/home/newsroom/news/2021/Scanias-electrificationroadmap.html.

CALSTART's knowledge of the truck and bus industries indicates a rapid transition to zero-emission vehicles is achievable in many medium- and heavy-duty vehicle segments. CALSTART's "beachhead" strategy, summarized in Figure 9 below, envisions such deployments can be achieved through waves of investments, policies, and deployments that begin with vehicle segments most suited for zero-emission technology based on duty cycle, business case, and performance and progressively expand to additional applications as technology matures and manufacturing capacity increases.15 [EPA-HQ-OAR-2019-0055-1313-A1, pp.17-18]

15 More information on CALSTART's market-ready, "beachhead" strategy can be found at: https://globaldrivetozero.org/public/The_Beachhead_Model.pdf

BYD, a world leader in electric car, truck, and bus deployments, represents a company deploying vehicles across market-ready applications, including transit buses, coach buses, delivery trucks, regional haul tractors, yard trucks, and school buses (BYD, n.d.). Proterra also represents an example of the company deploying zero-emission technology in waves as it expands in scale. An early and current leader in zero-emission transit buses, Proterra now uses its battery technology in partnership with vehicle manufacturers that make school buses, coach buses, delivery vehicles, and construction equipment.16 [EPA-HQ-OAR-2019-0055-1313-A1, p.18]

16 Proterra's zero-emission product offerings can be found at: https://www.proterra.com/applications/

The state of zero-emission technologies for medium- and heavy-duty applications can be seen in CARB's assessment of Technology Readiness Levels in Figure 10 below (CARB, 2021). In all applications shown, covering nearly every use-case except long-haul, emergency, and construction, zero-emission technologies were determined to be in the commercial stage with early market entries. [EPA-HQ-OAR-2019-0055-1313-A1, p.18]

While further from maturation, the industry is progressing to zero-emission long-haul trucking, a transition once deemed impossible by some in the heavy-duty industry. In the Research Hub for Electric Technologies in Truck Applications (RHETTA) project funded by the California Energy Commission, CALSTART is working with industry partners to develop, test, and deploy megawatt charging systems for medium- and heavy-duty vehicles. This and similar pilot projects represent steps underway in the transition of long-haul trucking to zero-emission technologies. The Department of Energy's SuperTruck 3 program will fund two legacy vehicle manufacturers to develop megawatt charging systems for Class 8 trucks (DOE, 2021a). A $650 million private investment from a vehicle manufacturer, utility, and investment management firm will support charging and hydrogen refueling corridors for long-haul electric and fuel cell trucks along the West and East coasts of the US and across Texas, with construction expected to begin next year (Saul, 2022). This follows a similar announcement by three legacy vehicle manufacturers to jointly develop charging infrastructure for heavy-duty long-haul trucks in Europe (Mossalgue, 2021). Funding in the IIJA could also help build out these corridors, particularly the $2.5 billion "Discretionary Grants Program for Charging and Fueling infrastructure" in Section 11401 of this law. Standardization of a megawatt charging connector by SAE (J3271) is also enabling the development of charging infrastructure for long-haul trucks (SAE, 2021). [EPA-HQ-OAR-2019-0055-1313-A1, pp.19-20]

Demonstration and pilot projects involving fuel cell trucks and buses have also expanded in recent years. CARB and the California Energy Commission have supported a project in Oakland that will deploy 30 Hyundai fuel cell trucks for drayage operations starting in early 2023. As part of the Department of Energy's SuperTruck 3 program, three legacy vehicle manufacturers will develop fuel cell trucks, including a Class 8 tractor and Class 6 vehicle based on a popular chassis used for combustion vehicles (DOE, 2021a). A Nikola Fuel Cell truck delivered beer to the Superbowl, Hino and Toyota have announced fuel cell trucks, and Hyzon is working to bring their fuel cell truck to the US after deployments in China and Europe (Ericson, 2022). Fuel cell trucks are also being developed by Kenworth in partnership with Toyota and Navistar in partnership with GM. [EPA-HQ-OAR-2019-0055-1313-A1, p.20]

The range of current battery and fuel cell electric trucks can meet many fleets' operational demands. Based on the national Vehicle Inventory and Use Survey (VIUS), more than 80 percent of all Class 2b-8 trucks have a primary operating range (the farthest distance from the vehicle's home base) of less than 100 miles. More than 75 percent of Class 2b-8 trucks travel 30,000 miles or less each year, which corresponds to 120 miles per day for 250 operational days per year. Sixty five percent of Class 2b-8 vehicles travel less than 20,000 miles each year or 80 miles per day for 250 operational days per year (Figure 11).17 An updated survey of heavy-duty vehicles in California found similar vehicle miles traveled by truck class, suggesting results from the 2002 VIUS still reflect present day vehicle miles traveled by medium- and heavy-duty vehicles (Komanduri, 2019). [EPA-HQ-OAR-2019-0055-1313-A1, p.20]

> 17 Analysis of truck operating ranges and annual mileages by the Union of Concerned Scientists can be found at: https://www.ucsusa.org/resources/ready-work

In a study of Class 6-7 school bus operations in three states (Washington, New York, and Colorado) and of over 1,500 individual operating shifts found an average driving distance of 32 miles. A 99.7 percent confidence interval on route distance was found to be zero to 77 miles (route distances were doubled to determine an average daily driving distance of 64 miles, with a 99.7 percent cutoff of 154 miles) (Duran, 2013). [EPA-HQ-OAR-2019-0055-1313-A1, p.20]

As shown in the next section, these daily distances are well within the range of existing heavy-duty electric vehicles on a single charge or tank of hydrogen. [EPA-HQ-OAR-2019-0055-1313-A1, p.20]

An increasing number of battery and fuel cell electric trucks are being offered by legacy vehicle manufacturers and new vehicle manufacturers alike. Many new products are being offered by vehicle manufacturers and many more are moving from the demonstration and pilot stage and into mainstream production with significant manufacturing capacities being added to the market.

CALSTART's tracking of the industry, shown in Figure 12 below, indicates that by 2023, 56 manufacturers will offer 244 different models of zero-emission trucks and buses in the United States and Canada.18 Policies requiring the deployment of zero-emission vehicles are critical to ensuring these vehicles come to market in significant amounts. [EPA-HQ-OAR-2019-0055-1313-A1, p.21]

> 18 More information on CALSTART's Zero-Emission Technology Inventory Tool can be found at: https://globaldrivetozero.org/tools/zero-emission-technology-inventory/

The number of zero-emission models available provides an important indicator in the market, showing the breadth of manufacturers and suppliers investing in these technology platforms. The more manufacturers and suppliers producing zero-emission components and vehicles, costs will likely be lower, consumer choice will be expanded, and production times accelerated compared to a market with a limited number of commercial manufacturers. The presence of larger vehicle manufacturers in the marketplace will help bring prices down due to economies of scale and efficiencies in production processes. [EPA-HQ-OAR-2019-0055-1313-A1, p.21]

All major manufacturers and several new innovators are now in active sales and product development stages. In Class 7 and 8, applications include drayage and regional haul trucks. Eight manufacturers have Class 8 tractors available for sale in California. Longer range and lower, more competitively priced trucks are in the pipeline. Scania, for example, has recently announced longer range capable trucks in Europe by 2023. [EPA-HQ-OAR-2019-0055-1313-A1, p.21]

The last mile delivery market is also seeing significant transformation. With the huge increases in e-commerce and last mile delivery needs, EV-only startups as well as established OEMs have increased offerings. GM and their EV600, leveraging their Ultium battery and drive system, has begun delivering vans to some major customers and Ford has started delivery of their eTransit as well. Other manufacturers such as Envirotech, Green Power Motors, Lightning eMotors, Motiv, SEA Electric, Workhorse, and Xos all have delivery vans available for sale. Companies like Zeem, WattEV, and others are offering new 'transportation as a service' models to help speed the adoption of zero-emission trucks. [EPA-HQ-OAR-2019-0055-1313-A1, p.22]

Most zero-emission truck models available today serve lower-mileage applications, but manufacturers are increasingly bringing vehicles to market with longer ranges. CALSTART's chart in Figure 13 below shows zero-emission truck and bus offerings expected through 2022 by vehicle type and range. [EPA-HQ-OAR-2019-0055-1313-A1, p.22]

There is growing consensus that electric trucks and buses are becoming cost competitive with diesel technologies today and will offer measurable savings with continued decreases in battery and fuel cell costs over the next 10 years (Ledna, 2022; CARB, 2021b). Vehicle applications with higher annual mileages are expected to benefit from electrification the most due to the significant fuel and maintenance savings electrification can provide over diesel. Total cost of ownership studies by CARB, ICF, ICCT are shown in the Figures 14 and 15 below and illustrate the expected costs savings for Class 6 delivery vehicles and Class 8 drayage and short-haul tractors, without financial incentives or revenue from low carbon fuel standards (O'Dea, 2019). [EPA-HQ-OAR-2019-0055-1313-A1, p.23]

Based on a total cost of ownership analysis, NREL estimates that across all modes and travel distances of heavy-duty vehicles, zero-emission technologies will comprise 42 percent of vehicle sales by 2030, 98 percent by 2040, and 100 percent by 2046, with zero-emission vehicles achieving cost parity with combustion vehicles no later than 2035 for operations of all distances (Ledna, 2022). [EPA-HQ-OAR-2019-0055-1313-A1, p.23]

CALSTART's examination of truck vocations indicates the sales percentages in the ACT can be exceeded through deployments of zero-emission vehicles just in fleet segments that are ready for zero-emission technologies today, including urban and regional delivery vehicles (vans, box trucks, and tractors), school buses, transit buses, shuttle buses, heavy-duty short/regional haul (Al-Alawi, 2022b). These applications typically follow a return-to-base model, traveling to predictable destinations and with consistent daily mileage. [EPA-HQ-OAR-2019-0055-1313-A1, p.25]

These results reflect the timing for technology readiness of zero-emission technologies for different vehicle vocations, types and weights, and recognize that zero-emission technologies can be transferred across vehicle types as technologies evolve and costs decrease. Slower along the adoption timeline are more specialized vehicles like refuse and construction trucks (e.g., which represent a relatively small share of medium- and heavy-duty vehicles. [EPA-HQ-OAR-2019-0055-1313-A1, p.25]

Projections of zero-emission sales are based on CALSTART's quantitative and qualitative assessments of zero-emission feasibility based on technology readiness (i.e., availability and suitability of the technology to an application); fleet bias towards new technologies (i.e., preference towards technology risk and reliability, and time it takes for fleets to have confidence in a new technology), and scalability for different vehicle segments (i.e., how fast manufacturers can scale up production, accounting for different levels of supply scalability with OEM market share and financial position). [EPA-HQ-OAR-2019-0055-1313-A1, p.25]

Figure 16 below shows CALSTART's projections of zero-emission medium- and heavy duty vehicle sales in alignment with the Global MOU discussed above, which commits to 30 percent zero-emission truck and bus sales by 2030 and 100 percent sales by 2040 (Al- Alawi, 2022b).19 The figure below presents only the Class 4-8 sales targets associated with this analysis. The dashed black line represents the sales-weighted average across all categories of Class 4-8 vehicles. In model year 2027, sales of zero-emission Class 4-8 vehicles represent approximately 20 percent of total sales; 28 percent in model year 2028, 40 percent in model year 2029 and 50 percent in model year 2030. These sales levels exceed the sales weighted average requirements in the ACT standard. [EPA-HQ-OAR-2019-0055-1313-A1, p.25]

> 19 Buses and passenger shuttles include transit buses, school buses, coach buses, and shuttles used at locations such as airports and hotels. Urban and regional delivery vehicles include single unit trucks. Short-haul tractors include drayage, intracity, and

lower mileage intercity operations. Examples of construction vehicles include utility trucks and dump trucks.

The final rule should achieve zero-emission vehicle deployments of at least 18 percent, 26 percent, and 34 percent in model years 2027-2029, equivalent to those in states' Advanced Clean Trucks standard. [EPA-HQ-OAR-2019-0055-1313-A1, p.26]

Organization: *Center for Climate and Energy Solutions (C2ES)*

In short-haul medium- and heavy-duty applications, many vehicles' use cases make them particularly well-suited to early adoption of electrification technology. For example, slow speeds, frequent stops, and relatively predictable routes of last-mile delivery vehicles enable them to fully utilize the advantages of regenerative braking and the cost savings of depot charging. [EPA-HQ-OAR-2019-0055-1165-A1, p.2]

In the heavy-duty sector, transit and school buses are also favorable for early adoption of zero emission vehicle (ZEV) technologies, with their predictable routes and charging times. Because these vehicles are most often used by children and other vulnerable populations, the reduction of air pollution from these vehicles is particularly impactful in historically marginalized communities. [EPA-HQ-OAR-2019-0055-1165-A1, p.2]

Last year's passage of the Infrastructure Investment and Jobs Act (IIJA) marked a significant commitment to the development and deployment of low- and zero-emission bus technologies. The bill's more than $5 billion in funding for electric and alternative fuel school buses, alongside its $4 billion in funding for transit bus electrification, related infrastructure, and workforce development, will build on existing momentum in the field to accelerate the deployment of zero-emission technologies in the coming decade. [EPA-HQ-OAR-2019-0055-1165-A1, p.2]

The market is currently moving much more rapidly toward electrification than was expected at the time EPA initially finalized the Phase 2 standards in 2016. In considering whether and to what extent to make targeted adjustments to the Phase 2 standards, EPA cites two vastly different projections for 2030 market penetration of ZEV powertrains by total vehicle miles traveled: the U.S. Energy Information Administration's 2018 Annual Energy Outlook, which projects 0.08 percent, and the 2018 NREL Electrification Futures Study, which projects 29 percent. However, the more recent 2022 Annual Energy Outlook projects this share will be 13 percent by 2050.5 Given the developments in the market and the industry since then, C2ES believes more optimistic projections are more appropriate. [EPA-HQ-OAR-2019-0055-1165-A1, pp.2-3]

> 5 U.S. Energy Information Administration, *Annual Energy Outlook 2022* (Washington, DC: U.S. Department of Energy, 2022), https://www.eia.gov/outlooks/aeo/pdf/AEO2022_Narrative.pdf.

Based on recent progress in battery technology development extending range and reducing cost, in combination with increasing corporate ambition and federal procurement commitments, BloombergNEF's 2021 Electric Vehicle Outlook predicts that "battery electric trucks of any size become the cheapest option for several use cases in the 2020s."6 For example, Atlas Public

Policy finds that, as of February 2022, the total cost of ownership of the forthcoming electric Ford F-150 Lightning—one of the most popular pickup truck models in the U.S. market—is 17 percent lower than its gas-powered version.7 The Environmental Defense Fund and ROUSH Industries also project that electric versions of all class 3, 5, 7, and 8 vehicles will reach parity in total cost of ownership with their diesel counterparts by 2027, and all apart from shuttle buses will reach purchase price parity by the same year.8 [EPA-HQ-OAR-2019-0055-1165-A1, p.3]

6 Colin McKerracher et al., *Electric Vehicle Outlook 2021* (New York: BloombergNEF, 2021), https://about.newenergyfinance.com/electric-vehicle-outlook.

7 Tom Taylor and Josh Rosenberg, *Total Cost of Ownership Analysis* (Washington, DC: Atlas Public Policy, 2022), https://atlaspolicy.com/wp-content/uploads/2022/01/Total-Cost-of-Ownership-Analysis.pdf.

8 Vishnu Nair et al., *Technical Review of Medium and Heavy-Duty Electrification Costs for MY 2027-2030* (Environmental Defense Fund and ROUSH Industries, 2022), http://blogs.edf.org/climate411/files/2022/02/EDF-MDHD-Electrification-v1.6_20220209.pdf.

Recent federal policy developments since the 2020 Advanced Notice of Proposed Rulemaking also lend additional funding and political support to the development of the nascent heavy-duty ZEV industry in the United States. The IIJA includes a transformative investment in capital funding to support battery technology development and targeted ZEV deployment. [EPA-HQ-OAR-2019-0055-1165-A1, p.3]

As EPA references throughout the proposed rule, momentum is also building at the state and local levels, as states move to adopt California's Advanced Clean Trucks standards. 15 states and the District of Columbia signed the Multi-state Medium- and Heavy-Duty Zero Emission Vehicle Memorandum of Understanding setting a target of making 100 percent of new trucks zero-emission by 2050 and 30 percent zero-emission by 2030.9 Additionally, cities including Los Angeles and Boston have committed to fully electrifying their municipal fleets, including their heavy-duty transit vehicles. 10 [EPA-HQ-OAR-2019-0055-1165-A1, p.3]

9 Multi-State Zero Emission Vehicle Task Force, Multi-state Medium- and Heavy-duty Zero Emission Vehicle Memorandum of Understanding, (signed July 13, 2020), https://ww2.arb.ca.gov/sites/default/files/2020-07/Multistate- Truck-ZEV-Governors-MOU-20200714.pdf.

10 Steve Hanley, 'Electric Vehicle Master Plan–10,000 EVs for Los Angeles,' *CleanTechnica*, April 12, 2022, https://cleantechnica.com/2022/04/12/electric-vehicle-master-plan-10000-evs-for-los-angeles; 'Boston's Zero- Emission Vehicle Roadmap Summary,' Boston Transportation Department, Last modified October 2020, https://www.boston.gov/sites/default/files/file/2020/10/Executive%20Summary.pdf.

One successful example of heavy-duty fleet electrification can be found in Antelope Valley, California, which transitioned its entire transit fleet to electric in 2022, a full 18 years ahead of the state's 2040 electrification mandate.11 The fleet now includes 57 zero-emission buses, 10 EV microtransit vans, and 20 battery-electric commuter coaches, serving a community with more than 450,000 residents. The agency reported no disruptions to service and millions of dollars saved in avoided diesel fuel costs, as well as significant emissions reduction benefits. This successful example demonstrates not only that fleet electrification is possible, but it also sets a model for other transit authorities to follow. [EPA-HQ-OAR-2019-0055-1165-A1, p.3]

> 11 Antelope Valley Transit Authority, 'AVTA Becomes the First All-Electric Zero-Emission Transit Agency in North America,' press release, March 16, 2022, https://www.avta.com/avta-becomes-first-all-electric-zero-emission-transit-agency.

Given these developments in both technology advancement and policy support, EPA should adopt the most stringent emissions standards feasible with the earliest feasible target date. [EPA-HQ-OAR-2019-0055-1165-A1, p.3]

Organization: *ChargePoint, Inc. (ChargePoint)*

In 2020, 15 states and the District of Columbia signed a joint MOU pledging to achieve a 30% heavy duty electric vehicle (HDEV) market penetration by 2030 and 100% market penetration by 2050.5 Additionally, six of these MOU states have already adopted the Advance Clean Trucks (ACT) standard to set a minimum level of ZEV sales at nearly 20 percent of Class 4-8 sales in model year 2027, nearly 30 percent in model year 2028, and nearly 40 percent in model year 2029.6 Although, EPA concludes MDHVs will have 1.5% market penetration by 2027, ChargePoint strongly urges EPA to take the ACT standard market's impact into consideration moving forward in the Clean Trucks Plan. ChargePoint would strongly suggest federal deployment standards match those of the ACT in order to urge a swifter adoption of ZEV vehicles on our highways and aiding in the reduction of NOx, VOC, and GHG emissions from the MDHV sector. Based on the adoptions of the ACT plan, manufacturers will be required to sell between 40% and 75% ZEVs to the MHDV sector by 2035. [EPA-HQ-OAR-2019-0055-1294, p. 2]

> 5 https://calstart.org/wp-content/uploads/2022/02/ZIO-ZETs-Report_Updated-Final-II.pdf

> 6 Based on sales-weighted averages of zero-emission vehicle sales requirements in the Advanced Clean Trucks standard for Class 4-8 straight trucks and Class 7-8 tractors.

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

Zero-emission technologies can achieve significant pollutant reductions and are already being deployed within the heavy-duty fleet today. Despite the increasing growth of these technologies, EPA undermines its proposed criteria pollutant and GHG programs by greatly underestimating baseline (business-as-usual) heavy-duty zero-emission vehicle (HD ZEV) market penetration in MY 2027 and later. As a result of this underestimate, EPA proposes less stringent emissions standards than are warranted; overlooks the generation of a significant amount of credits that will allow vehicles to pollute at higher levels; and inadvertently exempts many vehicles from having to install any emissions controls to meet GHG standards. EPA's proposed HD ZEV baseline penetration rate of 1.5% for MY 2027 is based on outdated information and flawed methodology. It also fails to account for current market projections indicating significantly higher baseline sales; HD ZEV sales required by the Advanced Clean Trucks (ACT) rule and other state-level requirements; federal, state, local, and private sector commitments and incentives; and recent cost estimates supporting the viability of HD ZEVs across vehicle segments. Based on our analysis, EPA should revise its assessment of baseline HD ZEV penetration to at least 8–11% for MY 2027, and 19–27% by MY 2030. This correction is necessary for the standards to perform as EPA intends. In addition, we urge EPA to use this rulemaking to drive additional ZEV deployment in the heavy-duty sector in light of the current and rapidly increasing feasibility of zero-emission technologies across the range of HDV classes and applications. [EPA-HQ-OAR-2019-0055-1302-A1, pp.7-8]

Advancements in zero-emission technologies and the rapid growth of HD ZEV sales have created a critical need for EPA to update its Phase 2 GHG standards. But by dramatically underestimating baseline HD ZEV penetration and failing to include zero-emission technologies in its standard-setting analysis, EPA proposes unjustifiably weak standards that will effectively exempt many vehicles from installing any GHG emissions control technologies. [EPA-HQ-OAR-2019-0055-1302-A1, p.8]

EPA has the opportunity in this rulemaking to set a strong foundation for ambitious future rules that will achieve significant emissions reductions through widespread deployment of zero-emission technologies within the heavy-duty sector. Both now and in the future, EPA must fully analyze zero-emission technologies as feasible emissions control technologies, and it must set standards that reflect these technologies' deep emissions reductions capability. Electrification and fuel cell technologies are, or will soon be, feasible and cost-effective across the full range of HDVs, including long-haul applications. In order to achieve the United States' climate goals and carry out the Clean Air Act's mandate to protect public health and welfare, EPA must forge paths toward greater acceleration of zero-emission technology deployment in the entire heavy-duty sector. [EPA-HQ-OAR-2019-0055-1302-A1, pp.8-9]

EPA's goal of strengthening existing criteria pollutant and GHG standards for MY 2027 and later HDVs is appropriate considering the urgent need to address these air pollutants and the significant harms they cause to public health and welfare. However, the Agency's proposed standards are too lenient, in part because they rely on inaccurate estimates of future baseline HD ZEV market penetration levels, and because they fail to further drive the implementation of zero-emission technologies that can achieve deep emissions reductions. For the reasons explained in this section, instead of EPA's proposed 1.5% HD ZEV sales estimate for MY 2027, the Agency should—at a minimum—assume baseline HD ZEV sales will progress such that they reach between 8% and 11% by MY 2027, and between 19% and 27% by MY 2030.54 Moreover, because zero-emission technologies are already feasible and cost-competitive in many HD market segments, including those for which EPA proposes revisions, in order to fulfill its obligations under the Clean Air Act the Agency should adopt standards that would accelerate the deployment of these technologies above these baseline estimates. [EPA-HQ-OAR-2019-0055-1302-A1, p.20]

54 EPA’s 1.5% HD ZEV baseline penetration rate applies to Class 4–8 HDVs and omits vehicles in Classes 2b and 3. EPA also is not proposing adjusting standards for long-haul trucks. Accordingly, the 8–11% estimate for MY 2027 HD ZEV sales includes vehicles in Classes 4–8 and not Class 2b/3 vehicles and not long-haul tractors. For greater detail on the assumptions underlying this estimate, please see Appendix A. Including Class 2b and 3 vehicles would raise baseline ZEV penetration rates even higher, given the rapid market advancements in Class 2b and 3 ZEVs. Throughout this section, 'heavy-duty' vehicles only refer to Class 4–8 vehicles and not Class 2b and 3.

The Proposal’s underestimate of the baseline market penetration of HD ZEVs and its failure to propose standards that further drive adoption of zero-emission technologies ignores the Agency’s obligations under the Clean Air Act and weakens the proposed standards in several ways:

1. Considering more accurate (higher) baseline HD ZEV market penetration ‘could lead to a more stringent NOx emission standard,’ as EPA acknowledges. 87 Fed. Reg. at 17,561.
2. Underestimating the baseline market penetration of HD ZEVs will lead to the generation of a significant amount of credits that will dramatically undermine the goals of the NOx standards and fail to protect public health and welfare. 87 Fed. Reg. at 17,561.55 Allowing for ZEVs to generate NOx emissions credits is a significant departure from EPA’s prior rules,56 and a revised, more accurate baseline HD ZEV penetration estimate would require reconsideration of these credits to ensure that the rule reflects the greatest degree of emission reduction achievable, as is EPA’s statutory mandate.
3. Disregarding the feasibility of zero-emission technologies in establishing the stringency of the proposed criteria pollutant standards unjustifiably takes proven emission reduction technologies off the table. [EPA-HQ-OAR-2019-0055-1302-A1, pp.20-21]

55 EPA notes that it includes an FEL cap on NOx emissions to help limit the impact credits generated from BEVs or FCEVs could have in enabling vehicles to exceed the NOx standard. However, if HD ZEV market penetration is higher than EPA projects, 'there is the potential for a greater portion of CI engines to emit up to the level of the FEL cap,' 87 Fed. Reg. at 17,560, further undermining the goals of the regulatory program. EPA notes the importance of 'consider[ing] what impact NOx emissions credits generated from BEVs and FCEVs might have on the NOx emission reductions expected from the proposed rulemaking. Id. at 17,561. Further, as discussed in Section IV.D.2.c of these comments, EPA’s proposed FEL cap is unreasonably high.

56 See 87 Fed. Reg. at 17,556 ('However, under the current criteria pollutant program, manufacturers do not have a pathway to generate NOx emission credits for HEVs, BEVs, or FCEVs. For BEVs and FCEVs, current 40 CFR 86.016-1(d)(4) stipulates that these technologies may not generate NOx emission credits…'); id. at 17,561–62 (proposing to allow ZEVs to generate NOx emissions credits); 40 CFR 86.016-1(d)(4) ('Electric heavy-duty vehicles may not generate NOx or PM emission credits.').

4. Because the GHG standards apply as a fleet average, by underestimating the MY 2027 HD ZEV market penetration in the Proposal, EPA in turn underestimates the percentage of vehicles that would be able to meet the current Phase 2 standards without installing emission-reduction

technologies, undermining the program’s goal of requiring all conventional vehicles to install such controls.57

57 EPA explains in the Proposal that '[t]he intent of the existing HD GHG Phase 2 program was to set the stringency of the standards at a level that all conventional vehicles would need to install some level and combination of emission-reducing technologies or offset another conventional vehicle not installing such technology, since at that time we predicted very little market penetration of EVs.' 87 Fed. Reg. at 17,603.

5. Failing to revisit the GHG standards with an approach that would further drive adoption of zero-emission technologies—a regulatory path that is clearly feasible—results in standards that fall far short of achieving necessary climate and health benefits. [EPA-HQ-OAR-2019-0055-1302-A1, p.21]

The combination of applying an unreasonably low baseline HD ZEV market penetration estimate and failing to set criteria pollutant and GHG standards that further drive adoption of zero-emission technologies means that not only does EPA fail to set technology-forcing standards, as Congress directed it to do, but that the Agency actually limits itself to technologies that are inferior to what is available today. See NRDC v. EPA, 655 F.2d at 328 (emphasizing that EPA should ‘press for the development and application of improved technology rather than be limited by that which exists today’). [EPA-HQ-OAR-2019-0055-1302-A1, p.21]

The Proposal underestimates baseline HD ZEV market penetration in several ways. First, EPA bases its estimate on the number of HD ZEVs it expects as a result of California’s regulatory requirements for HDVs in 2027, extrapolated to a national level, but its methodology is flawed for several reasons. In particular, EPA relies on HD ZEV projections from California’s ACT58 rulemaking in 2019, which are based on projected 2027 HD sales that are significant underestimates—notably lower than EPA’s own projections in its MOtor Vehicle Emission Simulator (MOVES) model and when compared to historical HDV sales data, as discussed in more detail below. As a result, the Proposal’s baseline ZEV sales projections for California in 2027 are unreasonably low and out of line with other, more accurate data and information. In calculating its baseline HD ZEV penetration estimate, EPA should rely on its own up-to-date MOVES data (which is also more in line with historical sales data) rather than California’s 2019 projections. [EPA-HQ-OAR-2019-0055-1302-A1, pp.20-21]

58 CARB, Advanced Clean Trucks Regulation—Final Regulation Order (Mar. 15, 2021), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/fro2.pdf.

Further, in extrapolating to the national level, EPA relies on a ratio from a 2021 report by ICCT on U.S. and Canada ZEV sales. But there is no reason to believe that this ratio will continue to hold in the future. Moreover, EPA ignores the HD ZEV sales that will result in other states that have already adopted the ACT rule, as well as those that have signed the Multi-State Medium- and Heavy-Duty Zero Emission Vehicle Memorandum of Understanding (MOU),59 which targets ZEV sales and commits to ZEVs achieving 30% of all HDV sales by 2030 and 100% of all HDV sales by 2050. If EPA used MOVES data and looked at these existing state-level commitments, the baseline HD ZEV market penetration for 2027 would be significantly higher than that calculated in the Proposal. [EPA-HQ-OAR-2019-0055-1302-A1, p.21]

> 59 See NESCAUM, Multi-State Medium- and Heavy-Duty Zero-Emission Vehicle Memorandum of Understanding (NESCAUM MOU) (last accessed May 10, 2022), https://www.nescaum.org/documents/mhdv-zev-mou-20220329.pdf/.

In addition to the flaws in EPA's methodology, the Agency ignores other highly relevant information that shows that its approach in the Proposal is a significant underestimate of baseline ZEV penetration in the heavy-duty sector. This includes:

- Current market projections indicating significantly higher baseline HD ZEV sales;
- Federal, state, local, and private sector actions supporting a much higher baseline HD ZEV penetration rate; and
- Recent HD ZEV cost estimates supporting the viability of ZEVs across vehicle segments. [EPA-HQ-OAR-2019-0055-1302-A1, p.22]

EPA must consider the additional data available and presented in these comments to fulfill its obligations to engage in reasoned decision making and to set emissions standards that are supported by the record. In particular, EPA should update its assessment of baseline HD ZEV penetration in the range of at least 8–11% for MY 2027, significantly higher than EPA's proposed rate of just 1.5%.60 Assuming that all states that have signed the MOU also adopt the ACT, national HD ZEV market penetration will reach 8% in 2027. Assuming that additional state programs and private sector commitments drive some ZEV penetration in non-MOU states, national HD ZEV market penetration will reach 11% in 2027. By 2030, baseline HD ZEV penetration will reach 19–27%, accordingly. It is important for EPA to consider baseline market penetrations beyond MY 2027 since manufacturers have three model years to carry back ZEV credits; sales between MY 2028 and MY 2030 are, consequently, available for compliance in 2027. See 81 Fed. Reg. at 73,638 ('The agencies proposed and are adopting for Phase 2 the five year credit life and three year deficit carry-over provisions from Phase 1 (40 CFR 1037.740(c) and 1037.745).'). High baseline HD ZEV penetration in MYs 2028–2030 would allow manufacturers to accrue large numbers of credits that they could apply to prior years, diluting the standards. The carry-over provision effectively allows manufacturers to average sales across a multi-year period; having permitted compliance on a multi-year average basis, EPA is required to examine baseline market penetration across the same multi-year period. [EPA-HQ-OAR-2019-0055-1302-A1, pp.22-23]

> 60 See, e.g., 87 Fed. Reg. at 17,458 (noting that EPA 'may re-evaluate our approach, especially if we receive information showing higher BEV/FCEV market penetration in the MY 2027 or later timeframe'); id. at 17,471 (requesting comment on whether to include zero-emission technologies in the feasibility analysis for the final rule); id. at 17,599 (considering 'whether it would be appropriate in the final rule to increase the stringency of the standards more than what we have proposed'); id. (requesting information and data to support 'HD ZEV penetration rates of 5 or 10 percent (or higher)' in the MY 2027–2029 timeframe).

Moreover, to comply with its Clean Air Act obligations, EPA should go further than correcting its baseline HD ZEV penetration estimate by including zero-emission technologies in the technology packages underlying the criteria pollutant and GHG standards. EPA requested comment ‘on how the Agency can best consider the potential for ZEV technologies to significantly reduce air pollution from the heavy-duty vehicle sector.’ 87 Fed. Reg. at 17,420. As detailed below, zero-emission technologies are already available and cost-competitive in many HD market segments. Importantly, given technological advancements and substantial investments and commitments in the public and private sectors, greater adoption of zero-emission technologies is clearly feasible prior to MY 2030. In addition to these comments, EPA should consider the data presented in the comments on this Proposal submitted by the Moving Forward Network (MFN), Environmental Defense Fund (EDF), and ICCT, all of which further elaborate on the feasibility and importance of achieving significantly greater levels of ZEV penetration within the HD fleet.61 Doing so would fulfill EPA’s statutory mandate by delivering substantial climate and health benefits, as is detailed in the research supporting the MFN, EDF, and ICCT comments on this Proposal. [EPA-HQ-OAR-2019-0055-1302-A1, p.23]

> 61 When considering GHG standards that further drive adoption of zero-emission technologies, EPA should ensure that it preserves the original Phase 2 stringency for ICE vehicles. See, e.g., Sara Kelly et al, ICCT Comments on EPA’s Proposed Heavy-Duty Engine and Vehicle Standards 17–18, ICCT (May 10, 2022), https://theicct.org/wp-content/uploads/2022/04/public-webinar_10May2022.pdf (urging EPA to preserve the original Phase 2 stringency for internal combustion engine (ICE) vehicles by removing ZEV crediting and requiring all ICE vehicles to meet the original Phase 2 GHG standards).

Second, EPA wrongly assumes that California will continue to represent an oversized share of national HD ZEVs sales by failing to accurately capture the impact of other states’ policies on HD ZEV sales. The Proposal correctly points out that numerous states ‘have announced plans to shift the heavy-duty fleet toward zero-emission technology.’ 87 Fed. Reg. at 17,598.79 Yet when calculating baseline HD ZEV market penetration, EPA fails to discuss or account for the full range of state policies and commitments, particularly those from outside of California. Considering them would lead to substantially higher and more accurate baseline HD ZEV penetration rates. [EPA-HQ-OAR-2019-0055-1302-A1, p.26]

> 79 See, e.g., 87 Fed. Reg. at 17,595, n.813, n.814 (citing states’ and cities’ expansion of electric bus fleets); id. at 17,596–97 (noting that the 'BEV market for transit and school buses continues to grow,' and identifying several cities with ZEV transit bus programs); id. at 17,597 (listing several states with ZEV school bus programs); id. at 17,598 (explaining the ACT rule and states that have signed a related MOU).

EPA notes that ‘[o]utside California, several states have signaled interest in shifting to heavy-duty ZEV technologies and/or establishing specific goals to increase the heavy-duty electric vehicle market.’ 87 Fed. Reg. at 17,598. EPA further explains that 15 states and the District of Columbia have signed the MOU targeting ZEV sales equaling 30% of all HDV sales by 2030 and 100% of all HDV sales by 2050. 87 Fed. Reg. at 17,598. The Proposal fails to include both Virginia and Nevada as MOU signatories, and these two states bring the total MOU signatories to 17 states and the District of Columbia.80 HDV sales in MOU states, including California, make up a significant portion of national HDV sales—about 36.5%.81 In March 2022, Northeast States for Coordinated Air Use Management (NESCAUM) and the MOU states issued a comprehensive and detailed draft Action Plan to meet their goals.82 Despite mentioning the MOU, the Proposal does not factor into its baseline HD ZEV market penetration the fact that ZEVs will be added to the heavy-duty fleet more rapidly in these 17 states and D.C., which make up more than a third of national HDV sales.83 An analysis by ICCT estimates that 36% of HDV sales in MOU states (excluding California) would be ZEVs in 2030 if all states implement the goal set out in the MOU.84 ICCT estimates that this would translate to 153,820 HD ZEV sales in MOU states (excluding California) in 2030.85 [EPA-HQ-OAR-2019-0055-1302-A1, pp.26-27]

80 Electrification Coalition, Nevada Joins Multi-State Agreement to Electrify Trucks and Buses (Mar. 31, 2022), https://www.electrificationcoalition.org/nevada-joins-multi-state-agreement-to-electrify-trucks-and-buses/; Sierra Club, Governor Northam Signs Virginia onto Multi-State Agreement to Electrify Trucks and Buses (Dec. 9, 2021), https://www.sierraclub.org/press-releases/2021/12/governor-northam-signs-virginia-multi-state-agreement-electrify-trucks-and.

81 Claire Buysse, et al., Racing to Zero: The Ambition We Need for Zero-Emission Heavy-Duty Vehicles in the UnitedStates, ICCT (Apr. 8, 2022). This is consistent with MOVES3 projections for MY 2027, which show 219,092 heavy-duty sales in all the MOU states, as compared to 606,659 total heavy-duty sales nationally, or 36% of all sales. See Appendix A for the relevant MOVES3 sales projections.

82 NESCAUM, Multi-State Medium- and Heavy-Duty Zero-Emission Vehicle Action Plan: A Policy Framework to Eliminate Harmful Truck and Bus Emissions, Draft for Public Comment (NESCAUM Action Plan) (Mar. 10, 2022), https://www.nescaum.org/documents/mhd-zev-action-plan-public-draft-03-10-2022.pdf.

83 The MOU signatories are: California, Connecticut, Colorado, Hawaii, Maine, Maryland, Massachusetts, Nevada, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia, Washington, and the District of Columbia. See NESCAUM MOU.

84 Arijit Sen et al., Benefits of the 2020 Multi-State Medium- and Heavy-Duty Zero-Emission Vehicle Memorandum of Understanding 5, ICCT (Apr. 2022), https://theicct.org/wp-content/uploads/2022/04/md-hd-mou-benefits-apr22.pdf.

85 Id. at 5, Figure 1; id. at 15, Table A4, excluding 2b/3 vehicles.

In addition to the MOU, EPA cites the adoption of the ACT rule in three states—New York, New Jersey, and Washington, 87 Fed. Reg. at 17,598 nn.846–48—but in fact, five states in addition to California have adopted the ACT rule,86 which with California would comprise 20%87 of total HDV sales in 2027.88 Other states also have relevant legislation underway. In May 2022, Connecticut passed legislation authorizing the state's Department of Energy and Environmental Protection to adopt the ACT rule.89 Maine has also made progress toward adopting ZEV standards for the state's HDVs and is currently seeking additional public and stakeholder comment on its proposed ACT rule.90 The Proposal correctly notes the expectation that more states will follow,91 and Colorado, Illinois, and Vermont have 'signaled plans to weigh the new regulations' as well.92 HD ZEV sales in ACT-adopting states will need to reach between 30% (Class 7–8 tractors) and 50% (Class 4–8 trucks) by 2030, and 40% (Class 7–8 tractors) to 75% (Class 4–8 trucks) by 2035 in order to meet the ACT targets.93 But again, EPA fails to account for the fact that the states that have adopted the ACT rule have committed to ZEV adoption at a more rapid pace than EPA projects, even absent any additional federal regulation, and that others are already taking action to join them. [EPA-HQ-OAR-2019-0055-1302-A1, pp.27-28]

86 States that have adopted the ACT rule include New York, New Jersey, and Washington, as cited in the Proposal, along with Oregon and Massachusetts.

87 Calculated using EPA MOVES3, https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves. See Appendix A for the relevant MOVES3 sales projections.

88 Laura Bliss, How Six States Could Transform the U.S. Trucking Industry, Bloomberg (Jan. 6, 2022), https://www.bloomberg.com/news/articles/2022-01-06/how-zero-emission-laws-will-reshape-u-s-trucking.

89 See Electric Trucks Now, States Are Embracing Electric Trucks (last accessed May 10, 2022), https://www.electrictrucksnow.com/states; Governor Ned Lamont, State of Connecticut, Governor Lamont Applauds Final Passage of Climate Legislation That Includes New Emissions Standards for Medium and Heavy-Duty Vehicles (Apr. 29, 2022), https://officeofthegovernor.cmail20.com/t/ViewEmail/j/74D52C48B1231B922540EF23F30FEDED/BC5917CDF0297FE1025DA65DC0D0F53A?alternativeLink=False.

90 State of Maine Board of Environmental Protection, Meeting Minutes (Jan. 20, 2022), https://www.maine.gov/dep/bep/calendar.html.

91 87 Fed. Reg. at 17,598 (noting that 'we anticipate more states to follow with similar proposals' to the states that have adopted California's ACT rule).

92 Laura Bliss, How Six States Could Transform the U.S. Trucking Industry, Bloomberg (Jan. 6, 2022), https://www.bloomberg.com/news/articles/2022-01-06/how-zero-emission-laws-will-reshape-u-s-trucking.

93 CARB, Advanced Clean Trucks Regulation, Final Regulation Order, Table A-1 at 5 (Mar. 15, 2021), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/fro2.pdf; Rachel MacIntosh et al., Electric Vehicle Market Update 15, EDF (Apr. 2022), http://blogs.edf.org/climate411/files/2022/04/electric_vehicle_market_report_v6_april2022.pdf.

Instead of factoring these state policies directly into its calculations, EPA takes an approach that leads to a significant underestimate of baseline HD ZEV market penetration by MY 2027. In the DRIA, EPA cites a 2021 analysis by ICCT that notes that 42% of cumulative HD ZEVs sold through 2020 in the U.S. and Canada have been in California.94 This leads EPA to conclude that 42% of annual national HD ZEV sales will be in California in MY 2027. But this will not be the case in 2027. While California represents 42% of cumulative HD ZEV sales in the United States and Canada, it only comprises 10% of U.S. HDV registrations.95 As noted above, states that have signed the MOU, including California and other ACT-adopting states, represent 36.5% of HDV registrations.96 As these policies take effect in these states, the relative share of HD ZEV sales in California will fall, even as national sales increase. California would only represent 28% of total HD ZEV sales nationally if all MOU states achieve the ACT targets (with the MOU states representing 72% of total HD ZEV sales).97 And these figures do not account for the high possibility that other states beyond the MOU states also see growth in HD ZEV sales, as detailed in Section III.C below. [EPA-HQ-OAR-2019-0055-1302-A1, p.28]

94 Ben Sharpe & Claire Buysse, Zero-Emission Bus and Truck Market in the United States and Canada: A 2020 Update 5, ICCT (May 21, 2021), https://theicct.org/publication/zero-emission-bus-and-truck-market-in-the-united-states-and-canada-a-2020-update/.

95 For MY 2020. See Appendix A for details on these calculations.

96 Claire Buysse et al., Racing to Zero: The Ambition We Need for Zero-Emission Heavy-Duty Vehicles in the United States, ICCT (Apr. 8, 2022). See also MOVES3 projections for MY 2027.

97 See Appendix A for details on these calculations. Calculated using EPA MOVES3, https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves.

There has been a similar trend of other states making up a larger share of light-duty ZEV sales. In 2015, a total of 64,175 light-duty ZEVs were sold in the United States, with 53% sold in California.98 However, as of 2021, California's relative share has fallen to 35% as light-duty ZEV sales have dramatically accelerated nationally, driven by other federal and state policies and significant consumer interest in ZEVs (Figure 2). As of 2021, new light-duty ZEV sales totaled 166,582 in California (nearly 5 times higher than in 2015) and 473,426 nationally (nearly 7 times higher than in 2015).99 These trends demonstrate not only how quickly ZEV sales have accelerated but also how they have grown in states beyond California. Over the long term, with other state policies and federal incentives taking effect, regional differences in ZEV sales will diminish for HDVs, just as they have for light-duty vehicles.

[EPA-HQ-OAR-2019-0055-1302-A1, pp.28-29] [Figure 2 has footnote 100]

98 Alliance for Automotive Innovation, Electric Vehicle Sales Dashboard (last accessed May 10, 2022), https://www.autosinnovate.org/resources/electric-vehicle-sales-dashboard.

99 Id.

100 Developed using data from the Electric Vehicle Sales Dashboard. See id.

In light of this data, EPA should not calculate forward-looking national HD ZEV sales using outdated HDV sales estimates and backward-looking sales shares. Instead, EPA should factor in the impact of policies in other states beyond California in the Agency's estimate of baseline HD ZEV market penetration. This should include states that 1) have adopted the ACT rule; 2) have committed to the MOU; and 3) are taking actions to deploy zero-emission transit and school buses (where it is possible to separately quantify those actions). This would result in a baseline HD ZEV market penetration estimate of at least 8% by 2027 and 19% by 2030.101 [EPA-HQ-OAR-2019-0055-1302-A1, p.29]

101 This assumes MOU states adopt ACT targets for 2027 and 2030. For detailed description of the methodology to develop these estimates, see Appendix A.

Still, even these more accurate baseline estimates would fail to reflect growing HD ZEV deployment in states that may adopt regulatory policies in the future or deployment that is driven by local government programs and private sector investments, as discussed below in Section III.C. As such, a baseline HD ZEV market penetration of 8% by 2027 and 19% by 2030 would be conservative. Accounting for modest additional state and private sector actions would bring baseline HD ZEV market penetration to at least 11% by 2027 and 27% by 2030.102 In addition, the faster-than-expected gains in the cost-competitiveness of HD ZEVs, as detailed below in Section III.D, offers additional evidence that HD ZEV uptake will continue to increase and that a MY 2027 HD ZEV penetration rate of between 8% and 11% by 2027 is a feasible and conservative baseline estimate.103 [EPA-HQ-OAR-2019-0055-1302-A1, pp.29-30]

102 This assumes MOU states adopt ACT targets for 2027 and 2030 and non-MOU states achieve 4% HD ZEV penetration by 2027 and 11% HD ZEV penetration by 2030. For a detailed description of the methodology to develop these estimates, see Appendix A.

103 For a detailed description of the methodology to develop these estimates, see Appendix A.

Current market analyses project rapid growth in HD ZEVs by the late 2020s, further illustrating that EPA's proposed baseline market penetration is a significant underestimate and that standards that further drive adoption of zero-emission technologies are clearly feasible. [EPA-HQ-OAR-2019-0055-1302-A1, p.30]

In discussing advances to the HD ZEV market, EPA cites two modeled projections: the Energy Information Administration's (EIA) Annual Energy Outlook 2021 ('AEO 2021') and the National Renewable Energy Laboratory's (NREL) Electrification Futures Study (2018). EPA also requests comment on sources for estimates and projections of the HD ZEV market. There are additional and up-to-date projections that demonstrate much higher baseline national HD ZEV penetration than the limited information that EPA considered in the Proposal, as shown in Table 2 below. These include:

- Boston Consulting Group discusses the fact that 'change is unfolding at electrifying speed in the commercial vehicle industry,' driven by economics and policies.104 The report predicts BEV sales in the range of 19–23% and FCEV sales in the range of 3–6%, with a central estimate of 25% ZEVs by 2030 (and 10% ZEVs by 2025). Even in its conservative scenario, zero-emission commercial vehicle sales would reach 6% in 2025 and 15% in 2030. [EPA-HQ-OAR-2019-0055-1302-A1, p.30]

  104 Peter Wiedenhoff et al., What the Shift to Zero-Emission Vehicle Means for Commercial Transportation, Boston Consulting Group (Mar. 22, 2022), https://www.bcg.com/en-us/publications/2022/what-the-shift-to-zero-emission-vehicles-means-for-commercial-transportation.

- NREL's 'Decarbonizing Medium- and Heavy-Duty On-Road Vehicles' report finds that 'zero-emission vehicles (ZEVs) can reach total-cost-of-driving parity with conventional diesel vehicles by 2035 for all medium- and heavy-duty (MD/HD) vehicle classes,' with smaller trucks and short-haul trucks achieving cost parity soon.105 The analysis concludes that 'demand for ZEV could rise rapidly...once cost parity is reached' and that ZEV sales could reach 42% by 2030.106 [EPA-HQ-OAR-2019-0055-1302-A1, p.30]

  105 Catherine Ledna et al., Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis 2, NREL (Mar. 2022), https://www.nrel.gov/docs/fy22osti/82081.pdf.

  106 Id. at 3.

- ACT Research's 'Charging Forward Update' report projects that BEVs will reach 21% of Class 4–8 sales by 2027.107

  107 Jennifer McNealy, ACT Research Releases Updated BEV and FCEV Study & Adoption Forecasts for NA CV Markets, ACT Research (Feb. 7, 2022), https://content.actresearch.net/blog/nacev-act-research-releases-updated-bev-and-fcev-study-adoption-forecasts-forna-cv-markets.

- The International Energy Agency's Global EV Outlook 2021 projects that due to federal and state policies incentivizing ZEVs and charging infrastructure, ZEV sales for buses and trucks will reach 20% and 8%, respectively, by 2030.108

  108 IEA, Prospects for Electric Vehicle Deployment (2021), https://www.iea.org/reports/global-ev-outlook-2021/prospects-for-electric-vehicle-deployment (IEA's definition appears to include Class 2b/3 categories).

- BNEF's Electric Vehicle Outlook 2021 states that 'in urban duty cycles, battery electric trucks of any size become the cheapest option for several use cases in the 2020s,' with 'battery electric trucks becoming a viable option for heavy-duty long-haul operations' by the late 2020s.109 BNEF's Economic Transition Scenario projects that U.S. HD ZEV sales will reach 5% in 2027 for commercial HDVs and 38% in 2027 for buses. [EPA-HQ-OAR-2019-0055-1302-A1, p.31]

109 BNEF, Electric Vehicle Outlook 2021 (2021), https://about.bnef.com/electric-vehicle-outlook/.

The AEO 2021 report that EPA cites in the Proposal projects that HD ZEVs will only make up 0.12% of new truck sales in 2027.110 This projection is substantially lower than other available market-based projections and should not be relied upon for the rulemaking. The model projects that only 485 electric medium- or heavy-duty vehicles will be sold in 2027, which is completely inconsistent with existing state policies and private sector commitments.111 Importantly, the National Energy Modeling System (NEMS), the model used for the AEO 2021 report, does not consider the impact of California and other states adopting the ACT rule or signing the MOU. NEMS also does not factor in total cost-of-ownership in calculating vehicle sales demand,112 does not appear to reflect the latest projected battery costs, and imposes exogenous maximum zero-emission technology penetration of 10%.113 [EPA-HQ-OAR-2019-0055-1302-A1, p.31]

110 87 Fed. Reg. at 17,596

111 EIA, Annual Energy Outlook 2021, Table 49. Freight Transportation Energy Use (last accessed May 10, 2022), https://www.eia.gov/outlooks/archive/aeo21/tables_ref.php (attached to these comments as an Excel spreadsheet).

112 EIA, Transportation Sector Demand Module of the National Energy Modeling System: Model Documentation (Dec. 2020), https://www.eia.gov/outlooks/aeo/nems/documentation/transportation/pdf/m070(2020).pdf.

113 National Energy Modeling System input file 'Max Share of Each Fuel Type' corresponding to parameter 'EFSHXG' for formula (199) as discussed in id. at 108. NEMS input files can be found at: https://www.eia.gov/outlooks/aeo/info_nems_archive.php

For its second source, EPA cites the NREL Electrification Futures Study (EFS).114 Compared to AEO 2021, NREL projects a greater market penetration of HD ZEVs, but the analysis is still dated compared to more recent analyses. NREL EFS projects 2027 HD ZEV sales shares of 5% for Class 3–6, 2% for Class 7–8, and 9% for buses in its Medium Scenario; and 10% for Class 3–6, 7% for Class 7–8, and 45% for buses in its High Scenario. As NREL’s analysis was completed in 2017, it does not account for all the significant advancements in the HD ZEV market that EPA proposes to take into account in this rulemaking. For instance, the NREL EFS assumes that battery costs decline such that they reach $135/kWh by 2050. This is a much slower pace than has been demonstrated in the real world. In fact, according to BNEF, the average lithium-ion battery pack cost was $137/kWh in 2020, down from $295/kWh in 2016.115 Projected battery costs have fallen significantly to such an extent that a report by Roush Industries notes that ‘battery cost projections made in 2017-2018 are already obsolete.’116 Analysis conducted by Roush finds that battery costs could reach $59–68/kWh by 2027. Other analyses have cited costs of $100/kWh by 2025.117 Furthermore, the NREL EFS pre-dates California's ACT program and the MOU signed by 17 states, so it does not consider the impact that these policies will have on market evolution. [EPA-HQ-OAR-2019-0055-1302-A1, pp.31-32]

114 Trieu Mai et al., Electrification Futures Study: Scenarios of Electric Technology Adoption and Power Consumption for the United States, NREL (2018), https://www.nrel.gov/docs/fy18osti/71500.pdf.

115 BNEF, Electric Vehicle Outlook 2021 (2021).

116 Vishnu Nair et al., Technical Review of: Medium and Heavy-Duty Electrification Costs for MY 2027- 2030 44, Figure 15, Roush Industries for EDF (Feb. 2, 2022), http://blogs.edf.org/climate411/files/2022/02/EDF-MDHD-Electrification-v1.6_20220209.pdf.

117 Peter Wiedenhoff et al., What the Shift to Zero-Emission Vehicle Means for Commercial Transportation, Boston Consulting Group (March 22, 2022); Chad Hunter, NREL, Spatial and Temporal Analysis of the Total Cost of Ownership for Class 8 Tractors and Class 4 Parcel Delivery Trucks 10 (Sept. 2020), https://www.nrel.gov/docs/fy21osti/71796.pdf.

Accordingly, EPA should place greater weight on recent studies that more accurately reflect a current assessment of the HD ZEV market, and which project more rapid market penetration of HD ZEVs in the coming years. [EPA-HQ-OAR-2019-0055-1302-A1, p.32]

Table 2: Recent Studies with Market Projections for HD ZEVs

- ACT Research 'Charging Forward Update'118
  - Percent National HD ZEV Sales: 24% by 2027 for Class 4–8 commercial vehicles

118 Jennifer McNealy, ACT Research Releases Updated BEV and FCEV Study & Adoption Forecasts for NA CV Markets, ACT Research (Feb. 7, 2022), https://content.actresearch.net/blog/nacev-act-research-releases-updated-bev-and-fcev-study-adoption-forecasts-forna-cv-markets.

- NREL 'Decarbonizing Medium and Heavy-Duty On-road Vehicles'119
  - Percent National HD ZEV Sales: 42% by 2030 for Class 3–8 vehicles

119 Catherine Ledna et al., Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis 2, NREL (Mar. 2022), https://www.nrel.gov/docs/fy22osti/82081.pdf.

- Boston Consulting Group 'What the Shift to Zero-Emission Vehicles Means for Commercial Transportation'120
  - Percent National HD ZEV Sales: 25% by 2030 (range of 21% to 29%)

120 Peter Wiedenhoff et al., What the Shift to Zero-Emission Vehicle Means for Commercial Transportation, Boston Consulting Group (Mar. 22, 2022).

- IEA Global EV Outlook121
  - Percent National HD ZEV Sales: 8% for trucks and 20% for buses by 2030 under Stated Policies Scenario

121 IEA, Prospects for Electric Vehicle Deployment (2021), https://www.iea.org/reports/global-ev-outlook-2021/prospects-for-electric-vehicle-deployment.

- BNEF Electric Vehicle Outlook 2021122
  - Percent National HD ZEV Sales: 5% for trucks and 38% for buses by 2027 [EPA-HQ-OAR-2019-0055-1302-A1, p.32]

122 BNEF, Electric Vehicle Outlook 2021 (2021).

EPA's proposed HD ZEV market penetration estimate also fails to account for plans by entities at all levels within the public and private spheres beyond state-adopted ACT rules and the MOU, which would significantly expand the HD ZEV market. This suggests that even a MY 2027 baseline HD ZEV penetration rate of 8% to 11% is a conservative estimate. The federal government, cities, and states across the country have implemented plans to transition their heavy-duty fleets to ZEVs. The private sector, too, has seen rapidly increasing commitments from both manufacturers and fleet managers. The Proposal notes a few of these public and private commitments, but it fails to capture the depth and breadth of the pace at which these commitments and goals are being announced. This section offers a non-exhaustive survey of some of the many goals and commitments already made; several sources are regularly updated and available to EPA to track the rapidly expanding HD ZEV market.123 A more accurate picture of the national HD ZEV landscape clearly indicates that EPA's estimate of only 9,376 HD ZEV sales nationally by MY 2027124 is a gross underestimate—especially given that fleets have already ordered or deployed at least 19,000 Class 4–8 ZEVs125—and supports a baseline HD ZEV market penetration of at least 8–11% in MY 2027. In addition, these goals and commitments further show the need for EPA to treat zero-emission technologies as feasible and to incorporate them into its standards-setting analysis. [EPA-HQ-OAR-2019-0055-1302-A1, p.33]

123 For updated information, EPA should consult the following resources: EDF, Electric Fleet Deployment & Commitment List (last accessed May 10, 2022), https://docs.google.com/spreadsheets/d/1l0m2Do1mjSemrb_DT40YNGou4o2m2Ee-KLSvHC-5vAc/edit#gid=2049 738669 (tracking fleet-level orders, vehicles in operation, and commitments); CALSTART, Zero-Emission Technology Inventory (2022), https://globaldrivetozero.org/tools/zero-emission-technology-inventory/ (tracking HDV ZEV models and commercial availability); DOE, Federal and State Laws and Incentives, Alternative Fuels Data Center (last accessed May 10, 2022), https://afdc.energy.gov/laws (tracking federal, state, and local laws and commitments within all ZEV sectors).

124 87 Fed. Reg. at 17,600.

125 This value was calculated by selecting the Class 4–8 trucks listed as deployed or ordered in EDF's Electric Fleet Deployment & Commitment List, as of May 10, 2022. The list is regularly updated to include additional new commitments. EDF, Electric Fleet Deployment & Commitment List.

On the state level, commitments and incentives extend beyond the ACT rule and the MOU. For example, CARB's Innovative Clean Transit regulation directs large transit agencies to make 25% of new bus purchases zero-emission in 2023, increasing to 50% by 2026 and 100% by 2029.126 More than 3,500 BEV and hydrogen FCEV transit buses are already in operation or on order nationwide.127 New York has also signed into law plans to electrify all school buses in the state by 2035—yielding 50,000 electric HDVs in that state alone.128 CARB is also developing the Advanced Clean Fleets (ACF) rule, which EPA did not analyze in the Proposal, to complement the ACT rule. The ACF rule will regulate public and private fleets, new mobility fleets, large employer fleets, rental fleets, and delivery fleets, with the 'goal of achieving a zero-emission public bus and truck fleet in California by 2045 and significantly earlier for certain market segments like last mile delivery and drayage trucks.'129 In addition, California's Low NOx Heavy-Duty Omnibus Regulation (the 'Omnibus'), adopted in 2020, 'will cut NOx emissions from heavy-duty trucks by roughly 75 percent below current standards beginning in 2024 and 90 percent in 2027.'130 These regulations are expected to be fully effective by 2024, likely increasing HD ZEV uptake in California even more than the ACT rule alone.131 [EPA-HQ-OAR-2019-0055-1302-A1, pp.33-34]

126 Sandra Wappelhorst & Felipe Rodríguez, ICCT, Decarbonizing Bus Fleets: Global Overview of Targets for Phasing Out Combustion Engine Vehicles (Dec. 9, 2021), https://theicct.org/decarbonizing-bus-fleets-global-overview-of-targets-for-phasing-out-combustion-engine-vehicles/; CARB, Innovative Clean Transit Fact Sheet (May 16, 2019), https://ww2.arb.ca.gov/resources/fact-sheets/innovative-clean-transit-ict-regulation-fact-sheet.

127 NESCAUM Action Plan at 15; Hannah Hamilton et al., CALSTART, Zeroing in on ZEBs 10 (Dec. 2021), https://calstart.org/wp-content/uploads/2022/01/2021-ZIO-ZEB-Final-Report_1.3.21.pdf.

128 Michelle Lewis, New York State Commits to 100% Electric School Buses by 2035, Electrek (Apr. 8, 2022), https://electrek.co/2022/04/08/new-york-state-governor-100-electric-school-buses-2035/ (New York City had already passed legislation that required electrifying its entire school bus fleet—9,500 buses—by 2035 prior to the state's commitment); World Resources Institute (WRI), Statement: New York Enacts First-in-Nation Plan to Electrify All State School Buses (Apr. 7, 2022), https://www.wri.org/news/statement-new-york-enacts-first-nation-plan-electrify-all-state-school-buses.

129 Rachel MacIntosh et al., Electric Vehicle Market Update 15, EDF (Apr. 2022).

130 Id.; Patricio Portillo, Natural Resources Defense Council, California Omnibus Rule Adds Momentum to Cut Truck Pollution (Aug. 27, 2020), https://www.nrdc.org/experts/patricio-portillo/california-omnibus-rule-adds-momentum-cut-truck-pollution.

131 Id.

In addition, state-level commitments do not end with states that have enacted the ACT rule or signed the MOU. In fact, goals have been announced, commitments made, regulations passed, or financial incentives provided (such as rebates or funding) specific to the heavy-duty sector in at least 39 states plus the District of Columbia.132 These heavy-duty sector programs are in addition to many broader state and local programs targeted at ZEV adoption generally (across all vehicle sectors), which exist in all 50 states133 and include: medium- and heavy-duty or diesel emissions reduction funding, rebates, or HDV replacement grants in states such as Delaware, Idaho, Indiana, Iowa, Michigan, Montana, New Mexico, Ohio, South Dakota, Texas, and Wyoming;134 allowance for HD ZEVs to exceed weight limits in Arizona; ZEV school and/or transit bus programs and incentives in Illinois, Minnesota, Missouri, Oklahoma, Texas, West Virginia, and Wisconsin; and a diesel refuse truck replacement program in Nebraska.135 Other states beyond those that have adopted the ACT rule or signed the MOU have also been forming smaller regional-specific collaborations aimed at HD ZEV adoption. For example, Illinois, Indiana, Michigan, Minnesota, and Wisconsin recently signed an MOU establishing the Regional Electric Vehicle Midwest Coalition (REV Midwest), which 'aims to create [a] cohesive regional framework to accelerate the transition to electric vehicles.'136 One of REV Midwest's three key foundations is to accelerate medium- and heavy-duty fleet electrification.137 These state actions provide strong support for reducing emissions from the heavy-duty sector by transitioning to ZEVs, which will further enable HD ZEV market penetration in excess of that projected in the Proposal. [EPA-HQ-OAR-2019-0055-1302-A1, pp.34-35]

132 See DOE, Federal and State Laws and Incentives, Alternative Fuels Data Center (last accessed May 10, 2022), https://afdc.energy.gov/laws (tracking federal, state, and local laws and commitments within all ZEV sectors).

133 Information on regulations and programs in all states, including those that have signed the MOU or adopted ACT regulations, is available in id., and from the NC Clean Energy Technology Center, Database of State Incentives for Renewables and Efficiency (last accessed May 10, 2022), https://programs.dsireusa.org/system/program.

134 Many of these programs are funded as part of the Volkswagen Environmental Trust/Volkswagen settlement.

135 This list is compiled from information available at DOE, Federal and State Laws and Incentives, Alternative Fuels Data Center (last accessed May 10, 2022), https://afdc.energy.gov/laws (does not include the vast array of programs and incentives available in the MOU and ACT states).

136 Rachel MacIntosh et al., Electric Vehicle Market Update 16, EDF (Apr. 2022); Regional Electric Vehicle Midwest Coalition, Memorandum of Understanding Between Illinois, Indiana, Michigan, Minnesota, and Wisconsin 1 (Sept. 30, 2021), https://www.michigan.gov/documents/leo/REV_Midwest_MOU_master_737026_7.pdf.

137 Rachel MacIntosh et al., Electric Vehicle Market Update 16, EDF (Apr. 2022); Regional Electric Vehicle Midwest Coalition, Memorandum of Understanding Between Illinois, Indiana, Michigan, Minnesota, and Wisconsin 1 (Sept. 30, 2021), https://www.michigan.gov/documents/leo/REV_Midwest_MOU_master_737026_7.pdf.

The federal government's procurement goals and commitments will also lead to greater HD ZEV market penetration. President Biden recently signed Executive Order 14,057, directing the federal government to transition to 100% ZEV acquisitions for all federal fleets (including HDVs) by 2035.138 The federal fleet is large, and in 2020 included 39,246 heavy-duty trucks (Classes 5–8), 103,215 medium-duty trucks (Classes 2b–4), and 8,057 buses.139 As this large number of vehicles ages, the directive in the Executive Order will further drive HD ZEV penetration as federal agencies replace conventional vehicles with ZEVs. The ZEV transition within the federal fleet is already underway, with the General Services Administration (GSA) doubling the amount of ZEV medium- and heavy-duty models available to federal agencies.140 In accordance with Executive Order 14,057, individual agencies will develop and annually update their own ZEV fleet strategies to meet the ZEV target in the Executive Order, and already have been directed to 'maximiz[e] acquisition and deployment of zero-emission light-, medium-, and heavy-duty vehicles where the General Services Administration…offers one or more zero-emission vehicle options for that vehicle class.'141 [EPA-HQ-OAR-2019-0055-1302-A1, p.35]

138 U.S. Office of the Federal Chief Sustainability Officer, 100% Zero-Emission Vehicle Acquisitions by 2035, Including 100% Light-Duty Acquisitions by 2027, Federal Sustainability Plan (last accessed May 10, 2022), https://www.sustainability.gov/federalsustainabilityplan/fleet.html; The White House, Executive Order on Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability, Executive Order 14,057, Section 102(a)(ii) (Dec. 8, 2021), https://www.whitehouse.gov/briefing-room/presidential-actions/2021/12/08/executive-order-on-catalyzing-clean-ene
rgy-industries-and-jobs-through-federal-sustainability/.

139 GSA, FY 2020 Federal Fleet Open Data Set, at tab 2-6T (May 25, 2021), https://www.gsa.gov/policy-regulations/policy/vehicle-management-policy/federal-fleet-report.

140 The White House, Fact Sheet: Vice President Harris Announces Actions to Accelerate Clean Transit Buses, School Buses, and Trucks (Mar. 7, 2022), https://www.whitehouse.gov/briefing-room/statements-releases/2022/03/07/fact-sheet-vice-president-harris-announces-actions-to-accelerate-clean-transit-buses-school-buses-and-trucks/ (noting increase in GSA models available).

141 White House, Executive Order on Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability, Executive Order 14,057, Section 204 (Dec. 8, 2021), https://www.whitehouse.gov/briefing-room/presidential-actions/2021/12/08/executive-order-on-catalyzing-clean-energy-industries-and-jobs-through-federal-sustainability/.

The federal government has also committed significant funds toward achieving increased HD ZEV development and demand.142 The Infrastructure Investment and Jobs Act of 2021 (the 'Bipartisan Infrastructure Law') 'provides critical funding for states to accelerate MHD vehicle electrification.'143 Examples of programs that the law will fund include: EPA's Clean School Bus Program with $5 billion over the next five years (FY 2022–2026) to replace conventional school buses with ZEV models;144 the Department of Transportation's (DOT) Low-No Program with $5.5 billion toward purchases of low- or no-emission transit vehicles, 'more than 10 times greater than the previous five years of funding;'145 and DOT's Grants for Buses and Bus Facilities Program with $5.1 billion over the next five years to support modernizing and electrifying bus fleets.146 DOT's Federal Transit Administration also plans to award funding for ZEVs through the American Rescue Plan, including $7 million to replace diesel school buses with ZEV buses in underserved communities, and an additional $10 million for ZEV school buses through the Diesel Emissions Reduction Act School Bus Rebate Program.147 DOE has also increased funding for ZEV research, allocating $127 million in funding to industry through its SuperTruck 3 program, 'focused for the first time on reducing costs and improving durability in hydrogen and battery electric trucks.'148 EPA does not discuss or account for the Bipartisan Infrastructure Law funding or other recent federal funding in the Proposal, and these commitments will certainly accelerate the pace of growth in the HD ZEV market nationwide. When adopting the final rule, EPA must consider the impacts that this federal funding will have on HD ZEV development and uptake. [EPA-HQ-OAR-2019-0055-1302-A1, pp.35-36]

142 For a list of ZEV-related programs funded by the Bipartisan Infrastructure Law, see DOE, Bipartisan Infrastructure Law (Infrastructure Investment and Jobs Act of 2021), Alternative Fuels Data Center (last accessed May 10, 2022), https://afdc.energy.gov/laws/infrastructure-investment-jobs-act; see also The White House, Fact Sheet: The Bipartisan Infrastructure Deal (Nov. 6, 2021), https://www.whitehouse.gov/briefing-room/statements-releases/2021/11/06/fact-sheet-the-bipartisan-infrastructure-deal/; NESCAUM Action Plan at 18.

143 Id.

144 EPA, Clean School Bus Program Funding (last accessed May 10, 2022), https://www.epa.gov/cleanschoolbus.

145 Federal Transit Administration, Biden-Harris Administration and the U.S. Department of Transportation Announce Nearly $1.5 Billion in Grants Funded by the Bipartisan Infrastructure Law to Modernize Bus Fleets and Facilities, New Release (Mar. 7, 2022), https://www.transit.dot.gov/about/news/biden-harris-administration-and-us-department-transportation-announce-nearly-15-billion.

146 Federal Transit Administration, President Biden and the U.S. Department of Transportation Announce $409 Million for 70 Transportation Projects in 39 States (Mar. 14, 2022), https://www.transit.dot.gov/about/news/president-biden-and-us-department-transportation-announce-409-million-70 -transportation; Federal Transit Administration, Fiscal Year 2021 Buses and Bus Facilities Projects (last accessed May 10, 2021), https://www.transit.dot.gov/funding/grants/fiscal-year-2021-buses-and-bus-facilities-projects.

147 White House, Fact Sheet: Vice President Harris Announces Actions to Accelerate Clean Transit Buses, School Buses, and Trucks (Mar. 7, 2022), https://www.whitehouse.gov/briefing-room/statements-releases/2022/03/07/fact-sheet-vice-president-harris-announces-actions-to-accelerate-clean-transit-buses-school-buses-and-trucks/. See also Rachel MacIntosh et al., Electric Vehicle Market Update 18, EDF (Apr. 2022).

148 The White House, Fact Sheet: Vice President Harris Announces Actions to Accelerate Clean Transit Buses, School Buses, and Trucks (Mar. 7, 2022), https://www.whitehouse.gov/briefing-room/statements-releases/2022/03/07/fact-sheet-vice-president-harris-announces-actions-to-accelerate-clean-transit-buses-school-buses-and-trucks/. Multiple other governmental and industry research projects are focused on ZEVs, including: Advanced Research on Integrated Energy Systems (providing a real-world environment for testing large battery and fuel cell electric trucks); Million Mile Fuel Cell Truck consortium (developing cost effective technology with industry for next generation fuel cells); and 21st Century Truck Partnership (launching a new electrification tech team focused on removing barriers to wide-scale truck electrification and deploying technology to improve freight efficiency).

Cities and other local governments are also committing to a shift to zero-emission technologies in the heavy-duty sector. EPA notes one specific commitment by the Los Angeles Department of Transportation (LADOT) to electrify its entire transit fleet by 2030 or sooner. 87 Fed. Reg. 17,597. The commitment from just this one municipal agency will yield approximately 501 ZEVs by 2030.149 But several other cities and states have announced commitments specifically aimed at electrifying local fleets. As EPA notes, numerous other cities and localities across the country have set ZEV transit and/or school bus commitments or piloted ZEV bus programs. 87 Fed. Reg. at 17,597. EPA lists ZEV transit bus programs in Chicago, Seattle, New York City, and Washington, D.C., and school bus programs in school districts in California, Virginia, Massachusetts, Michigan, Maryland, Illinois, New York, and Pennsylvania. 87 Fed. Reg. at 17,597. According to data from the World Resources Institute (WRI), in the six months prior to April 2022, ‘the number of committed electric school buses increased over 50 percent to a total of more than 1,800,’ and at least 37 states have either procured one or more electric school buses, or announced plans to do so, ‘with California, Maryland and Florida leading the way.’150 States and cities have also ordered other Class 4–8 ZEVs across the country, such as refuse and fire trucks, including in states beyond those that have signed the MOU or adopted the ACT rule, such as Wisconsin, Florida, Arizona, and Alaska. 151 Despite noting a few of these commitments, the Proposal fails to capture the speed and breadth of local government actions, and its projections fail to account for any significant HD ZEV penetration outside of California. All of these commitments provide further evidence that even baseline HD ZEV market penetrations within the range of 8–11% for MY 2027 and 19–27% for MY 2030 are conservative estimates. At least some modest level of HD ZEV uptake in states that have not adopted the ACT rule or signed the MOU is likely and would lead to baseline HD ZEV penetration of 11% or higher by MY 2027. [EPA-HQ-OAR-2019-0055-1302-A1, pp.37-38]

149 LADOT, Zero-Emission Bus Rollout Plan 7 (Oct. 2020), https://ww2.arb.ca.gov/sites/default/files/2020-12/LADOT_ROP_Reso_ADA12172020.pdf.

150 Arianna Skibell & Ariel Wittenberg, How Electric Buses Reduce Toxic Exposure for Kids, E&E News (Apr. 13, 2022), https://www.eenews.net/articles/how-electric-buses-reduce-toxic-exposure-for-kids/. See also Leah Lazer and Lydia Freehafer, WRI, The State of Electric School Bus Adoption in the U.S. (Aug. 5, 2021), https://www.wri.org/insights/where-electric-school-buses-us; WRI, Dataset of Electric School Bus Adoption in the United States (last accessed May 10, 2022), https://datasets.wri.org/dataset/electric_school_bus_adoption; Hannah Hamilton et al., CALSTART, Zeroing in on ZEBs (Dec. 2021), https://calstart.org/wp-content/uploads/2022/01/2021-ZIO-ZEB-Final-Report_1.3.21.pdf. School buses have especially attractive potential for electrification, as districts have begun to look into using electric school bus fleets to provide vehicle-to-grid services, meaning that 'when electric school buses sit idle in the evenings and summer months, the batteries can be used to store and discharge electricity back to the grid during periods of peak demand when electricity is costlier,' which 'improves the economics of fleet electrification while reducing electricity distribution system costs for ratepayers.' NESCAUM Action Plan at 15–16; see also, e.g., The Lion Electric Co., Lion Electric Announces Successful Electric School Bus Vehicle-to-Grid Deployment with Con Edison in New York (Dec. 14, 2020), lion-electric-announces-successful-electric-school-bus-vehicle-to-grid-deployment-with-con-edison-in-new-york-301191980.html. For a recent compilation of current and proposed electric school bus V2G project, see Norma Hutchinson and Greggory Kresge, 3 Design Considerations for Electric School Bus Vehicle-to-Grid Programs, TheCityFix (Feb. 14, 2022), https://thecityfix.com/blog/3-design-considerations-for-electric-school-bus-vehicle-to-grid-programs/.

151 EDF, Electric Fleet Deployment & Commitment List (last accessed May 10, 2022), https://docs.google.com/spreadsheets/d/1l0m2Do1mjSemrb_DT40YNGou4o2m2Ee-KLSvHC-5vAc/edit#gid=2049738669 (listing 10,034 HD ZEVs already deployed or ordered by federal, state, and local governments).

As heavy-duty fleet managers establish their own environmental goals and recognize the increasingly favorable economics of ZEVs, both the speed of innovation and the demand for HD ZEVs are increasing at a rate that EPA’s proposed 1.5% market penetration does not reflect. A 2018 survey of fleet managers listed ‘sustainability and environmental goals’ as the primary motivator for transitioning to ZEVs, with ‘lower cost of ownership’ as the second most important factor.152 In fact, ‘[l]arge corporate fleets are responsible for much of the early momentum in commercial MHD fleet electrification…driven by corporate sustainability commitments and a desire to achieve operational savings.'153 These cost and sustainability motivations exist independent of regulatory requirements, and support the expectation that HD ZEV uptake will continue to grow in all states, including those that have not yet adopted more stringent regulations. While the Proposal mentions a few examples of fleet commitments to a zero-emission future, it again fails to capture the speed and breadth of these commitments that are driven not only by governmental policy but also by private industry interests, with commitments being made nationwide. [EPA-HQ-OAR-2019-0055-1302-A1, p.38]

152 See 87 Fed. Reg. at 17596; Steven Nadel & Peter Huether, Electrifying Trucks: From Delivery Vans to Buses to 18-Wheelers 10–11, American Council for an Energy-Efficient Economy (ACEE) (June 2021), https://www.aceee.org/research-report/t2102.

153 NESCAUM Action Plan at 16.

According to EDF's Electric Fleet Deployment & Commitment List (see Attachment 101 to these comments), commercial fleets have already ordered or deployed more than 164,000 medium- and heavy-duty electric vehicles, of which at least 19,000 are Class 4–8 electric vehicles.154 The Proposal cites a few examples of commercial fleets that have made efforts toward acquiring ZEVs, such as UPS, FedEx, DHL, Walmart, Anheuser-Busch, Amazon, and PepsiCo. 87 Fed. Reg. at 17,597. These orders cover the full range of heavy-duty applications—from last-mile delivery vehicles to trucks intended to cover longer distances—and include orders such as UPS's order of 10,000 Class 4 cargo vans155 and orders and/or deployments of over 2,500 Class 8 tractors by Amazon, UPS, PepsiCo, DHL, Walmart, and Anheuser-Busch.156 Walmart and PepsiCo have also both placed orders with Tesla for its upcoming electric Semi, for 130 and 100 trucks, respectively.157 Examples from just these six companies total 12,730 HD ZEVs already ordered or deployed, evidencing significant momentum toward greater deployment within private fleets. EPA should factor such commitments and deployments into its HD ZEV market penetration estimates. At the very least, these fleet commitments show significant momentum toward greater HD ZEV deployment within private fleets and offer further support for a MY 2027 baseline HD ZEV market penetration of 8–11%, as a conservative estimate. [EPA-HQ-OAR-2019-0055-1302-A1, pp.38-39]

154 These values were calculated from EDF's Electric Fleet Deployment & Commitment List as of May 10, 2022. The list is regularly updated to include additional new commitments. See id. See also NESCAUM Action Plan at 16.

155 EDF, Electric Fleet Deployment & Commitment List.

156 Id.

157 Rachel MacIntosh et al., Electric Vehicle Market Update 33, EDF (Apr. 2022); Fred Lambert, Tesla Semi Receives Order of 30 More Electric Trucks from Walmart, Electrek (Sept. 6, 2018),
https://electrek.co/2018/09/06/tesla-semi-new-order-electric-truck-walmart/; Fred Lambert, Tesla (TSLA) Secures Massive Order of Tesla Semi Electric Trucks from Walmart, Electrek (Sept. 29, 2020),

https://electrek.co/2020/09/29/tesla-tsla-secures-order-tesla-semi-electric-trucks-walmart/.

Companies with heavy-duty fleets are also announcing their commitment to a zero-emissions future. Several of these commitments include aims to reduce carbon emissions by one-third to one-half by 2030.158 Amazon, PepsiCo, and Walmart all plan to reach net zero carbon emissions across their businesses by 2040, including their long-haul tractor operations.159 AT&T plans to be carbon neutral even earlier, by 2035.160 Anheuser-Busch plans to reduce carbon emissions by 25% by 2025, and FedEx is committed to 50% of its pickup and delivery fleet purchases being electric by 2025 and 100% by 2030.161 [EPA-HQ-OAR-2019-0055-1302-A1, p.39]

158 EDF, Electric Fleet Deployment & Commitment List.

159 Id.

160 Id.

161 Id.

It is true that several large fleets such as those cited by EPA are some of the earliest adopters of HD ZEVs, but they are not alone. Interest in developing HD ZEV fleets is far-ranging, evidenced by the fact that over 135 different commercial fleets have either ordered or deployed HD ZEVs.162 Additionally, at least 59 commercial fleets, both large and small, have announced fleet-level commitments to increased ZEV penetration and/or reduced carbon emissions.163 In a recent survey of nearly 250 U.S.-based fleets that have used clean fuels and vehicles, nearly 85% said that their use of clean vehicle technologies would grow over the next five years.164 In considering what the heavy-duty sector will look like in MY 2027 and beyond, EPA must consider the breadth and scale of these announcements and the fact that these commitments are considered technologically and economically feasible by such a large range of fleet managers. [EPA-HQ-OAR-2019-0055-1302-A1, p.39]

162 Id.

163 Id.

164 Jack Roberts, On the Glide Path to Net Zero, HDT Truckinginfo (May 10, 2022), https://www.truckinginfo.com/10170224/on-the-glide-path-to-net-zero.

Government and fleet commitments would not be possible if manufacturers were not producing HD ZEVs, and manufacturers are in fact rapidly increasing their HD ZEV production to meet the growing demand. For example, at May 2022's Advanced Clean Transportation Expo, manufacturers such as Cummins and Navistar made clear that they are committed to deploying zero-emission technologies at a rapid pace. Cummins CEO Tom Lineburger stressed the need 'to move faster for the sake of our kids and grandkids,'165 and Navistar CEO Mathias Carlbaum suggested that '[b]y 2030…50% of all trucks by volume will be BEVs.'166 Navistar's CEO reiterated to reporters that ‘[w]e believe 50% of our sales will be electric by 2030,’ and that 100% of sales would be ZEVs by 2040.167 EPA should consider manufacturers’ vehicle offerings, plans, and commitments when estimating baseline HD ZEV market penetration for the final rule, as well as when considering more stringent emissions standards that drive adoption of zero-emission technologies. [EPA-HQ-OAR-2019-0055-1302-A1, pp.39-40]

165 Jack Roberts, Cummins CEO: Get on the Path to Net-Zero Emissions, HDT Truckinginfo (May 12, 2022), https://www.truckinginfo.com/10170751/cummins-ceo-get-on-the-path-to-net-zero-emissions.

166 Jack Roberts, Navistar CEO Calls for Long-Term Commitment to Net Zero, HDT Truckinginfo (May 12, 2022), https://www.truckinginfo.com/10170459/navistar-ceo-calls-for-long-term-commitment-to-get-to-net-zero.

167 Alan Ohnsman, Big Rigs Going Electric as Navistar, Cummins, Daimler Rev Up Next-Generation Trucks, Forbes (May 13, 2022), https://www.forbes.com/sites/alanohnsman/2022/05/13/big-rigs-going-electric-as-navistar-cummins-daimler-rev-upnext-generation-trucks/?sh=5daf4f25419d.

According to ACEEE, ‘growing numbers of electric truck and bus models are reaching the market or are scheduled to be on the market soon, with models ranging from heavy-duty pickup trucks to 18-wheel tractor-trailers.’168 The pace of innovation in this sector has accelerated in recent years. In 2016, Oak Ridge National Laboratory identified just eight commercially available medium- and heavy-duty ZEV options.169 By 2019 this number had grown more than tenfold. EPA’s DRIA includes ‘a snapshot of BEVs in the heavy-duty truck and bus markets as of 2019,’ based on 2019 research by the Union of Concerned Scientists (UCS). According to this ‘snapshot,’ by 2019 there were already at least 82 different HD ZEV models: 34 trucks and 48 buses. See DRIA at 58–59.170 And by MY 2020, the market had grown even larger. EPA’s own research conducted for the Proposal and contained in EPA’s Memorandum to Docket reveals that by 2020, the number of ZEVs available for purchase climbed again to 177 unique makes and models from 52 producers in regulatory classes 3–8.171 [EPA-HQ-OAR-2019-0055-1302-A1, p.40]

168 Steven Nadel & Peter Huether, Electrifying Trucks: From Delivery Vans to Buses to 18-Wheelers at iv, ACEEE (June 2021).

169 Paige Jadun et al., Electrification Futures Study: End-Use Electric Technology Cost and Performance Projections through 2050 20, NREL (2017), https://www.nrel.gov/docs/fy18osti/70485.pdf (citing Alicia K. Birky et al., Oak Ridge National Laboratory, Transportation Electrification Beyond Light Duty: Technology and Market Assessment (Sept. 2017), https://info.ornl.gov/sites/publications/Files/Pub72938.pdf).

170 See also UCS, Ready for Work: Now Is the Time for Heavy-Duty Electric Vehicles (2019), https://www.ucsusa.org/resources/ready-work.

171 See Angela Cullen, HD2027 Proposed Changes to Heavy-Duty Greenhouse Gas Emissions—Memorandum to Docket 2 (Docket No. EPA-HQ-OAR-2019-0055) (Nov. 2021), https://www.regulations.gov/document/EPA-HQ-OAR-2019-0055-0880; 87 Fed. Reg. at 17,595.

These numbers are certain to increase further, but EPA's grossly underestimated 1.5% baseline HD ZEV market penetration fails to reflect this anticipated growth. As EPA notes, 'given the dynamic nature of the BEV market, the number and types of vehicles available are changing fairly rapidly,' 87 Fed. Reg. at 17,595, as evidenced by the increasing frequency of new HD ZEV product announcements and commitments by manufacturers. Some of these are included below in Table 3. [EPA-HQ-OAR-2019-0055-1302-A1, p.40]

Table 3: Manufacturer Commitments for HD ZEV Production [EPA-HQ-OAR-2019-0055-1302-A1, pp.41-43]

- Daimler Trucks
  - Announced goals of selling carbon neutral commercial vehicles across all markets by 2039.172
  - Freightliner division currently taking orders for all-electric eCascadia and eM2 trucks.173
  - Freightliner division has developed electric versions of Cascadia Class 8 tractor, M2 Class 6 medium-duty chassis, and MT50 medium-duty step van.174
  - Freightliner Electric Innovation Fleet has been operating at customer sites, totaling over one-million miles of operation as of October 2021.175
  - Partnered with NextEra Energy Resources and BlackRock Renewable Power in January 2022 to invest approximately $650 million to design, develop, install, and operate a nationwide charging network for M/HD BEV and hydrogen fuel cell trucks.176
  - Full line of ZEV commercial vehicles could be ready by 2027.177
  - Daimler's Mercedes-Benz division unveiled a new electric model, the eActros LongHaul, expected to be ready for production by 2024, and an electric-fuel cell truck, the GenH2, which has potential to drive more than 600 miles before refueling and should be commercially available by 2025.178

172 Rachel MacIntosh et al., Electric Vehicle Market Update 29, EDF (Apr. 2022).

173 Id.

174 Id.

175 Id.; Daimler Truck, One Million Real-World Electric Miles: Freightliner's Battery Electric Customer Fleets Reach Important Milestone (Oct. 5, 2021), https://northamerica.daimlertruck.com/PressDetail/one-million-real-world-electric-miles-freightliner-s-2021-10-05.

176 Rachel MacIntosh et al., Electric Vehicle Market Update 29, EDF (Apr. 2022); Heavy Duty Trucking, Daimler Plans to Create Nationwide Truck Charging Network, HDT Truckinginfo (Jan. 31, 2022), https://www.truckinginfo.com/10160673/daimler-truck-plans-to-create-nationwide-truck-charging-network.

177 Reuters, Daimler Trucks Labour Chief Wants Clean Tech Investments in Germany (Feb. 13, 2021), https://www.reuters.com/article/us-daimler-trucks-divestiture-idUSKBN2AD0EO.

178 Mike De Socio, Keep Your Eyes on These 9 Electric Truck and Van Companies in 2021, GreenBiz (Jan. 4, 2021), https://www.greenbiz.com/article/keep-your-eyes-these-9-electric-truck-and-van-companies-2021.

- Envirotech Vehicles Inc
    - Investing $280.7 million in manufacturing all-electric, zero-emission vehicles and zero-emission drive trains for medium to heavy-duty commercial vehicles. 179

179 Rachel MacIntosh et al., Electric Vehicle Market Update 58, Appendix D, EDF (Apr. 2022); Andrew Moreau, Electric-Vehicles Firm Going to Osceola Plans to Invest Millions, Hires 800 Workers, Arkansas Democrat Gazette (Feb. 23, 2022), https://www.arkansasonline.com/news/2022/feb/23/electric-vehicles-firm-going-to-osceola/.

- General Motors
    - In January 2021, launched BrightDrop, which focuses on electric first-to-last-mile products, software, and services. Working with FedEx to add up to 20,000 ZEVs to the fleet.180
    - Will release two all-electric models in 2021.181

180 Rachel MacIntosh et al., Electric Vehicle Market Update 29, EDF (Apr. 2022); General Motors, GM Launches BrightDrop, a New Business That Will Electrify and Improve the Delivery of Goods and Services (Jan. 12, 2021), https://media.gm.com/media/us/en/gm/home.detail.html/content/Pages/news/us/en/2021/jan/ces/0112-brightdrop.html.

181 Rachel MacIntosh et al., Electric Vehicle Market Update 29, EDF (Apr. 2022).

- Lion Electric Company
    - Started work on a new factory in early 2022 that will 'represent the largest dedicated production site for zero-emission medium and heavy-duty vehicles in the U.S. upon its completion, with an expected annual production capacity of up to 20,000 vehicles per year,'182 a nine-fold increase in production capacity.183

182 Id.

183 Alejandro de la Garza, U.S. School Buses May Never Be the Same Thanks to Biden's Infrastructure Plan, Time (Nov. 15, 2021), https://time.com/6117544/electric-school-buses/.

- Mack Trucks
  - Added production of Mack LR Electric model as part of $84 million site overhaul.184

184 Rachel MacIntosh et al., Electric Vehicle Market Update 61, Appendix D, EDF (Apr. 2022); Pamela Stroka-Holzmann, Mack Trucks Completes $84M Plant Renovation in Lehigh County, Lehigh Valley Live (Oct. 2, 2020), https://www.lehighvalleylive.com/allentown/2020/10/mack-trucks-completes-84m-plant-renovation-in-lehigh-county.html.

- Navistar
  - Launched NEXT eMobility solutions unit to focus on electrification in truck and school bus markets.185
  - Developed prototype electric school bus and electric truck.186
  - Launched fully electric International eMV series in August 2021.187
  - Developing properties in Texas that will invest more than $275 million in electrification efforts.188

185 Rachel MacIntosh et al., Electric Vehicle Market Update 29, EDF (Apr. 2022).

186 Id.; Navistar, Navistar Launches New Business Unit, NEXT eMobility Solutions (Oct. 28, 2019), https://news.navistar.com/2019-10-28-Navistar-Launches-New-Business-Unit-NEXT-eMobility-Solutions.

187 Rachel MacIntosh et al., Electric Vehicle Market Update 29, EDF (Apr. 2022); Navistar, Navistar Launches New Electric International eMV Series, Now in Production and Available to Order (Aug. 31, 2021), https://news.navistar.com/2021-08-31-Navistar-Launches-New-Electric-International-R-eMV-TM-Series,-Now-in-Production-and-Available-to-Order.

188 Rachel MacIntosh et al., Electric Vehicle Market Update 29, EDF (Apr. 2022).

- Nikola Motor Company
  - Has over 9,000 orders for its hydrogen semi trucks.189

189 Sebastian Blanco, Anheuser-Busch's Order for 800 Nikola Hydrogen Trucks is a Play for Younger Beer Drinkers, Forbes (May 3, 2018), https://www.forbes.com/sites/sebastianblanco/2018/05/03/anheuser-busch-800-nikola-hydrogen-trucks/?sh=3f74aba74d4c.

- PACCAR's Kenworth & Peterbilt divisions
  - Partnering with Dana for electric truck powertrain development.190

- Kenworth, Peterbilt, and DAF brands now have over 60 alternative-fuel trucks being tested in real-world applications across North America and Europe.191
- Has delivered hydrogen fuel cell Kenworth T680 trucks for field and performance testing.192
- Orders in the last three months of 2021 tripled over previous orders, with customers in 44 states.193

190 Rachel MacIntosh et al., Electric Vehicle Market Update 29, EDF (Apr. 2022).

191 Josh Fisher, Paccar Tests More Zero-Emission Trucks Ahead of 2021 Production, FleetOwner (July 30, 2020), https://www.fleetowner.com/emissions-efficiency/article/21137951/paccar-tests-more-zeroemission-trucks-ahead-of-2021-production.

192 Id.

193 Scooter Doll, Kenworth Says Electric Truck Orders Have Tripled the Past Three Months, Quoting Customers in 44 States, Electrek (Jan. 14, 2022), https://electrek.co/2022/01/14/kenworth-says-electric-truck-orders-have-tripled-the-past-three-months-quoting-customers-in-44-states/.

- Proterra
  - Announced a $76 million investment in new zero-emission electric transit and commercial ZEV manufacturing operations.194

194 Rachel MacIntosh et al., Electric Vehicle Market Update 62, Appendix D, EDF (Apr. 2022); South Carolina Office of the Governor, Proterra Expanding South Carolina Operations with New EV Battery System Manufacturing Facility in Spartanburg County (Dec. 14, 2021), https://governor.sc.gov/news/2021-12/proterra-expanding-south-carolina-operations-new-ev-battery-system-manufacturing.

- Tesla
  - Investing $1 billion in Gigafactory, to produce a range of ZEVs including the Tesla Semi Truck.195
  - As of 2018, Tesla had about 2,000 Semi pre-orders,196 and pre-orders have continued.197

195 Rachel MacIntosh et al., Electric Vehicle Market Update 41, EDF (Apr. 2022); Rebecca Hennes, Tesla's New $1b 'Gigafactory' Will Open Near Austin, with Musk Calling it an 'Ecological Paradise,' Houston Chronicle (July 23, 2020), https://www.chron.com/news/houston-texas/article/Tesla-Texas-gigafactory-Austin-Abbott-Musk-15428792.php.

196 Luke Stangel, Tesla Semi Picks Up Another Big Backer, the Country's Second-Largest Grocery Chain, Silicon Valley Business Journal (Nov. 19,

2018), https://www.bizjournals.com/sanjose/news/2018/11/19/tesla-semi-big-customers-albertsons-tsla.html (noting pre-order announcement by Elon Musk).

197 See, e.g., Suvrat Kothari, Tesla Semi: Everything We Know in May 2022, TopElectricSUVs (Apr. 30, 2022), https://topelectricsuv.com/news/tesla/tesla-semi-all-we-know-feb-2022/#Large_order_book (noting Tesla's 'large order book' including orders for 100 trucks by PepsiCo, 40 trucks by Anheuser-Busch, 130 trucks by Walmart, at least 150 trucks by Pride Group Enterprises, and 50 trucks plus plans to reserve 'thousands more' by EV Semi-Fleet).

- Volvo
    - Using nearly $45 million in CARB grant funding, launched Volvo LIGHTS, focused on 'providing a range of vehicle, charging, and workforce development innovations' in the HD ZEV market. Innovations include 'new lithium-ion battery chemistries that increase energy density by more than 20 percent and prevent premature degradation to reduce cost, as well as multiple truck configurations with all-electric ranges of up to 250 miles.'198
    - Currently taking orders for the electric Mack refuse truck.199
    - Committed to selling 50% zero-emission trucks globally by 2030.200

198 Rachel MacIntosh et al., Electric Vehicle Market Update 29, EDF (Apr. 2022); Volvo LIGHTS, About Volvo LIGHTS (last accessed May 10, 2022), https://www.lightsproject.com/about/.

199 Rachel MacIntosh et al., Electric Vehicle Market Update 29, EDF (Apr. 2022).

200 Deborah Lockridge, Volvo: Take the Leap in Electrification, Truckinginfo (Oct. 12, 2021), https://www.truckinginfo.com/10153752/volvo-take-the-leap-in-electrification.

While the above table includes a sample of relevant product announcements and commitments, CALSTART's Zero-Emission Technology Inventory (ZETI) offers information regarding HD ZEV commercial availability. According to the ZETI tool, the growth of zero-emission medium- and heavy-duty models in the United States and Canada has been rapid, with more manufacturers entering the market and the number of available ZEV models exceeding 200.201 The progress and potential in the manufacturing sector further underscores that EPA's proposed baseline HD ZEV market penetration of 1.5% in MY 2027 is an underestimate, and that much higher deployment is eminently feasible. [EPA-HQ-OAR-2019-0055-1302-A1, p.44]

201 CALSTART, Model Availability to Follow Upward Trajectory, ZETI Analytics, https://globaldrivetozero.org/tools/zeti-analytics/ (see table titled 'Growth of Models Available by Region and OEMS by Region Trending Upwards').

Declining costs for HD ZEVs also support a baseline market penetration rate much higher than 1.5%, as well as the feasibility of including HD ZEVs in EPA's standard-setting analysis. EPA notes that '[t]he lifetime total cost of ownership (TCO)...is likely a primary factor for heavy-duty fleets considering BEV purchases.' 87 Fed. Reg. at 17,596. Numerous cost studies—including those cited by EPA—estimate that at least some categories of HD ZEVs have already reached TCO parity with their diesel counterparts, and more categories will reach TCO parity prior to 2027. EPA should consider these favorable TCO projections in its estimates for baseline HD ZEV market penetration, which would support much higher penetration rates in MY 2027 and beyond. [EPA-HQ-OAR-2019-0055-1302-A1, p.44]

In addition to the ICCT (2019) estimate cited by EPA, which concluded that at least some HD ZEVs could reach cost parity in the 'early 2020s,' see 87 Fed. Reg. at 17,596, several other recent studies that EPA did not consider estimate when various classes of HD ZEVs will reach cost parity with their conventional counterparts. These studies generally show that transit buses, refuse trucks, school buses, and Class 4–7 short-haul rigid trucks such as delivery and utility vehicles—all of which are covered by the Proposal and make up approximately 47% of the entire HD market—either have already reached cost parity with their diesel counterparts for some vehicle categories, or will do so by 2027 for nearly all categories. Table 4 below [Table 4 includes footnotes 202 and 211] includes TCO parity estimates from the key recent literature. [EPA-HQ-OAR-2019-0055-1302-A1, p.44]

202 Dale Hall & Nic Lutsey, Estimating the Infrastructure Needs and Costs for the Launch of Zero-Emission Trucks, ICCT (Aug. 2019), https://theicct.org/wp-content/uploads/2021/06/ICCT_EV_HDVs_Infrastructure_20190809.pdf.

203 Dan Welch et al., International ZEV Alliance, Moving Zero-Emission Freight Toward Commercialization, (Oct. 2020), https://www.zevalliance.org/zero-emission-freight-2020/.

204 Ehsan Sabri Islam et al., Argonne National Laboratory (ANL), A Detailed Vehicle Modeling & Simulation Study Quantifying Energy Consumption and Cost Reduction of Advanced Vehicle Technologies Through 2050 (Oct. 1, 2021), https://anl.app.box.com/s/xzhqi4x5sw3anw6rbgz7f67l6ti0qikd (using ANL's BEnefit ANalysis modeling); see also ANL, Vehicle Systems & Mobility Group, BEAN (last accessed May 10, 2022), https://vms.es.anl.gov/tools/bean/.

205 Chad Hunter et al., NREL, Spatial and Temporal Analysis of the Total Cost of Ownership for Class 8 Tractors and Class 4 Parcel Delivery Trucks (Sept. 2021), https://www.nrel.gov/docs/fy21osti/71796.pdf.

206 Andrew Burnham et al., ANL, Comprehensive Total Cost of Ownership Quantification for Vehicles with Different Size Classes and Powertrains (Apr. 2021), https://publications.anl.gov/anlpubs/2021/05/167399.pdf.

207 Dana Lowell & Jane Culkin, M.J. Bradley & Associates, Medium- & Heavy-Duty Vehicles: Market Structure, Environmental Impact, and EV Readiness (July 2021), https://www.edf.org/sites/default/files/documents/EDFMHDVEVFeasibilityReport22jul21.pdf.

208 These CARB estimates include California incentives. CARB, Draft Advanced Clean Fleets Total Cost of Ownership Discussion Document, Advanced Clean Fleet Workshop (Sept. 9, 2021), https://ww2.arb.ca.gov/sites/default/files/2021-08/210909costdoc_ADA.pdf.

209 Vishnu Nair et al., Technical Review of: Medium and Heavy-Duty Electrification Costs for MY 2027-2030, Roush Industries for EDF (Feb. 2, 2022).

210 Catherine Ledna et al., Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis, NREL (Mar. 2022).

211 Id. at 21. NREL investigated different cost-parity situations. For most scenarios, medium-duty Class 4–6 trucks reached cost parity well before 2035, often before 2030.

Each of these cost studies contains slightly different parameters, leading to some variation in the projections based on factors such as the study's estimated battery pack price or the inclusion of infrastructure costs. However, the variation is small and the studies all indicate that TCO is not far from favoring HD ZEVs for the classes that have not yet already achieved TCO parity. ICCT considered many of these cost studies to develop a summary of literature that includes consensus estimates for when HD ZEVs will reach TCO parity, as shown in the table below:212 [EPA-HQ-OAR-2019-0055-1302-A1, p.46]

212 This table summarizing ZEV cost literature is from: Sara Kelly et al., ICCT Comments on EPA's Proposed Heavy-Duty Engine and Vehicle Standards at 23.

One reason for these favorable TCO projections is that upfront HD ZEV prices have been declining as '[b]attery prices have been consistently reducing more rapidly than projections,' and lower battery prices mean that HD ZEVs will reach cost parity sooner.213 As battery costs and HD ZEV prices decline, more fleet managers will seek to add ZEVs to their heavy-duty fleets. In 2010, battery pack costs were over $1,000/kWh, but have fallen dramatically to approximately $132/kWh in 2021.214 Costs are expected to continue this downward trajectory, 'reaching $100/kWh between 2023 and 2025 and $61–72/kWh by 2030. Auto manufacturers have endorsed these projections.'215 Other analysis has found battery costs in the range of $59-68/kWh by 2027.216 BNEF projects battery pack prices will drop to approximately $80/kWh in 2026 and $60/kWh in 2029, and Ford has targeted $80/kWh by 2030.217 [EPA-HQ-OAR-2019-0055-1302-A1, pp.46-47]

213 Amol Phadke et al., Why Regional and Long-Haul Trucks are Primed for Electrification Now 8, Lawrence Berkeley National Laboratory (Mar. 2021), https://eta-publications.lbl.gov/sites/default/files/updated_5_final_ehdv_report_033121.pdf.

214 Rachel MacIntosh et al., Electric Vehicle Market Update 10, EDF (Apr. 2022). These 2021 battery pack price estimates are based on BloombergNEF. Id. at 20.

215 Id. at 10.

216 Vishnu Nair et al., Technical Review of: Medium and Heavy-Duty Electrification Costs for MY 2027- 2030 36, Roush Industries for EDF (Feb. 2, 2022).

217 Rachel MacIntosh et al., Electric Vehicle Market Update 20, EDF (Apr. 2022); Colin McKerracher, Hyperdrive Daily: The EV Price Gap Narrows, Bloomberg (May 25, 2021), https://www.bloomberg.com/news/newsletters/2021-05-25/hyperdrive-daily-the-ev-price-gap-narrows; Todd Gillespie, Rising Battery Costs Hit Carmakers, Threaten Climate-Change Path, Bloomberg Green (Nov. 30, 2021), https://www.bloomberg.com/news/articles/2021-11-30/even-the-battery-boom-can-t-escape-world-s-supply-chain-woes.

Battery prices have fallen largely due to a rise in the search for and extraction of key raw materials, greater manufacturing scale, and technological improvements such as improved quality and material substitution. Because of significant commitments to the development of a domestic battery raw material and manufacturing industry, temporary changes in battery raw material prices or supply chain issues should not have a significant impact on these longer-term cost projections and trends.218 There are substantial industry and government investments in developing the battery manufacturing sector and lowering battery costs. Many manufacturers are making strides toward significant domestic battery production, with an expected 13 new battery cell gigafactories opening in the United States by 2025,219 further supporting this downward trend. Automakers have also announced research and production partnerships aimed at securing ready supplies of batteries and developing less expensive batteries.220 For example, Daimler recently announced a battery technology partnership through which the company will work with lithium-ion battery manufacturer and developer Contemporary Amperex Technology Co. Limited (CATL) for its supply of lithium-ion battery packs and to jointly work toward designing and developing next-generation battery cells and packs specifically for trucks.221 Additionally, in its Energy Storage Grand Challenge, DOE announced a goal to reduce battery cost to $80/kWh by 2030 for 300-mile range EVs.222 The Bipartisan Infrastructure Law also includes additional funds aimed at ‘expand[ing] the processing and manufacturing of advanced batteries, including for EVs and the electric grid.’223 These federal funds include: $3 billion for battery material processing; $3 billion for battery manufacturing and recycling; $10 million for the Lithium-Ion Battery Recycling Prize; $60 million for Battery Recycling RD&D; $50 million for state and local programs; and $15 million for Collection Systems for Batteries.224 The White House has also issued Executive Order 14,017, directing the Secretary of Energy and the relevant agencies to identify and address any risks to the battery supply chain.225 Advances in battery recycling technology are likely to lead to additional decreases in battery prices. A report by Roush Industries also details additional advancements in battery systems, such as lithium iron phosphate batteries, dry battery electrode coating processes, and tabless anodes, that will lead to greater efficiency and reduced costs for ZEVs.226 Finally, sustained high diesel and gasoline prices would likely make HD ZEVs more attractive and could allow for TCO parity even sooner. [EPA-HQ-OAR-2019-0055-1302-A1, pp.47-48]

218 See, e.g., Laurence Iliff, At a Toxic Lake in California, Enough Lithium to Transform North America’s EV Industry, Automotive News (Nov. 29, 2021), https://www.autonews.com/manufacturing/salton-sea-california-has-enough-lithium-transform-north-americas-ev-industry (noting that as more ZEVs come to the market, the

demand for lithium and other minerals will increase, making the value and development of domestic mineral extraction projects more certain); DOE, Vehicle Technologies Office, Federal Consortium for Advanced Batteries (FCAB), https://www.energy.gov/eere/vehicles/federal-consortium-advanced-batteries-fcab (DOE and ANL project aimed at long-term competitiveness in the global battery value chain).

219 Rachel MacIntosh et al., Electric Vehicle Market Update 21, EDF (Apr. 2022); Fred Lambert, 13 Battery Gigafactories Coming to the US by 2025—Ushering New Era of US Battery Production, Electrek (Dec. 27, 2021), https://electrek.co/2021/12/27/13-battery-gigafactories-coming-us-2025-ushering-new-era/.

220 Rachel MacIntosh et al., Electric Vehicle Market Update 23, EDF (Apr. 2022).

221 Cristina Commedatore, Daimler Trucks to Ramp Down ICE Spending, Focus on ZEVs, FleetOwner (May 25, 2021), https://www.fleetowner.com/technology/article/21165073/daimler-truck-to-ramp-down-ice-spending-focus-on-zevs.

222 Rachel MacIntosh et al., Electric Vehicle Market Update 20, EDF (Apr. 2022); DOE, Department of Energy Releases Energy Storage Grand Challenge Roadmap (Dec. 21, 2020), https://www.energy.gov/articles/department-energy-releases-energy-storage-grand-challenge-roadmap.

223 Rachel MacIntosh et al., Electric Vehicle Market Update 17, EDF (Apr. 2022).

224 Id.

225 The White House, Executive Order on America's Supply Chains, Executive Order 14,017 3(b)(ii) (Feb. 24, 2021), https://www.whitehouse.gov/briefing-room/presidential-actions/2021/02/24/executive-order-on-americas-supply-chains/.

226 Vishnu Nair & Gary Rogers, Reducing Medium- and Heavy-Duty Fuel Consumption and Criteria Pollutants, Roush Industries (Sept. 2021).

Moreover, charging infrastructure is developing alongside ZEV demand. The Biden Administration has already allocated $7.5 billion toward charging infrastructure,227 and manufacturers are investing as well. For example, Daimler Truck North America recently partnered with NextEra Energy Resources and BlackRock Renewable Power to invest approximately $650 million to design, develop, install, and operate a nationwide charging network for medium- and heavy-duty BEV and hydrogen fuel cell trucks.228 Cost studies such as Roush (2022) and ICCT (2019) have found that even if fleets bear high infrastructure costs, overall vehicle ownership cost parity is not far off, with ICCT (2019) concluding that overall fleet ownership costs will generally favor electric trucks over conventional trucks by 2030.229 [EPA-HQ-OAR-2019-0055-1302-A1, p.48]

227 Rachel MacIntosh et al., Electric Vehicle Market Update 25, EDF (Apr. 2022).

228 Id. at 29; Heavy Duty Trucking, Daimler Truck Plans to Create Nationwide Charging Network, HDT
Truckinginfo (Jan. 31, 2022),
https://www.truckinginfo.com/10160673/daimler-truck-plans-to-create-nationwide-truck-charging-network.

229 Dale Hall & Nic Lutsey, Estimating the Infrastructure Needs and Costs for the Launch of Zero-Emission Trucks
at i, ICCT (Aug. 2019); Vishnu Nair et al., Technical Review of: Medium and Heavy-Duty Electrification Costs for
MY 2027-2030, Roush Industries for EDF (Feb. 2, 2022).

We urge EPA to comprehensively consider these numerous relevant studies pointing to transformative cost projections for HD ZEVs in the classes and time periods covered by the Proposal. The cost studies show that many HD ZEVs are already both technologically feasible and cost effective, or will be so prior to MY 2027, meaning that they will be independently attractive to HD truck purchasers. As Daimler Truck AG's chief technology officer explained, 'In the very moment that the customer starts benefiting more from a zero-emission truck than from a diesel truck, there is no reason to buy the diesel truck anymore.'230 By failing to consider the full literature of cost projections, EPA assumes inappropriately low HD ZEV adoption and, as a result, proposes standards that are too lenient. These favorable cost projections provide additional support for EPA to reconsider its baseline HD ZEV market penetration rates for MY 2027 and beyond in the final rule. [EPA-HQ-OAR-2019-0055-1302-A1, p.48]

230 Cristina Commendatore, Daimler Truck to Ramp Down ICE Spending, Focus on ZEVs, Fleetowner (May 25, 2021),
https://www.fleetowner.com/technology/article/21165073/daimler-truck-to-ramp-down-ice-spending-focus-on-zevs.

In sum, EPA's proposed 1.5% baseline HD ZEV market penetration for MY 2027 vastly underestimates the number of HD ZEVs that will enter the market. EPA must reconsider its estimates to account for current market projections; federal, state, local, and private sector actions and commitments; and recent cost estimates, all of which point to baseline HD ZEV market penetrations in the range of 8–11% for MY 2027 and 19–27% for MY 2030. Failure to adjust the proposed emissions standards to account for these more accurate baseline figures will undermine the goals of the criteria pollutant and GHG programs. More accurate and reasonable baseline HD ZEV market penetration rates will support more stringent standards at levels that fulfills the Agency's duty to protect public health and welfare. Moreover, the recent cost studies outlined in Table 4 and in the separate comments on this Proposal submitted by MFN, EDF, and ICCT—along with the numerous public and private commitments detailed above—offer a strong record to support inclusion of zero-emission technologies in the technology packages underlying the criteria pollutant and GHG standards. EPA should revise the Proposal accordingly. [EPA-HQ-OAR-2019-0055-1302-A1, p.49]

The feasibility analysis underlying EPA's proposed NOx, PM, HC and CO emissions standards does not address the reductions achievable through zero-emission technologies, including hybrid electric vehicle (HEV), BEV, or FCEV technologies. 87 Fed. Reg. at 17,458. EPA bases that decision on 'current market penetration of BEVs (0.06 percent in MY 2019) or projected penetration rate in the MY 2027 timeframe (1.5 percent),' concluding that assessment of those technologies would not 'meaningfully impact [EPA's] analysis for developing the numerical level of the proposed Option 1 and 2 standards.' Id. But EPA recognizes that 'information showing higher BEV/FCEV market penetration in the MY 2027 or later timeframe' could require 'inclu[ding] HEV, BEV and/or FCEV technologies in [its] feasibility analysis,' and that it may have to 're-evaluate [its] approach' in the final rule. Id. (requesting comment on revising numeric standards to include HEV, BEV and FCEV technologies). [EPA-HQ-OAR-2019-0055-1302-A1, p.51]

EPA should revise its emissions standards to reflect both the feasibility and the baseline market penetration of zero-emission technologies. The Agency's reason for excluding those technologies—a projected market penetration rate of no more than 1.5% by MY 2027—is a gross underestimate. An updated, more accurate record indicates that by MY 2027, zero-emission technologies will be (and in many cases are already) cost-effective and feasible across the heavy-duty fleet, and are capable of providing deep reductions in NOx, PM, and HC emissions. See Section III, supra. The Clean Air Act's core command—that standards 'reflect the greatest degree of emission reduction achievable through the application of technology' which 'will be available for the model year to which the standards apply,' 42 U.S.C. 7521(a)(3)(A)(i)—therefore requires EPA to consider and include these technologies within its standard-setting analysis. That is especially so in light of the statute's technology-forcing nature. Nat'l Petrochemical & Refiners Ass'n, 287 F.3d at 1140 (noting that the statute does not require 'present availability'). EPA cannot consequently base its standards solely on 'currently available technologies'—and even if it could, zero-emission technologies are currently available. See 87 Fed. Reg. at 17,418, 17,458 (characterizing updated standards as reflecting 'technology improvements which have become available over the 20 years since' EPA's prior standards were promulgated). Rather, its standards must be based on a reasonable assessment of the technologies that 'will be available for the model years to which [the] standards apply.' 42 U.S.C. 7521(a)(3)(A)(i). [EPA-HQ-OAR-2019-0055-1302-A1, p.51]

Just as EPA must strengthen its criteria pollutant proposal to carry out its statutory mandate under the Clean Air Act, Commenters urge EPA to improve its proposed GHG standards. EPA proposes to make targeted adjustments to the existing HDV GHG Phase 2 standards and advanced technology incentives finalized in 2016 for certain vocational vehicles and combination tractors. 87 Fed. Reg. at 17,598–609. EPA predicated these existing standards and incentives on an assumption that it was unlikely that ZEV options would be available for HDVs during Phase 2's timeframe (MY 2021 through MY 2027 and later). Id. at 17,595. That assumption has been proven incorrect in the intervening years. Id. at 17,595–98. EPA notes the increasing number of manufacturers now producing electric HDVs along with state legislation and commitments for zero-emission trucks. Id. In light of these developments, EPA proposes to revise CO2 emissions standards for a subset of MY 2027 vehicles and adjust the advanced technology multipliers. 87 Fed. Reg. at 17,598–609. While these revisions are directionally necessary, the Agency continues to dramatically underestimate both baseline HD ZEV market penetration and the feasibility of zero-emission technologies to achieve increasingly stringent emissions standards. In doing so, it fails to 'utiliz[e] emission standards to prevent reasonably anticipated endangerment from maturing into concrete harm.' Coal. for Responsible Regulation, 684 F.3d at 122 (describing 'the job Congress gave [EPA] in 202(a)'). [EPA-HQ-OAR-2019-0055-1302-A1, p.64]

Significant improvements in zero-emission technologies and the rapid growth of HD ZEV sales have brought about a critical need for updates to the Phase 2 GHG standards. The Phase 2 standards were not based on hybrid, fuel cell, or battery electric vehicle technology. 87 Fed. Reg. at 17,594. Instead, EPA premised the vocational vehicle standards on controls including improvements in powertrain and driveline technology. Id. at 17,593. The standards for combination tractors were based on improvements in the tractor's powertrain, aerodynamics, tires, idle reduction, and other vehicle systems. Id. at 17,594. However, considering the improvements and growth in zero-emission technologies described above in Section III, EPA should in this rulemaking reconsider the technology package underlying the Phase 2 standards.246 [EPA-HQ-OAR-2019-0055-1302-A1, pp.64-65]

> 246 Comments on this Proposal submitted by MFN, EDF, and ICCT also detail the feasibility of achieving significantly greater deployment of zero-emission technologies within the HD fleet.

The Agency's mandate and stated intent was, and continues to be, to ensure that all regulated vehicles must install *some* combination of GHG emission reduction technology. 87 Fed. Reg. at 17,602–03. Because manufacturers comply with the standards on a fleetwide average basis, every additional ZEV (which is counted at a 0 g/mi CO2 emissions level) means that the remainder of the fleet can do less to reduce its GHG emissions. Id. at 17,601. In 2016, EPA dramatically underpredicted the level of future ZEV production, especially for school buses, transit buses, delivery trucks, and short haul tractors, which, according to EPA's estimates in the Proposal, now means that 'approximately five percent of conventional heavy-duty vehicles would be able to meet the current HD GHG Phase 2 standards without installing emission-reducing technologies because the standards apply as a fleet-average.' Id. (citing EPA, Memo to Docket, HD 2027 Proposed Changes to Heavy-Duty Greenhouse Gas Emissions (Nov. 2021)). While Commenters support EPA's plan to increase the stringency of 17 of the 33 MY 2027 vocational vehicle and tractor standards in line with updated baseline HD ZEV market penetration estimates, id. at 17,598, basing those updates on the Agency's proposed *underestimate* would result in standards that remain far too lenient—continuing the same problem EPA currently seeks to fix. Moreover, in light of Commenters' cost and market projections described in Section III, the record now supports including zero-emission technologies in the technology package underlying the GHG standards. [EPA-HQ-OAR-2019-0055-1302-A1, p.65]

EPA estimates that ZEVs will make up just 1.5% of HD sales in MY 2027. Id. at 17,601. At this level, the Agency estimates that 5% of the conventional HD fleet would not need to do anything to meet the fleet-average standards. Id. This calculation demonstrates how imperative it is to get the baseline ZEV penetration estimate right: without correction, for every 1.5% of additional ZEV penetration, roughly an additional 5% of the fleet will install no GHG emission controls, counter to the requirements of the Clean Air Act. See 42 U.S.C. 7521(a)(1) (requiring standards that 'prevent or control' pollution). To update the stringency of the proposed standards, EPA merely applied the technology packages finalized in Phase 2 to the 5% of the conventional fleet it predicts would otherwise not install any technology due to the increased ZEV penetration. 87 Fed. Reg. at 17,601. Therefore, an accurate baseline ZEV penetration estimate, at minimum, is imperative to properly strengthening the standards. [EPA-HQ-OAR-2019-0055-1302-A1, p.65]

As described in detail above in Section III, EPA's estimates are significantly and demonstrably incorrect. Its proposed 1.5% baseline ZEV penetration estimate is based on outdated data and a flawed methodology, and fails to consider recent, relevant studies and to take into account real-world ZEV sales commitments. Commenters' analysis provides support for at least 8–11% HD ZEV penetration by 2027 and 19–27% HD ZEV penetration by 2030. Failing to increase the stringency of the standards in line with this already conservative estimate would result in approximately 27–37% of the fleet installing *no* GHG emission controls in MY 2027, and 63–90% of the fleet installing *no* GHG emission controls in MY 2030.247 [EPA-HQ-OAR-2019-0055-1302-A1, pp.65-66]

247 8% ÷ 1.5% = 5.33 x 5% = 26.66%; 11% ÷ 1.5% = 7.33 x 5% = 36.66%; 19% ÷ 1.5% = 12.67 x 5% = 63.3%; 27% ÷ 1.5% = 18 x 5% = 90%

Given the data presented in Section III above, the Agency has a long way to go to 'provide a reasoned explanation of its basis for believing that its projection is reliable…[and] defen[d]…its methodology for arriving at numerical estimates.' Bluewater Network, 370 F.3d at 22 (internal citations omitted). Emissions standards must properly account for 'the rapid pace of progress…, and the industry's own forecasts,' NRDC v. EPA, 655 F.2d at 333—factors that here support a baseline HD ZEV penetration rate much higher than 1.5%, as well as incorporating zero-emission technologies into the standard-setting analysis. EPA must therefore update the record in accordance with these comments and examine the relevant data and demonstrate that the data is accurate and defensible. See Dist. Hosp. Partners v. Burwell, 786 F.3d 46, 57 (D.C. Cir. 2015). Courts require agencies to use 'the best information available,' Catawba County v. EPA, 571 F.3d 20, 45 (D.C. Cir. 2009), which the Agency failed to do in the Proposal. The market for ZEVs is accelerating rapidly with changes in technology, consumer demand, regulatory requirements, and fleet and manufacturer commitments, and '[a]gency reasoning…must adapt as the critical facts change.' Flyers Rights Educ. Fund, Inc. v. FAA, 864 F.3d 738, 745 (D.C. Cir. 2017). The Agency's baseline HD ZEV market penetration estimate must exhibit a 'sufficient linkage between theory, reality, and the result reached.' API v. EPA, 862 F.3d 50, 68 (D.C. Cir. 2017). Considering that even the *known* commitments for ZEV production—including state-level commitments related to the ACT rule—far outpace EPA's estimate, the linkage between reality and result must be corrected. [EPA-HQ-OAR-2019-0055-1302-A1, p.66]

EPA recognizes the gravity of the climate crisis and acknowledges that some sectors of the HD market are transitioning to zero-emission technologies at rates exceeding the Agency's original expectations. However, the Proposal continues EPA's history of significantly underestimating the future of ZEVs. This flawed forecast results in standards that do not comport with the requirements of the Clean Air Act and are not responsive to the dire effects of climate change, the transportation sector's outsized impact, or the available information indicating significantly higher baseline HD ZEV penetration and the further advancement of zero-emission technologies. [EPA-HQ-OAR-2019-0055-1302-A1, p.66]

In addition to fixing the insufficiencies in the Proposal, we urge EPA to consider zero-emission technologies in establishing its GHG emissions standards, both now and when the Agency sets Phase 3 standards for MY 2030 and later. Already, baseline HD ZEV market penetration will reach 19–27% by 2030.272 Analysis conducted by ICCT finds that new HD ZEV sales of 45% or higher by 2030 is necessary to avoid greater than 2â„ƒ of warming, and policies that allow greater than 2â„ƒ of warming will fail to protect health and welfare.273 EPA must set standards now with these goals and obligations in mind. [EPA-HQ-OAR-2019-0055-1302-A1, p.73]

272 See Appendix A.

273 Claire Buysse et al., Racing to Zero: The Ambition We Need for Zero-Emission Heavy-Duty Vehicles in the United
State, ICCT (Apr. 8, 2022); Arijit Sen & Josh Miller, Emissions Reduction Benefits of a Faster, Global Transition to
Zero-Emission Vehicles, ICCT (Mar. 2022), https://theicct.org/wp-content/uploads/2022/03/Accelerated-ZEV-transition-wp-final.pdf.

Accelerating the deployment of zero-emission technologies is feasible, cost-effective, and necessary in order to achieve the United States' climate goals and protect public health and welfare. There are additional advancements in zero-emission technologies that EPA should consider, as detailed in a recent analysis by Roush Industries.274 Manufacturers have also acknowledged that regulations help provide the motivation needed to achieve goals. For example, Daimler's general manager for product strategy and market development explained that '[r]egulations provide motivation—and we all need some of that sometimes,' and that '[i]t's always easier to just do what you've always done. So we see the need for things like [California's Advanced Clean Trucks Rule] to help us along.'275 Moreover, considering zero-emission technologies in the standard-setting analysis fulfills Congress's expectations that '[w]hen a breakthrough occurs....standards can be toughened.' See 116 Cong. Rec. S20598 (daily ed. Dec. 18, 1970) (statement of Sen. Muskie); see also 116 Cong. Rec. H5348, H5358–59 (daily ed. June 10, 1970) (statement of Rep. Farbstein) (expressing the belief that the internal combustion engine was unsustainable and that alternative power sources were necessary and achievable). There has been such a 'breakthrough' in zero-emission technologies, across all HDV classes and applications. EPA must acknowledge these developments and set standards accordingly, now and in the future. [EPA-HQ-OAR-2019-0055-1302-A1, p.73]

274 Vishnu Nair & Gary Rogers, Reducing Medium- and Heavy-Duty Fuel Consumption and Criteria Pollutants,
Roush Industries (Sept. 2021).

275 Jack Roberts, On the Glide Path to Net Zero, Truckinginfo.com (May 10, 2022), https://www.truckinginfo.com/10170224/on-the-glide-path-to-net-zero.

In proposing updates to the GHG standards, EPA focuses on four vehicle types (school buses, transit buses, delivery trucks, and short-haul tractors) ‘because they will likely have the highest EV sales of all heavy-duty vehicle types between now and 2030.’ 87 Fed. Reg. at 17,598. While these sectors are likely to transition to zero-emission technologies the fastest, there is also increasing potential in long-haul sectors beyond MY 2027. Several long-haul ZEVs are currently in development, and cost studies find that TCO parity is not far off for even the largest HD ZEVs that travel long distances. As shown in Table 4 in Section III.C, several studies estimate that TCO parity will be achieved as early as 2030–2035 for long-haul rigid trucks and 2025–2030 for long-haul tractors.276 [EPA-HQ-OAR-2019-0055-1302-A1, p.74]

276 ICCT (2019), ZEV Alliance (2020), ANL (2021), EDF/MJB (2021), CARB (2021), and NREL (2022) all find
TCO parity reached for long-haul tractors at least by 2035. Only BEAN (2021) and NREL (2021) find TCO parity
for long-haul tractors to be achieved later than 2035 (between 2040 and 2050). For long-haul rigid trucks, both
studies that provide estimates find similar timelines for TCO parity—EDF/MJB (2021) estimates after 2030 and
NREL (2022) estimates between 2030–2035.

EPA believes ‘that it is not appropriate to propose updates to the sleeper cab tractor standards in this action because the typical usage and daily miles traveled by these vehicles is beyond the range available in current electric tractors under development.’ 87 Fed. Reg. at 17,600. In fact, however, ‘many manufacturers are now road-testing electric tractor prototypes for hauls significantly longer than 100 miles…Daimler, Peterbilt, Tesla, and Volvo seem to be furthest along, but several other companies are also developing products.’277 EPA should at least consider these developments for the Phase 3 standards, as reducing criteria pollutants and GHG emissions from these larger vehicles is necessary for protecting public health and welfare. [EPA-HQ-OAR-2019-0055-1302-A1, p.74]

277 Steven Nadel & Peter Huether, Electrifying Trucks: From Delivery Vans to Buses to 18-Wheelers 18, ACEEE
(June 2021).

The pattern of driving for many long-haul routes also supports a potential path to achieving zero emissions. ‘The estimated average distance traveled between 30-minute driver breaks is 150 miles and 190 miles for regional-haul and long-haul trucks respectively in the U.S. Thirty minutes of charging using 500 kW or mega-Watt scale fast-chargers would add sufficient range without impairing operations and economics of freight movement.’278 According to a recent report by the North American Council for Freight Efficiency, about half of all Class 8 tractors engaged in regional-haul applications (range of about 200 miles) could already switch to battery-electric technology ‘with minimal or no impact on operations, productivity, or efficiency.’279 The Federal Motor Carrier Safety Administration also has several restrictions on the driving hours for long-haul trucks. The maximum continuous driving allowed without a 30-minute mandatory break is 8 hours (approximately 450 miles), meaning that ‘a range of 500 miles will be sufficient to cover the maximum allowed continuous driving.’280 Long-range tractor models, including at least one with a range of up to 500 miles, are scheduled to enter the market soon.281 For example, Tesla's Semi, expected to hit the market next year, will have a range of 500 miles at highway speed, and will be powered by a new solar-powered high-speed DC charging system that will supply about 400 miles of electricity in 30 minutes.282 Moreover, nearly 80% of freight in the United States is transported less than 250 miles, meaning that 500-mile range is not necessary for all long-haul applications.283 Daimler's Mercedes-Benz brand has started customer testing a new long-haul truck, the Actros LongHaul, which has a 310-mile range and should be ready for production by 2024.284 [EPA-HQ-OAR-2019-0055-1302-A1, pp.74-75]

278 Amol Phadke et al., Why Regional and Long-Haul Trucks are Primed for Electrification Now, Lawrence
Berkeley National Laboratory (Mar. 2021).

279 Jack Roberts, Half of All Regional-Haul Trucks Could Go Electric Now, HDT Truckinginfo (May 5, 2022),
https://www.truckinginfo.com/10169971/half-of-all-regional-haul-trucks-could-go-electric-now; see also North
American Council for Freight Efficiency, Electric Trucks Have Arrived: The Use Case for Heavy-Duty Regional
Haul Tractors (May 2022),
https://nacfe.org/wp-content/uploads/edd/2022/05/HD-Regional-Haul-Report-FINAL.pdf.

280 Amol Phadke et al., Why Regional and Long-Haul Trucks are Primed for Electrification Now 5, Lawrence
Berkeley National Laboratory (Mar. 2021).

281 Steven Nadel & Peter Huether, Electrifying Trucks: From Delivery Vans to Buses to 18-Wheelers, ACEEE (June
2021).

282 John O'Dell, Elon Musk Unveils Superfast, 500-mile Range Tesla Semi-Truck, trucks.com (Nov. 17, 2017),
https://www.trucks.com/2017/11/17/elon-musk-unveils-tesla-electric-semi-truck/.

283 Id.

284 Mike De Socio, Keep Your Eyes on These 9 Electric Truck and Van Companies in 2021, GreenBiz (Jan. 4, 2021),
https://www.greenbiz.com/article/keep-your-eyes-these-9-electric-truck-and-van-companies-2021.

Long-haul fleet managers are likely to find zero-emission technologies advantageous for other reasons as well. 'Electric motors can deliver peak torque almost instantly, allowing them to do very well in towing large loads from a dead start or up a gradient.'285 While battery packs add additional weight to the truck, electric drivetrains are 'substantially lighter relative to a diesel drive train, which offsets a significant amount of battery pack weight.'286 And even the additional battery pack weight is unlikely to be an issue for trucks, 'since most truck trips tend to be limited by volumetric capacity of payload as opposed to payload weight,' meaning that any minor weight added by electrification 'is likely to be acceptable for most trucks.'287 [EPA-HQ-OAR-2019-0055-1302-A1, p.75]

285 Steven Nadel & Peter Huether, Electrifying Trucks: From Delivery Vans to Buses to 18-Wheelers 10, ACEEE (June 2021).

286 Amol Phadke et al., Why Regional and Long-Haul Trucks are Primed for Electrification Now 5, Lawrence
Berkeley National Laboratory (Mar. 2021).

287 Id.

Regardless of whether EPA considers more stringent emissions standards for long-haul trucks in this rulemaking, the Agency should consider these and future developments in this sector as promising evidence of the technological and economic feasibility of heavy-duty zero-emission technologies on a broad scale. In order to achieve the United States' climate goals and carry out the Clean Air Act's mandate to protect public health and welfare, EPA must consider paths toward greater deployment of zero-emission technologies in the entire heavy-duty sector, including long-haul trucks. [EPA-HQ-OAR-2019-0055-1302-A1, p.75]

The heavy-duty truck market is rapidly innovating, and EPA should consider all of these innovations in setting emissions standards, including developments in hydrogen fuel cell technology. For medium- and heavy-duty long-haul trucks, full transition to zero-emissions may require some use of hydrogen fuel cells. Hydrogen FCEVs are scheduled to enter the heavy-duty tractor market in 2022, and will provide an alternative to BEVs that may be attractive in long-haul applications.288 For long-haul trucks, a hydrogen tank can be fueled approximately 15 times faster than a battery can be charged, takes up significantly less cargo capacity, and has a longer range.289 [EPA-HQ-OAR-2019-0055-1302-A1, pp.75-76]

288 Chris Randall, Hyzon to Deliver 18 FC Trucks to Hylane, Electrive.com (Apr. 11, 2022),
https://www.electrive.com/2022/04/11/hyzon-to-deliver-18-fc-trucks-to-hylane/#:~:text=Delivery%20of%20the%20
vehicles%20is,part%20of%20Hylane%27s%20mobility%20model.

289 Thomas Walker, Why the Future of Long-Haul Heavy Trucking Probably Includes Lots of Hydrogen, GreenBiz
(June 15, 2021),
https://www.greenbiz.com/article/why-future-long-haul-heavy-trucking-probably-includes-lots-hydrogen.

EPA recognizes FCEV potential, stating that '[i]f additional data on FCEV sales is available when we are conducting analyses for the final rulemaking, then we would likely evaluate using those data.’ DRIA at 56. And manufacturers are currently developing FCEV models. Daimler’s Mercedes-Benz brand, for example, has recently announced the GenH2, an electric-fuel cell truck that promises to drive more than 600 miles before needing to refuel.290 [EPA-HQ-OAR-2019-0055-1302-A1, p.76]

290 Mike De Socio, Keep Your Eyes on These 9 Electric Truck and Van Companies in 2021, GreenBiz (Jan. 4, 2021).

Several recent studies have also considered the entry of FCEVs into the market, including NREL (2022) (projecting that FCEVs will make up 2% of heavy-duty sales by 2030 and 21% by 2040)291 and BNEF EV Outlook (2021) (projecting that FCEVs will comprise 3% of heavy-duty sales by 2040 in the Economic Transition Scenario and 10% of heavy-duty sales by 2050 in the Net Zero Scenario).292 DOE has explained that ‘[d]ue to advancements for fuel cells and clean hydrogen production, hydrogen fuel cell electric vehicles are expected to become cost-competitive for long-haul heavy-duty trucks with greater than 500-mile range by 2035.’293 EPA should consider all feasible zero-emission technologies, including both battery electric and fuel cell technologies, both now and when setting the upcoming Phase 3 standards. [EPA-HQ-OAR-2019-0055-1302-A1, p.76]

291 Catherine Ledna et al., Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost
Analysis, NREL (Mar. 2022).

292 BNEF EV Outlook (2021).

293 DOE, DOE Projects Zero Emissions Medium- and Heavy-Duty Electric Trucks Will Be Cheaper than
Diesel-Powered Trucks by 2035 (Mar. 7, 2022), https://www.energy.gov/articles/doe-projects-zero-emissions-medium-and-heavy-duty-electric-trucks-will-be-cheape
r-diesel.

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

The Proposal underestimates baseline HD ZEV market penetration in several ways. First, EPA bases its estimate on the number of HD ZEVs it expects as a result of California’s regulatory requirements for HDVs in 2027, extrapolated to a national level, but its methodology is flawed for several reasons. In particular, EPA relies on HD ZEV projections from California’s ACT58 rulemaking in 2019, which are based on projected 2027 HD sales that are significant underestimates—notably lower than EPA’s own projections in its MOtor Vehicle Emission Simulator (MOVES) model and when compared to historical HDV sales data, as discussed in more detail below. As a result, the Proposal’s baseline ZEV sales projections for California in 2027 are unreasonably low and out of line with other, more accurate data and information. In calculating its baseline HD ZEV penetration estimate, EPA should rely on its own up-to-date MOVES data (which is also more in line with historical sales data) rather than California's 2019 projections. [EPA-HQ-OAR-2019-0055-1302-A1, pp.20-21]

58 CARB, Advanced Clean Trucks Regulation—Final Regulation Order (Mar. 15, 2021), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/fro2.pdf.

Further, in extrapolating to the national level, EPA relies on a ratio from a 2021 report by ICCT on U.S. and Canada ZEV sales. But there is no reason to believe that this ratio will continue to hold in the future. Moreover, EPA ignores the HD ZEV sales that will result in other states that have already adopted the ACT rule, as well as those that have signed the Multi-State Medium- and Heavy-Duty Zero Emission Vehicle Memorandum of Understanding (MOU),59 which targets ZEV sales and commits to ZEVs achieving 30% of all HDV sales by 2030 and 100% of all HDV sales by 2050. If EPA used MOVES data and looked at these existing state-level commitments, the baseline HD ZEV market penetration for 2027 would be significantly higher than that calculated in the Proposal. [EPA-HQ-OAR-2019-0055-1302-A1, p.21]

59 See NESCAUM, Multi-State Medium- and Heavy-Duty Zero-Emission Vehicle Memorandum of Understanding (NESCAUM MOU) (last accessed May 10, 2022), https://www.nescaum.org/documents/mhdv-zev-mou-20220329.pdf/.

EPA's approach to calculating national HD ZEV sales in 2027 is flawed because it relies on outdated data and fails to capture the impact of state policies driving additional HD ZEV sales. In its proposed approach, EPA begins by estimating MY 2027 HD ZEV sales in California. To do this, EPA takes into consideration the ACT rule passed by CARB in June 2020. 87 Fed. Reg. at 17,600.62 The ACT rule requires that HD ZEVs make up a certain percentage of a manufacturer's California sales. For example, in MY 2027, 20% of Class 4–8 vehicles and 15% of Class 7–8 tractors sold in California must be ZEVs. 87 Fed. Reg. at 17,597 Tbl.XI-2 & 17,600.63 EPA then scales to a national estimate of HD ZEV market penetration for MY 2027 using a static assumption that California will represent 42% of national HD ZEV sales. This approach is problematic for several reasons detailed below. [EPA-HQ-OAR-2019-0055-1302-A1, pp.23-24]

62 See also CARB, Notice of Decision: Advanced Clean Trucks Regulation (June 2020), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/nod.pdf.

63 See also CARB, Appendix A – Proposed Regulation Order: Advanced Clean Trucks Regulation 5–6 (May 2020), https://ww3.arb.ca.gov/regact/2019/act2019/30dayatta.pdf.

First, EPA underestimates the number of vehicles impacted by California standards by relying on inaccurate sales projections used in the ACT rulemaking. EPA uses estimates from the ACT rulemaking of the total Class 4–8 on-road vocational vehicle and tractor sales in California in MY 2027 of 20,938 (15,945 Class 4–8 vehicles and 4,993 tractors).64 These sales estimates are well below the on-road Class 4–8 vocational vehicle and tractor sales in California derived from several other sources and are inconsistent with actual sales and registration data. [EPA-HQ-OAR-2019-0055-1302-A1, p.24]

64 87 Fed. Reg. at 17,600, Table XI-3 (citing CARB, Advanced Clean Trucks Regulation Standardized Regulatory Impact Analysis 25 (Aug. 8, 2019), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/appc.pdf.).

According to the California DMV, 50,000 MY 2018 HDVs were registered as of October 2018; 52,688 MY 2019 HDVs were registered as of January 1, 2020; and 59,758 MY 2020 HDVs were registered as of January 1, 2021.65 These real-world new model year registrations are more than double those EPA estimated for MY 2027 in the Proposal. CARB's estimate of 20,938 HDV sales in MY 2027 is based on data from the EMFAC2017 modeling tool with an adjustment to 'remove out-of-state sales' as explained in the ACT Standardized Regulatory Impact Analysis (SRIA).66 In its documentation, CARB states that 84–90% of new registrations for Class 4–8 vehicles of model year age -1 or 0 were first sold in California.67 CARB states that it applied this factor to the EMFAC2017 projections to estimate new in-state sales of HDVs in MY 2027, but even applying this factor to EMFAC2017 projections still results in higher estimated MY 2027 sales than what CARB presents in the SRIA. Furthermore, if the out-of-state sales factor were applied to real-world California DMV registration data, new HDV sales would still be significantly higher than CARB's EMFAC2017-based estimates. [EPA-HQ-OAR-2019-0055-1302-A1, p.24]

65 California Department of Motor Vehicles (CA DMV), Vehicle Fuel Type Count by Zip Code (May 5, 2022), https://data.ca.gov/dataset/vehicle-fuel-type-count-by-zip-code.

66 CARB, Advanced Clean Trucks Regulation Standardized Regulatory Impact Analysis at 24.

67 CARB, Attachment D: Emissions Inventory Methods and Results for the Proposed Advanced Clean Trucks Regulation Proposed Modifications 3 (2019), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/30dayattd.pdf.

Furthermore, a retrospective analysis by CARB has found that EMFAC2017 significantly underestimated future HDV sales compared to real-world sales.68 For instance, analysis by CARB found that EMFAC2017 projected sales for heavy-duty trucks and buses in 2018 underestimated real-world sales by 15,633 in calendar year 2018.69 CARB has updated its estimates of in-state HDV sales in its EMFAC2021, which projects higher sales for 2027.70 [EPA-HQ-OAR-2019-0055-1302-A1, p.24]

68 See CARB, EMFAC202x Updates 34, 68, 94 (July 30, 2020), https://ww2.arb.ca.gov/sites/default/files/2020-07/EMFAC202x_2nd_Workshop_07302020_ADA.pdf (showing EMFAC2017 projections underestimated HD sales in California).

69 Id. at 68.

70 CARB, Emissions Inventory, EMFAC, https://arb.ca.gov/emfac/emissions-inventory (last accessed May 10, 2022) (attached to these comments as an Excel spreadsheet).

In addition, EPA has developed its own sales projections using its MOVES3 modeling tool, which finds much higher sales for the relevant vehicles in California. The sales projections in MOVES3 are more consistent with California vehicle registration data. EPA's MOVES 'is a state-of-the-science emission modeling system'71 that 'undergoes major updates and review every few years,'72 including significant peer-reviewed updates for the most recent MOVES3 version. In MOVES3, EPA put substantial effort into estimating vehicle populations by source type and calendar year, acknowledging that vehicle population is 'a critical input' that is 'ever changing as new historical data becomes available and new projections are generated.'73 [EPA-HQ-OAR-2019-0055-1302-A1, pp.24-25]

71 EPA, Overview of EPA's MOtor Vehicle Emission Simulator (MOVES3) 3 (Mar. 2021), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1011KV2.pdf.

72 EPA, Population and Activity of Onroad Vehicles in MOVES3 8 (Apr. 2021), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1011TF8.pdf.

73 Id. at 7–8.

In the Proposal, EPA relies on MOVES for all HDV sales and inventory projections, except those used in estimating the 2027 HD ZEV sales.74 However, even when using MOVES sales and inventory data in the Proposal, EPA is inconsistent with versions, mixing data from the most recent MOVES3 version with data from previous MOVES versions. See 87 Fed. Reg. at 17,600–01 (basing MY 2027 projections on vehicle population data from the 2016 HD GHG Phase 2 rulemaking, which used a previous version of MOVES, but basing short-haul tractor sales share on MOVES3 data). EPA should be consistent in the data source used for the sales and inventory projections. For these reasons, EPA should rely on its own and most current MOVES3 data rather than outdated MOVES versions or California's previous projections. Sales estimates by MOVES3 and other sources are significantly higher than what EPA assumes in the Proposal, as shown in Table 1 below. [EPA-HQ-OAR-2019-0055-1302-A1, p.25]

74 See, e.g., 87 Fed. Reg. at 17,492 (MOVES data used for inventory analysis when considering feasibility of standards); id. at 17,568 ('MOVES-projected sales volumes were used to determine first-year sales and cumulative sales' when calculating direct manufacturer costs); id. at 17,608 (MOVES data used to project sales in MY 2027 to model emissions impact and technology costs of GHG standard revisions); DRIA at 204 (MOVES was used to 'estimate emission inventories for air quality monitoring'); 87 Fed. Reg. at 17,600 (MOVES3 used to determine the fraction of short-haul tractors relative to overall tractor sales for MY 2027). EPA also used MOVES projections of total HD sales for MY 2027 but used EMFAC for California sales to extrapolate ZEV penetration rates, and then applied those to MOVES-based national sales numbers to arrive at a national percentage ZEV sales number). See 17 Fed. Reg. at 17,600–01 (noting that total national HDV sales numbers are based on sales split by vehicle category used in HD GHG Phase 2 rulemaking); EPA, Regulatory Impact Analysis: Greenhouse Gas Emission and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles–Phase 2 at 7-49, Tbl. 7-55 (Aug. 2016) (noting that sales estimates are based on MOVES).

Table 1 Comparison of California HD Sales Estimates by Source, Class 4-8 Vocational and Tractor Sales in California [EPA-HQ-OAR-2019-0055-1302-A1, p.26]

- EPA Proposal
    - 2020 - blank
    - 2025 - blank
    - 2027 - 20,938
    - 2030 - blank
- CA DMV (actual registrations)75
    - 2020 - 59,758
    - 2025 - blank
    - 2027 - blank
    - 2030 - blank

75 CA DMV, Vehicle Fuel Type Count by Zip Code (May 5, 2022), https://data.ca.gov/dataset/vehicle-fuel-type-count-by-zip-code. These are California DMV registrations for MY 2020 'Heavy' vehicles as of January 1, 2021. The California DMV does not provide which vehicle classes are included in this category.

- MOVES376
    - 2020 - 60,421
    - 2025 - 61,003
    - 2027 - 62,047
    - 2030 - 63,614

76 Calculated using EPA MOVES3 version 3.0.2, https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves. See Appendix A for details.

- EMFAC2021 77
    - 2020 - 43,161
    - 2025 - 44,397
    - 2027 - 45,326
    - 2030 - 47,809

77 CARB, Emissions Inventory, EMFAC.

- EMFAC2017 78
    - 2020 - 36,642
    - 2025 - 40,459
    - 2027 - 42,013
    - 2030 - 43,486

78 CARB, EMFAC2017 Web Database (last accessed May 10, 2022), https://arb.ca.gov/emfac/2017/ (attached to these comments as an Excel spreadsheet).

Second, EPA wrongly assumes that California will continue to represent an oversized share of national HD ZEVs sales by failing to accurately capture the impact of other states' policies on HD ZEV sales. The Proposal correctly points out that numerous states 'have announced plans to shift the heavy-duty fleet toward zero-emission technology.' 87 Fed. Reg. at 17,598.79 Yet when calculating baseline HD ZEV market penetration, EPA fails to discuss or account for the full range of state policies and commitments, particularly those from outside of California. Considering them would lead to substantially higher and more accurate baseline HD ZEV penetration rates. [EPA-HQ-OAR-2019-0055-1302-A1, p.26]

> 79 See, e.g., 87 Fed. Reg. at 17,595, n.813, n.814 (citing states' and cities' expansion of electric bus fleets); id. at 17,596–97 (noting that the 'BEV market for transit and school buses continues to grow,' and identifying several
> cities with ZEV transit bus programs); id. at 17,597 (listing several states with ZEV school bus programs); id. at 17,598 (explaining the ACT rule and states that have signed a related MOU).

EPA notes that '[o]utside California, several states have signaled interest in shifting to heavy-duty ZEV technologies and/or establishing specific goals to increase the heavy-duty electric vehicle market.' 87 Fed. Reg. at 17,598. EPA further explains that 15 states and the District of Columbia have signed the MOU targeting ZEV sales equaling 30% of all HDV sales by 2030 and 100% of all HDV sales by 2050. 87 Fed. Reg. at 17,598. The Proposal fails to include both Virginia and Nevada as MOU signatories, and these two states bring the total MOU signatories to 17 states and the District of Columbia.80 HDV sales in MOU states, including California, make up a significant portion of national HDV sales—about 36.5%.81 In March 2022, Northeast States for Coordinated Air Use Management (NESCAUM) and the MOU states issued a comprehensive and detailed draft Action Plan to meet their goals.82 Despite mentioning the MOU, the Proposal does not factor into its baseline HD ZEV market penetration the fact that ZEVs will be added to the heavy-duty fleet more rapidly in these 17 states and D.C., which make up more than a third of national HDV sales.83 An analysis by ICCT estimates that 36% of HDV sales in MOU states (excluding California) would be ZEVs in 2030 if all states implement the goal set out in the MOU.84 ICCT estimates that this would translate to 153,820 HD ZEV sales in MOU states (excluding California) in 2030.85 [EPA-HQ-OAR-2019-0055-1302-A1, pp.26-27]

> 80 Electrification Coalition, Nevada Joins Multi-State Agreement to Electrify Trucks and Buses (Mar. 31, 2022), https://www.electrificationcoalition.org/nevada-joins-multi-state-agreement-to-electrify-trucks-and-buses/; Sierra Club, Governor Northam Signs Virginia onto Multi-State Agreement to Electrify Trucks and Buses (Dec. 9, 2021), https://www.sierraclub.org/press-releases/2021/12/governor-northam-signs-virginia-multi-state-agreement-electrify-trucks-and.
>
> 81 Claire Buysse, et al., Racing to Zero: The Ambition We Need for Zero-Emission Heavy-Duty Vehicles in the UnitedStates, ICCT (Apr. 8, 2022). This is consistent with MOVES3 projections for MY 2027, which show 219,092 heavy-duty sales in all the MOU states, as compared to 606,659 total heavy-duty sales nationally, or 36% of all sales. See Appendix A for the relevant MOVES3 sales projections.

82 NESCAUM, Multi-State Medium- and Heavy-Duty Zero-Emission Vehicle Action Plan: A Policy Framework to Eliminate Harmful Truck and Bus Emissions, Draft for Public Comment (NESCAUM Action Plan) (Mar. 10, 2022), https://www.nescaum.org/documents/mhd-zev-action-plan-public-draft-03-10-2022.pdf.

83 The MOU signatories are: California, Connecticut, Colorado, Hawaii, Maine, Maryland, Massachusetts, Nevada, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia, Washington, and the District of Columbia. See NESCAUM MOU.

84 Arijit Sen et al., Benefits of the 2020 Multi-State Medium- and Heavy-Duty Zero-Emission Vehicle Memorandum of Understanding 5, ICCT (Apr. 2022), https://theicct.org/wp-content/uploads/2022/04/md-hd-mou-benefits-apr22.pdf.

85 Id. at 5, Figure 1; id. at 15, Table A4, excluding 2b/3 vehicles.

In addition to the MOU, EPA cites the adoption of the ACT rule in three states—New York, New Jersey, and Washington, 87 Fed. Reg. at 17,598 nn.846–48—but in fact, five states in addition to California have adopted the ACT rule,86 which with California would comprise 20%87 of total HDV sales in 2027.88 Other states also have relevant legislation underway. In May 2022, Connecticut passed legislation authorizing the state's Department of Energy and Environmental Protection to adopt the ACT rule.89 Maine has also made progress toward adopting ZEV standards for the state's HDVs and is currently seeking additional public and stakeholder comment on its proposed ACT rule.90 The Proposal correctly notes the expectation that more states will follow,91 and Colorado, Illinois, and Vermont have 'signaled plans to weigh the new regulations' as well.92 HD ZEV sales in ACT-adopting states will need to reach between 30% (Class 7–8 tractors) and 50% (Class 4–8 trucks) by 2030, and 40% (Class 7–8 tractors) to 75% (Class 4–8 trucks) by 2035 in order to meet the ACT targets.93 But again, EPA fails to account for the fact that the states that have adopted the ACT rule have committed to ZEV adoption at a more rapid pace than EPA projects, even absent any additional federal regulation, and that others are already taking action to join them. [EPA-HQ-OAR-2019-0055-1302-A1, pp.27-28]

86 States that have adopted the ACT rule include New York, New Jersey, and Washington, as cited in the Proposal, along with Oregon and Massachusetts.

87 Calculated using EPA MOVES3, https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves. See Appendix A for the relevant MOVES3 sales projections.

88 Laura Bliss, How Six States Could Transform the U.S. Trucking Industry, Bloomberg (Jan. 6, 2022), https://www.bloomberg.com/news/articles/2022-01-06/how-zero-emission-laws-will-reshape-u-s-trucking.

89 See Electric Trucks Now, States Are Embracing Electric Trucks (last accessed May 10, 2022), https://www.electrictrucksnow.com/states; Governor Ned Lamont, State of

Connecticut, Governor Lamont Applauds Final Passage of Climate Legislation That Includes New Emissions Standards for Medium and Heavy-Duty Vehicles (Apr. 29, 2022), https://officeofthegovernor.cmail20.com/t/ViewEmail/j/74D52C48B1231B922540EF23F30FEDED/BC5917CDF0297FE1025DA65DC0D0F53A?alternativeLink=False.

90 State of Maine Board of Environmental Protection, Meeting Minutes (Jan. 20, 2022), https://www.maine.gov/dep/bep/calendar.html.

91 87 Fed. Reg. at 17,598 (noting that 'we anticipate more states to follow with similar proposals' to the states that have adopted California's ACT rule).

92 Laura Bliss, How Six States Could Transform the U.S. Trucking Industry, Bloomberg (Jan. 6, 2022), https://www.bloomberg.com/news/articles/2022-01-06/how-zero-emission-laws-will-reshape-u-s-trucking.

93 CARB, Advanced Clean Trucks Regulation, Final Regulation Order, Table A-1 at 5 (Mar. 15, 2021), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/fro2.pdf; Rachel MacIntosh et al., Electric Vehicle Market Update 15, EDF (Apr. 2022), http://blogs.edf.org/climate411/files/2022/04/electric_vehicle_market_report_v6_april2022.pdf.

Instead of factoring these state policies directly into its calculations, EPA takes an approach that leads to a significant underestimate of baseline HD ZEV market penetration by MY 2027. In the DRIA, EPA cites a 2021 analysis by ICCT that notes that 42% of cumulative HD ZEVs sold through 2020 in the U.S. and Canada have been in California.94 This leads EPA to conclude that 42% of annual national HD ZEV sales will be in California in MY 2027. But this will not be the case in 2027. While California represents 42% of cumulative HD ZEV sales in the United States and Canada, it only comprises 10% of U.S. HDV registrations.95 As noted above, states that have signed the MOU, including California and other ACT-adopting states, represent 36.5% of HDV registrations.96 As these policies take effect in these states, the relative share of HD ZEV sales in California will fall, even as national sales increase. California would only represent 28% of total HD ZEV sales nationally if all MOU states achieve the ACT targets (with the MOU states representing 72% of total HD ZEV sales).97 And these figures do not account for the high possibility that other states beyond the MOU states also see growth in HD ZEV sales, as detailed in Section III.C below. [EPA-HQ-OAR-2019-0055-1302-A1, p.28]

94 Ben Sharpe & Claire Buysse, Zero-Emission Bus and Truck Market in the United States and Canada: A 2020 Update 5, ICCT (May 21, 2021), https://theicct.org/publication/zero-emission-bus-and-truck-market-in-the-united-states-and-canada-a-2020-update/.

95 For MY 2020. See Appendix A for details on these calculations.

96 Claire Buysse et al., Racing to Zero: The Ambition We Need for Zero-Emission Heavy-Duty Vehicles in the United States, ICCT (Apr. 8, 2022). See also MOVES3 projections for MY 2027.

97 See Appendix A for details on these calculations. Calculated using EPA MOVES3, https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves.

There has been a similar trend of other states making up a larger share of light-duty ZEV sales. In 2015, a total of 64,175 light-duty ZEVs were sold in the United States, with 53% sold in California.98 However, as of 2021, California's relative share has fallen to 35% as light-duty ZEV sales have dramatically accelerated nationally, driven by other federal and state policies and significant consumer interest in ZEVs (Figure 2). As of 2021, new light-duty ZEV sales totaled 166,582 in California (nearly 5 times higher than in 2015) and 473,426 nationally (nearly 7 times higher than in 2015).99 These trends demonstrate not only how quickly ZEV sales have accelerated but also how they have grown in states beyond California. Over the long term, with other state policies and federal incentives taking effect, regional differences in ZEV sales will diminish for HDVs, just as they have for light-duty vehicles. [EPA-HQ-OAR-2019-0055-1302-A1, pp.28-29] [Figure 2 has footnote 100]

98 Alliance for Automotive Innovation, Electric Vehicle Sales Dashboard (last accessed May 10, 2022), https://www.autosinnovate.org/resources/electric-vehicle-sales-dashboard.

99 Id.

100 Developed using data from the Electric Vehicle Sales Dashboard. See id.

In light of this data, EPA should not calculate forward-looking national HD ZEV sales using outdated HDV sales estimates and backward-looking sales shares. Instead, EPA should factor in the impact of policies in other states beyond California in the Agency's estimate of baseline HD ZEV market penetration. This should include states that 1) have adopted the ACT rule; 2) have committed to the MOU; and 3) are taking actions to deploy zero-emission transit and school buses (where it is possible to separately quantify those actions). This would result in a baseline HD ZEV market penetration estimate of at least 8% by 2027 and 19% by 2030.101 [EPA-HQ-OAR-2019-0055-1302-A1, p.29]

101 This assumes MOU states adopt ACT targets for 2027 and 2030. For detailed description of the methodology to develop these estimates, see Appendix A.

Still, even these more accurate baseline estimates would fail to reflect growing HD ZEV deployment in states that may adopt regulatory policies in the future or deployment that is driven by local government programs and private sector investments, as discussed below in Section III.C. As such, a baseline HD ZEV market penetration of 8% by 2027 and 19% by 2030 would be conservative. Accounting for modest additional state and private sector actions would bring baseline HD ZEV market penetration to at least 11% by 2027 and 27% by 2030.102 In addition, the faster-than-expected gains in the cost-competitiveness of HD ZEVs, as detailed below in Section III.D, offers additional evidence that HD ZEV uptake will continue to increase and that a MY 2027 HD ZEV penetration rate of between 8% and 11% by 2027 is a feasible and conservative baseline estimate.103 [EPA-HQ-OAR-2019-0055-1302-A1, pp.29-30]

102 This assumes MOU states adopt ACT targets for 2027 and 2030 and non-MOU states achieve 4% HD ZEV penetration by 2027 and 11% HD ZEV penetration by 2030. For a detailed description of the methodology to develop these estimates, see Appendix A.

103 For a detailed description of the methodology to develop these estimates, see Appendix A.

Current market analyses project rapid growth in HD ZEVs by the late 2020s, further illustrating that EPA's proposed baseline market penetration is a significant underestimate and that standards that further drive adoption of zero-emission technologies are clearly feasible. [EPA-HQ-OAR-2019-0055-1302-A1, p.30]

In discussing advances to the HD ZEV market, EPA cites two modeled projections: the Energy Information Administration's (EIA) Annual Energy Outlook 2021 ('AEO 2021') and the National Renewable Energy Laboratory's (NREL) Electrification Futures Study (2018). EPA also requests comment on sources for estimates and projections of the HD ZEV market. There are additional and up-to-date projections that demonstrate much higher baseline national HD ZEV penetration than the limited information that EPA considered in the Proposal, as shown in Table 2 below. These include:

- Boston Consulting Group discusses the fact that 'change is unfolding at electrifying speed in the commercial vehicle industry,' driven by economics and policies.104 The report predicts BEV sales in the range of 19–23% and FCEV sales in the range of 3–6%, with a central estimate of 25% ZEVs by 2030 (and 10% ZEVs by 2025). Even in its conservative scenario, zero-emission commercial vehicle sales would reach 6% in 2025 and 15% in 2030 [EPA-HQ-OAR-2019-0055-1302-A1, p.30]

  104 Peter Wiedenhoff et al., What the Shift to Zero-Emission Vehicle Means for Commercial Transportation, Boston Consulting Group (Mar. 22, 2022), https://www.bcg.com/en-us/publications/2022/what-the-shift-to-zero-emission-vehicles-means-for-commercial-transportation.

- NREL's 'Decarbonizing Medium- and Heavy-Duty On-Road Vehicles' report finds that 'zero-emission vehicles (ZEVs) can reach total-cost-of-driving parity with conventional diesel vehicles by 2035 for all medium- and heavy-duty (MD/HD) vehicle classes,' with smaller trucks and short-haul trucks achieving cost parity soon.105 The analysis concludes that 'demand for ZEV could rise rapidly...once cost parity is reached' and that ZEV sales could reach 42% by 2030.106 [EPA-HQ-OAR-2019-0055-1302-A1, p.30]

  105 Catherine Ledna et al., Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis 2, NREL (Mar. 2022), https://www.nrel.gov/docs/fy22osti/82081.pdf.

106 Id. at 3.

- ACT Research's 'Charging Forward Update' report projects that BEVs will reach 21% of Class 4–8 sales by 2027.107

  107 Jennifer McNealy, ACT Research Releases Updated BEV and FCEV Study & Adoption Forecasts for NA CV Markets, ACT Research (Feb. 7, 2022), https://content.actresearch.net/blog/nacev-act-research-releases-updated-bev-and-fcev-study-adoption-forecasts-forna-cv-markets.

- The International Energy Agency's Global EV Outlook 2021 projects that due to federal and state policies incentivizing ZEVs and charging infrastructure, ZEV sales for buses and trucks will reach 20% and 8%, respectively, by 2030.108

  108 IEA, Prospects for Electric Vehicle Deployment (2021), https://www.iea.org/reports/global-ev-outlook-2021/prospects-for-electric-vehicle-deployment (IEA's definition appears to include Class 2b/3 categories).

- BNEF's Electric Vehicle Outlook 2021 states that 'in urban duty cycles, battery electric trucks of any size become the cheapest option for several use cases in the 2020s,' with 'battery electric trucks becoming a viable option for heavy-duty long-haul operations' by the late 2020s.109 BNEF's Economic Transition Scenario projects that U.S. HD ZEV sales will reach 5% in 2027 for commercial HDVs and 38% in 2027 for buses. [EPA-HQ-OAR-2019-0055-1302-A1, p.31]

  109 BNEF, Electric Vehicle Outlook 2021 (2021), https://about.bnef.com/electric-vehicle-outlook/.

The AEO 2021 report that EPA cites in the Proposal projects that HD ZEVs will only make up 0.12% of new truck sales in 2027.110 This projection is substantially lower than other available market-based projections and should not be relied upon for the rulemaking. The model projects that only 485 electric medium- or heavy-duty vehicles will be sold in 2027, which is completely inconsistent with existing state policies and private sector commitments.111 Importantly, the National Energy Modeling System (NEMS), the model used for the AEO 2021 report, does not consider the impact of California and other states adopting the ACT rule or signing the MOU. NEMS also does not factor in total cost-of-ownership in calculating vehicle sales demand,112 does not appear to reflect the latest projected battery costs, and imposes exogenous maximum zero-emission technology penetration of 10%.113 [EPA-HQ-OAR-2019-0055-1302-A1, p.31]

110 87 Fed. Reg. at 17,596

111 EIA, Annual Energy Outlook 2021, Table 49. Freight Transportation Energy Use (last accessed May 10, 2022), https://www.eia.gov/outlooks/archive/aeo21/tables_ref.php (attached to these comments as an Excel spreadsheet).

112 EIA, Transportation Sector Demand Module of the National Energy Modeling System: Model Documentation (Dec. 2020), https://www.eia.gov/outlooks/aeo/nems/documentation/transportation/pdf/m070(2020).pdf.

113 National Energy Modeling System input file 'Max Share of Each Fuel Type' corresponding to parameter 'EFSHXG' for formula (199) as discussed in id. at 108. NEMS input files can be found at: https://www.eia.gov/outlooks/aeo/info_nems_archive.php

For its second source, EPA cites the NREL Electrification Futures Study (EFS).114 Compared to AEO 2021, NREL projects a greater market penetration of HD ZEVs, but the analysis is still dated compared to more recent analyses. NREL EFS projects 2027 HD ZEV sales shares of 5% for Class 3–6, 2% for Class 7–8, and 9% for buses in its Medium Scenario; and 10% for Class 3–6, 7% for Class 7–8, and 45% for buses in its High Scenario. As NREL's analysis was completed in 2017, it does not account for all the significant advancements in the HD ZEV market that EPA proposes to take into account in this rulemaking. For instance, the NREL EFS assumes that battery costs decline such that they reach $135/kWh by 2050. This is a much slower pace than has been demonstrated in the real world. In fact, according to BNEF, the average lithium-ion battery pack cost was $137/kWh in 2020, down from $295/kWh in 2016.115 Projected battery costs have fallen significantly to such an extent that a report by Roush Industries notes that 'battery cost projections made in 2017-2018 are already obsolete.'116 Analysis conducted by Roush finds that battery costs could reach $59–68/kWh by 2027. Other analyses have cited costs of $100/kWh by 2025.117 Furthermore, the NREL EFS pre-dates California's ACT program and the MOU signed by 17 states, so it does not consider the impact that these policies will have on market evolution. [EPA-HQ-OAR-2019-0055-1302-A1, pp.31-32]

114 Trieu Mai et al., Electrification Futures Study: Scenarios of Electric Technology Adoption and Power Consumption for the United States, NREL (2018), https://www.nrel.gov/docs/fy18osti/71500.pdf.

115 BNEF, Electric Vehicle Outlook 2021 (2021).

116 Vishnu Nair et al., Technical Review of: Medium and Heavy-Duty Electrification Costs for MY 2027- 2030 44, Figure 15, Roush Industries for EDF (Feb. 2, 2022), http://blogs.edf.org/climate411/files/2022/02/EDF-MDHD-Electrification-v1.6_20220209.pdf.

117 Peter Wiedenhoff et al., What the Shift to Zero-Emission Vehicle Means for Commercial Transportation, Boston Consulting Group (March 22, 2022); Chad Hunter, NREL, Spatial and Temporal Analysis of the Total Cost of Ownership for Class 8 Tractors and Class 4 Parcel Delivery Trucks 10 (Sept. 2020), https://www.nrel.gov/docs/fy21osti/71796.pdf.

Accordingly, EPA should place greater weight on recent studies that more accurately reflect a current assessment of the HD ZEV market, and which project more rapid market penetration of HD ZEVs in the coming years. [EPA-HQ-OAR-2019-0055-1302-A1, p.32]

Table 2: Recent Studies with Market Projections for HD ZEVs

- ACT Research ‘Charging Forward Update’118
    - Percent National HD ZEV Sales: 24% by 2027 for Class 4–8 commercial vehicles

  118 Jennifer McNealy, ACT Research Releases Updated BEV and FCEV Study & Adoption Forecasts for NA CV Markets, ACT Research (Feb. 7, 2022), https://content.actresearch.net/blog/nacev-act-research-releases-updated-bev-and-fcev-study-adoption-forecasts-forna-cv-markets.

- NREL ‘Decarbonizing Medium and Heavy-Duty On-road Vehicles’119
    - Percent National HD ZEV Sales: 42% by 2030 for Class 3–8 vehicles

  119 Catherine Ledna et al., Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis 2, NREL (Mar. 2022), https://www.nrel.gov/docs/fy22osti/82081.pdf.

- Boston Consulting Group ‘What the Shift to Zero-Emission Vehicles Means for Commercial Transportation’120
    - Percent National HD ZEV Sales: 25% by 2030 (range of 21% to 29%)

  120 Peter Wiedenhoff et al., What the Shift to Zero-Emission Vehicle Means for Commercial Transportation, Boston Consulting Group (Mar. 22, 2022).

- IEA Global EV Outlook121
    - Percent National HD ZEV Sales: 8% for trucks and 20% for buses by 2030 under Stated Policies Scenario

  121 IEA, Prospects for Electric Vehicle Deployment (2021), https://www.iea.org/reports/global-ev-outlook-2021/prospects-for-electric-vehicle-deployment.

- BNEF Electric Vehicle Outlook 2021122
    - Percent National HD ZEV Sales: 5% for trucks and 38% for buses by 2027 [EPA-HQ-OAR-2019-0055-1302-A1, p.32]

  122 BNEF, Electric Vehicle Outlook 2021 (2021).

Organization: *Colorado Energy Office, et al.*

Given the use of older ZEV heavy-duty sales projections in the proposed rule that don’t take into account more recent manufacturer commitments and state action, it is likely that heavy-duty

ZEV sales will be higher than EPA's projections (see more below on Colorado's estimated sales). [EPA-HQ-OAR-2019-0055-1297-A1, p.2]

EPA proposes to increase the stringency of GHG limits by 1.5% in MY 2027 based on sales-weighted average projections of electric school buses, transit buses, delivery trucks, and short-haul tractors. These projections are based on outdated data and significant market, technical, and policy developments that have occurred since, including reductions in battery costs, improvements in range, and the introduction of numerous new models for different vehicle classes. [EPA-HQ-OAR-2019-0055-1297-A1, p.2]

We recommend EPA update its estimates of heavy-duty ZEV sales based on more recent technology and market trends, as well as policy development and investments occurring at the state level. Colorado has developed a comprehensive Clean Truck Strategy that includes goals for 30% of medium- and heavy-duty vehicle sales to be ZEV by 2030, and to achieve 35,000 ZEV M/HD vehicles on the road by 2030.7 To achieve these goals, Colorado intends to pursue adoption of the Advanced Clean Trucks and Low NOx Omnibus rule, implement new vehicle incentive and replacement programs that have been funded by legislative action, invest in M/HD charging infrastructure, support workforce development, work with our utilities to invest in make-ready and other needed infrastructure investments, and numerous other strategies. Projected Class 4-8 Colorado ZEV sales for MY 2027-2029 based on adoption of the Advanced Clean Trucks rule, if no trading between classes occurs, are included below: [EPA-HQ-OAR-2019-0055-1297-A1, p.3] [See docket numberEPA-HQ-OAR-2019-0055-1297-A1, p.3 for table of CO ZEV Sales.]

7 This goal includes classes 2b and 3, and includes additional actions beyond adoption of the ACT and Low NOx rules.

Organization: *Consumer Reports (CR)*

The proposed rule significantly underestimates the future market penetration of ZEVs, and overlooks existing and reasonably foreseeable future ZEV technology. In doing so, the rule fails to set sufficiently stringent standards, and fails to encourage the adoption of ZEVs. As such, the EPA is not meeting its mandate under the Clean Air Act (CAA). [EPA-HQ-OAR-2019-0055-1285-A1, p.3]

Existing ZEV technology can meet the needs of most local and regional operations. Studies show that most straight trucks,22 in particular those used for local deliveries, do not travel more than 100 miles per day.23 There are a number of zero-emission trucks and buses commercially available today that already exceed 100 miles in range. Moreover, there are several battery and fuel cell models being demonstrated that can exceed 200 miles per day.24 With a number of companies such as Amazon, FedEx, and UPS committing to purchasing electric delivery vehicles, the possibility for a significant increase in adoption of ZEVs for this class is promising.25 The ZEV outlook for other classes of heavy-duty vehicles is also promising. [EPA-HQ-OAR-2019-0055-1285-A1, p.4]

22 Trucks designed with all axles on a single chassis

23 California Air Resources Board, Staff Report: Initial Statement of Reasons for the Advanced Clean Trucks Regulation, (October 22, 2019). Available at: https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/isor.pdf

24 Id.

25 Environmental Defense Fund, Ready for Delivery, (March 6, 2020) Available at: http://blogs.edf.org/energyexchange/2020/03/06/ready-for-delivery-electric-package-trucks/?_gl=1*khvyat*_ga*ND Q2MzkxMDgwLjE2NDU2MzQyMjg.*_ga_2B3856Y9QW*MTY1MTE2OTA2MC4xLjEuMTY1MTE2OTA4NC4zNg..*_ga_WE3BPRQKW0*MTY1MTE2OTA2MC4xMC4xLjE2NTExNjkwODQuMzY.*_ga_Q5CTTQBJD8*M TY1MTE2OTA2MC4xLjEuMTY1MTE2OTA4NC4zNg..*_gcl_aw*R0NMLjE2NDYzMjYzNzYuQ2owS0NRaUE2NEdSQmhDWkFSSXNBSE9McmlMMjNtX3ZrVEI5X25LZmZodWF0ZTNHQmRDZmNvLUlzT1RuU0NmaG1l clpzdElDMi1BVFpBY2FBb3dSRUFMd193Y0I.*_gcl_dc*R0NMLjE2NDYzMjYzNzYuQ2owS0NRaUE2NEdSQmhDWkFSSXNBSE9McmlMMjNtX3ZrVEI5X25LZmZodWF0ZTNHQmRDZmNvLUlzT1RuU0NmaG1lclpzdElDMi1BVFpBY2FBb3dSRUFMd193Y0I.; Amazon, Climate Pledge Fund Investments, Available at: https://sustainability.aboutamazon.com/about/the-climate-pledge/the-climate-pledge-fund

Manufacturers are planning to commercialize regional-haul ZEV trucks in the coming years.26 Finally, as seen in CALStart’s 'Drive to Zero' zero-emission technology inventory, a number of class 8 models, including battery-electric vehicles (BEV) and fuel-cell-electric vehicles (FCEV) that can travel over 300 miles on a single charge will be available in the coming model years.27 [EPA-HQ-OAR-2019-0055-1285-A1, p.5]

26 Seth Clevenger. (2019, Dec. 6). The Dawn of Electric Trucks, Transport Topics. See https://www.ttnews.com/articles/dawn-electric-trucks

27 CALStart, Zero-Emission Technology Inventory. Available at: https://globaldrivetozero.org/tools/zero-emission-technology-inventory/

State policies such as California’s Advanced Clean Trucks (ACT) establish zero-emission sales requirements for heavy-duty vehicles.28 These regulations will further push the market and technology towards electrification as manufacturers work to comply with the regulation. [EPA-HQ-OAR-2019-0055-1285-A1, p.5]

28 13 C.C.R. 1963 et seq.

Heavy-duty vehicles account for 23% of transportation-related GHG emissions.56 The EPA is proposing to update existing heavy-duty GHG standards to better reflect the increase in electrification beyond what was anticipated when the GHG standards were initially set. Because the current standards do not accurately capture electrification, manufacturers are able to produce ICE vehicles without installing any GHG emission reducing technologies.57 [EPA-HQ-OAR-2019-0055-1285-A1, p.9]

56 EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2020, EPA–430–R–22–003 (April 14, 2022).

57 87 F.R. 17440.

Under the CAA, the Administrator is authorized to prescribe standards applicable to the 'emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines… which in his judgment cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare.'54 The EPA has issued numerous findings showing that GHGs are reasonably anticipated to both endanger public health and to endanger public welfare.55 [EPA-HQ-OAR-2019-0055-1285-A1, p.9]

54 42 U.S.C. 7251(a)(1).
55 Endangerment and Cause or Contribute Findings for Greenhouse Gasses Under Section 202(a) of the Clean Air Act; Final Rule 74 F.R. 66495 (January 14. 2010). Available at: https://www.govinfo.gov/content/pkg/FR-2009-12-15/pdf/E9-29537.pdf.

However, by continuing to underestimate the ZEV market, the proposed standards do little to address the issue, nor do they help set the U.S. on a path to achieve President Biden's goal of reducing greenhouse gas emissions by 50-52% compared to 2005 levels by 2030.58 [EPA-HQ-OAR-2019-0055-1285-A1, p.9]

58 White House, Fact Sheet: Vice President Harris Announces Actions to Accelerate Clean Transit, Buses, School Buses and Trucks,(March 07, 2022). Available at: https://www.whitehouse.gov/briefing-room/statements-releases/2022/03/07/fact-sheet-vice-president-harris-announces-actions-to-accelerate-clean-transit-buses-school-buses-and-trucks/

EPA should set GHG gas standards that more accurately reflect the current and future heavy-duty ZEV market, and that drive technology towards zero emission heavy-duty vehicles. [EPA-HQ-OAR-2019-0055-1285-A1, p.2]

As written, the proposed rule assumes a ZEV sales share of only 1.5% in key market segments in 2027.2 This is lower than the current requirements of state level policies, which would result in a market penetration of at least 3% by 20273, and underestimates current market trends. [EPA-HQ-OAR-2019-0055-1285-A1, pp.1-2]

2 87 F.R. 17414, 17458.

3 Claire Buysse, Sara Kelly Ray Minjares, Racing to Zero: The Ambition We Need for Zero-Emission Heavy-Duty Vehicles in the United States, International Council on Clean Transportation (April 8, 2022). Available at: https://theicct.org/racing-to-zero-hdv-us-apr22/

The EPA should establish standards that not only assume a higher market share of ZEVs, but that also push the market towards increased electrification. The Clean Air Act (CAA) is intended to be technology forcing 4 and the EPA should rely on this authority to encourage faster adoption of ZEV technology. [EPA-HQ-OAR-2019-0055-1285-A1, p.2]

4 42 U.S.C. 7521

As written, the proposed rule assumes a ZEV sales share of only 1.5% in key market segments in 2027.29 As discussed below, this assumption is lower than requirements in state level policies, and underestimates market trends. The EPA should establish standards that not only assume a higher market share of ZEVs, but that also push the market towards increased electrification. [EPA-HQ-OAR-2019-0055-1285-A1, p.5]

29 87 F.R. 17414, 17458.

On June 25, 2020, California adopted ACT which requires increasing percentages of heavy-duty trucks sales to be ZEVs starting in 2024. By 2035 the rule requires manufacturers to sell 55% Class 2b- 3 ZEV, 75% Class 4-8 ZEVs, and 40% class 7-8 ZEVs.30 Since California passed ACT, six additional states have adopted the regulation.31 In total these states represent around one-fifth of heavy-duty trucks nationwide.32 In addition, 17 states and the District of Columbia signed a memorandum of understanding (MOU) targeting 30% of all new trucks and buses by 2030.33 These states(and D.C.) represent 36.5% of heavy-duty vehicles nationwide.34 Combined, these state-level policies alone will result in a 3% market share of ZEVs by 2027 and an 8% market share by 2030.35 EPA's baseline calculations do not account for the passage of ACT in states outside California, and do not take into consideration the MOU. At the very least, EPA's baseline should reflect state regulations and policies that require the adoption of ZEV. However, even these percentages likely underestimate market trends. In fact, a study by the National Renewable Energy Lab (NREL), estimates that 42% of heavy-duty vehicle sales will be zero emission by 2030.36 [EPA-HQ-OAR-2019-0055-1285-A1, pp.5-6]

30 13 C.C.R. 1963.1.

31 Recently, Connecticut passed legislation that will allow the state to adopt ACT.

32 Claire Buysse, Sara Kelly Ray Minjares, Racing to Zero: The Ambition We Need for Zero-Emission Heavy-Duty Vehicles in the United States, International Council on Clean Transportation (April 8, 2022). Available at: https://theicct.org/racing-to-zero-hdv-us-apr22/; This number includes the projection that 2% of buses nationwide will be zero-emission by 2030 as a result of California's Innovative Clean Transit Rule.

33 Multistate medium and Heavy-Duty Zero Emission Vehicle Memorandum of Understanding. Available at: https://www.nescaum.org/documents/mhdv-zev-mou-20220329.pdf/.

34 Claire Buysse, Sara Kelly Ray Minjares, Racing to Zero: The Ambition We Need for Zero-Emission Heavy-Duty Vehicles in the United States, International Council on Clean

Transportation (April 8, 2022). Available at: https://theicct.org/racing-to-zero-hdv-us-apr22/.

35 Id.

36 NREL, Decarbonizing Medium- and Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis, (March 2022). Available at: https://www.nrel.gov/docs/fy22osti/82081.pdf.

Standards for both NOx and GHG should reflect a higher ZEV market penetration, more than 3% in 2027 and increasing to more than 8% by 2030, and should work with state policies and regulations to push the heavy-duty market on a faster trajectory towards zero emissions. [EPA-HQ-OAR-2019-0055-1285-A1, p.6]

As the EPA notes, it is updating current GHG standards because the previous standards underestimated the impacts of the ZEV market.59 While the updates are needed, the current proposal simply repeats EPA's error of underestimating the ZEV market, and subsequently undermines the effectiveness of the GHG standards. [EPA-HQ-OAR-2019-0055-1285-A1, p.9]

59 87 F.R. 17594.

As discussed in detail in Section I, the EPA's baseline assumption of 1.5% ZEV market penetration underestimates market trends. As a result, more ZEVs will be on the road than predicted by the rule, and manufacturers will have to do less to reduce GHG emission from ICEs. Therefore, the proposed standards will do little to reduce GHG emissions. [EPA-HQ-OAR-2019-0055-1285-A1, p.10]

EPA should set GHG standards that accurately reflect ZEV market penetration as a result of state laws and policies. Furthermore, the EPA should do more, and set stringent standards that will drive further investment in clean vehicle technologies. Doing so is necessary to set the U.S. on track for achieving the President's goal of 50-52% net economy-wide greenhouse gas emission reductions below 2005 levels in 2030. [EPA-HQ-OAR-2019-0055-1285-A1, p.10]

Organization: *Eaton Vehicle Group (Eaton)*

Agency Request / Topic: We also are considering whether to establish more stringent standards beyond MY 2027, specifically in MY 2028 and MY 2029 using the methodology described in Section XI.C.1. We request comment on appropriate stringency and supporting data for each of those model years [EPA-HQ-OAR-2019-0055-1252-A1, p.11]

Eaton Comment Strategy / Materials: The approach to calculating new GHG standards is sound, but it is highly dependent on the market dynamics that are uncertain. Since the creation of the NPRM, more states finalized the NESCAUM MOU and the IIJA heavily subsidized the school bus market in 2023 – 2027. At a minimum, the EPA should assume ACT volumes across all NESCAUM MOU states, and separately, an approximate 20% EV market share in school and transit buses. However, the EPA should also consider the effect of simultaneous NOx and CO2 reduction on conventional powertrains that will also drive approximately 2% additional GHG improvement on the conventional fleet. [EPA-HQ-OAR-2019-0055-1252-A1, p.11]

Organization: *Edison Electric Institute (EEI)*

EPA includes a discussion in its preamble to this rule noting its long-term regulatory focus on driving the electrification of the transportation sector via future rulemakings. [EPA-HQ-OAR-2019-0055-1282-A1, p. 5]

> 87 Fed. Reg. 17,421. This discussion also builds on EPA's statements in its 2021 final rule on light duty vehicles, which included a significant discussion of the major announcements by every major automaker regarding new EV sales goals and cites the growing prevalence of EV penetration globally. Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards, 86 Fed. Reg. 74,434 (Dec. 30, 2021). [EPA-HQ-OAR-2019-0055-1282-A1, p. 6]

These discussions and acknowledgments provide important market and regulatory signals to all interested stakeholders—in particular, to the electric sector. States such as California, a leader in vehicle electrification, often include these kinds of discussions in their long-term planning documents, which have provided critical direction to California electric companies in building the infrastructure necessary to support increased electrification of the transportation sector. These types of broad market and regulatory signals will be helpful to all of EEI's members as they engage with their state commissions to move quickly to deploy EV infrastructure. Specific language regarding upcoming likely moves by EPA to set further regulatory standards to incentivize an increase in transportation electrification can send these signals effectively and should be included in any final rule. [EPA-HQ-OAR-2019-0055-1282-A1, p. 6]

EEI member companies are leading the charge to ready the market for widescale adoption of light-, medium- and heavy-duty EVs. EEI members are making investments and offering programs designed to help their customers overcome barriers to EV adoption, while also supporting existing EV users and year-over-year growth in the EV market. Many of these programs help to deploy and/or offset the cost of EV charging infrastructure in homes, workplaces, public locations, as well as for fleet operators. To date, more than 30 states and the District of Columbia have approved customer programs and investments totaling more than $3.4 billion.14 Furthermore, EEI members are leading by example with their own fleets by setting individual fleet electrification goals that put them on track to electrify more than a third of their fleet vehicles by 2030. [EPA-HQ-OAR-2019-0055-1282-A1, pp. 6 - 7]

> 14. See EEI, Electric Transportation Biannual State Regulatory Update, https://www.eei.org/-/media/Project/EEI/Documents/Issues-and-Policy/Electric-Transportation/ET-Biannual-State-Regulatory-Update.pdf.

Electric company investments coupled with those of other companies and stakeholders have dramatically increased access to charging in the U.S. Electric company investments have the potential (pending regulatory approval) to support more than 300,000 new charging stations.15 As of September 2021, there were more than 108,000 public charging ports, not including home chargers.16 This represents a more than 2000 percent increase in the number of public charging ports since 2011.17 The National Electric Highway Coalition, administered by EEI, is made up of more than 60 electric companies that are committed to fill in gaps in the public fast charging network needed to ensure long distance EV travel.18 While initially focused on light-duty passenger cars, this type of collaboration among electric companies is critical to lay the groundwork for EV charging infrastructure that can support other vehicle types that may have charging needs outside of fixed-route, return to base EV charging. [EPA-HQ-OAR-2019-0055-1282-A1, p. 7 - 8]

15. Atlas EV Hub, Electric Utility Filings Dashboard, https://www.atlasevhub.com/materials/electric-utility-filings/ (last visited September 21, 2021).

16. Department of Energy, Alternative Fuels Data Center, Alternative Fueling Station Counts by State, https://www.afdc.energy.gov/fuels/stations_counts.html (last visited September 21, 2021).

17. See Electric Vehicle Charing Association, State of the Charge: Report of the Northeast's Electric Vehicle Charging Industry at 3 (May 2018), http://www.evassociation.org/uploads/5/8/0/5/58052251/evca_stateofchargereport_2018.pdf.

18. EEI, https://www.eei.org/issues-and-policy/national-electric-highway-coalition.

Electric companies are also collaborating on infrastructure specific to medium- and heavy-duty electrifications. Efforts such as the West Coast Clean Transit Corridor Initiative and private partnerships like that between Daimler Truck North America and NextEra Energy Resources are laying the groundwork for dedicated medium- and heavy-duty EV charging infrastructure. In short, electric companies are preparing for a growing wave of fleet electrification and are eager to partner with both corporate and public fleet customers to ensure a seamless transition. [EPA-HQ-OAR-2019-0055-1282-A1, p. 8]

These investments are substantial and demonstrate that the industry—with the support of stakeholders necessary to authorize and enable these investments—are ready and willing to help facilitate America's shift towards EVs. The Agency should continue to be clear about its regulatory commitment to increased transportation electrification in this rule. As the electric sector continues its progress on and leadership on clean energy, EEI's members continue to make progress as they continue to propose and implement even more EV infrastructure projects across their service territories (to be augmented by the funds from the bipartisan infrastructure bill signed into law in 2021). EPA should look to leverage the progress the electric sector is making, and the investments being made, to choose electrification pathways in its regulatory regimes that match this progress. Agency comments regarding future electrification both acknowledges this progress while also laying out the roadmap on how future standards will provide a clear path for increasing electrification in the transportation sector—and send a strong signal about the need to build even greater EV infrastructure to meet an electrified future. [EPA-HQ-OAR-2019-0055-1282-A1, pp. 8 - 9]

EPA's role is consistent with both the Administration's and broad electrification stakeholder community's objectives and will be helpful to EEI's members as they continue to propose and implement even more EV infrastructure projects across their service territories. [EPA-HQ-OAR-2019-0055-1282-A1, p. 9]

Organization: *Elders Climate Action*

HDVs that are commercially available today with zero emission power trains obviously satisfy the available technology requirement for MY 2027. A large fraction of the CO2 comes from HD vehicle types that are NOW commercially available with zero emission power trains. These include transit and school buses, drayage vehicles linking ports and airports with distribution centers, delivery vans, service trucks, and shuttles serving airports, hotels and resorts. [EPA-HQ-OAR-2019-0055-1218-A1, p. 4]

EPA improperly estimates the zero emission HDVs that will likely be available in 2027 as a result of current incentive policies and state regulations. EPA does not estimate the potential availability of zero emission HDVs that could be produced and sold if EPA were to promulgate zero emission standards. [EPA-HQ-OAR-2019-0055-1218-A1, p. 4]

Instead EPA assumes that the rule will marginally improve the efficiency of IC engines and "induce" enough ZEV sales to reduce CO2 emissions less than 1% from new HDVs sold in 2027 and subsequent years. By failing to require the production and sale of zero emission HDVs along with a fleet averaging rule that allows engine manufacturers to sell "dirty" uncontrolled HDVs through the use of emission reduction credits obtained by selling zero emission vehicles in California and section 177 states, EPA is effectively allowing engine manufacturers to capture the benefits of clean zero emission vehicles for themselves while increasing the exposure of at risk communities to harmful pollutants in non-177 states. [EPA-HQ-OAR-2019-0055-1218-A1, p. 5]

By setting zero emission standards for NOx beginning in 2027 for the vehicle types currently available as zero emission vehicles (ZEVs), EPA could avoid an estimated 20,440 tons of NOx in South Coast and 22,630 tons in San Joaquin Valley. A zero emission standard for CO2 would avoid 54 million MT of CO2 from these three model years between now and 2050. The urgency of the public health and climate crises demands that the U.S. must not forego those reductions. [EPA-HQ-OAR-2019-0055-1218-A1, p. 5.]

EPA must start now with a zero emission standard for short haul vehicles in 2027 to put our nation's heavy duty vehicle fleet on a clear path to 100% zero-emissions sales by 2035. Allowing more vehicles that emit particulate and ozone precursor pollutants also fails to reflect the urgent need for ending particulate and ozone nonattainment within the Clean Air Act's statutory deadlines for attainment. [EPA-HQ-OAR-2019-0055-1218-A1, p. 5]

EPA has not answered the question Congress directed the agency to address with respect to the availability of zero emission technologies in MYs 2027-29 for most if not all HDV classes covered by the rule. [EPA-HQ-OAR-2019-0055-1218-A1, p. 10]

In the rule documents, EPA undertakes a detailed analysis of the technical feasibility of SCR technologies to control emissions from engines, the degree of reduction achievable, and an analysis of the cost to add such control technology. EPA concludes that we found that the fuel savings significantly exceed the costs associated with the technologies over the lifetime of the vehicles, with payback occurring in the fourth year of operation for vocational vehicle and in the second year for tractor-trailers.\870\ This same payback analysis would apply to the proposed revised standards, again as we are applying the same technology packages with the same costs and fuel saving to conventional vehicles that were originally intended to have these packages under the existing HD GHG Phase 2 program but would not with the current rise in electrification, absent these changes we are proposing in this action. 87 FR 17602. [EPA-HQ-OAR-2019-0055-1218-A1, pp. 10 - 11]

EPA does not perform a similar detailed updated analysis of the availability of zero emission power trains or the cost of deploying such technology. [EPA-HQ-OAR-2019-0055-1218-A1, p. 11]

EPA does not contend that zero emission power trains are not "available" within the statutory context of section 202(a)(3). On the contrary, EPA acknowledges in the NPR that – EPA's heavy-duty vehicle GHG certification data shows that EV products are being certified in most of the compression-ignition vocational vehicle subcategories, including the school buses and transit buses optional custom chassis subcategories, and the day cab tractor subcategories (about half of the total tractor subcategories). [EPA-HQ-OAR-2019-0055-1218-A1, p. 11]

> 87 FR 17601. EPA also cites "a report by international agency International Energy Agency (IEA) [that] provides a comprehensive accounting of recent announcements made by UPS, Fedex, DHL, Walmart, Anheuser-Busch, Amazon and PepsiCo for fleet electrification." EPA acknowledges that tens of thousands of zero emission vehicles are on order. Id., 17597. Based on these data, the Agency concludes that "the heavy-duty BEV market seems to be growing fastest in the areas of school buses, transit buses, delivery trucks, and short haul tractors." Id. [EPA-HQ-OAR-2019-0055-1218-A1, p. 11]

EPA discusses the availability of zero emission vehicles in MYs 2027-29 for the purpose of granting credits that allow manufacturers to sell more diesel and gasoline vehicles with higher NOx or CO2 emissions greater than the nominal standard. EPA discusses these credits as inducements to sell ZEV technologies, but does not explore in any significant degree the inducement that would be created by setting a zero emission standard for a share of new vehicle sales intended for duty cycles that are currently being served by vehicles certified as EVs. [EPA-HQ-OAR-2019-0055-1218-A1, p. 11]

EPA faulted the US Postal Service (USPS) for not evaluating the climate, air quality and public health benefits and the fleet total cost of ownership benefits that would flow from the purchase of battery electric vehicles for 75% of its delivery vehicle fleet as a "reasonable alternative" to the 90% ICE/10% BEV scenario evaluated in the EIS.10 But EPA has not proposed or even seriously analyzed the climate, public health and other environmental benefits that would flow from a regulatory strategy that requires fleet operators (such as the USPS) to purchase ZEVs for such service. [EPA-HQ-OAR-2019-0055-1218-A1, pp. 11 - 12]

10. EPA Comment Letter to U.S. Postal Service in re Final EIS for NGDV Acquisitions, downloaded 5/10/22 (available at Environmental Impact Statement (EIS) Database|USEPA).

Throughout the proposed rule EPA makes frequent references to the fact that HDVs with electric power trains have increased significantly in sales, and have become a larger portion of the on-road fleet than was expected in the projections made as part of the 2016 CO2 standards rulemaking. EPA identifies the CARB Advanced Clean Truck rule as the reason for this penetration of EVs into the HDV sector. [EPA-HQ-OAR-2019-0055-1218-A1, p. 12]

The necessary conclusion is that EPA has found zero emission HDVs to be "available technology" within the meaning of those terms as used in section 202(a)(3)(A). But EPA offers no detailed analysis to explain why, based on any of the relevant factors identified by Congress, zero emissions should not be the standard for some or all HDV classes or categories. The necessary conclusion is that EPA has found zero emission HDVs to be "available technology" within the meaning of those terms as used in section 202(a)(3)(A). The failure to propose and consider zero emission standards for significant portions of the HDV market is arbitrary and capricious, and not consistent with the statutory obligation to set standards that reflect greatest degree of emission reduction achievable. [EPA-HQ-OAR-2019-0055-1218-A1, p. 12]

For these reasons, Elders Climate Action asks that EPA adopt zero emission standards for NOx, PM and CO2 for HDVs that EPA has identified in short-haul duty cycles for which zero emission power trains are currently available, and for which zero emission power trains are expected to be available by 2027. At a minimum, zero emission standards should apply to the share of HDVs covered by the ZEV requirement in the CARB ACT rule. [EPA-HQ-OAR-2019-0055-1218-A1, p. 13.]

EPA acknowledges that under the fleet averaging rule, 5% of HDVs can meet the current CO2 standard without installing any emission reduction measures because they can take credit for the reductions achieved by replacing 1.5% of the HDV fleet with zero CO2 emission EVs. 87 FR 17601. In other words, EPA acknowledges that the CO2 reductions achieved by CARB's more aggressive regulatory approach have been used to allow manufacturers to sell dirty trucks without emission reduction technologies in other states. [EPA-HQ-OAR-2019-0055-1218-A1, p. 12]

In this admission, EPA acknowledges that engine manufacturers have aggregated to themselves the benefits of CARB's Clean Truck rule and stolen those benefits from the public they were intended to protect. EPA could remedy this inequitable impact on frontline communities most exposed to HDV emissions by requiring that CARB's ZEV mandates for trucks be applied nationally. But instead of accelerating the production of HDV ZEVs to deliver their climate and public health benefits to the remainder of the Nation, EPA is proposing only to modify the fleet averaging program to allow more dirty trucks to take credit for the CO2 reductions required by CARB and the other states that have, or will soon, are adopt the CARB clean truck rule. [EPA-HQ-OAR-2019-0055-1218-A1, p. 12]

This result has two outcomes that violate the Clean Air Act, Title VI of the Civil Rights Act and various Executive Orders: 1) it shifts the inequity experienced by frontline, BIPOC communities exposed to HDV pollutants in CA to similar communities in other parts of the country rather than reducing emissions to protect the public health; and 2) it fails to implement the CAA mandate to set "standards that reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply." [EPA-HQ-OAR-2019-0055-1218-A1, p. 12]

In addition, it defeats President Biden's promise to the American people in E.O. 14008 to address the Climate Crisis by transitioning the Nation to a zero emission economy by 2050 to ensure that the U.S. takes the actions needed to stabilize the global economy. [EPA-HQ-OAR-2019-0055-1218-A1, p. 13]

We ask EPA to revise the rule set a zero emission standard for all new HDVs by 2035, and establish a phase-in schedule for the standard that includes ZEV sales targets for MYs 2027-29 that are the same as the CARB ACT rule. [EPA-HQ-OAR-2019-0055-1218-A1, p. 18]

As discussed above in section II, the Clean Air Act requires EPA to set emission standards for HDVs that "reflect the greatest degree of emission reduction achievable…." [EPA-HQ-OAR-2019-0055-1218-A1, p. 19.]

Given the science informing the world that the climate cannot be stabilized short of achieving "net zero" GHG emissions, and the Presdient's commitment to achieving a net zero economy by 2050, we ask the Administrator to make the determination that emissions of both GHGs and precursors to the criteria pollutants PM and ozone emitted from light duty vehicles must be reduced to zero to protect the public health and welfare from the many adverse effects of climate warming. [EPA-HQ-OAR-2019-0055-1218-A1, p. 19.]

The Act provides that "[a]ny such [standard] under this subchapter may provide for a phase-in of the standard."13 We ask the Administrator to begin phasing in a zero emission standard by establishing a sales mandate that requires each manufacturer to achieve ZEV sales during the 2027 MY that are comparable to CARB's ACT rule with the goal of achieving 100% HDV ZEV sales by 2035 in order to achieve zero emissions from on-road vehicles by 2050. [EPA-HQ-OAR-2019-0055-1218-A1, p. 19.]

13. Id.

Commenters understand that additional rulemaking will be required to establish a zero emission standard and phase-in schedule for HDV classes not addressed by this rule. However, the current proposal can be revised to incorporate this approach for the HDV classes and categories addressed by this proposal. We ask that the Administrator not delay completion of the current proposed rule so that it can apply to 2027-29 MY vehicles. We ask that the Administrator open a rulemaking for the additional vehicle classes to promulgate a zero emission standard and a phase-in schedule that begins with the 2027 MY. [EPA-HQ-OAR-2019-0055-1218-A1, p. 19.]

ZEV sales targets are needed now –

- to establish benchmarks for all engine manufacturers to create a level playing field that promotes competitive market conditions for zero emission vehicles based on performance, reliability and cost;
- to ensure a market for ZEVs that will justify early investment by third parties in the development of supply chains needed for production of batteries and fuel cells;
- to ensure the capacity of the industry to ramp up to 100% of sales to ensure that ZEVs will be available in time to replace on-road ICE vehicles by 2050;
- for MY 2027 to give the industry enough lead time to develop supply chains, plan the conversion of production facilities and develop marketing campaigns designed to assure public acceptance of their products. [EPA-HQ-OAR-2019-0055-1218-A1, p. 18]

EPA does not investigate a ZEV sales mandate for the years 2027-2029 with respect to GHG emissions reductions, but the Rhodium Group estimates that light duty ZEV sales would need to reach 99% of total LDV sales by 2030 to achieve a zero emission fleet by 2045 (Fig. 2). Since HDVs have longer useful lives than LDVs, converting the HDV fleet to zero emission will require more aggressive regulatory approaches. Assuming the electric power sector achieves zero emissions by 2035 as President Biden has proposed, the HDV portion of the transport sector could achieve zero emissions by 2050 if a zero emission standard applies to all new HDVs by 2031. [EPA-HQ-OAR-2019-0055-1218-A1, pp. 26 - 27]

In its Regulatory Impact Assessment for the SAFE 2 rule, at 2-15, EPA acknowledges that -- … long-term GHG reduction goals will require a far greater penetration of ZEVs than this proposal would require through MY2026. The need for substantial increases in fleet penetration of ZEVs over the long term is supported by the recommendations of the National Academy of Sciences, which states in its 2021 Light-duty Vehicle Technology Assessment: "The agencies should use all their delegated authority to drive the development and deployment of ZEVs, because they represent the long-term future of energy efficiency, petroleum reduction, and greenhouse gas emissions reduction in the light-duty fleet". [EPA-HQ-OAR-2019-0055-1218-A1, p. 27]

But EPA does not disclose what its “long-term GHG reduction goals” are for either LDVs or HDVs, how it intends to achieve them, or whether and how the current rulemaking contributes to achieving those goals. The reasonableness of the current proposal turns on whether EPA 1) is committed to achieving the GHG reductions identified by the IPCC as necessary to avoid the dire public health and environmental consequences of warming greater than 1.5°C, 2) recognizes that zero emissions from on-road vehicles are a necessary component of the President’s national policy of transforming the U.S. into a zero emission economy by 2050, and 3) can establish how the current proposal contributes to a strategy designed to achieve those objectives. [EPA-HQ-OAR-2019-0055-1218-A1, p. 27]

In the absence of any consideration of these factors and an explanation by the Agency of how it has addressed those factors in developing its proposed decision in this rulemaking, the current proposal fails to consider relevant factors, fails to provide a rational basis for the proposal, and is arbitrary and capricious. [EPA-HQ-OAR-2019-0055-1218-A1, p. 27]

Based on these data and other available evidence, we petition the Administrator to find that –

1) climate warming already caused by GHG emissions harms the public health and is causing unacceptable adverse impacts on public welfare and the human environment, and

2) the expected increase in the severity and frequency of harms to health and the public welfare that will be caused by more extreme events that will occur as the global mean temperature advances toward and above the 1.5°C level resulting from growing GHG concentrations in the atmosphere, establish the need for a zero GHG emissions standard for HDVs pursuant to section 202(a)(1) and (3)(A) of the Clean Air Act. [EPA-HQ-OAR-2019-0055-1218-A1, p. 27.]

We petition the Administrator to make this finding as the predicate for re-opening this rulemaking for the purpose of promulgating a zero emission standard for HDVs, and a phase-in schedule that prescribes for each automaker a share of total HDV sales that must be ZEVs beginning with the 2027 MY. [EPA-HQ-OAR-2019-0055-1218-A1, pp. 27-28.]

Organization: *Energy Innovation, LLC*

Such trends are inconsistent with a climate stable future and must be reversed as quickly as possible. The EPA can and should promulgate more stringent GHG tailpipe standards that align with the U.S. Nationally Determined Contribution under the Paris Climate Agreement and achieve the emissions reductions in 2030 required for a 1.5°C trajectory. Strong tailpipe standards will also ensure compliance with Executive Order 14037, Strengthening American Leadership in Clean Cars and Trucks, aimed at making zero-emission vehicles (ZEVs), including EVs, 50 percent of all new cars sold in 2030.v They will help achieve the goals of Executive Order 14008, Tackling the Climate Crisis at Home and Abroad, as well, reducing economy-wide GHGs by 50 to 52 percent by 2030.vi [EPA-HQ-OAR-2019-0055-1310-A1, p.2]

v Executive Office of the President, Executive Order 14037 of August 5, 2021: Strengthening American Leadership in Clean Cars and Trucks, Federal Register, National Archives and Records Administration, August 10, 2021, https://www.federalregister.gov/documents/2021/08/10/2021-17121/strengthening-american-leadership-in-clean-cars-and-trucks; and White House, FACT SHEET: President Biden Announces Steps to Drive American Leadership Forward on Clean Cars and Trucks, August 5, 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-president-biden-announces-steps-to-driveamerican-leadership-forward-on-clean-cars-and-trucks/.

vi White House, Fact Sheet: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies, April 22, 2021, https://www.whitehouse.gov/briefing-room/statementsreleases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-payingunion-
jobs-and-securing-u-s-leadership-on-clean-energy-technologies/; and Executive Office of the President, Executive Order 14008 of January 27, 2021: Tackling the Climate Crisis at Home and Abroad, Federal Register, National Archives and Records Administration,

February 1, 2021 https://www.federalregister.gov/documents/2021/02/01/2021-02177/tackling-the-climate-crisis-at-home-and-abroad

It has been six years since the EPA last updated Phase 2 GHG standards, yet the proposed rule falls far short of what is needed to meaningfully address the urgency of the climate crisis. Given the long life of vehicles and the lead time required for market transformation, the standards set for MY 2027-2029 should expedite the shift to zero-emission electric vehicles (EVs). Waiting until 2030 to meaningfully reduce the GHG emissions from heavyduty trucks (HDTs) will significantly hinder efforts to combat climate change. Fortunately, electrification is a known climate solution that can quickly cut emissions from the transportation sector. The standards for MY 2027- 2029 will either put the U.S. on a path to achieve rapid transportation decarbonization or will prevent the necessary market transformation. [EPA-HQ-OAR-2019-0055-1310-A1, p.2]

In response to the EPA's request for comment and data on higher penetration rates, which could serve as the basis for increasing stringency of the CO2 standards for specific Phase 2 vehicle subcategories,xi we offer the following additional supporting information: [EPA-HQ-OAR-2019-0055-1310-A1, p.4]

xi EPA Proposed Rules, 17419.

While the proposed rule does not aim to enact percentage sales requirements, the EPA should exercise its authority to set tailpipe GHG standards that reflect emissions reductions consistent with percentage sales standards that would put the U.S. on a climate stable path, such as those outlined in the previously mentioned studies. [EPA-HQ-OAR-2019-0055-1310-A1, p.4]

The EPA projects a zero-emission vehicle penetration rate of 1.5 percent in the MY 2027 timeframe, with nominal gains of market share before 2030.xii Yet several studies combined with current market trends suggest that HDEV growth could be much higher in that timeframe. For example: [EPA-HQ-OAR-2019-0055-1310-A1, p. 4]

xii EPA Proposed Rules, 17438

- According to CALSTART's Advanced Technology Truck Index, between 2019 and 2021, the U.S. market saw a 625 percent increase in Class 2b to Class 8 zero-emission trucks available for purchase, growing from 20 models in 2019 to 145 models in 2021. They anticipate 165 models available by 2023, and 30 of which will be heavy-duty models.xiii Notably, the CALSTART analysis shows available HDEV models span anywhere from 100 to 500 miles of range, which covers the vast majority of trucking operational ranges—research from the National Renewable Energy Laboratory (NREL) shows 70 percent of HDTs operate primarily within 100-mile ranges, and 80 percent operate primarily within the 200-mile range.xiv [EPA-HQ-OAR-2019-0055-1310-A1, p. 4]

xiii Baha M. Al-Alawi, Owen MacDonnell, Ross McLane, and Kevin Walkowicz, Zeroing In On Zero-Emission Trucks, The Advanced Technology Truck Index: A U.S.

ZET Inventory Report, CALSTART, January 2022, 8, https://calstart.org/wp-content/uploads/2022/02/ZIO-ZETs-Report_Updated-Final-II.pdf.

xiv Catherine Ledna, Matteo Muratori, Arthur Yip, Paige Jadun, and Chris Hoehne, Decarbonizing Medium- and Heavy-Duty On-Road
Vehicles: Zero-Emission Vehicles Cost Analysis, National Renewable Energy Laboratory, March 2022, 38-40,
https://www.nrel.gov/docs/fy22osti/82081.pdf.

- Energy Innovation, the University of California, Berkeley, and GridLab's 2035 2.0 Report illustrates the technoeconomic feasibility of 100 percent EV sales for passenger, medium- and heavy-duty vehicles by 2035 which, if achieved, would translate to around 40 percent HDEV sales by 2027, and around 80 percent HDEV sales in 2030. Notably, electrifying all new cars and trucks by 2035 would (by 2050) save consumers $2.7 trillion, prevent 150,000 premature deaths, avoid $1.3 trillion in environmental and health costs by reducing air pollution, and would support a net increase of over 2 million jobs in 2035.xv [EPA-HQ-OAR-2019-0055-1310-A1, p. 4]

  xv Amol Phadke, N. Abhyankar, J. Kersey, T. McNair, U. Paliwal, D. Wooley, O. Ashmoore, R. Orvis, M. O'Boyle, R. O'Connell, U. Agwan, P. Mohanty, P. Sreedharan, and D. Rajagopal, Plummeting Costs and Dramatic Improvements in Batteries Can Accelerate Our Clean Transportation Future, University of California, Berkeley Goldman School of Public Policy, Energy Innovation, and Grid Lab, April 2021, http://www.2035report.com/transportation/wp-content/uploads/2020/05/2035Report2.0-1.pdf?hsCtaTracking=544e8e73-752a-40eeb3a5-90e28d5f2e18%7C81c0077a-d01d-45b9-a338-fcaef78a20e7.

- California's Advanced Clean Trucks (ACT) rule requires 75 percent of class 4 to class 8 truck sales in the state to be ZEVs by 2035.xvi The six states1 that have adopted the ACT Rule to date represent approximately 20 percent of the heavy-duty market.xvii According to an ICCT analysis, these states will constitute at least 8 percent of heavy-duty zero-emission vehicle (ZEV) sales by 2030.xviii Additional states2 have indicated they are working toward adopting ACT rules,xix with governors from 17 states and the District of Columbia signing a memorandum of understanding (MOU) to work collaboratively to achieve 100 percent of medium- and heavy-duty EV sales by 2050, with an interim target of 30 percent by 2030.xx Combined with existing state adoption of the ACT rules, the MOU could increase the heavy-duty ZEV market to 11 percent by 2030.xxi Although state action remains critical, national leadership is necessary to scale HDEV growth more quickly. [EPA-HQ-OAR-2019-0055-1310-A1, pp. 4-5]

  1 California, Massachusetts, New Jersey, New York, Oregon, Washington.

  2 Connecticut, Colorado, and Rhode Island.

xvi California Air Resources Board, Advanced Clean Trucks Fact Sheet: Accelerating Zero-Emission Truck Markets, https://ww2.arb.ca.gov/resources/fact-sheets/advanced-clean-trucks-fact-sheet.

xvii Buysse, Racing to Zero.

xviii Buysse, Racing to Zero.

xix Adam Hsu, 'California Leads, States Follow on Zero-Emission Rules for MD, HD Trucks, Advanced Clean Tech News, February 8, 2022, https://www.act-news.com/news/california-leads-states-follow-on-zero-emission-rules-for-md-hd-trucks/.

xx Buysse, Racing to Zero and California Air Resources Board, '15 states and the District of Columbia join forces to accelerate bus and truck electrification,' July 14, 2020, https://ww2.arb.ca.gov/news/15-states-and-district-columbia-join-forces-accelerate-bus-and-truckelectrification.

xxi Buysse, Racing to Zero.

- A growing number of truck manufacturers have announced new EV modelsxxii and/or have made commitments to sell a certain percentage of zero-emission trucks by 2030.xxiii Stronger standards would send the signal to all manufacturers to forge ahead with plans to develop and sell more electric models for the heavy-duty sector sooner than later. [EPA-HQ-OAR-2019-0055-1310-A1, p. 5]

  xxii Daimler Truck North America, 'Daimler Truck Electric Commercial Vehicles,' https://northamerica.daimlertruck.com/emobility; Mark Vaughn, 'Electric Big Rigs are Coming—We Drive Four of Them,' Autoweek, May 24, 2021, https://www.autoweek.com/news/green-cars/a36506185/electric-big-rig-semi-trucks/; and Caleb Miller, 'General Motors Will Launch Electric Heavy-Duty Trucks by 2035,' Car and Driver, January 7, 2022, https://www.caranddriver.com/news/a38696855/general-motorselectric-heavy-duty-trucks/.

  xxiii Volvo, 'Taking the Lead: Embracing a Cleaner Mobility,' https://group.volvocars.com/company/innovation/electrification; and Ben Preston and Jeff S. Bartlett, 'Automakers Are Adding Electric Vehicles to Their Lineups. Here’s What’s Coming,' Consumer Reports, May 13, 2022, https://www.consumerreports.org/hybrids-evs/why-electric-cars-may-soon-flood-the-us-market-a9006292675/.

Another factor very likely to shift the market to favor HDEVs in the near-term is the economic advantage HDEVs hold over their diesel counterparts (especially as gasoline and diesel prices remain high and subject to increasing volatility due to reliance on unstable international markets). Several analyses confer on the savings advantage of HDEVs over the vehicle’s lifetime:

- The 2035 2.0 Report found HDEVs are already cheaper than their diesel counterparts, on a total cost of ownership (TCO) basis (as shown in Figure 4), and this advantage grows to $0.22 per mile in 2030 and $0.25 by 2035. This translates to roughly $200,000 in savings across the vehicle lifetime. xxiv [EPA-HQ-OAR-2019-0055-1310-A1, p.5]

  xxiv Amol Phadke, et al., Plummeting Costs and Dramatic Improvements in Batteries Can Accelerate Our Clean Transportation Future.

- Lawrence Berkeley National Laboratory research shows a Class 8 electric truck, compared to a diesel truck, can offer about 13 percent lower TCO per mile when operating 300 miles per day with a 375-mile range.xxv Operating fewer miles per day further improves this cost advantage. [EPA-HQ-OAR-2019-0055-1310-A1, p.5]

  xxv Amol Phadke, Aditya Khandekar, Nikit Abhyankar, David Wooley, and Deepak Rajagopal, Why Regional and Long-Haul Trucks are Primed for Electrification Now, Lawrence Berkeley National Laboratory, March 2021, 1, https://etapublications.lbl.gov/sites/default/files/updated_5_final_ehdv_report_033121.pdf.

- A meta-analysis from the Union of Concerned Scientists of three independent studies (from California Air Resources Board, ICF, and ICCT) suggests the TCO of electric trucks in 2030 will be less expensive than diesel for both Class 6 delivery trucks and Class 8 short-haul/drayage trucks.xxvi [EPA-HQ-OAR-2019-0055-1310-A1, p.5]

  xxvi Union of Concerned Scientists, Ready for Work: Now is the Time for Heavy-Duty Electric Vehicles, December 2019, https://www.ucsusa.org/sites/default/files/2019-12/ReadyforWorkFullReport.pdf.

- A recent study from the Department of Energy (DOE) shows by 2030, 'nearly half of medium- and heavyduty trucks will be cheaper to buy, operate, and maintain…than traditional diesel-powered combustion engines.'xxvii In addition, DOE’s recently released supply chain strategyxxviii along with President Biden’s invocation of the Defense Production Act will set the U.S. on a path to procure the foundational materials that drive a clean energy economy, including the components necessary for electric and zero-emission transportation and charging technologies, in order to bring upfront costs down over time (while also improving America’s competitiveness). [EPA-HQ-OAR-2019-0055-1310-A1, pp.5-6]

  xxvii U.S. Department of Energy, 'DOE Projects Zero Emissions Medium- and Heavy-Duty Electric Trucks Will be Cheaper than Diesel-Powered Trucks by 2035,' March 7, 2022, https://www.energy.gov/articles/doe-projects-zero-emissions-medium-and-heavy-duty-electrictrucks-will-be-cheaper-diesel.

  xxviii U.S. Department of Energy Office of Policy, 'Securing America’s Clean Energy Supply Chain,' https://www.energy.gov/policy/securingamericas-clean-energy-supply-chain.

With the opportunity for significant cost savings over the life of heavy-duty vehicles, more large fleet owners are making commitments to electrify their vehicles within the decade. Amazon, for example, has already started using an electric delivery van and has placed an order for 100,000 custom EVs from Rivian.xxix Nearly two dozen other companies have announced plans to switch to electric fleets.xxx And, at the state level, there has been a significant uptick in state policies regarding commercial fleets, government fleets, and medium- and heavy-duty vehicles since Q4 2021.xxxi [EPA-HQ-OAR-2019-0055-1310-A1, p.6]

> xxix Mary Meisenzahl, 'Amazon’s first electric delivery vans are now making deliveries—see how there were designed,' Business Insider, February 3, 2021, https://www.businessinsider.com/amazon-creating-fleet-of-electric-delivery-vehicles-rivian-2020-2.
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> xxx Christine Lellis, 'These 21 Companies Are Switching to Electric Vehicle Fleets,' EHS Management Blog, Perillon, October 26, 2021, http://www.perillon.com/blog/21-companies-switching-to-electric-vehicle-fleets.
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> xxxi NC Clean Energy Technology Center, 'The 50 States of Electric Vehicles: Transportation Electrification Plans, Fast Charging Networks, & Underserved Communities in Focus During 2021,' February 9, 2022, https://nccleantech.ncsu.edu/2022/02/09/the-50-states-of-electricvehicles-transportation-electrification-plans-fast-charging-networks-underserved-communities-in-focus-during-2021/.

Finally, the billions of dollars of federal investments in EVs and EV charging infrastructure supported by the Infrastructure Investment and Jobs Act (IIJA),xxxii combined with other federal efforts and existing state leadership on charging infrastructure, will provide further support for an expanded HDEV market in the near-term. Expanded charging will help prospective owners and operators gain confidence in their ability to charge their vehicles as they travel throughout the country. According to an NREL analysis, if charging infrastructure is deployed to support EV adoption, sales of medium- and heavy-duty EVs could reach 42 percent by 2030 and greater than 99 percent by 2045.xxxiii Numerous charging infrastructure efforts are underway that will likely transform the market in the next few years: [EPA-HQ-OAR-2019-0055-1310-A1, p.6]

> xxxii M. Moaz Uddin, 'Electric Vehicle Programs in the Bipartisan Infrastructure Bill,' Great Plains Institute, December 6, 2021, https://betterenergy.org/blog/electric-vehicle-programs-in-the-bipartisan-infrastructure-bill/.
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> xxxiii Ledna, et al., Decarbonizing Medium- and Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis, 2.

- The IIJA provides $7.5 billion for EV charging network across America, including increased charging in rural areas and historically disadvantaged and frontline communities.xxxiv The funding also supports the 6th round of Alternative Fuel Corridors designations to recognize highway segments that offer EV charging.xxxv [EPA-HQ-OAR-2019-0055-1310-A1, p.6]

xxxiv White House, Fact Sheet: The Biden-Harris Electric Vehicle Charging Action Plan, December 13, 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/12/13/fact-sheet-the-biden-harris-electric-vehicle-charging-actionplan/.

xxxv U.S. Department of Energy, Alternative Fuels Data Center, https://afdc.energy.gov/stations/#/corridors.

- California's 2021-2023 Investment Plan allocated $690 million across medium- and heavy-duty ZEV infrastructure, including for electric charging and hydrogen fueling. This includes funding for charging infrastructure for 1,000 zero-emission school buses, 1,000 zero-emission transit buses, and 1,150 zero emission drayage trucks.xxxvi [EPA-HQ-OAR-2019-0055-1310-A1, p.6]

  xxxvi Dan Mihalascu, 'California Investing $1.4B In EV Charging And Hydrogen Stations,' Inside EVs, November 26, 2021, https://insideevs.com/news/550670/california-zev-infrastructure-investment/.

- NREL is working in partnership with automotive industry group CharIn to develop new high-powered charging standards for medium- and heavy-duty vehicles, known as the Megawatt Charging System (MCS), which will allow for charging capacity seven times greater than current LDEV fast charging technology.xxxvii This effort will help address the current challenges of interoperability and inconsistent standards across the current network of over 100,000 public chargers. [EPA-HQ-OAR-2019-0055-1310-A1, p.6]

  xxxvii NREL, 'Industry Experts, Researchers Put Charging Systems for Electric Trucks to the Test,' August 30, 2021, https://www.nrel.gov/news/program/2021/industry-experts-researchers-put-charging-systems-for-electric-trucks-to-test.html.

In summary, current trends and compelling cost savings data suggest the HDT market segment is ripe for technology innovation and the introduction of more all-electric models in the next few years, along with a substantial expansion of charging infrastructure to meet demand for cleaner trucks. However, the standards set in this rulemaking have the potential to accelerate these developments and achieve the rapid GHG emissions reductions that are needed to avoid the worst impacts of climate change. A strong standard will incentivize greater private sector innovation and compel broader market changes that lead to faster uptake of clean, all electric trucks within this decade—which must occur to align with a 1.5°C to 2°C climate stable trajectory. [EPA-HQ-OAR-2019-0055-1310-A1, p.6]

Organization: *Environmental Protection Network (EPN)*

EPN recommends that the GHG proposal be significantly strengthened. The proposal lacks any ambition whatsoever and reinforces that EPA is now the laggard in reducing HD GHGs rather than the leader. The recent Intergovernmental Panel on Climate Change (IPCC) Report makes clear that now is the time for strong action to address the climate crisis. EPA's proposal fails to step up to this challenge and is an important lost opportunity. [EPA-HQ-OAR-2019-0055-1233-A1, p. 2]

There is a wealth of information available to EPA that supports this approach to the GHG standards. The recent government-funded National Renewable Energy Laboratory (NREL) report projects that ZEV sales could reach 42% of all medium-duty (MD)/HD trucks by 2030, reflecting lower combined vehicle purchase and operating costs (see Decarbonizing Medium- & HD On-Road Vehicles: Zero-Emission Vehicles Cost Analysis. The International Council on Clean Transportation is an important source of technical and other information on the transition to electrification in the HD and other sectors. For example, see Racing to zero: The ambition we need for zero-emission heavy-duty vehicles in the United States. These are just a few examples of the wealth of information available to EPA showing the potential for HD EVs to support a more aggressive regulatory approach to this sector. We expect many organizations and States will provide comprehensive sources of information to EPA in their comments. EPA's final decision needs to address the need for a much more aggressive but practical set of near-term GHG standards for this sector. [EPA-HQ-OAR-2019-0055-1233-A1, pp. 3 - 4]

Organization: *Environmental Defense Fund (EDF) (1265 and 2855)*

Momentum for electric vehicle development and production is accelerating rapidly, both globally and in the United States. Numerous recent studies highlight key automaker commitments and deployments, the dynamic and growing market for ZEVs, decreasing battery costs and the opportunity for new American jobs. States and business coalitions are taking the lead in supporting the industry in its transition to electrification. [EPA-HQ-OAR-2019-0055-1265-A1, pp.7-8]

ERM recently released its fifth Electric Vehicle Market Update, which tracks the current status and projected growth of the U.S. electric vehicle industry.31 The April 2022 report found robust growth indicators for the electric vehicle sector just since the last update was published one year prior. Medium- and heavy-duty vehicle manufacturers and fleets are making substantial commitments to zero-emitting vehicles. Daimler Trucks North America, the leading manufacturer of class 8 trucks in the U.S., has committed to offering only carbon-neutral trucks in the U.S. by 2039,32 and expects that by 2030, as much as 60 percent of its sales will be ZEVs.33 Volvo Group, owner of the Mack truck brand, has set a goal of having 100 percent of its truck and bus sales be zero-emission by 2040.34 Navistar recently announced its goal of having 50 percent sale of its sales volume be ZEVs by 2030, its commitment to achieve 100 percent zero emissions by 2040 across all operations and carbon-neutrality by 2050.35 Both FedEx and Walmart have committed to transition their entire global truck fleets to ZEVs by 2040.36 [EPA-HQ-OAR-2019-0055-1265-A1, p.8]

31 Rachel MacIntosh, Sophie Tolomiczenko, Grace Van Horn. April 2022. Electric Vehicle Market Update: Manufacturer Commitments and Public Policy Initiatives Supporting Electric Mobility in the U.S. and Worldwide, ERM for EDF, Version 6. http://blogs.edf.org/climate411/files/2022/04/electric_vehicle_market_report_v6_april2022.pdf The original report was released in May of 2019.

32 David Cullen, ‘Daimler to Offer Carbon Neutral Trucks by 2039,’ (October 25, 2019). https://www.truckinginfo.com/343243/daimler-aims-to-offer-only-co2-neutral-trucks-by-2039-in-key-markets

33 Deborah Lockridge, ‘What Does Daimler Truck Spin-off Mean for North America?,’ Trucking Info (November 11, 2021). https://www.truckinginfo.com/10155922/what-does-daimler-truck-spin-off-mean-for-north-america

34 https://www.oemoffhighway.com/trends/electrification/press-release/21203695/volvo-group-global-volvo-group-focuses-on-electrification-and-emissions-reduction-strategy

35 Navistar presentation at the Advanced Clean Transportation (ACT) Expo, Long Beach, CA (May 9-11, 2022).

36 Fed Ex Newsroom, ‘FedEx Commits to Carbon-Neutral Operations by 2040,’ March 3, 2021. https://newsroom.fedex.com/newsroom/Sustainability2021 Doug McMillon, President & CEO, Walmart, ‘Walmart’s Regenerative Approach: Going Beyond Sustainability,’ September 21, 2020. https://corporate.walmart.com/newsroom/2020/09/21/walmarts-regenerative-approach-going-beyond-sustainability

According to ERM, the labor market is also benefiting from the transition to electrification. Manufacturers have announced new investments in the United States of almost $2 billion in medium and heavy-duty assembly plants, investments that will support approximately 15,000 new direct U.S. jobs over the next decade.37 [EPA-HQ-OAR-2019-0055-1265-A1, p.8]

37 Rachel MacIntosh, Sophie Tolomiczenko, Grace Van Horn. April 2022. Electric Vehicle Market Update: Manufacturer Commitments and Public Policy Initiatives Supporting Electric Mobility in the U.S. and Worldwide, ERM for EDF, Version 6. http://blogs.edf.org/climate411/files/2022/04/electric_vehicle_market_report_v6_april2022.pdf

The numbers of electric trucks and buses already on the roads is growing, in part because of the increased selection of model availability. According to CALSTART, as of December 2021, 1,215 Class 2b through Class 8 ZEVs have been deployed in the United States across over 163 fleets.38 CALSTART has developed an interactive online tool that tracks available and soon-to-be-available medium- and heavy-duty zero-emission trucks (ZETs).39 In 2019, there were only 20 models of Class 2b-8 ZETs available for purchase in the United States. Today there are more than 400 models available across all classes and CALSTART estimates that could increase to 544 total models by the end of 2022. EPA also conducted an analysis of the manufacturer-supplied end-of-year production reports and found that out of the 380 BEVs certified in MY 2020, a total of 177 unique makes and models were available for purchase by 52 producers in classes 3-8.40 For example, General Motors launched a new business unit, BrightDrop, in January 2021 that focuses on electric first-to-last-mile delivery trucks. FedEx signed an agreement reserving 2,500 delivery vans and is working with BrightDrop to add up to 20,000 more vehicles in coming years.41 UPS and DHL ordered 950 electric trucks and 63 delivery vans, respectively, from Workhorse42 and Amazon has ordered 100,000 zero-emitting vehicles from Rivian.43 [EPA-HQ-OAR-2019-0055-1265-A1, pp.8-9]

38 Baha, Al-Alawi, et al. 'The Advanced Technology Truck Index: A U.S. ZET Inventory Report.' CALSTART. Jan 2022. https://calstart.org/wp-content/uploads/2022/02/ZIO-ZETs-Report_Updated-Final-II.pdf.

39 CALSTART's Zero Emission Technology Inventory (ZETI) tool. https://globaldrivetozero.org/tools/zero-emission-technology-inventory/

40 EPA memorandum from Angela Cullen, Center Director, Assessment and Standards Division to Docket EPA-HQ-OAR-2019-0055, 'HD2027 Proposed Changes to Heavy-Duty Greenhouse Gas Emissions,' (November 2021).

41 'BrightDrop Announces Walmart as New EV Customer and Expands Collaboration with FedEx at CES.' 5 Jan. 2022. https://media.gm.com/media/us/en/gm/home.detail.html/content/Pages/news/us/en/2022/jan/ces/0105-brightdrop.html

42 Hanley, Steve, 'UPS Places Order For 950 Workhorse N-GEN Electric Delivery Vans.' CleanTechnica, 20 June 2018, https://cleantechnica.com/2018/06/20/ups-places-order-for-950-workhorse-ngen-electric-delivery-vans/#:~:text=UPS%20Places%20Order%20For%20950%20Workhorse%20N-GEN%20Electric,to%20UPS%2C%20bringing%20the%20total%20order%20to%201%2C000 ; DHL. 'DHL Expands Green Fleet with Addition of New Electric Delivery Vans.' 7 Feb 2019, https://www.dhl.com/us-en/home/press/pressarchive/2019/dhl-expands-green-fleet-with-addition-of-new-electric-delivery-vans.html

43 Andrew J. Hawkins, 'Amazon unveils its new electric delivery vans built by Rivian,' The Verge (Oct. 8, 2020). https://www.theverge.com/2020/10/8/21507495/amazon-electric-delivery-van-rivian-date-specs

Leading businesses have also recognized the importance of pollution standards and complementary policies in hastening ZEV deployment. The Zero Emission Transportation Association (ZETA) – a coalition of major businesses including electric vehicle manufacturers, power companies, and many others – has urged adoption of ambitious policies to support medium- and heavy-duty electrification, including multi pollutant standards under the Clean Air Act.44 The National Zero-Emission Truck (ZET) Coalition is a group of America's biggest truck equipment manufacturers, suppliers and key stakeholders, such as Cummins, Daimler, PACCAR, Eaton, Tesla and Rivian, advocating for federal charging and refueling infrastructure and increased federal investments and incentive programs to help drive the near-term production of ZEV trucks and buses in the United States.45 And the European Automobile Manufacturers Association – which includes Scania, Daimler Truck AG, Ford Trucks and Volvo Group, among others – together with the Potsdam Institute for Climate Impact Research, has pledged that by 2040 all new commercial vehicles sold must be fossil free.46 [EPA-HQ-OAR-2019-0055-1265-A1, pp.9-10]

44 https://www.zeta2030.org/

45 Calstart. 2020. National Zero-Emission Truck Coalition Statement of Principles. https://calstart.org/zet-statement-of-principles-6-17-20/

46 Joint statement, ACEA and Potsdam Institute for Climate Impact Research, 'The Transition to Zero-emission Road Freight Transport,' December 2020. https://www.acea.be/uploads/publications/acea-pik-joint-statement-the-transition-to-zero-emission-road-freight-trans.pdf

Importantly, California also adopted more protective heavy-duty low NOx emissions standards to help the state meet national ambient air quality standards and vital state public health and environmental justice goals. In August 2020, California adopted the Heavy-Duty Engine and Vehicle Omnibus Regulation, which substantially tightens the NOx emission standard for on-road heavy-duty engines by 75 percent beginning in 2024 and ramping up to 90 percent in 2027.56 Once fully phased in by 2031, the rule is expected to reduce harmful NOx emissions in California by more than 23 tons per day – the equivalent of taking 16 million light-duty cars off the road in 2031. The emissions reductions will result in 3,900 avoided premature deaths and 3,150 avoided hospitalizations statewide over the life of the rule (2024 – 2050), and lead to estimated statewide health benefits of approximately $36.8 billion.57 [EPA-HQ-OAR-2019-0055-1265-A1, pp.12-13]

In November 2021, Oregon became the first state outside of California to adopt both the ACT rule and the Heavy-Duty Omnibus rule, which will apply to model years 2025 and beyond.58 Four other states – New Jersey, New York, Washington and Massachusetts – have all adopted the Advanced Clean Trucks rule.59 These states, together with California and Oregon are estimated to contain more than 20-percent of the national fleet of medium- and heavy-duty trucks.60 And many other states, including Connecticut,61 Colorado and Maine are currently contemplating adoption of the ACT rule. [EPA-HQ-OAR-2019-0055-1265-A1, p.13]

56 ARB press release, 'California adopts strong new regulation to further reduce smog-forming pollution from heavy-duty diesel trucks,' (August 28, 2020). https://ww2.arb.ca.gov/news/california-adopts-strong-new-regulation-further-reduce-smog-forming-pollution-heavy-duty

57 Id.

58 Work Truck staff, 'Oregon Adopts Clean-Trucks Rules; Other States May Follow,' Work Truck (November 18, 2021). https://www.worktruckonline.com/10156330/oregon-leads-convoy-of-states-toward-cleaner-trucks Oregon will see a projected $21.2 billion in net societal benefits, including saving fleet owners over $1 billion annually, preventing 160 premature deaths and avoiding 84,000 respiratory illnesses by 2050 with the adoption of these two rules. Dana Lowell et. al. 2021. Oregon Clean Trucks Program: An Analysis of the Impacts of Zero-Emission Medium- and Heavy-Duty Trucks on the Environment, Public Health, Industry, and the Economy, M.J. Bradley & Associates for the Natural Resources Defense Council

and the Union of Concerned Scientists.
https://static1.squarespace.com/static/613127fc91a6b76873be6446/t/61561514cf312212c5dceee6/1633031446406/MJ+Bradley_MHD+Clean+Trucks+Report_Oregon+2021.pdf

59 Laura Bliss, 'How Six States Could Transform the U.S. Trucking Industry,' Bloomberg (January 26, 2022).
https://www.bloomberg.com/news/articles/2022-01-06/how-zero-emission-laws-will-reshape-u-s-trucking

60 Federal Highway Administration, Highway Statistics 2019, Truck and Truck-Tractor Registrations (2019).
https://www.fhwa.dot.gov/policyinformation/statistics/2019/mv9.cfm

61 With passage of Connecticut Senate Bill 4 in May 2022, which authorizes the state’s Department of Energy and Environmental Protection to adopt California medium and heavy-duty motor vehicle standards, Connecticut is expected to join these states soon.

As part of its statewide strategy to reduce transportation emissions, California is also developing the Advanced Clean Fleets regulation, which aims to accelerate the market for zero-emission trucks and buses by requiring fleets that are well suited for electrification to transition to ZEVs.62 The regulation would set requirements for new ZEV sales as well as in-use fleet composition, and would apply to fleets performing drayage operations, public agencies, federal governments, and high-priority fleets. [EPA-HQ-OAR-2019-0055-1265-A1, p.13]

62 ARB fact sheet, 'Advanced Clean Fleets: Accelerating Zero-Emission Truck Markets,' (March 3, 2022). https://ww2.arb.ca.gov/sites/default/files/2022-03/ACF%20Fact%20Sheet_ADA.pdf

The draft regulation includes setting a requirement that all new medium- and heavy-duty vehicle sales be ZEVs starting in 2040 – a target that is faster than that finalized in the ACT rule – and proposed to help contribute to the state’s goal of carbon neutrality by 2045 and the Governor’s executive order that 100 percent of medium- and heavy-duty vehicles where feasible be ZEVs by 2045. Under the draft regulation, public fleets would be required to purchase 100 percent ZEVs by 2027; all new drayage trucks would be ZEVs beginning in 2024 and by 2035 every drayage truck on the road would be a ZEV; and high priority and federal fleets would be required to meet ZEV targets as a proportion of their total fleet. The Air Resources Board (ARB) will hold additional public workshops on the draft regulation in May 2022 and it is scheduled to go to the Board for final action in late Summer 2022.63 [EPA-HQ-OAR-2019-0055-1265-A1, pp.13-14]

63 ARB website, 'Advanced Clean Fleets – Meetings and Events,' (last accessed May 11, 2022). https://ww2.arb.ca.gov/our-work/programs/advanced-clean-fleets/advanced-clean-fleets-meetings-events

In addition to state rulemakings, a diverse collection of seventeen states and the District of Columbia joined a multi-state initiative to advance and accelerate the market for electric medium- and heavy-duty vehicles.64 Together, the signatories account for 35 percent of the nation's medium- and heavy-duty fleet.65 The voluntary initiative set a target of 30 percent of new truck and bus sales being ZEV by 2030 and 100 percent ZEV sales by 2050 with an emphasis on the need to accelerate and prioritize deployment in disadvantaged communities. The agreement could result in an estimated reduction of up to 740 million barrels of oil by 2045, which is equivalent to more than 300 million metric tons of CO_2 pollution.66 A more recent report from ICCT estimates a cumulative emissions reduction of 646 million metric tons of CO_2 from 2020-2050.67 [EPA-HQ-OAR-2019-0055-1265-A1, p.14]

64 The current signatories are California, Colorado, Connecticut, Hawaii, Maine, Maryland, Massachusetts, New Jersey, New York, Nevada, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, Washington, and the District of Columbia. 'Multi-State Medium- and Heavy-Duty Zero Emission Vehicle Memorandum of Understanding,' (July 14, 2020), https://www.nescaum.org/documents/mhdv-zev-mou-20220329.pdf/

65 Arijit Sen, Ray Minjares, Josh Miller, and Caleb Braun. April 2022. 'Benefits of the 2020 Multi-State Medium- and Heavy-Duty Zero-Emission Vehicle Memorandum of Understanding,' ICCT Briefing. https://theicct.org/wp-content/uploads/2022/04/md-hd-mou-benefits-apr22.pdf

66 Emily Wimberger, Hannah Pitt, Kate Larsen, and Maggie Young. 2020. States Pave the Way for a Zero-Emission Vehicle Future, Rhodium Group. https://rhg.com/research/states-zero-emission-vehicles/

67 Arijit Sen, Ray Minjares, Josh Miller, and Caleb Braun. April 2022. 'Benefits of the 2020 Multi-State Medium- and Heavy-Duty Zero-Emission Vehicle Memorandum of Understanding,' ICCT Briefing. https://theicct.org/wp-content/uploads/2022/04/md-hd-mou-benefits-apr22.pdf

Moreover, states have adopted policies and already made significant investments related to charging infrastructure to support their adoption of the Advanced Clean Truck (ACT) regulation and accelerate ZEV deployment. For instance, Massachusetts, New Jersey, New York, Oregon, and Washington have all developed, or are developing, complementary policies and investments to support the rule.68 In addition, charging infrastructure costs are rapidly declining and utilities and fleets are innovating to help further reduce charging costs and more immediately unlock the substantial fuel saving benefits of ZEVs. EDF has developed and plans to separately submit more detailed information on these solutions. [EPA-HQ-OAR-2019-0055-1265-A1, p.14]

68 With passage of Connecticut Senate Bill 4 in May, which authorizes the state's Department of Energy and Environmental Protection to adopt California medium and heavy-duty motor vehicle standards, Connecticut is expected to join these states soon.

All of these state initiatives are critical drivers for the adoption of ZEV technology and help alleviate statewide pollution burdens. However, heavy-duty vehicles and their pollution do not always stay within state borders. For example, over half of the heavy-duty vehicle miles traveled in California are by federally certified vehicles that are not required to meet California's more protective standards.69 A durable EPA medium- and heavy-duty greenhouse gas and NOx rule will further encourage the investments needed to transition to a fully zero-emitting medium- and heavy-duty fleet. [EPA-HQ-OAR-2019-0055-1265-A1, pp.14-15]

> 69 Letter from Richard W. Corey, ARB Executive Officer to Liane Randolph, ARB Board Chair, 'Accelerating California's Transition to Zero-Emission Trucks,' (January 10, 2022). https://ww2.arb.ca.gov/sites/default/files/2022-02/ZE%20Trucks%20Board%20Memo_ADA.pdf

EPA has clear authority to set an emission standard at a level that ensures greater deployment of ZEVs. Doing so in this rule is critically important to ensure we are making needed progress prior to 2030, and accordingly, we urge EPA to ensure performance-based pollution standards help to achieve 80 percent sales for new school and transit buses by MY 2029 and 40 percent sale of new class 4-7 vehicles and class 8 short haul vehicles by that year. New analysis from ERM evaluated aspects of the ZEV sales baseline EPA failed to consider, including a range of scenarios, from very conservative to more optimistic, with midpoint scenarios projecting medium- and heavy-duty ZEV deployment in excess of 20 percent in 2029 and more optimistic scenarios projecting M/HD ZEV sales of over 33 percent of all class 4-8 single unit trucks, short-haul tractor trailers and school and transit buses in 2029.72 These estimates far exceed EPA's assumption in the proposal, and underscore that standards achieving these levels of ZEV deployment are both feasible and reasonable. However, they also make clear that it is absolutely critical for EPA to establish protective, pollution standards in this rulemaking to achieve this level of pollution reductions. [EPA-HQ-OAR-2019-0055-1265-A1, pp.16-17]

> 72 Ellen Robo and Dave Seamonds, 'Analysis of Alternative Medium- and Heavy-duty Zero-Emission Vehicle Baseline Scenarios,' Technical memo by ERM for EDF (May 12, 2022).

Developing a robust charging infrastructure for medium and heavy-duty zero-emission vehicles (ZEVs) is important to support wide-spread electrification. The vehicles that are most ready for electrification in the 2027-2029 timeframe are those that rely on depot charging, a technology that is widely available today. These vehicles include delivery vans, transit buses, box trucks, refuse haulers and last-mile-delivery trucks among other market segments.2 [EPA-HQ-OAR-2019-0055-2855-A2, p. 1]

> 2. M.J. Bradley & Associates, Medium- & Heavy-Duty Vehicles Market structure, Environmental Impact, and EV Readiness, July 2021.

EPA has manifest legal authority to adopt greenhouse gas emission standards for new medium and heavy-duty vehicles. Additionally, the authority established under Section 202(a)(1) and 202(a)(3) of the Clean Air Act (CAA) authorizes EPA to set protective standards that secure deep pollution reductions based on the increased deployment of available zero-emission technologies. [EPA-HQ-OAR-2019-0055-1265-A1, p.17]

As demonstrated above, EPA has clear authority under Section 202(a)(1) to establish standards that drive the uptake of technology that currently exists, or can feasibly be developed. It follows that EPA has authority under 202(a)(1) to promulgate standards that ensure the increased uptake and development of ZEV technology. As established above, EPA may set technology-forcing standards under 202(a)(1) driving the uptake of a particular existing technology; and zero-emission technologies are not only clearly established but are increasing in popularity and development across the vehicle market.88 Consistent with the technology-forcing history of Section 202, EPA can and should establish protective performance standards requiring GHG emissions reductions sufficient to drive increased development of ZEVs. [EPA-HQ-OAR-2019-0055-1265-A1, p.19]

88 See supra Section I.B

Charging costs are declining, and numerous technologies and approaches are continuing to lower those costs. Fleets have a range of options to consider when designing a depot charging infrastructure, including different kilowatt (kW) capacities for electric vehicle supply equipment (EVSE). Fleets also have access to detailed guidance on how to optimize their charging set-up to meet their operational needs.3 Fleets can maximize the economic benefit of this transition through managed charging software, on-site battery storage and on-site electricity generation, which enable fleets to minimize peak-power demand for their depot.4 There are also a variety of state and utility infrastructure programs emerging that are driving down the total cost of charging for fleets and providing technical support to achieve mass deployment. [EPA-HQ-OAR-2019-0055-2855-A2, pp. 1 - 2]

3. See, e.g., San Diego Gas & Electric, Electric Vehicles Charging Guidebook for Medium and Heavy-Duty Fleets, 2020.

4. Gladstein, Neandross & Associates, California Heavy-Duty Fleet Electrification Summary Report, March 2020.

By finalizing strong multi-pollutant standards that reflect the increasing availability and desirability of zero-emission medium and heavy-duty vehicles, EPA can send a powerful signal to help support and accelerate the many infrastructure investments and programs already under development. [EPA-HQ-OAR-2019-0055-2855-A2, p. 2]

A number of studies have found that current depot charging technology can cover the needs of fleets that return their trucks to a hub each night. For example, a study by Gladstein Neandross and Associates (GNA) evaluated the driving needs of two drayage fleets in California. They found that most of the trips performed by the two companies could have been completed with todays' electric truck models and charging equipment, without having to modify any fleet operations.5 Another similar study evaluated five Class 3 through 7 fleets based in New Jersey, finding that electric trucks could serve over 88% of their needed routes when only charging a single time, and 95% when including time for an additional charging session, either at the depot or en route.6 A report by M.J. Bradley & Associates looked at all Class 2b-8 vehicles to assess the readiness of zero-emitting technologies based on usage patterns and market status. The analysis found that 60% of all vehicles in the medium- and heavy-duty fleet will generally be able to use depot charging, and of these vehicles, more than 80% can meet their charging requirements with an inexpensive Level 2 charger. These examples indicate that the technology available on the market today can already cover a majority of the charging needed to electrify. [EPA-HQ-OAR-2019-0055-2855-A2, p. 2]

5. Gladstein, Neandross & Associates, California Heavy-Duty Fleet Electrification Summary Report, March 2021.

6. Emerging Futures, New Jersey Medium Duty Fleet Electrification Infrastructure Summary Report, May 2022.

Further significant work has been done to demonstrate that charging technology is capable of covering industry needs to transition to electric. Here are a few examples of the various utility and industry activities supporting charging infrastructure and underscoring its current capabilities to meet operational constraints:

- In New Jersey, 8 BYD refuse trucks are operational with a 280+ kWh battery pack and "a range of 600 pick-up plus 60 miles." They can be recharged in two and a half hours with DC fast charging.7 [EPA-HQ-OAR-2019-0055-2855-A2, p. 2]

  7. https://cleantechnica.com/2021/12/07/jersey-city-receives-its-5-byd-battery-electric-refuse-trucks/

- Volvo Lights project in California demonstrated the ability for 53 heavy-duty, battery electric trucks and equipment to reliably move freight between the city's two major ports and warehouses throughout the region with less noise and zero emissions. Key charging innovations demonstrated in this project were: networked chargers integrated with vehicle telematics to balance the needs of the vehicle, facility, and utility grid; the integration of onsite solar panels to mitigate grid impacts and energy costs; and use of second-life batteries to improve grid and facility resiliency, provide load management, and offset total cost of ownership.8 [EPA-HQ-OAR-2019-0055-2855-A2, p. 3]

  8. VolvoLights, About Volvo Lights Project, accessed May 2022.

- The South Coast Air Quality Management District, California Air Resources Board and the California Energy Commission are leading an effort to deploy 100 battery-electric regional haul and drayage trucks across California. The battery-electric trucks will be deployed through a partnership with NFI Industries and Schneider as part of a project known as the Joint Electric Truck Scaling Initiative that aims to demonstrate scaling fleet electrification of class 8 trucks. NFI and Schneider are collectively installing 50 electric vehicle chargers, warehouse upgrades, on-site energy storage and rooftop solar. 9 [EPA-HQ-OAR-2019-0055-2855-A2, p. 3]

  9. Heavy Duty Trucking, Electric Truck Project Deploys 100 Trucks in California, August 31, 2021.

- FedEx is installing 500+ charging stations to service their electric delivery truck fleets across California. These stations alone have the potential to support more than 1,000 electric vehicles. 10 [EPA-HQ-OAR-2019-0055-2855-A2, p. 3]

  10. FedEx, Charged Up About Electric Vehicles, accessed May 2022.

- Manhattan Beer Distributors has installed three Level 3 DC fast chargers at its Bronx facility that can fully recharge its 8 Volvo VNR Electric trucks up to 80 percent in 70 minutes. Lessons learned from this demonstration project will help the company build charging plans to accommodate its more than 400 delivery trucks to service customers throughout New York City, Long Island, and the surrounding counties.11 [EPA-HQ-OAR-2019-0055-2855-A2, p. 3]

  11. VolvoTrucks, Volvo Trucks delivers the first of five VNR Electrics to New York customer Manhattan Beer Distributors, August 13, 2021.

The market for fleet charging solutions is highly dynamic with new innovations and technologies coming to the market rapidly. Just this month, over two dozen companies exhibited charging solutions at the ACT Expo.12 Charging solutions are available for companies that want to provide depot charging for their own fleet of trucks solely, while other solutions are being installed at facilities where depot charging can be shared across numerous fleets. For example, WattEV and the Port of Long Beach just announced development of a charging plaza13 while Penske and Shell Recharge announced a collaboration to expand fleet charging to six states.14 [EPA-HQ-OAR-2019-0055-2855-A2, pp. 3 - 4]

13. Heavy-Duty Trucking, WattEV and the Port of Long Beach announced plans to build a charging plaza for heavy-duty electric trucks inside the port complex, May 11, 2022.

14. Fisher, Joel, Shell to install vehicle chargers at 33 Penske locations in 6 states, Fleet Owner, May 10, 2022.

Fleets have hundreds of charging station options currently available. As noted above, most fleets will likely meet their charging needs through a Level 2 charger, while others may want or need a faster charger. EnergIIZE Commercial Vehicles (Energy Infrastructure Incentives for Zero-Emission Commercial Vehicles), a fleet infrastructure incentive project funded by the California Energy Commission’s Clean Transportation Program and implemented by CALSTART, released a list of over 140 makes and models of EVSE designed for charging commercial vehicles and available today.15 Most chargers range in max power output from 1.4kW to 1,200 kW with the majority being around 7kW to 100kW. [EPA-HQ-OAR-2019-0055-2855-A2, p. 4]

15. Calstart Energiize Commercial EV Eligible Technology, Technology Catalogue, accessed May 16, 2022.

Some of the choices currently available include:

- Nuvve EVSE-B-P1-H1, 19.2 kW charger16

- Tellus Power TP5 30-480, 30 kW charger17
- ABB Terra 54, 50 kW DC Fast charger18
- Tellus Power TP3 60-480, 60 Kk DC fast charger19
- ChargePoint Express 250, 62.5 kW DC charger20
- Tritium RTM75, 75 kW DC charger21
- BTC Power L3R-100-480, 100 KW DC fast charger22
- Power Electronics NBD180, 180 KW DC fast charger23 [EPA-HQ-OAR-2019-0055-2855-A2, p. 4]

16. https://nuvve.com/wp-content/uploads/2019/02/nuvve-powerport-spec-sheet-2.20.19.pdf

17. http://telluspowergreen.com/usa/dc-chargers/

18. https://new.abb.com/ev-charging/dc-fast-chargers/terra-54-cjg

19. http://telluspowergreen.com/usa/dc-chargers/

20. https://www.chargepoint.com/products/commercial/cpe250

21. https://tritiumcharging.com/product/rtm-75/

22. https://www.btcpower.com/single-product/l3r-100

23. https://power-electronics.com/wp-content/uploads/2021/10/DATASHEET_NBI180.pdf

There are also high-powered charging depots of 350 kW per port with new higher powered charging stations coming to the market soon.24 While the vast majority of fleets do not require this level of power, a few examples of the highest-powered choices that fleets currently have available are:

- Proterra 1.5 MW charging system.25
- Tesla 1 MW charging station. 26
- ABB High Power enclosures27
- Heliox 600 kW ultra-fast charger28
- Signet 350 kW DC fast charger29 [EPA-HQ-OAR-2019-0055-2855-A2, p. 5]

24. Calstart Energiize Commercial EV Eligible Technology, Technology Catalogue, accessed May 16, 2022.

25. Proterra, 1.5 MW Charging System spec sheet, accessed May 16 2022.

26. Lambert, Fred, Tesla is deploying the first Megacharger to charge its Tesla Semi electric truck, electrek, October 12, 2021.

27. ABB, E-Mobility high-power enclosure, accessed May 16, 2022.

28. Heliox, Ultra Fast Charging Station, accessed May 16, 2022.

29. Signet, 350 KW DC fast charging cabinet, accessed May 16, 2022.

Fleet choices will further expand between now and 2027. There are many projects advancing new, more powerful charging options. These include:

- NREL developing and testing a 3.75 MW charging station, intended to enable extremely fast charging of a single vehicle, in partnership with CharIN and evaluation from four original equipment manufacturers.30
- Roadway Wireless charging being tested in Detroit to see if charging while driving is feasible. Currently also tested in Europe and Asia. 31
- Research and piloting of using box truck roofs to solar charge trucks while driving. 32 [EPA-HQ-OAR-2019-0055-2855-A2, p. 5]

30. Greencar Congress, NREL researchers, industry partners testing Megawatt Charging Systems; up to 3.75MW, September 2021.

31. Lambert, Fred, Tesla is deploying the first Megacharger to charge its Tesla Semi electric truck, electrek, October 12, 2021.

32. Sono Motors, Sono Motors and MAN Truck & Bus Want to Jointly Analyze Applications of Solar Technology in Commercial Vehicles, May 7, 2021.

The technologies, solutions, and approaches fleets are employing today underscore the availability of charging solutions and create a strong foundation for deeper electrification, particularly in those segments that will rely on depot charging and so are most ready for near term electrification. [EPA-HQ-OAR-2019-0055-2855-A2, p. 5]

Much attention has been given to the current cost of installing charging equipment. Current projections likely overstate the costs fleets will face when installing equipment between 2027 and 2029. [EPA-HQ-OAR-2019-0055-2855-A2, p. 6]

In a study of light-duty vehicle charging infrastructure, ICCT recently found that average charging costs decline per electric vehicle sold. number of factors lead to the decreasing costs. Higher utilization of chargers, in terms of hours of active charging per day per charger, results in fewer chargers needed per electric vehicle. And installation costs decline as the number of chargers per site increases with growing market penetration. ICCT also found a modeled 3% decline in per-charge hardware cost occurs per year. The figure below shows that while installation and hardware costs increase from approximately $110 million to $165 million dollars in 2025, the average cost per electric vehicle (blue line), calculated by dividing public and workplace charging costs in each year by the number of electric vehicles sold in that year, declines from $480 in 2019 to $300 in 2025.33 This study evaluated cost of L1, L2, and DC fast charging stations for public and workplace charging rated up to and including 350kW. Given fleets will similarly be charged with L2 and similarly rated DC fast chargers, this downward trend of cost as utilization increases for the light duty vehicle sector can be translated to the heavy duty sector and similar cost reductions would be expected as medium and heavy duty ZEV sales increase. [EPA-HQ-OAR-2019-0055-2855-A2, p. 6]

33. Nicholas, Michael, Estimating electric vehicle charging infrastructure costs across major U.S. metropolitan areas, August 2019.

It is also important to recognize that in the 2027-2029 timeframe, fleets will benefit from nearly a decade of experience in how to minimize charging costs through operations and system design. In the few years that fleets have been operating electric trucks and buses, many best practices have already been developed to maximize the economic benefit fleets gain from operating these vehicles. While difficult to precisely project, we should expect fleets will continue to improve charging costs as they become more familiar with operating electric fleets. [EPA-HQ-OAR-2019-0055-2855-A2, p. 7]

As fleets have begun to electrify, more insights into the solutions for charging infrastructure are being gleaned. One area that is evolving is shared charging hubs for commercial vehicles located in key corridors. This allows fleets to share the upfront cost of charging infrastructure, reducing the cost of charging, especially for smaller fleets. For example, Portland General Electric and Daimler Trucks North America (DTNA) are co-developing a large public charging site for medium- and heavy-duty electric trucks, known as Electric Island. The island will host up to nine charging stations with charging levels of up to 5 MW.34 [EPA-HQ-OAR-2019-0055-2855-A2, p. 7]

34. Lewis, Michelle, Portland and Daimler team up for 5MW electric semi public charging ‘Island’, electrek, December 1, 2020.

New ownership models such as Transportation-as-a-Service (TaaS) are allowing fleet operators to use battery electric vehicles without being responsible for the full upfront cost of the vehicles and charging equipment. Instead, under a TaaS model, an operator pays a recurring fee to the service provider, who in exchange provides zero-emitting trucks (ZETs), vehicle maintenance, installation and management of charging infrastructure, and vehicle charging management. For example, Zeem Solutions provides leasing, servicing, parking, charging, and energy storage for small- and medium-sized fleets looking to adopt Class 3-8 ZEVs but avoid their upfront costs.35 As one example, Highland Fleets is utilizing the TaaS model with their electric school buses. Montgomery County Public Schools in Maryland has contracted with Highland Fleets to use 326electric buses over the next four years.36 Forum Mobility aims to provide similar services for drayage trucks and has broken ground on an electric truck charging station in California.37 [EPA-HQ-OAR-2019-0055-2855-A2, p. 7]

35. Zeem Solutions, Zeem Solutions, accessed May 16, 2022.

36. Green Tech Media, Highland Electric Raises $235M, Lands Biggest Electric School Bus Contract in the US, https://www.greentechmedia.com/articles/read/on-heels-of-253m-raise-highland-electric-landsbiggest-electric-school-bus-contract-in-the-u.s.

37. Forum Mobility, Forum Mobility, accessed May 16, 2022.

A variation of the TaaS business model also coming to market is Charging as a Service (CaaS), being pioneered by companies like AMPLY Power and Electrada, which provide fleet charging infrastructure installation and management in exchange for a recurring fee. AMPLY Power is demonstrating its CaaS approach for an all-electric school bus fleet of 5 in New York City together with Logan Bus Company and Black and Veatch.38 Similar to TaaS providers, CaaS providers can lower the upfront capital costs and provide the expertise needed to transition to a BEV fleet. [EPA-HQ-OAR-2019-0055-2855-A2, pp. 7 - 8]

38. Amply Power, AMPLY Power & Logan Bus Announce Demonstration Project to Simplify Electric Transportation for Fleets, February 4, 2020.

Alongside industry trends, there are a number of technology developments and industry practices available today that can significantly lower the cost of charging, including managed charging, use of on-site distributed energy resources, and open-source communication standards. [EPA-HQ-OAR-2019-0055-2855-A2, p. 8]

One of the most significant technologies lowering the cost of charging, both in terms of infrastructure and electricity costs, is managed charging. Managed charging allows fleets to use real-time utility data like grid load or electricity cost to optimize charging schedules, lower the cost of charging, reduce stress on the grid and reduce emissions. The study that evaluated the cost of charging fleets in New Jersey showed significant savings for both upfront capital costs and electricity cost when fleets managed their charging. The figure below shows the difference in capital cost for one of the evaluated fleets, a food service fleet. The study found upfront capital cost savings of over $50,000 per vehicle, largely due to spreading the charge overnight when vehicles are parked, lowering maximum charger requirements and minimizing equipment costs. By utilizing the same charging hardware for multiple vehicles or lowering the peak power requirements, the cost of infrastructure can be significantly lowered.39 [EPA-HQ-OAR-2019-0055-2855-A2, p. 8]

39. Emerging Futures, New Jersey Medium Duty Fleet Electrification Infrastructure Summary Report, May 2022.

The study also assessed the impact of managed charging on five different fleet market segments covering Class 3 through 7 trucks. The figure below shows that regardless of the electricity rate to which the fleet subscribed, significant electricity cost savings are seen, with net present value per vehicle electricity cost savings ranging from ~$15,000 to ~$175,000 depending on the rate structure. [EPA-HQ-OAR-2019-0055-2855-A2, p. 9]

A similar study in California from GNA showed managed charging can increase affordability of charging for fleets and reduce grid needs. In some of the cases evaluated, managed charging resulted in annual savings of upwards of $130,000 compared to unmanaged charging, where trucks charge at any time that is convenient for the owner or business, often immediately upon return to the depot site. Not only can managed charging improve the economics of electrifying fleets, but the analysis suggests that optimized managed charging programs could be much more powerful than they are today.40 [EPA-HQ-OAR-2019-0055-2855-A2, p. 9]

40. Gladstein, Neandross & Associates, California Heavy-Duty Fleet Electrification Summary Report, March 2021.

Onsite distributed energy resources (DERs) such as solar and battery storage are another important solution to reducing charging costs for medium and heavy-duty fleets, which often experience short but high energy demand events that significantly increase their impact on the grid and energy bills. The California GNA study examined two types of clean DERs: on-site solar panels and on-site energy storage, or batteries. When added to the managed charging scenarios, DERs produced additional annual electric savings of $625,000 (Schneider) and $835,000 (NFI). Moreover, managed charging and DERs reduced annual on-peak load by 611 kW for the Schneider fleet and 4 MW for the NFI fleet. This would not only reduce costs for the truck companies, but the utility, as well.41 If scaled to all trucks in a utility's territory, these load reductions could drastically decrease the amount of grid upgrades needed to accommodate electric fleets. If leveraged for resiliency, DERs also offer the possibility for fleets to have power security in moments when the grid power is down. [EPA-HQ-OAR-2019-0055-2855-A2, pp. 9 - 10]

41. Gladstein, Neandross & Associates, California Heavy-Duty Fleet Electrification Summary Report, March 2021.

States and utilities offer a number of programs and policies to support truck and bus electrification. For example, EnergIIZE Commercial Vehicles (Energy Infrastructure Incentives for Zero-Emission Commercial Vehicles) is a commercial vehicle fleet infrastructure incentive project funded by the California Energy Commission's Clean Transportation Program and implemented by CALSTART.42 EnergIIZE provides incentives for ZEV infrastructure equipment for medium- and heavy-duty battery electric and hydrogen fuel cell vehicles in California. The project provides a user-friendly and streamlined process for participation by breaking down infrastructure deployment barriers through targeted incentives and specialized assistance. [EPA-HQ-OAR-2019-0055-2855-A2, p. 10]

42. Calstart Energiize Commercial Vehicles. https://www.energiize.org/

Below is a selection of other programs and policies that support electrification infrastructure. [EPA-HQ-OAR-2019-0055-2855-A2, p. 11]

Make-Ready Support:

Under make-ready programs, some of the infrastructure costs are paid for by the utility, reducing the cost of electrification to customers and fleets. Utilities typically recover the cost by adding it to the rate base or through another recovery mechanism. Make-ready costs can be divided into two components: the utility-side make-ready costs associated with upgrading grid components such as the power lines, transformer, and meter to accommodate new load; and the customer side make-ready or "behind the meter" upgrades, such as trenching to upgrade or extend a line, electric panels, conduits, and switch gear. Programs and policies that reduce these costs can help fleets transition to electrification. [EPA-HQ-OAR-2019-0055-2855-A2, p. 11]

In California, the Public Utility Commission released new rules requiring utilities to provide make-ready infrastructure, up to the meter and including trenching, to support electric vehicles charging at no cost to the typical customer.43 Utilities in New York launched a make-ready pilot program for commercial trucks and buses that participate in the New York Truck Voucher Incentive Program or the New York City Clean Trucks Program, to cover up to 90 percent of the utility side make-ready costs for L2 and fast chargers.44 Programs such as these reduce the costs of installing charging stations, fundamentally improving the economics of electrifying the transportation sector. [EPA-HQ-OAR-2019-0055-2855-A2, p. 11]

43. California Public Utilities Commissions, Resolution E-5167, October 7, 2021.

44. Joint Utilities of New York, Medium and Heavy Duty Make Ready Pilot, accessed May 20th, 2022.

Electricity Rates:

Electricity rates and their structure have a large impact on the cost of charging. Compared to passenger vehicles, commercial trucks and buses are a tremendously diverse segment that varies by vehicle type, duty cycle, fleet size, business model and experience with complex electric pricing. As such, there are a number of rate structure developments occurring that are helping lower the cost of charging for fleets. [EPA-HQ-OAR-2019-0055-2855-A2, pp. 11 - 12]

One of the largest portions of a fleet's bill, in particular in its early transition stage when utilization of charging equipment is low, is the demand and capacity ($/kw) portion. New rate structures are available to fleets to help alleviate this cost:

Demand Holidays: This approach eliminates the demand charge component for commercial EV rates for a specified amount of time (recovering delivery costs through volumetric pricing in the meantime), and phases them back in over time. Some utilities are exploring this approach to help ease transition until fleets reach a higher utilization. For example, Southern California Edison offers a seven-year demand holiday rate after which a demand charge is slowly reintroduced.45 [EPA-HQ-OAR-2019-0055-2855-A2, p. 12]

45. California Public Utilities Commissions, Application of San Diego Gas & Electric Company (U 902E) for Approval of SB 350 Transportation Electrification Proposals, June 6, 2018.

Subscription Rate: Customers subscribe in advance for a particular level of demand and pay a fixed monthly amount for service. The actual subscription rates now coming online are based on a pre-subscribed coincident peak demand maximum. This is often complemented with a grace period: if a customer exceeds their "allotted" demand, they will have a set amount of time to adjust their usage before their bill rises to a higher level and stays there.46 [EPA-HQ-OAR-2019-0055-2855-A2, p. 12]

46. See, e.g. California Public Utilities Commissions, Application for Approval of Pacific Gas and Electric Company's Commercial Electric Vehicle Rate. (U39E). October 28, 2019.

Time of Use (TOU) Rate: Customers are charged based on their highest demand level that coincides with system peak conditions. For the energy or dollar per kWh portion of the bill, offering a variety of TOU and real time prices will enable fleets to lower their charging costs by allowing them to charge when generation costs are lowest. Many utilities already offer TOU-based prices for demand and energy - and when coupled with managed charging, it can result in significant fuel cost savings for fleets. [EPA-HQ-OAR-2019-0055-2855-A2, p. 12]

Rate Reduction: Fixed rate reductions also ease the upfront cost when utilization is low. For example, Con Edison offers an electric rate reduction ranging from 34% to 39% for businesses in New York City and Westchester County that install a publicly accessible direct current (DC) fast electric vehicle supply equipment (EVSE).47 [EPA-HQ-OAR-2019-0055-2855-A2, p. 12]

47. Con Edison, Business Incentive Rate, accessed May 16, 2022.

Technical and Planning Support: As fleets enter the BEV space, it is important to understand the needs for charging, how to build a charging infrastructure plan and the types of financial support programs available. A number of utilities and states offer programs tailored to address technical and feasibility concerns for fleets. For example, National Grid in New York and Portland Gas and Electric currently offer fleet charging site feasibility analysis, technical support for charging, and electricity rate advice.48,49 Financial support for a charging site feasibility study and design is also part of SB 372 in California.50 [EPA-HQ-OAR-2019-0055-2855-A2, p. 13]

48. National Grid, Electric Vehicle Charging Station Programs, accessed May 16, 2022.

49. Portland General Electric, PGE Fleet Partner, Fleet Charging, accessed May 16, 2022.

50. Leyva, Connie, SB-372 Medium- and heavy-duty fleet purchasing assistance program: zero-emissionvehicles.(2021-2022), October 8, 2021.

Transit agencies are also getting support from utilities and states to electrify their fleets and build necessary charging networks. Southern California Edison's Charge Ready program provides fleets with technical knowledge and significantly reduces the upfront cost of infrastructure, making electrification more feasible for transit agencies.51 New York's Metropolitan Transit Authority finalized a $39 million agreement with the New York Power Authority to install more than 50 overhead chargers to power new electric buses as part of their goal of transitioning to a zero-emitting bus fleet by 2040.52 [EPA-HQ-OAR-2019-0055-2855-A2, p. 13]

51. Southern California Edison, Charge Ready Transport Program: Case Studies, accessed May 2022.

52. Metropolitan Transportation Authority , MTA Announces Plans to Increase Number of Electric Buses Purchased in 2021, May 25, 2021.

On Bill Financing and Tariffs: Some utilities offer Pay As You Save (PAYS) programs for certain market segments that allow utilities to invest in the charger and some of the additional costs needed to procure an electric vehicle. The utility's investment is recovered through a charge on their monthly electricity bill, and when the cost of the equipment is paid off, the fleet owns the vehicle and charging infrastructure. An example of this is the Duke Energy school bus program, which offers a PAYS program for school districts.53 [EPA-HQ-OAR-2019-0055-2855-A2, p. 13]

53. DSIRE, Duke Energy - EV School Bus Program, October 9, 2021.

While many PAYS programs are being developed in support of school bus fleets, there are also loan and financing programs being offered to help assist small businesses develop their charging infrastructure. For example, the Capital Access Program (CalCAP) helps small fleets design, develop, purchase and install electric charging stations at small business locations in California.54 These kinds of programs not only help overcome financial barriers of small businesses but also aid in developing the industry knowledge for expanding broader charging infrastructure coverage to support mass fleet electrification. [EPA-HQ-OAR-2019-0055-2855-A2, p. 13]

54. California Pollution Control Financing Authority, California Capital Access Program (CalCAP) Electric Vehicle Charging Station (EVCS) Financing Program, accessed May 16, 2022.

Rebate Programs:

Fleets can benefit from rebate programs offered by utilities and local governments, among others. These programs can significantly reduce the upfront costs of installing charging infrastructure, particularly for small businesses. Depending on the region, there are currently a variety of charging infrastructure rebate programs, including rebates for make-ready, charging stations, smart chargers, and onsite renewables. [EPA-HQ-OAR-2019-0055-2855-A2, p. 14]

Between now and 2027, it is reasonable to expect a significant expansion in the number of rebate programs available to fleets while also increasing the effectiveness of these programs for addressing fleet needs – as utilities and others benefit from several years of further learning and exploration that will enable them to sharpen these programs. Below is an illustrative list of current rebate programs. [EPA-HQ-OAR-2019-0055-2855-A2, p. 14]

Charging Infrastructure and Make Ready: Rebates offset the cost of installation and associated service upgrades needed to meet a fleet's growing need for electricity.

- Saratoga county offers rebates for charging infrastructure and tax incentives.55
- Massachusetts covers up to 60 percent of the cost for L1 and L2 chargers.56
- PG&E's EV Fleet program offers infrastructure incentives up to $9,000 per vehicle and charger rebates up to 50 percent of the cost of level 2 and DC fast chargers.57
- SDGE offers a rebate of up to 80 percent of the cost of "customer-side infrastructure".58

- Atlantic City, New Jersey offers commercial customers rebates covering up to 50 percent of eligible installation costs up to $2,500 per port, for a maximum of 10 ports.59 [EPA-HQ-OAR-2019-0055-2855-A2, p. 14]

55. Sarasota County, Electric Vehicles, accessed May 16, 2022.

56. Massachusetts Department of Environmental Protection, Apply for MassEVIP Workplace & FleetCharging Incentives, January 31, 2022.

57. Pacific Gas & Electric, EV Fleet program, accessed May 16, 2022.

58. San Diego Gas & Electric, Power Your Drive for Fleets, accessed May 16, 2022.

59. Atlantic City Electric, EVsmart Residential, Multi-family, Public, Workplace & Fleet Rebates, May 2021.

Smart Charging: Fleets can be incentivized to utilize software that guides them when to charge. This can help fleets minimize increases in peak-load while also enabling utilities to manage their generation.

- PGE Long Island offers a $300 rebate for installing a smart charger.60 [EPA-HQ-OAR-2019-0055-2855-A2, p. 14]

60. PSEG Long Island, Smart Charger Rebate, accessed May 16, 2022.

Disadvantaged Communities: Reflecting the significant health benefits of replacing diesel and other combustion vehicles with ZEVs, some agencies provide fleets with incentives for replacing or operating ZEV in frontline communities.

- Colorado offers grants for EVSE in disadvantaged communities61
- New Jersey Department of Environment offers incremental cost rebates, including charging equipment, to shuttle bus, school bus, garbage truck, and transit bus fleets operating in disadvantaged communities.62
- In California, transit agencies can apply to a voucher program to relieve costs for buses, charging equipment and design. 63 [EPA-HQ-OAR-2019-0055-2855-A2, pp. 14 - 15]

61. Clean Air Fleets, ALT Fuels Colorado, accessed May 16, 2022.

62. The New Jersey Department of Environmental Protection, RGGI Funding for Transportation Electrification, accessed May 16, 2022.

63. Clean Mobility Options, Providing funding for zero-emission carsharing, carpooling/vanpooling, bikesharing/scooter-sharing, innovative transit services, and ride-on-demand services in underserved communities, accessed May 16, 2022.

Solar and Storage: Leveraging distributed energy resources, such as on-site solar and battery storage, can lower peak electricity demand at fleet depots. This can have significant cost savings, especially when it helps fleets avoid or reduce demand charges.

- Commercial property owners in Asheville, North Carolina, can receive a rebate on their building permit by installing solar.64
- Pacific Gas and Electric (PGE) offers rebates to businesses to install behind the meter generation and storage. 65
- New York State Energy Research and Development (NYSERDA) is offering financing and upfront rebates to businesses to install solar.66 [EPA-HQ-OAR-2019-0055-2855-A2, p. 15]

64. Energy Sage, North Carolina solar incentives, accessed May 16, 2022.

65. Pacific Gas & Electric, Clean energy incentives and programs, accessed May 16, 2022.

66. NY-Sun, Commercial Solar Incentives and Financing, accessed May 16, 2022.

Utility Charging Station Ownership: Some utilities are exploring owning and operating charging infrastructure in certain demographic areas and market segments. In North Carolina, Duke Energy will install and own the charging equipment, provide funding to offset 30 electric school bus purchases, gather operational data, and explore vehicle-to-grid technology's technical capabilities.67 [EPA-HQ-OAR-2019-0055-2855-A2, p. 15]

67. North Carolina Utilities Commission, Application by Duke Energy Carolinas, LLC, and Duke Energy Progress, LLC, for Approval of Proposed Electric Transportation Pilot, November 24, 2020.

Bring Your Own Device (BYOD) program: In these programs, a rebate is offered for participation in programs that require advanced technology, such as smart charging. For example, Baltimore offers a BYOD rebate of $300 to entities that use a smart charger and enroll in a TOU rate.68 [EPA-HQ-OAR-2019-0055-2855-A2, p. 15]

68. Baltimore Gas and Electric, EVsmart® Vehicle Charging Time of Use Rate, accessed May 16, 2022.

Other BYOD programs are performance based and continually reimburse owners of the advanced technology for providing a grid service such as critical peak load reduction. Currently this is only offered for onsite solar and storage, often co-located with MHDV charging infrastructure, but programs like these could also be expanded to include smart charging services. Green Mountain Power's BYOD program offers a performance-based incentive for utilizing customers' behind-the-meter storage for grid services.69 Similarly, National Grid offers a BYOD device program for solar and storage.70 [EPA-HQ-OAR-2019-0055-2855-A2, pp. 15 - 16]

69. Green Mountain Power, Rebate Program: Bring Your Own Device, accessed May 16, 2022.

70. National Grid, ConnectedSolutions Program, accessed May 16, 2022.

Another report developed by M.J. Bradley & Associates for Environmental Defense Fund shows a large and growing opportunity to expand America's zero-emission freight trucks and buses. The report evaluates four factors in assessing the readiness of zero-emitting medium and heavy-duty vehicles in different applications – the availability of electric models from manufacturers, the requirements for charging, the ability of electric models to meet operating requirements, and the business case for zero-emitting vehicles. It finds that a large number of market segments have favorable ratings across at least three of these categories, which indicates strong potential for near-term zero-emitting vehicle deployment. These market segments, which represent about 66% of the current in-use fleet, include heavy-duty pickups and vans, local delivery and service trucks and vans, transit and school buses, class 3 to 5 box trucks, class 3 to 7 stake trucks, dump trucks and garbage trucks. [EPA-HQ-OAR-2019-0055-1265-A1, p.12]

Market sources clearly show that the medium- and heavy-duty industry has embraced zero-emitting vehicle technology and momentum is growing. Strong and durable federal emissions standards are needed to signal our nation's steadfast commitment to reducing truck emissions and support the industry in its transition to ZEVs. [EPA-HQ-OAR-2019-0055-1265-A1, p.12]

In June 2020, California adopted the world's first zero-emission truck rule. The Advanced Clean Truck (ACT) rule will require manufacturers to start selling new heavy-duty ZEVs by 2024 and require 55 percent of class 2b – 3 truck sales, 75 percent of class 4 – 8 straight truck sales, and 40 percent of truck tractor sales to be zero-emission by 2035 at the latest.54 This landmark rule is expected to prevent more than 900 premature deaths, save the state economy up to $12 billion over the next 20 years and create thousands of new jobs by 2035.55 [EPA-HQ-OAR-2019-0055-1265-A1, p.12]

54 ARB press release, "California takes bold step to reduce truck pollution," (June 25, 2020). https://ww2.arb.ca.gov/news/california-takes-bold-step-reduce-truck-pollution

55 Jamie Fine, 'Report: California's clean truck rule will save the economy billions, eliminate vast amounts of pollution,' EDF blog (June 17, 2020). http://blogs.edf.org/energyexchange/2020/06/17/report-californias-clean-truck-rule-will-save-the-economy-billions-eliminate-vast-amounts-of-pollution/#more-20253

EDF supports substantially strengthening the Phase 2 GHG standards. However, EPA's proposed adjustment to the standards not only dramatically underestimates the likely market penetration of ZEVs in the coming years; it fails to achieve any additional deployment of zero emission technologies. We urge the agency to set protective, performance-based GHG standards that more accurately reflect the likely baseline levels of ZEVs in the 2027 to 2029 time frame, and that also ensure greater deployment of zero-emissions technologies well beyond that baseline. [EPA-HQ-OAR-2019-0055-1265-A1, p.16]

Organization: *Environmental Protection Network (EPN)*

Electric vehicles (EVs) play an important role in achieving major NOx reductions in our country. EVs are a critically important component of a multi-pollutant emissions control strategy. The HD sector is already transitioning to EVs, with new announcements almost every day of plans to build and buy EVs for the HD sector. Progress is sure to accelerate given the immense public and private investments taking place. This includes support at the federal level, such as the recently passed Infrastructure Investment and Jobs Act, as well as many states providing financial and other support for this transition. [EPA-HQ-OAR-2019-0055-1233-A1, p. 1]

EPA properly includes EVs in its technology basis for setting the level of the revised GHG standards. EPA properly recognizes that many important circumstances have changed since the Phase 2 GHG standards were adopted—the quickening pace of EV development and use, adoption of regulations by California and other states, actions by countries across the world, and the immense investments being made and planned by industry and governments for the transition to EVs in the US and elsewhere. [EPA-HQ-OAR-2019-0055-1233-A1, p. 3]

EPN agrees and supports that now is the time to use this technology as part of the basis for setting the level of the GHG emissions standards. The problem is EPA appears to aim at a level that does no more than codify business as usual and, in fact, likely underestimates near-term EV sales in the HD sector. EPA's traditional approach to standard-setting analyzes the need for emissions reductions and the kinds of technologies that could achieve reductions, including the history of prior use, advances to date, cost, feasibility, lead time considerations, and other factors. EPA then sets the standard at a level that reflects a projection of technology penetration that could occur and reasonably balances the various factors. This projected rate of penetration is almost always more than what industry and the market already plan to do. EPA's proposal does not take this approach. It is a missed opportunity to promote the degree of near-term EV penetration necessary to begin to address the climate crisis. [EPA-HQ-OAR-2019-0055-1233-A1, p. 3]

EPN recommends that EPA set standards that aim for very high ZEV penetration for school buses and urban transit buses by MY 2029. For delivery vans and short-haul tractors, EPN recommends EPA aim for a much more aggressive, but practical, penetration rate by MY 2029 than proposed. More ambitious GHG standards will accelerate the introduction of zero-emissions technologies for all pollutants and set the stage for the standard setting in the next, longer-term rulemaking. The country can't rely on business as usual, whether for MYs 2027-29 or for MYs 2030 and later. [EPA-HQ-OAR-2019-0055-1233-A1, p. 3]

Organization: *Evangelical Environmental Network (EEN)*

While the proposed rules are a good start, they must be strengthened. Specifically

o On GHG part of rule, the agency's minor adjustments to existing Phase 2 greenhouse gas standards are weak and reflect neither the urgency of the climate crisis nor the rapid advancement in zero-emission truck technology. These adjustments must be strengthened. [EPA-HQ-OAR-2019-0055-1134-A1, p.2]

Organization: *Evolving Electric Motor Company*

The optimum reduction in GHG emissions from all vehicles, smallest to largest, is via electric vehicles charging at electric power stations using electricity generated solely via renewable methods. [EPA-HQ-OAR-2019-0055-2488,p.1]

That optimal advance will require many trillions of dollars in infrastructure to generate and distribute said renewable electricity. [EPA-HQ-OAR-2019-0055-2488, p.1]

Full Series Hybrid Electric Vehicles (FSHEV)...

This technology has been demonstrated by: the RST-V (a.k.a., Shadow) from General Dynamics Land Systems; the Ultra AP from Georgia Tech's Research Institute; the Nissan Note, E-Power, available only in Japan. [EPA-HQ-OAR-2019-0055-2488, p.1]

Large reductions in GHG emissions, accomplished by the vehicles listed above, have been possible for more than two decades. It will take more than a bit of insistence by the EPA, and other regulatory agencies, or nothing will continue to be done. [EPA-HQ-OAR-2019-0055-2488, p.1]

As was the case with seat belts... Little, to nothing, happens without significant regulatory pressure. In this case the EPA must take the lead as the agent of enforced progress. [EPA-HQ-OAR-2019-0055-2488, p.1]

Organization: *Ford Motor Company (Ford)*

Ford supports Greenhouse Gas Emissions Model (GEM)-based stringency changes. The GEM-based standards need to account for ZEVs that are expected to enter the heavy-duty fleet in the future. We believe that the targeted GEM-based standard reductions in 2027 model year and later reflect a reasonable assumption of the fraction of ZEVs that are expected in the heavy-duty fleet in that timeframe. [EPA-HQ-OAR-2019-0055-1300-A1, p. 4]

Organization: *Fuel Cell and Hydrogen Energy Association (FCHEA)*

However, regulatory efforts by the federal government to increase deployment of heavy-duty zero-emission vehicle transportation are only one piece of the puzzle needed to unlock greater investment and adoption in this sector. The hydrogen truck industry also needs sustained federal investment in developing a national hydrogen refueling infrastructure network, as well as incentives to encourage station development, vehicle adoption, and reductions in the cost of hydrogen fuel. The federal government can work to build adoption by encouraging government agencies to switch to zero-emission vehicle alternatives for their own operations. [EPA-HQ-OAR-2019-0055-1187-A2, p. 2]

Organization: *International Council on Clean Transportation (ICCT)*

ICCT research shows that the U.S. must achieve at least 45% zero-emission truck sales in 2030 and 100% no later than 2040 to meet domestic and global climate goals to limit warming to below 2 degrees Celsius. Limiting global warming to below 2°C would require the U.S. HDV sector to mitigate its projected cumulative CO2 emissions through 2050 by roughly 4 billion metric tons. Our analysis of EPA's proposal finds it is inadequate to meet domestic and global climate goals. EPA risks not meeting these goals if the agency waits until 2030 to require zero-emission HDV sales. Our modeling shows that EPA has the opportunity in this rulemaking to accelerate ZEV uptake in high priority vehicle segments to remain on a pathway consistent with 2°C. [EPA-HQ-OAR-2019-0055-1211-A1, p. 4]

RECOMMENDATION: We recommend EPA adopt GHG standards for MY2027, MY2028 and MY2029 consistent with achieving the following market shares of zero-emission vehicles—and to do so by the end of this year. This level of ZEV deployment falls between the ambition of the targets set by the Advanced Clean Trucks rule adopted by several U.S. states and those set out in a draft Advanced Clean Fleets rule also under discussion at the state level. This level of ambition is necessary, based on our analysis, to maintain an emissions pathway consistent with limiting warming to 2°C. Even higher ZEV deployment would be needed to reduce the gap with 1.5°C. [EPA-HQ-OAR-2019-0055-1211-A1, p. 4. See Table 1.]

RECOMMENDATION: We recommend EPA achieve these targets by requiring vehicle manufacturers to meet a zero-emission standard for CO2 for a minimum percentage of production in each segment. A zero emission CO2 standard would apply only to zero-emission vehicles only and would be in addition to current GHG standards. Such an approach represents a 'dual-averaging' set. If EPA chooses not to adopt this approach, we recommend EPA revise its GHG standards to reflect the combination of projected internal combustion engine and zero-emission vehicle technology needed to meet climate goals. [EPA-HQ-OAR-2019-0055-1211-A1, p. 4]

The EPA proposal includes baseline ZEV uptake assumptions that do not currently reflect the benefits of adopted state policies that require zero-emission truck sales. A more accurate reflection of baseline ZEV uptake resulting from already adopted state-level policies, based on ICCT estimates, is 3.8% in MY 2027 and 7.2% in MY 2029 in the 17 early-adopting segments for which EPA proposed revisions. ICCT estimates that implementation of the Advanced Clean Trucks regulation among all U.S. signatories to the Multi-State Memorandum of Understanding would increase this baseline to 6.7% in MY 2027 and 12.7% in MY 2029 in the same 17 segments. At the federal level, the Infrastructure Investment and Jobs Act allocates up to $5 billion in funding for zero-emission school buses.1 In addition, the Biden administration has directed the federal government to transition to 100% ZEV acquisition by 2035.2 Both of these federal actions are expected to supplement state-level actions and lead to higher heavy-duty ZEV uptake than considered in EPA's baseline. [EPA-HQ-OAR-2019-0055-1211-A1, p. 5]

1. The White House, "Fact Sheet: Competitive Infrastructure Funding Opportunities for Local Governments," accessed 13 May 2022, https://www.whitehouse.gov/wp-content/uploads/2022/01/BIL-Factsheet-Local-Competitive-Funding.pdf

2. The White House, “Fact Sheet: President Biden Signs Executive Order Catalyzing America’s Clean Energy Economy Through Federal Sustainability THE WHITE HOUSE, accessed 13 May 2022, https://www.whitehouse.gov/briefingroom/statements-releases/2021/12/08/fact-sheet-president-biden-signs-executive-order-catalyzing-americas-cleanenergy-economy-through-federal-sustainability/

RECOMMENDATION: We recommend EPA accurately reflect business-as-usual projections of ZEV sales, taking into consideration the requirements adopted in at least six U.S. states (as of this writing) who have adopted the Advanced Clean Trucks regulation and providing for further evolution of the baseline as more states take similar actions in coming years and as federal actions further accelerate deployment of heavy-duty ZEVs. [EPA-HQ-OAR-2019-0055-1211-A1, p. 6]

EPA has the opportunity in this rulemaking to accelerate zero-emission uptake in high priority vehicle segments to remain on a pathway consistent with 2°C.37 [EPA-HQ-OAR-2019-0055-1211-A1, p. 26]

37. Buysse, Kelly, and Minjares, “Racing to Zero: The Ambition We Need for Zero-Emission Heavy-Duty Vehicles in the United States.”

Achieving at least 45% heavy-duty ZEV sales by 2030 will require setting progressively stringent regulations beginning as soon as model year 2027 to ensure nationwide ZEV model availability for all HDV segments at production volumes consistent with achieving this ambition. HDV electrification is moving fastest in the most market-ready segments—transit buses, short-haul rigid trucks, and short-haul tractors—which are characterized by favorable total costs of ownership, dedicated parking facilities, and predictable low-cost overnight charging. [EPA-HQ-OAR-2019-0055-1211-A1, p. 26]

Long-haul tractors are the single largest contributor of HDV CO2 emissions (Table 9) and will rely upon a national publicly accessible network of charging and refueling infrastructure necessary to support zero emissions operation. Ensuring adequate density and distribution of infrastructure to support its flexible long distance operational profile requires a nationwide effort, which the Biden administration has initiated with the 2021 Infrastructure Investment and Jobs Act.38 Previous ICCT research has identified a need for $6 billion in cumulative public charging infrastructure investments by 2030 and $52 billion by 2040 to support a transition to 100% zero-emission long-haul tractor sales by 2040.39 [EPA-HQ-OAR-2019-0055-1211-A1, p. 26]

38. Infrastructure Investment and Jobs Act..

39. Minjares et al., “Infrastructure to Support a 100% Zero-Emission Tractor-Trailer Fleet in the United States by 2040.”

To understand how EPA could strengthen its proposal, we developed scenarios for CO2 emissions from Class 4–8 vehicles that explore a combination of ZEV pathways, GHG standards, and ZEV crediting schemes. [EPA-HQ-OAR-2019-0055-1211-A1, p. 27]

We developed several ZEV sales pathways to represent how we expect OEMs may choose to comply with future sales requirements. These pathways are shown below in Figure 9. See Attachment 1 – Appendix A for a detailed description of these scenarios. [EPA-HQ-OAR-2019-0055-1211-A1, p. 27. See Docket Number EPA-HQ-OAR-2019-0055-1211-A2 for Appendix A.]

We also modeled three policy scenarios for GHG standards:

• Current represents the original Phase II rulemaking, which includes ZEV super credits through MY 2027 (advanced technology credit multiplier of 4.5 for battery-electric vehicles);

• Proposal tightens MY 2027 GHG standards by 1.5% and retains ZEV super credits through MY 2027;

• ICCT assumes EPA adoption of minimum production requirements of zero-emission vehicles as explained in a previous ICCT paper.40 Under such an approach, minimum production percentage requirements are established for vehicles that meet a zero-emission CO2 standard, average GHG limits apply to other vehicles, and ZEVs cannot generate super credits. More detailed modeling methodology and scenario descriptions can be found in Attachment 1-Appendix A. [EPA-HQ-OAR-2019-0055-1211-A1, pp. 27 - 28. See Docket Number EPA-HQ-OAR-2019-0055-1211-A2 for Appendix A.]

> 40. https://theicct.org/wp-content/uploads/2022/02/HDV-US-adapting-vehicle-emission-stds-zero-emissioncommercial-truck-bus-fleet-feb22.pdf

We recommend EPA revise its proposal to accelerate heavy-duty ZEV uptake before 2030 in order to meet the goals of the Paris Climate Agreement. [EPA-HQ-OAR-2019-0055-1211-A1, p. 28]

Shown in Figure 11, our most ambitious scenario would reduce cumulative 2027–2050 well-to-wheel CO2 emissions by 6.4 Gt from current policies, well in line with the 4 Gt reduction compatible with a 2°C global climate target. These emission benefits result from ZEV deployment in our Alternative 3 pathway as well as alignment with our recommended GHG policy scenario, ICCT, which assumes the stringency of Phase II standards would be preserved for ICE vehicles regardless of ZEV deployment. Harmonizing federal ZEV sales targets with those set out in the ACT regulation, represented by our Alternative 2 pathway, also achieves this target with a 4.8 Gt reduction in cumulative emissions. A 3-year lag in harmonizing with the ACT regulation, represented in our Alternative 1 pathway, only achieves a 3.5 Gt reduction in cumulative emissions. Such a delay in accelerating heavy-duty ZEV deployment would reduce cumulative emissions benefits by 1.2 Gt compared to federal harmonization with the targets set out in the ACT regulation and would not be aligned with a 2°C-compatible future—steeper emissions reductions would be needed to maintain a chance of limiting warming to 1.5°C. [EPA-HQ-OAR-2019-0055-1211-A1, p. 29]

3. We recommend EPA revise its proposal to reflect at least 20% zero-emission HDV sales in MY 2027, 30% in MY 2028, and 40% in MY 2029 [EPA-HQ-OAR-2019-0055-1211-A1, p. 30]

To align with domestic and global climate targets, we recommend that EPA adopt annual MY 2027–2029 GHG standards that put the U.S. heavy-duty vehicle fleet on pace to achieve at least a 45% ZEV sales share in 2030.41 [EPA-HQ-OAR-2019-0055-1211-A1, p. 30]

41. Buysse, C., Kelly, S., and Minjares, R. (2022). Racing to zero: The ambition we need for zero-emission heavy-duty vehicles in the United States. Washington, D.C.: International Council on Clean Transportation. 8 April. https://theicct.org/racing-to-zero-hdv-us-apr22/

We recommend that EPA adopt MY 2027 GHG standards that reflect an average emission level for the combination of 20% production of zero-emission vehicles and 80% production of vehicles using internal combustion engines. We further recommend that EPA also adopt MY 2028 GHG standards that reflect an average emission level for the combination of 30% production of zero-emission vehicles and 70% of vehicles using internal combustion engines, as well as a set of MY 2029 GHG standards that reflect an average emission level for the combination of 40% production of zero-emission vehicles and 60% of vehicles using internal combustion engines. Manufacturers can take advantage of averaging, banking, and trading (ABT) crediting flexibility to comply with annual targets. [EPA-HQ-OAR-2019-0055-1211-A1, p. 31]

We recommend EPA establish minimum production requirements for heavy-duty ZEVs in the form of 'dual averaging sets' to provide certainty the ZEV transition will occur at the pace required to meet climate goals. [EPA-HQ-OAR-2019-0055-1211-A1, p. 31]

In his August 2021 Executive Order, President Biden called upon the EPA Administrator to consider establishing new NOx standards for heavy-duty engines and vehicles ‘‘in consideration of the role that zero emission heavy-duty vehicles might have in reducing emissions from certain market segments”; and to consider new greenhouse gas emission standards beginning as soon as MY 2030. 42 If designed appropriately, these actions by EPA could jump-start the national transition to zero-emission heavy-duty vehicles and take advantage of the infrastructure investments and fiscal policies the president is pursuing through legislation. [EPA-HQ-OAR-2019-0055-1211-A1, p. 31]

42. The White House, “Executive Order on Strengthening American Leadership in Clean Cars and Trucks,” (August 5, 2021), https://www.whitehouse.gov/briefing-room/presidential- actions/2021/08/05/executive-order-on- strengthening-american-leadership-in-clean-carsand-trucks/.

For decades, EPA set new vehicle emission standards under Section 202 of the Clean Air Act, focusing on the incremental improvement of internal combustion engine-powered vehicles. Standards for nitrogen oxides and particulate matter have encouraged the widespread adoption of diesel oxidation catalysts, diesel particulate filters, and selective catalytic reduction. Standards on greenhouse gases have encouraged the adoption of more efficient engines and transmissions, low rolling-resistance tires, improved vehicle aerodynamics, and low-GWP refrigerants. These emission standards have increased in stringency, generating fleet-wide emission reductions over time. The result has been steadily cleaner ambient air and significant public health and welfare benefits. [EPA-HQ-OAR-2019-0055-1211-A1, p. 31]

But the urgency of the climate crisis requires deeper, more rapid, and more sustained emission reductions than those delivered by incremental vehicle and engine standards. This need points to the role of zero emission powertrains as a leapfrog solution over continued incremental improvements. Transitioning to zero emission powertrains in the commercial truck and bus fleet requires an effective adaptation of the existing U.S. regulatory framework for internal combustion engines vehicles. [EPA-HQ-OAR-2019-0055-1211-A1, p. 31]

We recommend that EPA require vehicle manufacturers to meet a zero-emission standard for CO2 for a minimum percentage of production in each segment.43 This new zero-emission CO2 standard would be in addition to current GHG standards; for example, limits on emissions of refrigerants would still apply to these vehicles. For the purposes of this discussion, the vehicles subject to this minimum percentage requirement are called “transition” vehicles. This standard would require a vehicle to be powered by an electric motor and not have an internal combustion engine, resulting in no tailpipe emissions of GHGs. The multi-pollutant coverage of this control technology also means the transition vehicles would produce no emissions of NOx or PM. [EPA-HQ-OAR-2019-0055-1211-A1, p. 32]

> 43. Minjares, Ray, and John Hannon. 2022. “Adapting US Heavy-Duty Vehicle Emission Standards to Support a Zero-Emission Commercial Truck and Bus Fleet.” Washington, D.C.: International Council on Clean Transportation. https://theicct.org/publication/us-hvs-standards-ze-fleet-feb22/.

As part of the vehicle certification and production process, manufacturers would designate their vehicles as either transition vehicles, subject to the percentage requirements, or non-transition vehicles. A manufacturer would need to show that the transition vehicles were zero-emission vehicles and met the applicable percentage of production, as well as other applicable requirements. [EPA-HQ-OAR-2019-0055-1211-A1, p. 32]

The emissions standards for each group would be distinct and separate, and the requirements for each group would be based on the nature of their projected emissions control technology. For transition vehicles, this would reflect technology that produces zero tailpipe emissions for multiple pollutants. Non-transition vehicles would be subject to standards based on technology to control emissions from vehicles powered by internal combustion engines. [EPA-HQ-OAR-2019-0055-1211-A1, p. 32]

The engines used in non-transition vehicles would be subject to the new, more stringent NOx standard finalize by EPA in this rulemaking and would remain subject to current GHG and PM standards. The current provisions for categorization and averaging, banking, and trading would apply to non-transition vehicles and engines. [EPA-HQ-OAR-2019-0055-1211-A1, p. 32]

Credits generated by producing more zero-emission transition vehicles than required could be banked to meet that segment's percentage requirement in future MYs or used to show compliance with the percentage requirement for transition vehicles in another segment. For example, a manufacturer that produces more than the minimum zero-emission vehicles in Segment A in MY 2027 could bank those credits for use in that segment in future MYs, or could use the credits to show compliance with the percentage requirement for Segment B in MY 2027. EPA could establish appropriate adjustments for the transfer of these transition credits from one segment to another to account for differences in emissions and other variables. [EPA-HQ-OAR-2019-0055-1211-A1, p. 32]

Transition vehicles and non-transition vehicles would be distinct and separate averaging sets. Credits from producing more zero-emission transition vehicles than the required percentage could not be used to show compliance with the standards for non-transition vehicles, and vice versa. This would best ensure that the overall emissions reduction and zero-emission vehicle production goals are achieved. [EPA-HQ-OAR-2019-0055-1211-A1, p. 32]

However, manufacturers would retain flexibility in designating vehicles as either transition or non-transition vehicles. A manufacturer that produces greater zero- emission vehicles than the required percentage could certify some or all those extra zero-emission vehicles as non-transition vehicles and include them to demonstrate compliance with the standards for non-transition vehicles. This provides manufacturers flexibility while preserving the goals of overall emission reductions and production of zero-emission vehicles. [EPA-HQ-OAR-2019-0055-1211-A1, p. 32]

EPA could consider treating PHEVs as non-transition vehicles that do not meet the zero-emission vehicle percentage requirements. Designating PHEVs as non-transition vehicles would provide manufacturers with significant flexibility in achieving the more stringent engine and vehicle standards. This approach would avoid undercutting the critical goal of transitioning the vehicles in each segment to the desired percentage production of zero-emission vehicles. [EPA-HQ-OAR-2019-0055-1211-A1, pp. 32 - 33]

EPA could consider how vehicles subject to standards set by California and Section 177 States are addressed. If the standards adopted by California and Section 177 states for internal combustion vehicles are more stringent or require a greater percentage of zero-emission vehicles compared to EPA's corresponding standards, then EPA may consider not including vehicles certified to the California and Section 177 state standards in demonstrating compliance with EPA's corresponding standards. For example, assume California and Section 177 states require a greater percentage requirement of zero-emission vehicles for Segment A than EPA. In that case EPA's percentage requirement would only apply to vehicles that are not certified to the California and Section 177 state standards. If the California and Section 177 state standards are the same as EPA's or provide that compliance with the federal standards is deemed to be compliance with the state standards, then EPA could apply its standards to the entire national fleet. In any case, we recommend the federal standard ensure that the appropriate percentage of ZEVs are produced above and beyond any production called for by California and the Section 177 states. [EPA-HQ-OAR-2019-0055-1211-A1, p. 33]

It is critical that we achieve the long-term goal of broadly transitioning to zero- emission vehicles with their elimination of tailpipe criteria pollutant, air toxic, and greenhouse gas emissions over the full life of the vehicle. Treating zero-emission vehicles as a separate group, with standards set to reflect the use of zero emissions technology, provides high certainty that the projected transition to a percentage of zero-emission vehicles will occur. It also provides high certainty that the overall level of projected GHG, NOx, and PM reductions would be achieved. [EPA-HQ-OAR-2019-0055-1211-A1, p. 33]

If EPA chooses not to establish a zero-emission standard for CO2 for a specified percentage of production in each segment, we recommend EPA retain the current program structure of GHG regulation and revise standards to reflect the combination of projected internal combustion engine and zero-emission vehicle technology needed to meet climate goals. Under this approach, EPA would set MY2027 GHG standards that reflect an average emission level for the combination of zero-emission vehicle targets given in Table 11. There would be no requirement under this approach that manufacturers produce zero-emission vehicles. Credits from any segment would be banked or transferred to another segment, subject to the appropriate adjustments set by EPA to account for differences among segments and usage patterns. [EPA-HQ-OAR-2019-0055-1211-A1, p. 33]

EPA could adopt a bin structure that sets standards achievable by zero-emissions technology; a near-zero emissions standard, achievable by long-range plug-in hybrid-electric vehicles; and a stringent NOx bin achievable by engines in internal combustion-powered vehicles. Hybrid vehicles could be certified using a test procedure that appropriately reflects usage. [EPA-HQ-OAR-2019-0055-1211-A1, p. 33]

To ensure additionality, we recommend EPA consider only allowing ZEV credits for ZEV sales in excess of state or federal requirements. In the absence of federal action to require a minimum share of ZEV sales, this approach would effectively incentivize ZEVs only in non-ACT states. [EPA-HQ-OAR-2019-0055-1211-A1, p. 35]

Under EPA's proposal, if MOU states continue to adopt the ACT regulation, ICE vehicles would not need to attain any of the reductions originally envisioned by Phase II in model year 2027. To ensure that these ICE efficiency improvements are achieved, we recommend EPA minimize the impact of ZEV crediting on the stringency of the Phase II standard for ICE vehicles by establishing separate averaging sets, as detailed in section 3. [EPA-HQ-OAR-2019-0055-1211-A1, p. 35]

We estimate that tightening the Phase II standards to reflect expected state action on ZEVs (MOU ZEV pathway) could reduce cumulative well-to-wheel CO2 emissions from model year 2027 and later vehicles through 2050 by 372 Mt. If federal action drives additional ZEV deployment, represented in our Alternative 1–3 ZEV pathways, and ZEV crediting is limited to ZEV sales in excess of production requirements, cumulative emissions would be further reduced by 2.8 Gt (Alternative 1) to 5.2 Gt (Alternative 3). Failing to maintain the stringency of the original Phase II rule for ICE vehicles would result in a 143–194 Mt loss of these emissions reductions. [EPA-HQ-OAR-2019-0055-1211-A1, p. 35]

The EPA's baseline ZEV uptake assumptions are too low to account for currently adopted and likely state action, as well as support at a federal level. [EPA-HQ-OAR-2019-0055-1211-A1, p. 35]

The EPA proposal currently assumes roughly 1.5% ZEV penetration among 17 early adopting market segments in model year 2027. With six states having adopted the ACT regulation and with the ICT regulation in California, we estimate that minimum ZEV sales requirements in these same 17 market segments would drive national ZEV sales shares of 3.8% in model year 2027, 5.5% in model year 2028, and 7.2% in model year 2029. Further adoption of the ACT regulation by MOU signatories would increase national ZEV sales shares in those market segments to 6.7%, 9.7%, and 12.7% for model years 2027–2029, respectively. Further, federal actions to fund zero-emission school buses and transition the federal fleet to 100% zero-emission vehicle acquisitions by 2035 would supplement state-level action to accelerate deployment of heavy-duty ZEVs.44 [EPA-HQ-OAR-2019-0055-1211-A1, p. 35]

> 44. The White House, "Fact Sheet: Competitive Infrastructure Funding Opportunities for Local Governments"; The White House, "Fact Sheet: President Biden Signs Executive Order Catalyzing America's Clean Energy Economy Through Federal Sustainability."

We recommend EPA accurately reflect business-as-usual projections of ZEV sales, taking into consideration the requirements adopted in at least six U.S. states (as of this writing) who have adopted the Advanced Clean Trucks regulation and providing for further evolution of the baseline as more states take similar actions in 2023 and 2024 and with federal action to accelerate deployment of heavy-duty ZEVs. [EPA-HQ-OAR-2019-0055-1211-A1, p. 35]

We hold the view that market trends support the rapid electrification of most on-road medium- and heavyduty vehicle applications during the period covered by this rule. We attempt to summarize here the research and data that inform our views. [EPA-HQ-OAR-2019-0055-1211-A1, p. 36]

Technology readiness
California Air Resources Board staff undertake an annual review of battery-electric and hydrogen fuel cell readiness. This exercise informs the Long-Term Heavy-Duty Investment Strategy staff use to guide decisions on targeted technologies and project categories that merit funding to help the state reach its air quality and climate goals. [EPA-HQ-OAR-2019-0055-1211-A1, p. 36]

The most recent strategy was made available to the public on 19 November 2021.45 A summary of technology status for on-road battery electric vehicles is found in Figure 6 on page D-42. The figure shows that heavyduty delivery, medium-duty delivery (cargo van), drayage, shuttle bus, school bus, transit bus, refuse truck, and medium-duty delivery truck categories have all reached a technology readiness level of nine out of nine. This level reflects readiness to transition to commercial market entry. [EPA-HQ-OAR-2019-0055-1211-A1, p. 36]

> 45. California Air Resources Board (2022). Appendix D: Long-term heavy-duty investment strategy," Sacramento, CA: California Air Resources Board, accessed 12 May

2022, https://ww2.arb.ca.gov/sites/default/files/2021-10/fy21-22_fundingplan_appendix_d.pdf

The technology readiness of on-road fuel cell technology is behind that of battery-electric technology. Technology readiness of on-road fuel cell electric vehicles is visible in Figure 7 found on page D-46. Among the five use cases evaluated, transit buses are the only one to achieve a technology readiness level of 9. The other evaluated use cases, including heavy-duty delivery, medium-duty delivery, drayage, and shuttle bus are undergoing advanced technology demonstrations and pilots, reflecting a technology readiness level between 7 and 8. [EPA-HQ-OAR-2019-0055-1211-A1, p. 36]

Product availability

The ICCT most recently surveyed available zero-emission heavy-duty products in 2020.46 At that time, zero emission transit buses were available from every major legacy OEM, including Volvo, NFI Group, and Gillig as well as from zero-emission OEMs including Proterra, BYD, GreenPower, and Lion Electric. Volvo, NFI Group and Gillig represent nearly 90% of the transit bus market in the United States. [EPA-HQ-OAR-2019-0055-1211-A1, p. 36]

46. Sharpe, B., Buysse, C., Mathers, J., and Poudelet, V. (2020) How manufacturers are positioned for zero emission commercial trucks and buses in North America. Washington, DC: International Council on Clean Transportation, https://theicct.org/publication/race-to-zero-how-manufacturers-are-positioned-for-zero-emission-commercial-trucksand-buses-in-north-america/

School bus models were also well represented, including products from Thomas Built (Daimler Trucks), Navistar, Blue Bird, GreenPower and Lion Electric. We find that Thomas Built, Navistar, and Blue Bird control nearly 100% of the school bus market in the United States. [EPA-HQ-OAR-2019-0055-1211-A1, p. 36]

Electric coach buses, which travel longer average distances than school or transit buses, were represented in our 2020 survey by products from NFI Group, Van Hool, and BYD. These companies represent more than 90% of the coach bus fleet in the United States. [EPA-HQ-OAR-2019-0055-1211-A1, p. 36]

The Class 4-6 rigid truck category in our survey contains the greatest number of models and market players. Ninety percent of the market is dominated by Ford, Daimler, Isuzu, Navistar and Toyota. Ford products are developed in partnership with powertrain suppliers, including Lightning Systems, Motiv, Phoenix Motors, and SEA Electric. SEA Electric also partners with Isuzu and Toyota. Daimler also offers products in this category. Navistar is the one major market player not to announce a product. In the Class 6-8 refuse trucks category, PACCAR and Volvo Group through their MACK brand have introduced electric products, as have BYD and Lion Electric. [EPA-HQ-OAR-2019-0055-1211-A1, pp. 36 - 37]

The Class 7-8 tractor truck category is dominated almost entirely by four manufacturers – Daimler, PACCAR, Volvo, and Navistar. At the time of publication, all companies except for Navistar had announced product plans. Since that time, we are aware of orders and deliveries that all companies who announced product plans have made. This segment faces competition from new market entrants with electric products, including Hyundai, Hino (Toyota), Xos, Tesla, and Nikola. [EPA-HQ-OAR-2019-0055-1211-A1, p. 37]

A more recent update of model availability was published by CalStart in January 2022.47 Across Class 2b-8 categories, they estimate total models have grown to 145 in 2021 (Class 2b-8). They anticipate a further increase to 165 models by 2023. Manufacturers who produce the entire vehicle and only produce EVs account for 22 percent of models. Legacy manufactures, such as Daimler, Volvo, and Paccar, accounted for 13% of zero-emission models. The remainder are models produced by manufacturers who may repower an existing chassis or produce their own chassis for an existing vehicle frame. Medium-duty trucks were the largest share of available models, accounting for 43%. [EPA-HQ-OAR-2019-0055-1211-A1, p. 37]

47. Al-Alawi, B.M., Macdonnell, O., McLane, R., and Walkowicz, K. (2022) Zeroing in on zero-emission trucks. Pasadena, CA: CalStart, https://calstart.org/zeroing-in-on-zero-emission-trucks/

A representation of truck models available as of the time of this writing can be found on the website of the2022 Advanced Clean Trucks Expo.48 [EPA-HQ-OAR-2019-0055-1211-A1, p. 37]

48. “2022 Display Vehicles,” ACT EXPO, accessed 12 May 2022, https://www.actexpo.com/vehicles

To put the US market in context, consider the market in Europe.49 Battery-electric buses were more than 97% of new electric HDV registrations in 2020. While three companies – Daimler, CNH Industrial and Traton – were responsible for 70% of bus registrations in 2020, seven companies compete in the electric bus space. The market leader is BYD with their K9 model, followed by Volvo Group with their 7900 E. [EPA-HQ-OAR-2019-0055-1211-A1, p. 37]

49. Basma, H., and Rodriguez, F. (2021) Race toz ero: How manufacturers are positioned for zero-emission commercial trucks and buses in Europe.” Berlin, Germany: International Council on Clean Transportation, https://theicct.org/publication/race-to-zero-ze-hdv-eu-dec21/

The state of the Chinese market provides additional context.50 China is the world’s largest electric vehicle market and home to more than ninety percent of all electric buses and trucks on the road today. Eight manufacturers are responsible for 70 percent of all ICE vehicle sales while more than ten manufacturers control less than 70 percent of all zero-emission truck and bus sales. The Chinese market is unique in having more than 900 OEMs in the ICE truck and bus market. More than 200 of these were capable of offering an electric model in 2019. The only Chinese OEM listed in the top five for ICE vehicles and zero-emission vehicles is Foton. Foton also has a joint venture with both Daimler and Cummins, who have a strong presence in the US market. [EPA-HQ-OAR-2019-0055-1211-A1, p. 37]

50. Mao, S., and Rodriguez, F. (2021) Race to zero: How manufacturers are positioned for zero-emission commercial trucks and buses in China. Beijing, China: International Council on Clean Transportation, https://theicct.org/publication/race-to-zero-how-manufacturers-are-positioned-for-zero-emission-commercial-trucksand-buses-in-china/

Total cost of ownership

The potential for zero-emission sales growth is affected by the cost to purchase and own the vehicle. These costs are captured in estimates of upfront cost parity and total-cost-of-ownership parity with ICE vehicles. Table 14 summarizes the results of recently published total-cost-of-ownership studies.51 Additional information can be found in Attachment 1 - Appendix B included with these comments. [EPA-HQ-OAR-2019-0055-1211-A1, p. 38. See Docket Number EPA-HQ-OAR-2019-0055-1211-A3 for Appendix B.]

51. Argonne National Laboratory, “BEAN Techno-Economic Impact of Individual Technologies”; Hunter et al., “Spatial and Temporal Analysis of the Total Cost of Ownership for Class 8 Tractors and Class 4 Parcel Delivery Trucks”; Ledna et al., “Decarbonizing Medium- & Heavy-Duty On-Road Vehicles”; Lowell and Culkin, “Medium- & Heavy-Duty Vehicles Market Structure, Environmental Impact, and EV Readiness”; Burnham et al., “Comprehensive Total Cost of Ownership Quantification for Vehicles with Different Size Classes and Powertrains”; Welch et al., “Moving Zero-Emission Freight toward Commercialization”; CARB, “Draft Advanced Clean Trucks Total Cost of Ownership Discussion Document”; Nair et al., “Medium and Heavy-Duty Electrification Costs for MY 2027- 2030.”

ICCT has sorted the data reflected in these studies into 9 different use cases, aligned with regulatory source categories defined in MOVES.52 We then grouped use cases according to three broad groupings of cost and market readiness, as shown in Table 15. [EPA-HQ-OAR-2019-0055-1211-A1, p. 41]

52. MOVES is the U.S. EPA Motor Vehicle Emission Simulator, a state-of-the-science emissions modeling system that estimates emissions for mobile sources at the national, county, and project level for criteria air pollutants, greenhouse gases, and air toxics. For more visit https://www.epa.gov/moves.

This organization of cost and market readiness of each use case leads to several conclusions. The segments in the 'fast' group are expected to reach TCO parity before MY 2027 and will all see an upfront cost ratio under 1.5 by the same year. Combined, these segments make up over 40% of annual Class 4–8 vehicle sales. School buses share these characteristics with the fast group, and, along with transit busses, are one of only two segments where the EV market is already mature. However, we place them in the 'medium' group as a reflection of the financing challenges school bus programs can face and the additional time they may need to secure appropriate funds for ebus purchases. The 2021 Infrastructure Investment and Jobs Act provides up to $5 billion to finance the electrification of school buses.53 Vehicles in the 'slow' category currently include long-haul rigid and tractor trucks, which will require publicly accessible infrastructure to enable diesel equivalent performance. Navistar CEO Mathias Carlbaum has taken the view that battery-electric long-haul tractors will achieve cost parity without subsidies between 2025 and 2030, while fuel cell variants will achieve this by 2030.54 ICCT has conducted a meta-study of upfront cost parity of tractor-trailers, including a bottom up virtual tear-down of component cost for day cabs and sleeper cabs using a battery-electric or a fuel cell powertrain.55 Despite large reductions in powertrain costs expected this decade, the ICCT understands public infrastructure availability will dictate the pace of market penetration in this segment. [EPA-HQ-OAR-2019-0055-1211-A1, pp. 41 - 42]

53. "Investments in electric and low-emission school buses," EPA, accessed 13 May 2022,https://www.epa.gov/infrastructure/investments-electric-and-low-emission-school-buses

54. Carlbaum, M. (2022). The journey of electric trucks and zero-emission vehicles with Navistar CEO, Pres Mathias Carlbaum. Presentation to the 2022 ACT Expo, 10 May 2022. Accessible online at https://youtu.be/Uuq_Fg_F5XI

55. Sharpe, B., and Basma, H. (2021). A meta-study of purchase costs for zero-emission trucks. Washington, DC: International Council on Clean Transportation, https://theicct.org/publication/purchase-cost-ze-trucks-feb22/

Private sector commitments

Large global engine and vehicle manufacturers have adopted ambitious plans for producing new zero emission bus and truck models. In 2021 Daimler announced its goal to "phase down" the internal combustion engine from its product line within 10 to 15 years. The TRATON Group, the parent company of brands including MAN, Scania, and Navistar, aims to reduce conventional engines to just one-fifth of all product development by 2025. These commitments do not include the sizable number of all-electric products to be produced by new manufacturers. These commitments are also complemented by those of large customers of HDVs and fleet owners who are shaping the demand for ZEVs. Table 16 highlights a few such commitments to provide a sense of the expected pace of private sector activity in the ZE HDV market. [EPA-HQ-OAR-2019-0055-1211-A1, p. 44]

Public sector commitments

Governments around the world are committing to transition sales of new trucks and buses towards zero emission powertrains.65,66 President Biden signed an executive order on 8 December 2021 directing the federal government to acquire only zero-emission vehicles, including medium- and heavy-duty vehicles, from 2035.67 The United Kingdom is among fourteen countries to endorse the goal of 30% zero-emission truck sales in 2030 and 100% in 2040.68 On 12 May 2022 the national government became the first to translate this into an enforceable national policy.69 The Chilean Ministry of Economy has endorsed a non-binding goal to achieve 100% zero-emission new medium- and heavy-duty truck sales in the same year.70 Sub-national governments are also making commitments. New York State Governor Kathy Hochul has signed Senate Bill 2758 setting this goal into law, and has reached an agreement to electrify all school bus sales in 2027 and school bus operations in 2035.71,72 The State of California has begun a public consultation on a requirement to end ICE truck sales in 2040.73 This policy would deliver on Governor Newsom's executive order to achieve 100%

zero-emission drayage operations by 2035 and heavy-duty vehicles, where feasible, by 2045.74 The California Air Resources Board adopted a 100% zero-emission bus purchase requirement in 2018 to be fully implemented in 2029.75 Large volume transit bus purchases are becoming common, particularly in emerging economies. Convergence Energy Services Limited (CESL), a joint venture with the Indian Ministry of Power, recently closed a tender for 5,450 zero-emission buses to be leased within one year to five Indian cities at a cost of 43.49 INR per km (~0.35 USD per mile).76 The Metropolitan Transport Department of Santiago, Chile currently operates the largest electric bus fleet outside of China, including 776 buses with 991 ordered, 10 electric bus depots in operation, and 11 under development.77 Figure 13 and Figure 14 illustrate these political commitments recently announced as of December 2021.

65. Wappelhorst, S., and Rodriguez, F. (2021). Global overview of government targets for phasing-out internal combustion engine medium and heavy trucks. Washington, DC: International Council on Clean Transportation. Accessible at https://theicct.org/global-overview-of-government-targets-for-phasing-out-internal-combustion-enginemedium-and-heavy-trucks/

66. Wappelhortst, S., and Rodriguez, F. (2021).Decarbonizing bus fleets: Global overview of targets for phasing-out combustion engine vehicles. Washington, DC: International Council on Clean Transportation. Accessible at https://theicct.org/decarbonizing-bus-fleets-global-overview-of-targets-for-phasing-out-combustion-engine-vehicles/

67. “Fact Sheet: President Biden signs executive order catalyzing America’s clean energy economy through federalsustainability,” THE WHITE HOUSE, accessed 13 May 2022, https://www.whitehouse.gov/briefingroom/statements-releases/2021/12/08/fact-sheet-president-biden-signs-executive-order-catalyzing-americas-cleanenergy-economy-through-federal-sustainability/

68. “Global memorandum of understanding on zero-emission medium- and heavy-duty vehicles,” GLOBAL COMMERCIAL VEHICLE DRIVE TO ZERO, accessed 13 May 2022, https://globaldrivetozero.org/mou-nations/

69. “Heavy-goods vehicles: ending the sale of new non-zero emission models,” UK.GOV, accessed 13 May 2022,https://www.gov.uk/government/consultations/heavy-goods-vehicles-ending-the-sale-of-new-non-zero-emissionmodels

70. Government of Chile (2022). National Electromobility strategy. (In Spanish). Santiago, Chile: Ministry of Energy, Government of Chile. Accessible online at https://energia.gob.cl/sites/default/files/documentos/estrategia_nacional_de_electromovilidad_2021_0.pdf

71. New York State Senate (2021). An act to amend the environmental conservation law, in relation to providing that one hundred percent of in-state sales of new passenger cars and trucks shall be zero-emissions by two thousand thirty-five. Endorsed bill text accessible online at https://www.nysenate.gov/legislation/bills/2021/s2758

72. “STATEMENT: New York enacts first-in-nation plan to electrify all state school buses,” WORLD RESOURCES INSTITUTE, accessed 13 May 2022, https://www.wri.org/news/statement-new-york-enacts-first-nation-plan-electrifyall-state-school-buses

73. California Air Resources Board (2022). Advanced Clean Fleets Regulation, Proposed draft regulation language: 2040 100 ZEV sales requirement. Advanced Clean Fleets Workshop, 2 May 2021. Accessible online at https://ww2.arb.ca.gov/sites/default/files/2022-04/220502acfdraft100zevsales_ADA.pdf

74. “Governor Newsom announces California will phase-out gasoline-powered cars and drastically reduce demand for fossil fuel in California’s fight against climate change,” OFFICE OF GOVERNOR GAVIN NEWSOM, accessed 13 May 2022, https://www.gov.ca.gov/2020/09/23/governor-newsom-announces-california-will-phase-out-gasolinepowered-cars-drastically-reduce-demand-for-fossil-fuel-in-californias-fight-against-climate-change/

75. “Innovative Clean Transit (ICT) Regulation Fact Sheet,” CALIFORNIA AIR RESOURCES BOARD, accessed 13 May 2022, https://ww2.arb.ca.gov/resources/fact-sheets/innovative-clean-transit-ict-regulation-fact-sheet

76. “Lowest-ever prices in e-buses tender: CESL,” THE TIMES OF INDIA, 27 April, 2022, accessed 14 May 2022, https://timesofindia.indiatimes.com/india/lowest-ever-prices-in-e-buses-tender-cesl/articleshow/91112542.cms

77. “World Bank. 2020. Lessons from Chile’s Experience with E-mobility : The Integration of E-Buses in Santiago. World Bank, Washington, DC. © World Bank. https://openknowledge.worldbank.org/handle/10986/34435 License: CC BY3.0 IGO.”

Infrastructure

Vehicles and fuels are a single system, and so the electrification of medium- and heavy-duty on-road vehicles requires investments in the enabling power delivery infrastructure to support their operation. Our view is that infrastructure needs differ across vehicle use cases, and that first-mover segments benefit from less demanding infrastructure requirements. Table 15 represents our view of the pace of electrification of each segment and is informed by our understanding of infrastructure needs and availability. [EPA-HQ-OAR-2019-0055-1211-A1, p. 48]

In our view, certain enabling characteristics define first-mover segments:

Duty Cycle: Buses, refuse trucks, urban delivery trucks and other first-mover segments have predictable return-to-base operations, featuring predefined routes and schedules that change infrequently. Relatively narrow distribution of vehicle range and route variability translates to high predictability of energy needs and battery size requirements. These characteristics allow manufacturers to design products with diesel equivalent performance for a wide range of use cases, and they allow fleets to accelerate electrification on the basis of battery-electric powertrains. Local and regional-haul tractor-trailers, such as daycabs performing drayage operations near ports, share these characteristics. [EPA-HQ-OAR-2019-0055-1211-A1, p. 48]

Long overnight dwell time: Fleets whose vehicles operate on a single daytime shift will have a long overnight dwell time in which to re-charge the vehicle. This period allows fleets to take advantage of lower charging costs typical over nighttime periods. Fleets without long periods in which to re-charge would need to utilize fast or ultra-fast charging that can deliver power in a far shorter period of time but at higher cost to the fleet and to the utility sector. The utility sector will be a key partner, designing of electricity rates, building physical infrastructure, and balancing the utility system's own reliability, performance, and costs.78 In the interim, battery-electric HDVs whose recharging needs can be met without additional upgrades to the electric power system will be able to deploy even faster. [EPA-HQ-OAR-2019-0055-1211-A1, pp. 48 - 49]

78. Yihao Xie and Felipe Rodríguez, "Zero-Emission Integration in Heavy-Duty Vehicle Regulations: A Global Review and Lessons for China," (ICCT: Washington, DC, August 31, 2021) https://theicct.org/publication/zero-emissionintegration-in-heavy-duty-vehicle-regulations-a-global-review-and-lessons-for-china/.

Dedicated parking: Fleets with a reliable location to park their vehicles will have a clear advantage. Such locations allow fleets to be certain that opportunities to re-charge or re-fuel their vehicle will exist at the end of each day. Fleets that own or lease a yard or depot facility have greater freedom to establish charging or refueling equipment at the pace they require. [EPA-HQ-OAR-2019-0055-1211-A1, p. 49]

Investments in publicly accessible charging infrastructure will enable electrification of those segments who are not first-movers. Currently more than 7,400 publicly accessible DC fast chargers exist in the United States and Canada, equal to around 35 percent of the total we expect will be needed by 2030 to support overnight public charging up to 350 kW for tractor-trailers alone. This number does not take into consideration the challenges such vehicles may have accessing chargers – which may be designed exclusively for private vehicle access – nor does it account for higher power needs up to 1 MW to enable the shortest dwell times. [EPA-HQ-OAR-2019-0055-1211-A1, p. 49]

In September 2021, ICCT estimated the number of charging points and hydrogen refueling stations needed to enable the transition to 100 percent sales of zero-emission Class 7 and Class 8 tractor-trailers by 2040 in the United States.79 We found that by 2030, approximately 127,000 charging points and 220 hydrogen refueling stations will be necessary to support a fleet of 103,000 zero-emission tractor-trailers. The cumulative investment needed to install publicly available infrastructure is $6.4 billion, beginning in 2021. Of 32,000 publicly accessible chargers, 14,000 will require a charging speed of 350 kW or greater. [EPA-HQ-OAR-2019-0055-1211-A1, p. 49]

79. Minjares, R., Rodriguez, F., Sen, A., and Braun, C. (2022) Infrastructure to support a 100% zero-emission tractor-trailer fleet in the United States by 2040. Washington, DC: International Council on Clean Transportation, https://theicct.org/publication/infrastructure-to-support-a-100-zero-emission-tractor-trailer-fleet-in-the-united-statesby-2040/

We found that by 2050, the network of national charging points will need to support a fleet of 2.4 million zero-emission tractor-trailers. This will require 2.5 million charging points and 6,900 hydrogen fueling stations, while the cumulative investment in publicly accessible infrastructure will need to equal approximately $122 billion. Most of the investments required will need to satisfy overnight charging needs. Most of these chargers will be installed in privately owned and operated depots, meaning public access to these chargers will be limited. The cumulative private investment in this depot charging infrastructure will amount to approximately $116 billion through 2050. Overnight chargers at publicly accessible truck stops by 2050 would require a cumulative investment of approximately $20 billion. [EPA-HQ-OAR-2019-0055-1211-A1, p. 49]

But due to the nature of long-distance operations of Class 7 and Class 8 tractor-trailers, overnight chargers alone will not be sufficient to satisfy the charging needs of this fleet. Publicly accessible fast chargers at trucks stops with power levels of up to 1 MW will be required. The cumulative infrastructure investment to 2050 on these 350 kW and 1MW chargers represents $76 billion. For the longest-range tractor-trailers, that is those traveling more than 650 miles per day, a network of hydrogen refueling stations at a cumulative cost of $26 billion, or 21% of the total, may be necessary, although we project just 12% of the fleet would utilize them. [EPA-HQ-OAR-2019-0055-1211-A1, p. 49]

Public investment in this infrastructure will accelerate its deployment. Most of the estimated investment cost, particularly after 2030, can come from the private sector. However, government incentives for the purchase and installation of infrastructure, as well as public guarantees along critical corridors, will jump start the deployment of this infrastructure before 2030. [EPA-HQ-OAR-2019-0055-1211-A1, p. 50]

In 2021 President Biden signed into law the Infrastructure Investment and Jobs Act, which provides for $7.5 billion in funding towards the National Electric Vehicle Formula Program administered by the Joint Office of
Energy and Transportation. This office has issued guidance to states to apply for funding, including the stipulations that (1) all EV charging infrastructure be installed along a designated Alternative Fuel Corridor (b) infrastructure along Alternative Fuel Corridors must be complete before states can install infrastructure along other corridors (c) and each corridor is considered fully constructed when charging infrastructure is installed every 50 miles, each station includes at least four 150 kW DC fast chargers, and the minimum installed capacity at each station is 600 kW. A concern we have with these guidelines is they do not require that stations accommodate medium- and heavy-duty truck charging needs. [EPA-HQ-OAR-2019-0055-1211-A1, p. 50]

For context, the European Commission proposed an Alternative Fuels Infrastructure Regulation (AFIR) in July 2021. The regulation would set mandatory targets for the deployment of infrastructure for charging and hydrogen refueling for both light- and heavy-duty vehicles. The provisions concerning heavy-duty vehicles would set minimum requirements for the roll out of infrastructure serving zero-emission HDVs across the Trans-European Network for Transport (TEN-T), as well as related urban nodes and overnight truck parking areas. The proposed regulation sets targets for the minimum capacity and maximum distance between charging and hydrogen refueling points to be met by member states. The proposal has not been adopted by the

European Parliament or Council and the timeline of adoption is uncertain.80 [EPA-HQ-OAR-2019-0055-1211-A1, pp. 50 - 51]

> 80. Ragon, P, Mulholland, E., Basma, H., and Rodriguez, F. (2022). A review of the AFIR proposal: Public infrastructure needs to support the transition to a zero-emission truck fleet in the European Union. Washington, DC: International Council on Clean Transportation, https://theicct.org/publication/afir-eu-hdv-infrastructure-mar22/

Whatever the future direction of public investment in the United States, private sector investment is emerging to complement these public investments. On January 31, 2022, Daimler Truck North America announced it signed an MoU with NextEra Energy Resources and BlackRock Renewable Power to start a joint venture to develop a nationwide charging network for both battery-electric and hydrogen fuel cell vehicles. The first charging sites are expected in 2023 with funding of approximately 650 million dollars.81 Similarly, Volvo Group has established a new division called Volvo Energy, which will provide energy services. Volvo Group has formed a joint venture in Europe with Traton and Daimler with funding of 500 million Euros to install and operate at least 1,700 charging points along highways and at other key points in the road network.82 No similar announcement has been made for the U.S. [EPA-HQ-OAR-2019-0055-1211-A1, p. 51]

> 81. “Daimler Truck North America, NextEra Energy Resources and BlackRock Renewable Power announce plans to accelerate public charging infrastructure for commercial vehicles across the U.S.,” DAIMLER TRUCK, accessed 12 May 2022, https://media.daimlertruck.com/marsMediaSite/en/instance/ko/Daimler-Truck-North-America-NextEra-Energy-Resources-and-BlackRock-Renewable-Power-Announce-Plans-To-Accelerate-Public-Charging-Infrastructure-For-Commercial-Vehicles-Across-The-US.xhtml?oid=51874160
>
> 82. “Volvo Group, Daimler Truck, and the Traton Group plan to pioneer a European high-performance charging network for heavy-duty trucks,” VOLVO, accessed 12 May 2022, https://www.volvogroup.com/en/news-andmedia/news/2021/jul/news-4017125.html

Organization: *Lion Electric Co. USA Inc. (Lion)*

We support the EPA’s focus on school buses, transit buses, delivery trucks, and short-haul tractors as being the four major vehicle categories that will experience the most EV growth during the outlined time frame starting in model year (MY) 2027. However, it is also important to consider that fleets that utilize these vehicles may be smaller, operating in underserved communities, have minimal time and resources, or a any new emission standards to accommodate disadvantaged fleets that may not be able to comply as quickly as a larger fleet with more resources. This can take the form of a longer compliance timeframe or larger incentives for smaller fleets, which are often underrepresented in funding considerations. While expediting the transition to zero-emission technology is an exciting and important goal, it is crucial that we consider options for these fleets for whom the transition is currently less accessible. Prioritizing small fleets and disadvantaged communities in current and future EPA grant programs is a great way to ensure that these diverse industries are not lost or left behind as we strive to protect the environment. [EPA-HQ-OAR-2019-0055-1151-A2, pp. 1 - 2]

We support the EPA's consideration of incorporating the Advanced Clean Truck (ACT) regulation into the final rule. To meet the proposed Option 1 goal of reducing NOx emissions by over 50 percent by 2040, existing manufacturers will need to focus more of their operations on zero-emission vehicle (ZEV) production. While a variety of zero-emission vehicles are already available to the public, Lion believes that implementing this regulation on a federal level will provide further direction to this growing industry. [EPA-HQ-OAR-2019-0055-1151-A2, p. 2]

Organization: *Loren Marz*

I also support EPA declining to establish a "ZEV" mandate at this time (Page 25). HD EVs may reduce NOx emissions in most cases, but that comes at the expense of significantly higher PM10, PM2.5, and SOx emissions, even in urban locations, from a complete vehicle life-cycle (LCA) perspective in long- haul operations, and even short-haul operations in some regions of the U.S., per Argonne National Laboratory's latest version of its GREET model (GREET_2021). That's more or less reflected in the peer- reviewed paper - Lui et al., "Well-to-Wheels Analysis of Zero-Emission Plug-In Battery Electric Vehicle Technology for Medium- and Heavy-Duty Trucks" Environ. Sci. Technol. 2021, 55, 538-546 (Figure 4). Even GHG emissions are roughly the same for long-haul diesel ICEV and BEV in that study, and even higher for BEV on a freight ton-mile basis when taking into account the lower payload capacity of BEVs (Figure 7). That study considers only well-to-wheels (WTW) emissions, not full LCA as GREET_2021 does. Projections for 2045 do not change this trade-off per GREET_2021 even if this proposed rule is not implemented (LCA PM2.5 emissions are still ~2 times higher in long-haul BEV operations in both total and urban shares under the assumptions in GREET).

Mandates, or even incentives, for "ZEVs" are dubious proposals at this time, and may be for the foreseeable future. [EPA-HQ-OAR-2019-0055-1394]

Organization: *Mass Comment Campaign sponsored by Climate Action Campaign (22,659)*

- Cleaner trucks are not only available and ready now, they also are projected to deliver critical cost savings for operators and drivers. [EPA-HQ-OAR-2019-0055-1193, p.1]

- Across nearly every vehicle class, zero-emission electric trucks and buses are projected to be cheaper to own and operate than their combustion engine counterparts within five years. [EPA-HQ-OAR-2019-0055-1193, p.1]

Organization: *Mass Comment Campaign sponsored by Moms Clean Air Force and Arizona Climate Action Coalition (198)*

On the greenhouse gas portion of the rule, the proposed adjustments to existing Phase 2 greenhouse gas standards are weak and reflect neither the urgency of the climate crisis nor the rapid advancement in zero-emission truck technology. EPA should put our nation's heavy duty vehicle fleet on a clear path to 100% zero-emissions sales by 2035. [EPA-HQ-OAR-2019-0055-1192-A1, p.3]

Organization: *Mass Comment Campaign sponsored by Neighbors for Clean Air and Elders Climate Action (43)*

Thank you for proposing to reduce nitrogen oxide (NOx) pollution from medium and heavy-duty trucks and buses. However, we are concerned that the proposal fails to prevent the worst impacts of the climate crisis and is not adequate to protect our children and communities from the diseases of air pollution. [EPA-HQ-OAR-2019-0055-1619-A1,p .1]

We, the undersigned Oregon community organizations, elected officials and community members are joining together to request that you withdraw your proposal that allows millions more new diesel trucks and buses in 2027-29, that reduces CO2 from these vehicles by less than 1% and will lock-in over the next 20 years 1.7 billion tons of additional CO2 and thousands of tons of harmful particulate, NOx and toxic air emissions that could be avoided by requiring manufacturers to transition to commercially available zero emission technologies. [EPA-HQ-OAR-2019-0055-1619-A1, p.1]

The transportation sector is the leading source of climate pollution in the US, but the proposal fails to make any progress toward ending CO2 emissions from the transport sector to avoid the worst consequences of a warming climate. The proposed rule also fails to achieve the public health benefits that will flow from requiring trucks and buses to emit zero particles, NOx and toxic pollutants that cause urban smog, childhood asthma, respiratory and cardiovascular diseases, and premature deaths. [EPA-HQ-OAR-2019-0055-1619-A1, p.1]

We ask that you withdraw the proposed CO2 standards that will allow millions more diesel vehicles during model years 2027-29. These vehicles will remain on the road for at least 20 years, add to CO2 in the atmosphere and prevent the U.S. from achieving the CO2 reductions identified by the Intergovernmental Panel on Climate Change (IPCC) as necessary to keep within the 1.5 C target to avoid a climate catastrophe. Instead we ask you to propose zero emission standards for medium and heavy duty vehicles in short-haul applications that would require manufacturers to sell zero emission vehicles that are already commercially available with zero emission power trains. [EPA-HQ-OAR-2019-0055-1619-A1, p.1]

To protect our children's health, their future on a livable planet, our large Senior citizen population, and to address environmental injustice, EPA needs to immediately take urgent and bolder action. Please strengthen the proposed rule for heavy duty vehicle pollution by –

1) revising the NOx portion of the rule to match California's Heavy Duty Omnibus rule for vehicles not subject to a zero emission standard, which should be the baseline for smog and particulate matter reduction goals.
2) withdrawing both the NOx and greenhouse gas (CO2) portion of the rule for vehicles intended for short haul applications, and proposing zero emission standards for those vehicles beginning in 2027. A zero emission standard will eliminate all pollutants, including deadly particulates and air toxics as well as NOx and CO2. [EPA-HQ-OAR-2019-0055-1619-A1, pp.2-3]

Zero emission vehicles satisfy the Clean Air Act's directive that emission standards for heavy duty vehicles must provide "the greatest emission reduction achievable with [available] technology. [EPA-HQ-OAR-2019-0055-1619-A1, p.3]

School and transit buses, delivery vans, passenger vans, utility service vehicles, garbage trucks and cargo trucks conveying goods from ports and airports to local distribution centers are all available now with zero emission power trains. Proposed adjustments to existing Phase 2 greenhouse gas (CO2) standards and proposed NOx standards are not acceptable for vehicles that are now commercially available with zero emission power trains. [EPA-HQ-OAR-2019-0055-1619-A1, p.3]

Standards that allow, rather than prevent, more vehicles that burn fossil fuels fail to reflect the urgency of the climate crisis and the need to promote the rapid transformation of the transport sector to zero emission technology. Allowing more vehicles that emit particulate and ozone precursor pollutants also fails to reflect the urgent need for ending particulate and ozone nonattainment within the Clean Air Act's statutory deadlines for attainment. EPA must start now with a zero emission standard for short haul vehicles in 2027 to put our nation's heavy duty vehicle fleet on a clear path to 100% zero-emissions sales by 2035. [EPA-HQ-OAR-2019-0055-1619-A1, p.3]

We urge these changes to demonstrate EPA's dedication to protecting public health, achieving a zero emission economy by 2050 to stabilize the climate, and to advancing environmental justice and equity for communities at risk.[EPA-HQ-OAR-2019-0055-1619-A1, p.3]

Organization: *Mid-America Regional Council (MARC) Air Quality Forum*

The trucks included under this rule will be around for decades; therefore, heavy duty trucks must be cleaned up as soon as possible. Zero-emissions technology for heavy- and medium-duty trucks is already available. Additionally, a new study from the Department of Energy shows that within the timeframe of this rule, "nearly half of medium- and heavy-duty trucks will be cheaper to buy, operate, and maintain as zero emissions vehicles than traditional diesel-powered combustion engine vehicles." 1 [EPA-HQ-OAR-2019-0055-1131-A1, p. 1]

> 1. NREL Study: Decarbonizing Medium- and Heavy-Duty On-Road ..., https://reglobal.co/decarbonizing-medium-and-heavy-duty-on-road-vehicles-in-us/.

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

> Per EPA's request for information on heavy-duty electric vehicle sales projections, including for what HD vehicle types, to help inform their HD electric vehicle sales projections in the MY 2024 through MY 2029 timeframe, MEMA urges the EPA to avoid regulations that allow backsliding on ICE technologies to make sure that ICE vehicles are as clean as current technology will allow. [EPA-HQ-OAR-2019-0055-1322-A1, p. 9]

Organization: *Minnesota Pollution Control Agency (MPCA)*

Minnesota supports the goals of the Greenhouse Gas (GHG) portion of the program and encourages the EPA to adopt these standards as quickly as possible. Minnesota has supported heavy-duty electrification through Volkswagen settlement funds and other programs and believes accelerating heavy-duty electrification can help the state meet its climate and air pollution goals. [EPA-HQ-OAR-2019-0055-1044-A1, p. 2]

Organization: *Moving Forward Network (MFN)*

Zero Emission Solutions Are Widely Available Today, Making These Health Consequences Even More Unconscionable. The electric vehicle landscape has changed dramatically since EPA adopted its Phase 2 GHG rule in 2016, and in astounding ways since EPA last updated its Heavy-Duty NOx standards some twenty years ago. Today, there are already a staggering number of zero-emission heavy-duty models available. In fact, there are over 100 models of battery-electric heavy-duty vehicles available for purchase – nearly twice the amount EPA cited in its Draft Regulatory Impact Assessment (RIA) for this rulemaking.41,42 Moreover, the EPA's current Notice of Proposed Rulemaking (NPRM) and DRIA fail to cite critical technology developments beyond 2019, even though the battery-electric truck market has seen significant growth since then. A recent market assessment of the medium- and heavy-duty market by analysts at MJ Bradley & Associates examines the in-use truck fleet to assess readiness for adoption of zero-emission trucks.43 The analysis factors in charging patterns, operating requirements, market status, and the business case. It relies on conservative assumptions (from a 2019 ICF study), but nevertheless, finds that 66% of the truck fleet has "strong potential for near-term [pre-2025] uptake."44 [EPA-HQ-OAR-2019-0055-1277-A1, p. 12]

41. US Department of Energy - https://afdc.energy.gov/vehicles/search/

42. Draft Regulatory Impact Analysis p. 57

43. MJ Bradley, Market Medium- and Heavy-Duty Vehicle Market Structure and EV Readiness (July 2021) https://www.mjbradley.com/reports/medium-heavy-duty-vehicles-market-structure-environmental-impact-and-ev-readiness.

44. Id.

According to the US Census Bureau's Vehicle In-Use Survey, 70 percent of HD vehicles travel less than 50 miles daily, meaning that range is not the concern it once was.45 EPA correctly notes in the DRIA that urban delivery vehicles are fully primed for electrification, but fails to recognize that the potential to employ zero emissions regional haul tractors and vocational trucks also exists today as a result of advances in battery technology and new availability of suitable models.46 [EPA-HQ-OAR-2019-0055-1277-A1, p. 13]

45. US Census: https://www2.census.gov/library/publications/economic-census/2002/vehicle-inventory-and-use-survey/ec02tvus. pdf

46. Draft Regulatory Impact Analysis p. 54-55

Many heavy-duty trucks operate within 100-mile ranges (left), and many vehicle miles traveled (VMT) are attributable to trucks with operating ranges less than 100 miles (right). These trucks are particularly well suited to early electrification efforts. [EPA-HQ-OAR-2019-0055-1277-A1, p. 13]

Fleet operators and truck manufacturers themselves are already transitioning to zero-emissions trucks. Indeed, industry is well ahead of most states, and especially the federal government, in terms of zero emission heavy-duty truck adoption. This transition is significant, and speaks to the technical feasibility and availability of zero-emission trucks today—yet this reality is not reflected in EPA's current proposal. Well established truck manufacturers like Daimler Trucks48 and Volvo49 are preparing for a clean transportation future by shifting to a fully zero-emissions product line by 2040 and models from newcomers like Nikola, Rivian, and Tesla are beginning to hit the roads. Amazon made headlines with its order for some 100,000 Rivian electric delivery vans and several of the nation's largest fleet owners including PepsiCo, Walmart, and JB Hunt have piloted and placed orders for electric tractor and delivery trucks.50,51,52 Sysco, one of the largest food distribution companies in the world, has pledged to electrify 35 percent of its tractor fleet by 2030.53 [EPA-HQ-OAR-2019-0055-1277-A1, pp. 13 - 14]

48. Daimler Press Release: https://www.daimlertruck.com/innovation/efficient-emission-free/co2-neutral-transport.html

49. Volvo Press Release: https://www.volvotrucks.com/en-en/news-stories/insights/articles/2021/apr/electric-trucks-may-gomainstream- sooner-than-you-think-here-is-why.html

50. https://www.transportdive.com/news/pepsi-pepsico-electric-trucks-ev/619236/

51. https://corporate.walmart.com/newsroom/2020/09/21/walmarts-regenerative-approach-going-beyond-sustainability

52. https://www.jbhunt.com/content/dam/jbhunt/jbh/corporate-responsibility/documents/210714_ESG_EnvironmentalSummary.pdf

53. https://www.sysco.com/dam/Sysco/About/Corporate-Social-Responsibility/Sysco-2021-Corporate-Social-Responsibility- Report.pdf

To be sure, these companies are not transitioning to electric vehicles out of a sense of altruistic social and environmental responsibility – electric heavy-duty vehicles offer significant economic upsides for fleets. While the initial purchase cost for most zero-emissions models is currently higher than their combustion counterparts, their total lifetime costs can be lower in many use cases today. "The industry is moving quickly to deploy new technologies and the lifetime cost parity of HDEVs are rapidly approaching that of their combustion counterparts."54 [EPA-HQ-OAR-2019-0055-1277-A1, p. 14]

54. NRDC blog: https://www.nrdc.org/experts/patricio-portillo/epa-its-time-act-we-need-clean-trucks-now

As battery prices continue to decline, so will the upfront cost of electric trucks, furthering the cost parity for zero-emissions models. A February 2022 study from Roush Industries shows that electric class 5 delivery trucks will have the most favorable total cost of ownership (TCO) in the next two years, well before the first compliance period under the proposed regulation. Similarly, a total cost of ownership study by CARB, found that by 2030, ZEVs would be cheaper than diesel across every vehicle type examined, including Class 8 Sleeper Cabs, even while accounting for the costs associated with infrastructure and excluding rebates and incentives. The Department of Energy's own cost analysis (released the same day as EPA's draft rule) concluded that ZEVs can reach TCO parity with conventional diesel vehicles "by 2035 for all medium and heavy-duty (MD/HD) vehicle classes (without incentives)."55 DOE concluded that if economics alone drove adoption, ZEVs could reach 42% of all MD/HD trucks by 2030. [EPA-HQ-OAR-2019-0055-1277-A1, p. 14]

55. Catherine Ledna et al., Decarbonizing Medium & Heavy-Duty On-Road Vehicles Cost Analysis (Mar. 2022) https://www.nrel.gov/docs/fy22osti/82081.pdf at 2.

Electric trucks have significantly reduced operating and maintenance costs compared to diesel trucks – over 50 percent in some cases.56 Furthermore, the cost of electricity is far more stable than that of oil, which gives fleet operators more certainty in planning their business. Instead of worrying about the volatility of fossil fuels from geopolitics, our nation's trucks can do what they do best – deliver goods and services. [EPA-HQ-OAR-2019-0055-1277-A1, p. 14]

56. Roush Industries Inc., Table 67: https://blogs.edf.org/climate411/files/2022/02/EDF-MDHD-Electrification-v1.6_20220209.pdf

Advancements in zero-emission truck technology are being propelled by state-level ambition to tackle freight-related pollution. Six states that make up at least 17 percent of the U.S. medium- and heavy-duty vehicle market share have already adopted California's Advanced Clean Trucks (ACT) rule – a manufacturer requirement to increase ZEV sales to between 30-50 percent by 2030 and 40-75 percent by 2035, depending on vehicle class. In addition, 17 states and the District of Columbia (D.C.) – which make up 30 percent of the U.S. medium- and heavy-duty vehicle market share – signed a memorandum of understanding to achieve 100 percent zero-emission truck and bus sales by 2050, with an interim target of 30 percent ZEV sales by 2030.57 According to a recent analysis by ERM, if all the MOU states adopted the ACT rule, 27 percent of the Class 4-8 U.S. fleet would transition to ZEV by midcentury.58 While state ACT rule adoption is important, complementary federal action is critical to help address the remaining threequarters of the fleet that must transition to ZEVs. These state actions demonstrate the feasibility of requiring zero-emission trucks but cannot move the nation forward on electrification alone – an analysis completed by the Union of Concerned Scientists (UCS) estimates that ZEVs will account for roughly 1 in 8 of national heavy-duty sales in 2030 if all California ZEV Standard states adopt the ACT. Other projections, like that from IEA's Global EV Data Explorer, confirm this insufficient sales share, with HD ZE trucks at around 7 percent in 2030 without federal intervention.59 The same analysis completed by UCS shows that, if EPA adopted modest sales requirements like the ACT, it would more than double the anticipated market share for electric heavy-duty trucks (Figure 2). [EPA-HQ-OAR-2019-0055-1277-A1, pp. 14 - 15]

57. NESCAUM Medium- and Heavy-Duty Zero-Emission Vehicles: Action Plan Development Process: https://www.nescaum.org/documents/medium-and-heavy-duty-zero-emission-vehicles-action-plan-development-process/

58. Robo, E., D. Seamonds, and M. Freeman. 2022. Federal Clean Trucks Program: An analysis of the impacts of low-NOx and zero-emission medium- and heavy-duty trucks on the environment, public health, industry, and the economy. Report developed by ERM for the Natural Resources Defense Council and the Union of Concerned Scientists. (“ERM report”)

59. IEA Global EV Data Explorer: https://www.iea.org/articles/global-ev-data-explore

Estimate of the share of new truck sales driven under different state and federal ZEV policy requirements under a conservative assessment of status quo market adoption.60 While state commitments are helping to drive the HDZEV market, even a nationwide adoption of the ACT would fall short of the level of sales needed to meet climate, health, and equity goals. [EPA-HQ-OAR-2019-0055-1277-A1, p. 15]

60. IEA World Outlook 2021: https://www.iea.org/reports/world-energy-outlook-2021

Throughout EPA’s technological and market assessments in the NPRM and DRIA, the Agency notes the varying outlooks for HDZEV adoption in the coming years. What it does not do, however, is recognize that federal regulations, including mandates and incentives, are key to accelerating the national HDZEV market.61,62 This is despite some of the key literature relied upon in the DRIA pointing towards the inclusion of government actions in rapid technology and adoption scenarios.63 EPA cannot afford to waste this consequential opportunity to accelerate the market for HDZEVs within this rulemaking. It is beyond time for EPA to be part of the solution. [EPA-HQ-OAR-2019-0055-1277-A1, pp. 15 - 16]

61. Ibid.

62. Resources for the Future, An Analysis of US Subsidies for Electric Buses and Freight Trucks - https://www.rff.org/publications/issue-briefs/an-analysis-of-us-subsidies-for-electric-buses-and-freight-trucks/

63. National Renewable Energy Laboratory, Electrification Futures Study, p. 3: https://www.nrel.gov/docs/fy18osti/70485.pdf

EPA requested how to best consider the potential for ZEV technologies to significantly reduce air pollution from the heavy-duty vehicle sector.64 Put simply, vehicle electrification is the best method for controlling nitrogen oxide pollution from heavy-duty vehicles over the long term. Compliance for this rulemaking begins in MY 2027, roughly four years from its anticipated promulgation. HDZEVs have seen rapid technological growth and significant cost reductions over the past four years, and these are likely to accelerate even further in the near term. By excluding HDZEVs as the centerpiece of this regulation, EPA is all but guaranteeing that the regulation will be outdated before the first compliance period even begins. [EPA-HQ-OAR-2019-0055-1277-A1, p. 16]

64. 87 FR 17420

As noted above, there is ample evidence to expect that by model year 2027, 20 percent of new truck sales could be ZE trucks, and that number could increase year-over-year by roughly 10 percent to reach 100 percent by 2035. EPA's truck-wide standard therefore should be reduced to account for this feasible growth in ZE truck sales. Using 0.02 g/hp-hr as the conservative starting point for the emissions achievable by combustion engines (as noted, MFN believes even lower emissions are feasible), the combined standard for MY2027 should be no higher than 0.016 g/hp-hr to reflect that 20 percent of sales could feasibly be met with ZE trucks. To address stability requirements, EPA should set three-year standards that reflect the three-year average of projected ZE sales. Thus, for model years 2027 through 2029, EPA should assume an average of 30 percent ZE sales and set the three-year average standard at 0.014 g/hp-hr. [EPA-HQ-OAR-2019-0055-1277-A1, p. 20]

To project forward growth in the Class 4-8 ZEV market, we have conservatively assumed a rate of adoption consistent with the International Energy Agency's baseline policy case for 2030 in the United States,189 the majority of sales which are the result of California adopting the Advanced Clean Truck rule. We have then further adjusted the sales of EVs upward to reflect the additional adoption of the Advanced Clean Truck rule by Massachusetts, New Jersey, New York, Oregon, and Washington, which the IEA baseline did not account for, using the regulatory requirements and registration data. [EPA-HQ-OAR-2019-0055-1277-A1, p. 52]

189. https://www.iea.org/reports/global-ev-outlook-2021

This baseline scenario is meant to represent a conservative but reasonable assessment of adoption of zero emission trucks in order to better assess the impacts of the crediting provisions on conventional internal combustion engine trucks (Figure 9). As noted elsewhere in our comments, the actual future adoption of zero-emission trucks is likely to be much higher, owing to incentives, the cost-effectiveness of the technology, and additional state action like the MOU. [EPA-HQ-OAR-2019-0055-1277-A1, p. 52]

For all these reasons, this analysis is likely an underestimate of the impact of the ZEV crediting program. Furthermore, we have not considered in the below analysis any attempt by the agency to actually drive sales of zero-emission vehicles, because the agency did not do so in its proposal. [EPA-HQ-OAR-2019-0055-1277-A1, p. 52]

A conservative estimate of status quo deployment finds that electric trucks would achieve an 11 percent marketshare by 2030, with just over 6 percent of that market coming from conventional vehicles powered by engines (HDO, LHDD, MHDD, or HHDD) transitioning to zero-emission powertrains in states that have adopted the Advanced Clean Trucks rule (ACT), representing 15 percent of total vehicle sales. [EPA-HQ-OAR-2019-0055-1277-A1, p. 52]

“EPA requests comment on whether and how to consider including specific sales requirements for ZE trucks.” (87 FR 17420) [EPA-HQ-OAR-2019-0055-1277-A1, p. 17]

MFN urges EPA to finalize standards that include a separate standard for ZE trucks and require an increasing annual minimum number of ZE truck sales.66 Studies have consistently found that clear regulatory market signals are necessary to spur investment in the manufacturing, supply chains, and supporting infrastructure necessary to support the transition to ZE vehicles. A study of California’s transportation policies points to the ZEV sales requirement as sending a strong “signal, effectively channeling innovation activities towards ZEV development and increasing the availability of ZEVs for sale, where supply constraints have proven to be a major barrier to widespread uptake.”67 Multiple forward-looking models confirm that stringent ZEV mandates can play a large role in reducing emissions in the U.S.68 Noting the clear evidence of ZEV mandates’ effectiveness in the passenger vehicle space in California, researchers advised: “ZEV mandates should also be more actively considered for freight, drawing inspiration from California’s recent [Advanced Clean Trucks] policy.”69 [EPA-HQ-OAR-2019-0055-1277-A1, pp. 17 - 18]

66. The preamble explains that EPA is not proposing this sort of sales mandate but EPA's invitation for comment on sales requirements, and the overwhelming public testimony on such sales requirements suggest such requirements are well understood to be within the ambit of options for the final rule. See, e.g., Nat'l Mining Ass'n v. Mine Safety & Health Admin, 512 F.3d 696, 699 (D.C. Cir. 2008); City of Portland v. EPA, 507 F.3d 706, 715 (D.C. Cir. 2007); Ariz. Pub. Serv. Co. v. EPA, 211 F.3d 1280, 1299 (D.C. Cir. 2000).

67. John Axsen et al., Crafting strong, integrated policy mixes for deep CO2 mitigation in road transport Nature Climate Change (Aug 24, 2020) https://doi.org/10.1038/s41558-020-0877-y.

68. See, e. g. J.B. Greenblatt, Modeling California policy impacts on greenhouse gas emissions (Feb. 2015) https://escholarship.org/uc/item/9n62b5xv; and David Greene et al., Public policy and the transition to electric drive vehicles in the U.S.: the role of the zero emission vehicles mandate (Dec. 2014) https://doi.org/10.1016/J.ESR.2014.10.005.

69. John Axsen et al., Crafting strong, integrated policy mixes for deep CO2 mitigation in road transport Nature Climate Change (Aug 24, 2020) https://doi.org/10.1038/s41558-020-0877-y.

Clear regulatory requirements prime the investment pump and can bring ZE truck production to scale, which in turn will advance technologies and drive down prices in a virtuous feedback loop.70 California's experience just in developing the sales requirements of the Advanced Clean Truck rule was to see a rapid increase in the commercialization of ZE trucks, reinforced with strong fleet commitments to purchase the required ZE trucks and improved planning for the buildout of supporting charging infrastructure. Within the course of the CARB’s rulemaking for the Advanced Clean Trucks rule, new manufacturer announcements enabled CARB staff to revise upward their ZEV targets for manufacturers.71 In their updated analysis on increasing sales requirements, Staff noted that “the large number of ZEVs launched before the regulation begins [and] the more established ZEV marketplace…support higher ZEV sales requirements in the earlier years and is consistent with Board direction and many public comments seeking to increase the number of ZEVs deployed.”72 Having a separate requirement for the deployment of ZE trucks also ensures that the transition to ZE trucks does not undermine the stringency of combustion standards. [EPA-HQ-OAR-2019-0055-1277-A1, p. 18]

70. “[A ZEV mandate] sends the strongest transformational signal of all the policies examined, receiving a score of 5/5. As a regulatory policy, it is likely to be reasonably durable and it also provides clear directionality with respect to investment in PEVs” Noel Melton et al., Which plug-in electric vehicle policies are best? A multi-criteria evaluation framework applied to Canada (Dec. 2019) https://doi.org/10.1016/j.erss.2019.101411.

71. CARB, Updated Analysis Regarding Increased Manufacturer Zero-Emission Vehicles Sales Requirements – Attachment B (2019) https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/30dayattb.pdf

72. CARB, Updated Analysis Regarding Increased Manufacturer Zero-Emission Vehicles Sales Requirements – Attachment B (2019) https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/30dayattb.pdf

Manufacturers have acknowledged that the transition to ZE trucks is underway (press release pages for major truck manufacturers are dominated by news and stories about their electric trucks73). Industry experts testing ZEV trucks in real-world demonstrations concluded that “four market segments – vans and step vans, medium-duty box trucks, terminal tractors, and heavy-duty regional haul tractors – are ready to go electric,” and specifically, that “half of heavy-duty regional haul tractors are electrifiable now.” 74 As documented extensively in the previous section, there is widespread agreement, confirmed across multiple independent analyses, that these trucks already represent lower total costs of ownership in a large share of use cases.75 [EPA-HQ-OAR-2019-0055-1277-A1, p. 18]

73. See, e.g., Volvo, “News and Stories” https://www.volvotrucks.com/en-en/news-stories.html; Daimler, "Global Media Site” https://media.daimlertruck.com/marsMediaSite/en/instance/ko/Start.xhtml?oid=4836258; Traton, Press Releases” https://traton.com/en/newsroom/press_releases.html;

74. NACFE, Electric Trucks Have Arrived, Documenting a Real-World Electric Trucking Demonstration (Jan 2022) https://nacfe.org/heavy-duty-regional-haul-tractors/.

75. CARB, Draft Advanced Clean Fleets Total Cost of Ownership Discussion Document (Sept. 2021) https://ww2.arb.ca.gov/sites/default/files/2021-08/210909costdoc_ADA.pdf.

But the transition to ZE trucks is not happening at the pace necessary to address the public health crises created by truck pollution. As the Department of Energy’s study highlights, "it is possible that demand for ZEVs could rise rapidly in MD/HD trucks once cost parity is reached" but "manufacturing capacity…will need to increase commensurately to support vehicle adoption."76 Conventional manufacturers are incentivized to extend production of combustion trucks on existing manufacturing lines as long as possible to maximize the return on those old investments.77 Their current business model also relies on selling diesel trucks at a low cost with lucrative service and maintenance agreements.78 Setting a strong, feasible sales target in the final rule is critical to accelerate the transition to ZE trucks. The aforementioned ERM report found that a national ZEV sales requirement–with a schedule commensurate with the ACT rule–would result in 45 percent of the Class 4-8 fleet turning over to ZEV by 2040 and 73 percent by 2050.79 [EPA-HQ-OAR-2019-0055-1277-A1, pp. 18 - 19]

76. Id. at 3.

77. See, e.g., Peter Wiedenhoff et al., "What the Shift to Zero-Emission Vehicles Means for Commercial Transportation" (Mar. 22, 2022) https://www.bcg.com/en-us/publications/2022/what-the-shift-to-zero-emission-vehicles-means-for-commercial-transportation ("Most incumbents face the dual challenge of ensuring that their existing businesses remain profitable even as they tackle the investment-heavy challenges of developing electric powertrains.")

78. See, e.g. McKinsey&Company, Route 2030 – A Regional View of Truck Industry Profit Pools (Dec. 2018) at 7 ("[o]ur research reveals that advanced markets already exhibit greater profitability in aftersales than in new truck sales.") https://www.mckinsey.com/~/media/mckinsey/industries/automotive%20and%20assembly/our%20insights/a%20regional%20view %20of%20truck%20industry%20profit%20pools/a-regional-view-of-truck-industry-profit-pools-web-final.pdf .

79. Robo et al. 2022.

In terms of how to include a sales requirement, MFN recommends setting a separate ZE truck standard and phasing that standard in over time.80 This proposal is separate and additive to EPA's heavy-duty combustion engine requirements to ensure maximum emission reductions are achieved from new combustion engines. This structure is the preferred pathway to getting to zero-emissions, as it guarantees emission reductions from both the combustion engines and deployment of ZEVs. It also provides certainty to the market by identifying a clear schedule for the percentage of ZEVs that must be sold nationally. This market signal can help unlock additional resources from the public and private sector, such as charging infrastructure investments. By separating ZEV requirements from combustion engine requirements, this structure also avoids promoting "false solution fuels" such as natural gas vehicles. [EPA-HQ-OAR-2019-0055-1277-A1, p. 19]

80. For another example of a similar regulatory design, see Ray Minjares and John Hannon, ICCT, "Briefing: Adapting US heavyduty vehicle emission standards to support a zero-emission commercial truck and bus fleet" at 6-7 (Feb. 2020) (describing Dual Averaging Sets option) (available at: https://theicct.org/wp-

content/uploads/2022/02/HDV-US-adapting-vehicle-emission-stds-zeroemission-commercial-truck-bus-fleet-feb22.pdf). The key to whatever design option EPA chooses is to ensure that the standard provides a clear signal to manufacturers that they must begin ramping up production of ZE trucks, and that by 2035 the expectation is that all trucks can and will be zero-emissions.

The proposal currently sets standards for all trucks, including ZE trucks, see NPRM at 17458 (noting proposed 40 CFR 1036.104), but does not set the ZE standards based on what is achievable by ZE technology. The proposed standards are indefensible under the CAA because they fail to set standards that reflect the greatest degree of emission reductions achievable by ZE trucks and allow ZE trucks to undermine the greatest degree of emission reductions achievable by combustion engine vehicles. The appropriate criteria pollutant standard for ZE trucks is 0 g/hp-hr. EPA should set a ZEV standard and phase that standard in, over time. similar to EPA's approach for phasing in the Tier 2 standards for small volume manufacturers of light duty vehicles and trucks. See 40 C.F.R. § 86.1811–04(k). [EPA-HQ-OAR-2019-0055-1277-A1, p. 19]

MFN believes 20 percent of new sales in model year 2027 being ZEV is a feasible target, and that those targets can reasonably increase 10 percent each year, such that 50 percent of sales would need to meet the ZEV standard in model year 2030, and 100 percent by model year 2035. To comply with the stability requirements of Clean Air Act section 202(a)(3)(C), EPA could finalize a phase-in schedule using the three-year average sales target, and increase that target every three years in line with a 100% target beginning model year 2035. Thus, the first round of the ZEV standard would apply to 30% of sales for MY 2027- 2029. [EPA-HQ-OAR-2019-0055-1277-A1, pp. 19 - 20]

This initial round is consistent with the targets adopted by California, New York, New Jersey, Massachusetts, Washington and Oregon in the Advanced Clean Truck Rule, which requires between 15 and 30% of truck sales to be ZEVs between MY 2027-2029.81 It is in line with deployment rates projected in Europe82 and truckmakers' own voluntary commitments there to sell 100% zero-emission vehicles by 2040.83 Moreover, the fleet operators that are members of the Corporate Electric Vehicle Alliance have already made commitments to purchase 330,000 commercial ZEVs, which would represent roughly 9 percent of truck sales over the first three-year compliance period of MY27-MY29.84 [EPA-HQ-OAR-2019-0055-1277-A1, p. 20]

81. Claire Buysse et al., California's Advanced Clean Trucks regulation: Sales requirements for zero-emission heavy-duty trucks (July 2020) at 9 https://theicct.org/sites/default/files/publications/CA-HDV-EV-policy-update-jul212020.pdf.

82. "If Europe can deliver on its green Deal, with emission-cut targets rising to around 50% in 2030, the demand for green trucks will rise to as much as 50% of all the new ones sold." Peter Wiedenhoff et al., "What the Shift to Zero-Emission Vehicles Means for Commercial Transportation" (Mar. 22, 2022) https://www.bcg.com/en-us/publications/2022/what-the-shift-to-zero-emissionvehicles- means-for-commercial-transportation.

83. ACEA – PIK, Joint Statement – The Transition to Zero-Emission Road Freight Transport (Dec. 2020) https://www.acea.auto/files/acea-pik-joint-statement-the-transition-to-zero-emission-road-freight-trans.pdf.

84. CERES, "Major companies with large fleets release new electric vehicle 'blueprint' for car and truck manufacturers" (Jan 20, 2022) https://www.ceres.org/news-center/press-releases/major-companies-large-fleets-release-new-electric-vehicle-blueprint-car.

In the proposed rule, EPA requests comment on how the agency can best consider the potential for ZEV technology to significantly reduce air pollution from the heavy-duty vehicle sector, including but not limited to whether and how to consider including specific sales requirements for [heavy-duty] ZEVs. [EPA-HQ-OAR-2019-0055-1277-A1, p. 58]

While incentivizing zero-emission vehicle sales would be best incorporated into the NOx portion the EPA's final rule, it is possible to incentivize this transition through targeted revisions to the GHG Phase 2 program, as well, especially since these targeted updates are being crafted to reflect the "outlook for heavy-duty electric vehicles." [EPA-HQ-OAR-2019-0055-1277-A1, pp. 58 - 59]

Similar to our proposal above, in which a fleet averaging requirement that goes to zero g/bhp-hr emissions for spark ignition, light-, medium- and heavy heavy-duty engines through intermediate useful life and full useful life no later than 2035 proposed in the NOx section of our comments, EPA could make use of a fleet averaging requirement that increases in stringency and eventually goes to zero g of CO_2/ton-mile. This structure would allow ZEVs to play a larger role in "enabling stringent emission standards" and "balance further incentivizing zero and near-zero emissions vehicle development [while] ensuring that the standards achieve an appropriate fleet-wide level of CO_2 emissions reductions," both of which are stated considerations of EPA's, per the proposed rule. [EPA-HQ-OAR-2019-0055-1277-A1, p. 59]

Additionally, the EPA should further explore the relationship between the proposed rule and its Phase 2 stringency updates and the rapid electrification of the vehicle sectors the proposed updates intend to target. Ideally, EPA should set GHG stringency targets based on what the ICE engines are capable of meeting on their own, without averaging in zero-emission vehicles for compliance. Without taking this into account, the agency will be setting up many of the ICE vehicles in these sectors to backslide and avoid real-world emission improvements by allowing manufacturers to use ZEVs that were already expected to come to market for compliance – especially since EPA's proposal currently undercounts the ZEV market in MY 2027. [EPA-HQ-OAR-2019-0055-1277-A1, p. 59]

Organization: *National Association of Clean Air Agencies (NACAA)*

In addition to the NOx portion of this NPRM, EPA includes proposed "targeted updates" to the existing Heavy-Duty Greenhouse Gas Emissions Phase 2 program. The agency proposes to adjust the HD Phase 2 vehicle greenhouse gas (GHG) emission standards by sales-weighting the projected heavy-duty electric vehicle (EV) production levels of school buses, transit buses, commercial delivery trucks and short-haul tractors – four vehicle types EPA expects will have the highest EV sales of all HD vehicle types between now and 2030 – and by lowering the applicable emission standards in MY 2027 accordingly. EPA says that these updates are appropriate given the growing HD EV market and, considering other factors, including lead time and cost, would not fundamentally change the HD GHG Phase 2 program as a whole. [EPA-HQ-OAR-2019-0055-1232-A1, p. 16]

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For the past seven years, NACAA has urged EPA to develop and adopt a strong, technology-forcing rule to reduce NOx emissions from HD trucks. We welcomed President Biden's August 5, 2021, EO calling upon EPA to propose in January 2022 and finalize in December 2022 NOx standards for HD trucks for MYs 2027 through at least MY 2030 and begin work on a rule under the CAA, to be finalized by July 2024, to establish new GHG emission standards for HD engines to take effect as soon as MY 2030. In that same EO, the President called on EPA to consider the role zero-emission heavy-duty vehicles might have in reducing emissions from certain market segments and consider updating the existing GHG emissions standards for heavy-duty engines and vehicles beginning with model year 2027 and extending through and including at least model year 2029. [EPA-HQ-OAR-2019-0055-1232-A1, pp. 16 - 17]

NACAA's expressed preference was for EPA to reserve action on reducing GHG emissions from HD trucks for the July 2024 final rule so that EPA could focus on the immediate need for overdue HD NOx reductions and a final rule by not later than December 2022. While we support reducing HD truck GHG emissions, we do not want anything to impede the timely adoption of a final HD truck NOx rule. [EPA-HQ-OAR-2019-0055-1232-A1, p. 17]

Although NACAA's highest priority with this rule continues to be NOx reductions, we recognize that EPA's proposed updates can provide benefits in the form of increased fuel efficiency and reduced fuel consumption and pave the way for a more ambitious rule to be implemented as soon as MY 2030. Provided adopting EPA's proposed "targeted updates" to the Phase 2 truck provisions in no way slows the finalization of the NOx portion of the rule, impedes adoption of the NOx portion of the rule this year or undermines the rigor of the NOx program that NACAA recommends, NACAA supports the proposed targeted GHG updates. [EPA-HQ-OAR-2019-0055-1232-A1, p. 17]

Organization: *National Association of Clean Water Agencies (NACWA)*

NACWA also supports EPA's approach to allow both ZEVs and NZEVs. POTWs must use certain types of heavy-duty vehicles to repair and maintain their critical infrastructure. These vehicles must be able to cover long distances and operate for many hours, and often must be outfitted with specialized equipment or be capable of towing additional equipment. Heavy duty vehicles are also used to transport the biosolids produced by the wastewater treatment process for beneficial reuse as fertilizer or soil amendments, or for disposal in landfills. Since there are currently no ZEV options that can provide the necessary level of service for utilities, some NACWA members have already started purchasing NZEVs that are immediately available and emit 90 percent less NOx that current standards for heavy duty vehicles. EPA's approach to balance ZEV and NZEV development, while ensuring that vehicle options are available that can meet the needs of communities and the functions of POTWs, is both practical and environmentally protective. [EPA-HQ-OAR-2019-0055-1343-A1, pp.1-2]

Organization: *National Coalition for Advanced Transportation (NCAT)*

EPA's GHG emissions standards incentivize and support investment in the development and deployment of electric vehicles, other advanced low-emission and zero-emission vehicles and the infrastructure to support them. Federal vehicle standards have helped drive investment in electric vehicle manufacturing and technology because performance standards incentivize manufacturing vehicles with lower GHG and criteria pollutant emissions. Federal standards also play a key role in catalyzing major infrastructure and economic development plans. EPA's longer term GHG emissions standards for heavy-duty vehicles will play an important role by providing benchmarks to give manufacturers, state air agencies, public utility commissions and consumers a sense of long-term clarity. [EPA-HQ-OAR-2019-0055-1290-A1, p. 2]

NCAT's members collectively have invested, or are in the process of investing, billions of dollars in manufacturing electric vehicles and deploying charging-related infrastructure. NCAT members are making those significant investments and implementing long-term business strategies, in large part, to support the implementation of vehicle GHG emissions regulations. The regulations and resulting investments will stimulate technology innovation and market competition, enable consumer choice, attract private capital investments, and create high quality jobs. [EPA-HQ-OAR-2019-0055-1290-A1, p. 3]

Electric vehicles and other advanced technology vehicles and supporting infrastructure play a critical role in supporting U.S. global competitiveness, economic growth, energy security, and cost-effective protection of public health and environmental quality. To remain a leader in the global automotive market, the U.S. must continue to support policies that encourage adoption of electric and other advanced technology vehicles and related infrastructure to serve the needs of American consumers. Charging infrastructure providers continue to expand charging networks across the country and utilities are investing in the grid and transportation electrification infrastructure programs to support and complement those efforts. NCAT supports EPA adopting strong standards that continue to advance electric vehicle deployment and infrastructure investment. [EPA-HQ-OAR-2019-0055-1290-A1, p. 3]

The number of public and private electric vehicle chargers has increased dramatically. There are now more than 44,000 public charging stations across the U.S. with over 108,000 ports.4 Notably, this includes nearly 20,000 DC fast chargers nationwide.5 On average, the number of public chargers increased 30% from 2015 to 2019 in the top 50 most populous metropolitan areas.6 This trend of charging infrastructure build out is only accelerating. For example, Shell announced plans to build 500,000 charge points globally by 2025.7 Tesla's global network has grown to include over 3,000 Supercharger Stations with more than 27,000 individual connectors, as of August 1, 2021.8 In 2020, Tesla opened 743 new Supercharger locations around the world, which is an average of two new locations every day. Tesla's charging network also includes over 14,000 Destination Charging locations and over 28,000 Destination Charging connectors.9 Electrify America plans to invest $2 billion in charging infrastructure through 2026.10 [EPA-HQ-OAR-2019-0055-1290-A1, pp. 3- 4]

4. U.S. DOE Alternative Fuels Data Center, 'Alternative Fueling Station Counts by State,' https://afdc.energy.gov/stations/states (last updated Sept. 18, 2021).

5. Id.

6. Anh Bui, Peter Slowik, & Nic Lutsey, International Council on Clean Transportation, Update on Electric Vehicle Adoption Across U.S. Cities (August 2020) at 4-5, available at https://theicct.org/sites/default/files/publications/EV-cities-update-aug2020.pdf.

7. Shell, 'Shell Accelerates Drive for Net-Zero Emissions with Customer-First Strategy,' https://www.shell.com/media/news-and-media-releases/2021/shell-accelerates-drive-for-net-zeroemissions-with-customer-first-strategy.html (Feb. 11, 2021).

8. See Tesla, Supercharger, https://www.tesla.com/supercharger (last visited Sept. 24, 2021).

9. See Tesla, Destination Charging, https://www.tesla.com/destination-charging (last visited Sept. 24, 2021).

10. Electrify America, Our Investment Plan, https://www.electrifyamerica.com/our-plan/ (last visited Sept. 24, 2021).

Utilities are investing significantly in the build out of infrastructure related to electric vehicle charging. 'Throughout 2020, approved utility investment in transportation electrification increased three times over the amount approved in 2019' and almost $3 billion in utility electric vehicles programs have been approved through February 2021.11 Utilities have long-term planning horizons for considering investments in improvements to the electricity grid to support transportation electrification. In addition to preparing the grid to support increased electric vehicle adoption, utilities across the country have been planning and implementing significant transportation electrification infrastructure programs. As an example, in August of 2020, the California Public Utilities Commission (CPUC) approved NCAT member Southern California Edison's Charge Ready 2 program, a $437 million program that will fund the installation of approximately 38,000 charging ports.12 This program builds upon Southern California Edison's initial $22 million Charge Ready pilot in 2016, supporting the installation of 1,300 light-duty electric vehicle charge ports. NCAT member Exelon is part of the Electric Highway Coalition, a partnership among 14 U.S. utilities to create a seamless network of rapid electric vehicle charging stations connecting major highway systems, across the country from the Atlantic Coast through the Midwest, South and into the Gulf and Central Plains regions. Through approved programs at its utilities, Exelon will enable the installation of more than 7,000 residential, commercial and/or utility-owned charging ports across Maryland, D.C., Delaware and New Jersey.13 [EPA-HQ-OAR-2019-0055-1290-A1, p. 4]

11. Atlas Public Policy, supra note 42, at 13.

12. CPUC, Decision Authorizing Southern California Edison’s Charge Ready 2 Programs https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M345/K702/345702701.PDF (2020).

13. Exelon, Exelon Joins Electric Highway Coalition; Encourages EV Adoption, https://www.exeloncorp.com/newsroom/exelon-joins-electric-highway-coalition-encourages-ev-adoption (July 26, 2021).

Organization: *National Parks Conservation Association (NPCA)*

EPA’s proposed revisions to the Phase II GHG Standards to tighten existing standards in 2027 by 1.5% for school and transit buses, delivery vans, and short-haul tractors would result in only a .4% reduction in CO2 emissions for class 4-8 vehicles between 2027-2050.37 This level of reduction is drastically inadequate and falls far short of what is needed to limit global temperatures below the 2° C, which in itself is .5° C above the IPCC’s stated goal of limiting warming to 1.5° C. NPCA thus requests that EPA make additional improvements to the Phase II GHG standards for HD vehicles to drastically reduce GHG emissions and expand ZEV penetration in the coming years. [EPA-HQ-OAR-2019-0055-1314-A1, p.7]

37 Sara Kelly, et. al, ICCT comments on EPA’s proposed heavy-duty engine and vehicle standards, at slide 14, available at public-webinar_10May2022.pdf (theicct.org).

Analysis conducted by the International Council on Clean Transportation (ICCT) found that new heavy-duty ZEV sales of 46% or higher by 2030 are necessary to avoid a greater than 2° C increase in warming.38 To achieve this vital target of 46% or higher HD vehicle sales by 2030, we suggest EPA take a phased in approach to require sale mandates of 20% HD ZEV sales 2027, 30% in 2028, 40% in 2029, and 46% or greater in 2030, with an ultimate goal of achieving 100% HD ZEV sales in 2035. We believe this strategy is not only necessary to meet our climate goals but is also technologically achievable given recent advances in both short and long-haul HD vehicle technologies. Waiting until Phase III GHG standards will be too late. [EPA-HQ-OAR-2019-0055-1314-A1, p.7]

38 C. Buysse et al., Racing to Zero: The Ambition We Need for Zero-Emission Heavy-Duty Vehicles in the United States, International Council on Clean Transportation (Apr. 8, 2022), https://theicct.org/racing-to-zero-hdv-us-apr22/.

The approach taken by EPA in the in this rulemaking is far too conservative, and severely underestimates potential HD ZEV sales that will take place starting in 2027. For instance, EPA's analysis looks only at outdated projections conducted by CARB regarding HD ZEV adoption in California and fails to take into consideration additional factors such as dropping costs, improving technology, and growing public interest in HD ZEVs. Moreover, EPA's California focused analysis of HD ZEV potential fails to account for the growing list states that have adopted ACT, Omnibus, or HD Memorandum of Understanding (MOU), nor does it consider additional commitments at the federal, state, local, and private level. This underestimation of ZEV potential not only diminishes justifications for the feasibility of stringent ZEV advancements in the coming years, but when mixed with EPA's proposed ZEV credit scheme will incentivize industry to trade ZEVs that likely would already be purchased for additional NOx pollution harming localized communities. [EPA-HQ-OAR-2019-0055-1314-A1, p.7]

Organization: *National Waste & Recycling Association (NWRA)*

With the projected adoption of ZEVs in the waste industry, we ask that EPA work with U.S. Department of Transportation (USDOT) to resolve the issue of heavier battery vehicles needing to reduce the amount of mass they can haul to comply with truck weight restrictions. EPA and USDOT should work together to minimize pollution without sacrificing cargo carrying capacity of vehicles. This potential reduction of cargo capacity should also be included in EPA's economic analysis of the rule. [EPA-HQ-OAR-2019-0055-1242-A1, p. 2]

NWRA also asks that EPA work with the Department of Energy to understand the electrical load that would be needed to electrify the heavy-duty truck fleet. NWRA members are concerned that the electrical infrastructure is not expanding fast enough to support an electrified fleet. [EPA-HQ-OAR-2019-0055-1242-A1, p. 2]

Organization: *Natural Gas Vehicles for America (NGVAmerica)*

In its notice, EPA addresses the historic opportunity related to electric vehicles. However, we believe some caution should be exercised when it comes to evaluating the potential for electric vehicles to deliver significant emission reductions or to rapidly overtake the transportation sector. The successes to date have not been entirely a result of technology break-through and economics, but rather in our view have arisen in large part from the benefits of regulatory mandates, generous regulatory credits, and significant subsidies. [EPA-HQ-OAR-2019-0055-1330-A1, p.7]

There are many concerns related to the expectations surrounding battery electric vehicles. One concern, when it comes to plans to electrify everything, is the fact that the U.S. is a long way from being self-sufficient when it comes to sourcing and supply of the metals needed to support batteries. The New York Times and other media outlets have highlighted the concerns over becoming reliant on China and others for rare earth minerals and other critical components for batteries.13 Not only are these materials largely not available in the U.S. but the extraction and processing of these materials produces significant greenhouse gas emissions. Before moving further to increase reliance on battery electric vehicles it is important to understand how these negative consequences will be addressed. [EPA-HQ-OAR-2019-0055-1330-A1, p.7]

13 'A Power Struggle Over Cobalt Rattles the Clean Energy Revolution,' New York Times, November 20, 2021. This article highlights that China dominates the production and processing of clean energy metals.

Another issue of concern is the recent increase in costs of battery components, which like almost everything else are going up.17 But there is a difference with respect to battery costs. [EPA-HQ-OAR-2019-0055-1330-A1, p.7]

17 Precious Metal Values are Raising Battery Prices and Slowing EV Uptake, Newsweek April 4, 2022; Rising Battery Costs Hit Carmakers, Threaten Climate-Change Push, Bloomberg Nov. 30, 2021; https://www.bloomberg.com/news/articles/2021-11-30/even-the-battery-boom-can-t-escape-world-s-supply-chain-woes; Rising Battery Prices Add Uncertainty to Electric-Vehicle Costs: Demand for lithium outstrips supply, ending yearslong price declines, WSJ Feb 5, 2022.

The significant increase in demand at some point was always going to impact supply and costs. With mandates for light duty vehicles and now also heavy-duty vehicles, and with increased efforts to install battery storage as a means of storing and then supplying renewable energy, there was going to be an impact on pricing. It has long been presumed that battery prices would keep falling but few appear to really be looking at whether that is truly a reasonable assumption. [EPA-HQ-OAR-2019-0055-1330-A1, p.8]

Another concern with the push for electric vehicles in trucking is that that this technology is largely unproven from the standpoint of deployability, scalability, dependability, and cost-effectiveness. Many of the companies touting the ready availability of electric trucks are new market entrants with no track record of manufacturing, servicing, or supporting motor vehicles in actual use. Regarding their claims that the technology will be less costly to operate, there is insufficient data to support the argument because the vehicles are only now starting to be deployed. Another claim is that over time these trucks will cost less to purchase as the cost of batteries comes down, despite the significant increase in demand for battery materials and batteries. Consider the views expressed recently by Daimler Truck, a company that has many years of experience in manufacturing and supporting trucks. Daimler Truck CEO, Martin Daum stated, 'The first truth is, in heavy-duty commercial vehicles you need such a huge amount of energy, meaning you need such large batteries, that such a truck always will cost significantly more than a combustion engine powered truck.'18 [EPA-HQ-OAR-2019-0055-1330-A1, p.8]

18 Meghana Kandra, 'Daimler CEO Talks About Advancements in Heavy Electric Duty Truck', https://www.cnbc.com/2021/11/12/too-risky-to-not-use-battery-and-hydrogen-tech-daimler-truck-ceo.html, November 13th, 2021.

Claims regarding cost-effectiveness almost always overlook factors such as range, utility, and fleet turnover. In many cases, it appears that fleets deploying shorter-range electric vehicles will need to deploy more trucks to move the same amount of freight. The implications of this are huge (especially in case of upstream emissions associated with vehicle and battery production) as trucking fleets will need more trucks and more drivers in some cases if they deploy electric trucks. These factors appear to be ignored in cost-comparisons and emission comparisons, but they have significant implications. For shorter range trips and vehicles that do not accumulate significant daily mileage, electric trucks may be an excellent option, but it is also true that in these applications there is less opportunity to reduce fuel consumption and offset pollution. Few assessments acknowledge the additional monetary investments required and enormous challenges associated with the establishment of statewide heavy-duty vehicle charging infrastructure – including the build out of charge points, mandatory grid upgrades, and the expansion of transmission capacity – that must complement these new battery electric vehicle purchases once they are market ready and deployable. [EPA-HQ-OAR-2019-0055-1330-A1, p.8]

A number of recent reports have highlighted concerns regarding whether the electricity grid is ready for electric vehicles. One recent review of this issue by the Washington Post focused on the issues specific to New York state.19 Based on that report it appears that there are some very serious challenges to preparing the grid so that it can transport renewable electricity to the locations it will be needed to serve electric vehicles, and additional challenges installing necessary charging equipment. [EPA-HQ-OAR-2019-0055-1330-A1, pp.8-9]

19 https://www.washingtonpost.com/business/2021/10/13/electric-vehicles-grid-upgrade/

The infrastructure issue and challenges of getting electricity to where it is most needed goes to the issue of scalability and deployability which could significantly frustrate electrification plans even if vehicles become readily available and are lower in cost. An article published recently by Oregon Public Broadcasting highlights the very real concerns expressed by representatives of the trucking industry. Here are excerpts from that article: Oregon Trucking Associations President Jana Jarvis said there are opportunities for new technologies for the trucking industry but she's not sure if electric trucks are the fuel for the future, especially for medium- to heavy-duty trucks…it's unclear what the future holds when it comes to batteries and charging stations along transportation routes to ensure that trucks can deliver freight efficiently. 'Then you think about having to stop and recharge — if there was a charging infrastructure and if there was enough grid capacity. And both of those are questions today,' she said. 'You start thinking about doing that every couple hundred miles and you realize the inefficiencies the trucking industry would be subject to by conversion to electric vehicles.' Jarvis said some of her association's larger companies are trying to use electric trucks but getting the charging infrastructure installed in their terminals has been difficult, depending on their location. 'In many parts of the state there just isn't the grid capacity to accommodate that,' she said.20 [EPA-HQ-OAR-2019-0055-1330-A1, p.9]

20 M. Samayoa, OPB.org, Zero emissions trucks could be soon be required in Oregon (Nov. 15, 2021); https://www.opb.org/article/2021/11/15/zero-emissions-trucks-could-soon-be-required-in-oregon/

Even if electric vehicles become the dominate technology in coming years, there will continue to be applications and uses that are not a good fit for electric vehicles. For example, commercial pickup trucks operated in rural and remote parts of the country requiring extended range could continue to be an excellent niche market for natural gas. It also is unlikely that electric trucks will satisfy the needs of longer-range, medium- and heavy-duty trucks operating in challenging conditions or operating with a full load. [EPA-HQ-OAR-2019-0055-1330-A1, p.12]

Organization: Nikola Corporation

[*From Hearing Testimony, April 14, 2022, Alana Langdon, Nikola Corporation*] I am the head of government affairs and global policy at Nikola Corporation. On behalf of Nikola, we appreciate the opportunity to express our support for reducing pollution and the carbon emissions footprint from heavy-duty trucks through this EPA rulemaking process. Founded in 2015, Nikola has now grown over to 1,000 employees headquartered in Phoenix, Arizona, with manufacturing operations in Coolidge, Arizona. Nikola is a leading manufacturer of heavy-duty zero-emission commercial battery-electric and fuel cell electric vehicles and energy solutions. Nikola's mission is to transform the transportation industry while improving our employees' lives and leaving the world a better place. This includes doing our part to increase the health and well-being of communities impacted by heavy trucking. Our products and services are built to deliver on those core commitments by manufacturing BEV and fuel cell electric vehicle trucks plus working with strategic business partners and suppliers to build a complete infrastructure ecosystem that will support the transition to zero-emissions trucking. Operating as both a zero-emissions OEM and an energy company, Nikola is a game changer in the marketplace, transforming the future of the heavy-duty transportation sector, focused on addressing the entire value chain to deliver an economic total cost of ownership to fleets, which includes access to trucks, fuel, service, and maintenance for our customers. Nikola's truck portfolio of BEV and fuel cell offerings aims to address the short-, medium-, and long-haul applications of heavy trucking. Our current manufacturing capacity in Coolidge is up to 2,400 trucks per year and we are in the process of expanding our manufacturing facilities to be capable of manufacturing up to 20,000 trucks per year in late 2023. We delivered the first of several pre-series battery electric Tre BEV class eight trucks to our launch customer, Total Transportation Services, in December 2021 at the Port of Los Angeles, and started production of the Tre BEVs at our manufacturing facility on March 21st, 2022. Nikola has begun delivering the Tre BEV to customers in our dealer network across the country, anticipating between 300 to 500 Tre BEVs to be completed this year. The battery electric vehicle has a 753-kilowatt battery onboard with a 350-mile range. The battery pack is modular and can be reduced for shorter distances and to maximize payloads customized for our customers' operational needs and use cases. The next vehicle to market, the Nikola Tre fuel cell vehicle, has 70 kilograms of hydrogen on board with a 500-mile range. The Nikola fuel cell vehicle will enter production in 2023, and earlier this year, we delivered two of these alpha fuel cell vehicles to our launch customer, Anheuser-Busch, just in time for delivery of their first zero-carb beer for the Super Bowl. These vehicles were fueled at our headquarters facility in Phoenix and made the over 350-mile trek to Ontario, California, with hydrogen fuel to spare, showing that hydrogen fuel cell heavy-duty trucks are just around the corner. And finally, the Nikola Two sleeper cab fuel cell will arrive in 2025, addressing the long-haul commercial needs supported by a national hydrogen network of production and fueling facilities being developed by Nikola and our partners. In closing, we look forward to providing more details in our written comments in response to the proposed rule. However, we did want to take the opportunity to convey our support during these public hearings. As an American company, Nikola is excited about the role our innovative vehicle truck technology is and will play to advance cleaner transportation and energy technologies that will yield a healthier tomorrow while also creating jobs that will contribute to our nation's economic prosperity for generations to come. [EPA-HQ-OAR-2019-0055-2867]

Organization: *Northeast States for Coordinated Air Use Management (NESCAUM)*

Should EPA instead promulgate Option 1, we urge the Agency to make the following changes to the proposed standards: EPA estimated the percent sales of HD ZEVs in the baseline to be 1.5 percent ZEV sales in 2027. We urge EPA to update this estimation in the final rule to reflect recent substantial changes in heavy-duty ZEV technology, the regulatory landscape, and the market for heavy-duty ZEVs. EPA relied on the "medium" projection case from the NREL Electrification Futures study and EIA's 2018 Annual Energy Outlook for its heavy-duty ZEV sales estimate for 2027. Since the 2018 EIA Outlook and the Electrification Futures study have been published, CARB finalized the Advanced Clean Trucks regulation and five states outside of California have adopted the regulation as of April 2022 – Massachusetts, New Jersey, New York, Oregon, and Washington. Taken together, registered trucks and buses in these six states comprise over 20 percent of registered trucks and buses in the U.S.39 In addition, CARB has proposed the Advanced Clean Fleets rule40 that will increase the percent requirement for heavy-duty ZEVs above and beyond the ACT requirement in California. As a result of these regulatory actions, NESCAUM estimates a minimum of 30,000 class 4 to 8 heavy-duty ZEVs will be required to be sold in 2027 in California and states that have finalized the ACT regulation combined. In 2028, the number of class 4 to 8 heavy-duty ZEVs that will be required to be sold in the states that have adopted the ACT regulation will exceed 45,000 vehicles. This estimate likely underestimates the number of ZEVs that will be introduced as it does not account for heavy-duty ZEV sales in states outside of Section 177 states that have adopted ACT. It also does not account for the adoption of ACT in states that are currently proceeding with ACT adoption but have not yet finalized the regulation. Nor does it account for state specific heavy-duty zero emission sales requirements and goals above and beyond ACT requirements.41 As noted above, heavy-duty ZEV sales in years subsequent to 2027 will increase significantly as required by the ACT regulation. These requirements should be taken into consideration in EPA's baseline assessment. [EPA-HQ-OAR-2019-0055-1249-A1, pp. 12 - 13]

> 39. Federal Highway Administration, "Highway Statistics 2019." Available at Highway Statistics 2019 - Policy | Federal Highway Administration.
>
> 40. California Air Resources Board, "Advanced Clean Fleets" Regulation." Available at Advanced Clean Fleets | California Air Resources Board.
>
> 41 An example is New York State Education Law §3628 that requires no later than July 1, 2027, every school district shall only purchase or lease zero-emission school buses when purchasing or leasing new buses.

In addition to changes in the regulatory landscape, much has changed from a cost and technology standpoint since the studies EPA relied on in its analysis were published. The Electrification Futures study was published in 2017 and relied on studies published in 2016 for battery cost information. Since that time, significant improvements in battery technology have occurred. Rapid advances in battery chemistries, increased energy density, and more efficient pack design have driven sharp reductions in battery costs, which are the single largest factor influencing ZEV purchase prices. During the last decade, battery prices declined by nearly 90 percent and a steady decline in battery prices is forecasted through 2030. Declining battery costs and technology advances will be reflected in lower prices and longer ranges for vehicles, leading to an improved business case for electrification and making zero-emission trucks and buses more affordable. [EPA-HQ-OAR-2019-0055-1249-A1, p. 13]

EPA asks for comment on whether or not the “medium” NREL Electrification Future study assumptions should be used in the Agency’s assessment of heavy-duty ZEV sales in 2027. For the above reasons, NESCAUM recommends EPA not rely on the NREL “medium” scenario. We urge EPA to conduct a more up-to-date analysis to estimate heavy-duty ZEV sales in model years 2027 and later. An up-to-date analysis would estimate heavy-duty ZEV sales resulting from ACT regulation adoption in California and Section 177 states, quantify sales resulting from additional state heavy-duty ZEV requirements, and use more recent projections of heavy-duty ZEV sales, such as NREL’s March 2022 study and ACT Research’s 2021 analysis.42,43 [EPA-HQ-OAR-2019-0055-1249-A1, p. 13]

> 42. National Renewable Energy Laboratory, “Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero Emission Vehicles Cost Analysis,” March 2022. Available at Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis (accessed May 12, 2022).
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> 43. ACT Research, “Charging Forward 2020-2040 BEV & FCEV Forecast & Analysis,” updated December 2021. Available at CV Electrification Study - ACT Research Co., LLC (accessed May 12, 2022).

Organization: *Our Children's Trust*

Decarbonization of the transportation sector and other combustion engines is critical to achieving greenhouse gas emission reduction goals. Experts have opined that '[t]ransportation electrification is the most critical sector to achieve these electrification goals in due to the volume of liquid fuels it currently consumes.'6 [EPA-HQ-OAR-2019-0055-1317-A1, p.3]

> 6 Ben Haley et al., Evolved Energy Research, 350 PPM Pathways for the United States 38 (2019).

EPA must increase the stringency of its Phase 2 MYs 2027-2029 and beyond standards. These should be as stringent as possible and strive for electrification of the heavy-duty truck industry by 2030 and no later than 2035. It is EPA’s job to do as much as it can to push the transition to zero emissions to protect the air and climate for children and future generations. These standards need to go further faster so that the entire transportation sector, and supporting industrial sectors, can plan and respond as quickly as feasible. The technology is there to expedite the transition away from the internal combustion engine and eliminate their sales by 2030 for heavy duty vehicles. [EPA-HQ-OAR-2019-0055-1317-A1, pp.3-4]

Organization: *Public Citizen and Healthy Port Communities Coalition (HPCC)*

EPA should support an accelerated transition of the trucking industry toward zero emissions vehicles. [EPA-HQ-OAR-2019-0055-1417-A2, p. 4]

Heavy Duty vehicle manufacturers need to eliminate tailpipe emissions. The only way that we see this achieved is through the widespread adoption of zero emissions vehicles. Zero-emission, battery electric technology will address public health and the climate crisis without the risk of emissions cheating or SCR failure. [EPA-HQ-OAR-2019-0055-1417-A2, p. 4]

This EPA Proposal changes standards for school buses, transit buses, delivery trucks, and short haul tractors because EPA believes that the battery electric vehicle market is changing most rapidly in these areas. We believe that EPA should take a more proactive stance in moving forward zero emission heavy duty vehicles across the board. [EPA-HQ-OAR-2019-0055-1417-A2, p. 4]

While the market penetration of zero emission heavy-duty vehicles is still quite low, deployment is expected to ramp up quickly, according to Calstart13. The report states, “A complete transition to ZET technology would not only help mitigate the impacts of climate change and poor air quality but could eventually lower total cost of ownership (TCO) for fleets and create job growth in the United States.” [EPA-HQ-OAR-2019-0055-1417-A2, p. 4]

13. https://calstart.org/wp-content/uploads/2022/02/ZIO-ZETs-Report_Updated-Final-II.pdf

A recent Department of Energy14 study echoed these findings and showed that costs of zero emissions vehicles are decreasing. According to the study, by 2030, about half of the market-ready zero emissions medium- and heavy-duty trucks will cost less to purchase, maintain, and operate than medium- and heavy-duty diesel trucks. The study further states that zero emissions vehicles can be a boon to the US economy. US Secretary of Energy Jennifer Granholm states:

DOE is showing a clear pathway for trucking companies to make the switch from diesel to electric that will help them cut costs and pollution for their customers, while combating climate change. The Biden Administration’s comprehensive approach is working to make clean transportation a reality—by reducing exposure to volatile fuel prices, investing in American manufacturing and creating a national charging network to support more electric vehicles on the road.15 [EPA-HQ-OAR-2019-0055-1417-A2, p. 4]

14. https://www.nrel.gov/docs/fy22osti/82081.pdf

15. https://www.energy.gov/articles/doe-projects-zero-emissions-medium-and-heavy-duty-electric-trucks-will-be-cheaper-diesel

Because battery prices are dropping swiftly and the energy intensity of batteries is improving, zero emission battery electric trucks are primed to accelerate in adoption–if they can acquire the strong policy support needed to overcome higher upfront costs16. This is why it is necessary for the EPA to lay out a strong foundation for the adoption and implementation of zero emission battery electric trucks. [EPA-HQ-OAR-2019-0055-1417-A2, p. 4]

16. https://eta-publications.lbl.gov/publications/why-regional-and-long-haul-trucks-are

Some states are moving forward with their own policies to reduce harmful NOx emissions, like California, which set a goal for engines to cut NOx by 75% below current standards starting in 2024 and by 90% in 2027.17 This rule sets progressive electrification targets to help achieve these reductions.18 Because all components of the new rule will be phased in, engine manufacturers will have time to prepare for compliance. [EPA-HQ-OAR-2019-0055-1417-A2, pp. 4 - 5]

17. https://www.greencarcongress.com/2020/08/20200829-carb.html

18. https://www.scientificamerican.com/article/california-passes-historic-clean-truck-rule/

Several states and the District of Columbia have set targets to advance zero emission trucks and buses, aiming for 100% of sales to be zero emission by 2050. The interim goal is for 30% of vehicle sales to be zero emission by 2030.19 [EPA-HQ-OAR-2019-0055-1417-A2, p. 5]

19. Ibid 12.

However, given both the contribution of the greenhouse gas emissions from the trucking industry and the urgency of the climate crisis, we call on the EPA to reach 100% zero emission truck sales by 2035. [EPA-HQ-OAR-2019-0055-1417-A2, p. 5]

Organization: *Retail Industry Leaders Association (RILA)*

As EPA discusses in its proposed rule, the previously unanticipated acceleration towards electrification for heavy-duty (HD) zero-emission vehicles (ZEVs) will inherently reduce the aggregate GHG emissions from HD vehicles, even if the HD non-ZEVs do not exhibit emission reductions. EPA's proposed shift to more stringent heavy-duty 'phase 2' GHG emissions standards can therefore be viewed positively, as it responds to the quickened pace for the emergence of HD ZEVs. [EPA-HQ-OAR-2019-0055-1189-A2, pp.6-7]

As a supplement to these standards comments, EPA is encouraged to also review RILA's February comments submitted to FHWA/DOT in response to their Request for Information: Development of Guidance for Electric Vehicle Charging Infrastructure Deployment for more information about the RILA's views and suggestions concerning:

- accelerating fleet operational efficiency,
- enabling the role of fleet transition fuels and technologies,
- adapting regulatory processes to meet the needs of a widescale charging infrastructure rollout,
- pursuing public-private partnerships,
- investing in infrastructure designed to surpass the design and performance of current transportation refueling networks and facilitate the collaboration necessary for their success, and
- expeditiing adoption and availability of medium- and heavy-duty low and zero emission vehicles (ZEVs) by lowering upfront costs. [EPA-HQ-OAR-2019-0055-1189-A2, p.6]

One of the factors expected to drive adoption of HD ZEVs is California's development and adoption of Advanced Clean Truck (ACT) rules, that require manufacturers to increase the promotion of HD ZEVs sold within the state as a share of their overall HD vehicle sales annually over an annual implementation schedule. These ACT rules have also been adopted by five other states and been proposed for adoption in several others. The states that have adopted ACT rules account of over 20 percent of medium-duty and heavy-duty3 (MDHD) 2019 vehicle stock,4 while states that have proposed ACT rules account for nearly three percent more. Additionally, a total of 17 states and the District of Columbia have signed a joint memorandum of understanding (MOU) to join a Multi-State Medium- and Heavy-Duty Zero-Emissions Vehicle (MHD ZEV) initiative to develop a MHD ZEV Action Plan for rapid electrification of trucks and buses. Jurisdictions within the United States that are signatory to this MOU account for more than 36 percent of MDHD 2019 stock 4. This multi-jurisdictional MOU is anticipated to further accelerate the adoption of electrified heavy-duty trucks.[EPA-HQ-OAR-2019-0055-1189-A2, p.7]

3 Vehicles with gross vehicle weight rating (GVWR) class 2b-8

4 IHS Markit, 2019 United States stock data

Although the anticipated effectiveness or success of ACT rules and the MHD ZEV Action Plan against their stated objectives will not be known for at least several years to come and that enticing a rule in of itself does guarantee future market feasibility, their presence is expected to induce an increased presence of HD ZEVs across the United States. EPA's proposed rule mentions California's adoption of ACT rules. Similarly, the count of states having signed the MOU to join the MHD ZEV initiative has increased by three since EPA drafted the proposed rule. This signals both that the acceleration of HD ZEV adoption is likely to increase, and that EPA's proposed rule changes for HD GHG emissions still underestimates the full extent of the actual HD ZEV market penetration by 2027. EPA is therefore encouraged to review its estimates against these recent developments to identify if a more stringent GHG emissions standard is warranted. [EPA-HQ-OAR-2019-0055-1189-A2, p.7]

Organization: *Rivian Automotive, LLC (Rivian)*

EPA could likely adopt an even more stringent standard than Option 1, which should serve as a floor in agency deliberations on a final rule. This is because EPA has “not relied on the use of” hybrid or ZEV technologies in the development of the co-proposals offered in the NPRM. Seemingly, this was justified by the agency’s assessment that ZEV uptake will remain low enough through the MY2027 timeframe as to not “meaningfully impact” the analysis or proposal development.9 Rivian believes this fails to account for existing trends in the MHD ZEV market and underestimates the likely ZEV penetration rate in the second half of the decade. EPA currently predicts that just 1.5 percent of truck and bus sales will be battery-electric vehicles (“BEVs”) in MY2027. However, six states, representing 20 percent of national MHD vehicle registrations, have already adopted the Advanced Clean Trucks (“ACT”) standard, which sets a minimum level of zero-emission vehicle sales in these states. Additional states are likely to follow suit in the coming months and years. The ACT rule requires that ZEVs comprise 20 percent of Class 4-8 sales in MY2027 and 15 percent in other truck classes.10 This regulation alone appears highly likely to drive ZEV uptake well above 1.5 percent nationally by that time. Wider deployment of ZEVs than EPA currently anticipates could support a standard stronger than Option 1 and we encourage the agency to analyze that possibliity. [EPA-HQ-OAR-2019-0055-1229-A1, pp.3-4]

9 Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, 87 Fed. Reg. 59, 17,458 (Mar. 28, 2022) (revising 40 C.F.R. Parts 2, 59, 60, 80, 85, 86, 87, 600, 1027, 1030, 1033, 1036, 1037, 1039, 1042, 1043, 1045, 1048, 1051, 1054, 1060, 1065, 1066, 1068, and 1090).

10 13 C.C.R. §1963.

EPA rightly notes major progress in electrifying MHD vehicles and describes the current moment as an "historic opportunity" to achieve even greater emissions reductions from the sector. It is also important that the agency capitalize on the progress already seen to position the industry for what will necessarily be even more ambitious rulemakings later in the decade. To do so, Rivian encourages EPA to more fully account for the expected rate of truck and bus electrification in a BAU scenario. Stated industry commitments and strong state-level policy all suggest that this proposal has underestimated where the MHD ZEV market will be by MY2027.[EPA-HQ-OAR-2019-0055-1229-A1, p.7]

Organization: *Sierra Club, NJ Chapter*

EPA's proposed rule has requirements that do not come into effect until 2031 in order for technology to be fully available. Plenty of data shows, however, that this technology is already here and ready for use. Currently, there are over 100 models of zero emissions trucks and buses available and more coming in the future. The technology is here, now we just need the policy and standards to match it. As further evidence of this, there are already 6 States in the country that have adopted clean truck policies that go above and beyond the EPA's proposal. [EPA-HQ-OAR-2019-0055-2558, p. 1]

These states, my State being one of them, to name them: California; Oregon; Washington; New York; New Jersey; and Massachusetts, account for 20% of the truck market. However, the proposed EPA rule would only yield 1.5% of zero-emission new truck sales by 2027. To be specific, these 6 State policies will yield 40 to 75% of new zero-emissions truck sales by 2035. [EPA-HQ-OAR-2019-0055-2558, p. 1]

The US EPA can and must do more, because of three main reasons: 1) the technology is available; 2) other States are already doing it; and 3) most importantly, so all communities in the country, not just the ones from States with adequate clean truck policies, and especially those communities that are overburdened with pollution and economically disadvantaged, benefit from the same targets towards cleaner air. It is what is fair, equal clean air. [EPA-HQ-OAR-2019-0055-2558, pp. 1 - 2]

New Jersey's transportation sector accounts for 42% of greenhouse gas emissions, the largest contributor, to which medium duty and heavy duty vehicles, aka buses and trucks, account for a significant portion. Of course, that equally means a huge contribution of co-pollutants: NOx, Particulate Matter (PM), black carbon, a subset of PM, and other air toxics like benzene. The latest available data by NJ's State Department of Environmental Protection indicates that the highest carcinogenic risk driver in our State is diesel PM with a maximum predicted risk of 1,447 in a million, and a range of 100 to 300 in a million risk in the heavily trafficked areas like those surrounding I-95. These risk estimates are based on EPA's NATA or National Air Toxics Assessment data, your data. [EPA-HQ-OAR-2019-0055-2558, p. 2]

Although New Jersey will benefit from the clean truck rule recently adopted, federal action is absolutely necessary in order to move the manufacturers into a zero-emissions market. When we holistically move the market, everything else follows. Climate action cannot wait, and this proposed rule, if done correctly, will significantly deliver to the effort. [EPA-HQ-OAR-2019-0055-2558, p. 2]

Organization: *Southern Environmental Law Center (SELC)*

EPA's proposal underestimates ZEV penetration rates in light of declining costs and state requirements and initiatives, which results in less-stringent standards that do little to accelerate ZEV adoption in medium- and heavy-duty vehicles. [EPA-HQ-OAR-2019-0055-1247-A1, p.1]

As discussed further below, proposed Option 1 for the criteria pollutant emissions standards and the revised Phase 2 greenhouse gas (GHG) emissions standards do not go far enough. [EPA-HQ-OAR-2019-0055-1247-A1, p.1]

The standards should also be fully aligned with the California Heavy-Duty Omnibus Regulation in 2027, establish minimum ZEV production requirements, and preserve the stringency of GHG emissions requirements for internal combustion engine vehicles. [EPA-HQ-OAR-2019-0055-1247-A1, p.1]

At a minimum, EPA should fully align its criteria pollutant emissions standards with the California Heavy-Duty Omnibus Regulation in in 2027, establish minimum ZEV production requirements, and preserve the stringency of GHG emissions requirements for internal combustion engine vehicles. [EPA-HQ-OAR-2019-0055-1247-A1, p.8]

The stringency of both the proposed criteria pollutant emissions standards and the revised Phase 2 GHG emissions standards is undermined because EPA underestimates ZEV market penetration. When analyzing the feasibility of the proposed standards, EPA projects that only approximately 1.5 percent of medium- and heavy-duty vehicles will be ZEVs in model year 2027.20 Based on this estimate, EPA did not consider ZEV technologies when developing the criteria pollutant standards since the low ZEV market penetration would not 'meaningfully impact [the] analysis of the proposed [standards].'21 Similarly, this low projection influenced the stringency of the revised GHG Phase 2 emissions standards because the proposed reduction in the numeric standards is equal to 'the projected percentage of electric vehicles' in certain vehicle subcategories.22 [EPA-HQ-OAR-2019-0055-1247-A1, p.4]

20 Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, 87 Fed. Reg. 17414, 17458, 17601 (proposed Mar. 28, 2022).

21 Id. at 17458.

22 Id. at 17599.

In developing its ZEV market penetration rate, EPA failed to consider the full scope of regulations and policies adopted by states related to medium- and heavy-duty ZEV deployment. EPA included data from the California Air Resources Board's (CARB's) Advanced Clean Trucks (ACT) rulemaking in its projections,23 but the estimate does not seem to account for the six other states—Oregon, Washington, New York, New Jersey, Massachusetts, and Connecticut—that have also adopted the ACT regulations. The ACT regulations establish binding requirements that progressively increase the percentage of medium- and heavy-duty ZEVs that must be sold in these states starting in model year 2025.24 By model year 2035, ZEVs will be required to make up approximately 55 percent of Class 2b-3 vehicle sales, 75 percent of Class 4-8 Group sales, and 40 percent of Class 7-8 tractor sales in these states,25 which make up over 20 percent of the national fleet of medium- and heavy-duty vehicles.26 [EPA-HQ-OAR-2019-0055-1247-A1, p.4]

23 Id. at 17600.

24 ELEC. TRUCKS NOW, States Are Embracing Electric Trucks, https://www.electrictrucksnow.com/states (last visited May 9, 2022).

25 See CAL. AIR RES. BD., Updated Informative Digest, 5 (Jan. 20, 2021), https://ww3.arb.ca.gov/regact/2019/ act2019/uid.pdf. The ACT regulations provides some compliance flexibility through the use of credits. Id. at 6.

26 Press Release, Earth Justice, New York State Advances Clean Trucks Rule to Electrify Vehicles (Dec. 30, 2021), https://earthjustice.org/news/press/2022/new-york-state-advances-clean-trucks-rule-to-electrify-vehicles.

EPA also does not seem to consider the impact of commitments made in the Multi-State Medium- and Heavy-Duty Vehicle Memorandum of Understanding (MOU) when calculating national ZEV market penetration. In addition to the states that have adopted the ACT regulations, Colorado, Hawaii, Maine, Maryland, Nevada, North Carolina, Pennsylvania, Rhode Island, Vermont, Virginia, and Washington D.C. have signed the MOU.27 These 18 jurisdictions have committed to a goal of having at least 30 percent of all new medium- and heavy-duty vehicle sales be ZEVs by no later than 2030, and 100 percent of sales being ZEVs by no later than 2050.28 [EPA-HQ-OAR-2019-0055-1247-A1, pp.4-5]

27 Press Release, Northeast States for Coordinated Air Use Mgmt., NESCAUM Welcomes Nevada's Participation in the Multi-State Zero-Emission Electric Trucks Initiative (Mar. 31, 2022), https://www.nescaum.org/documents/ nescaum-welcomes-nevada-s-participation-in-the-multi-state-zero-emission-electric-trucks-initiative/.

28 Multi-State Medium- and Heavy-Duty Zero Emission Vehicle Memorandum of Understanding, https://www.nescaum.org/documents/mhdv-zev-mou-20220329.pdf/ (last updated Mar. 29, 2022).

Finally, declining costs and other economic forces are also likely to drive higher deployment of medium- and heavy-duty ZEVs in coming years. A study by the National Renewable Energy Laboratory found that ZEVs in all medium- and heavy-duty vehicle classes could reach cost parity with diesel vehicles by 2035, even without incentives.29 Coupled with the deployment of charging and refueling infrastructure, this could result in ZEVs accounting for 42 percent of medium- and heavy-duty sales by 2030, and over 99 percent of sales by 2045.30 [EPA-HQ-OAR-2019-0055-1247-A1, p.5]

29 Catherine Ledna et al., NAT'L RENEWABLE ENERGY LAB'Y, Decarbonizing Medium- & Heavy-Duty On-Road Vehicles Cost Analysis (Mar. 2022), https://www.nrel.gov/docs/fy22osti/82081.pdf.

30 Id.

These factors will have significant impacts on the medium- and heavy-duty vehicle market and will likely drive national ZEV market penetration rates higher than EPA's projected 1.5 percent. EPA should therefore re-evaluate the stringency of its proposed standards after accounting for a higher ZEV market penetration rate. [EPA-HQ-OAR-2019-0055-1247-A1, p.5]

Although EPA characterizes the current rulemaking as a minor revision of the Phase 2 GHG emissions standards, bold action is needed to put the medium- and heavy-duty vehicle fleet on the path to eliminating GHG tailpipe emissions and to set the stage for increasingly stringent standards in model year 2030. Establishing minimum ZEV production requirements—similar to requirements in the ACT regulations—is one of the best ways to accelerate the transition to ZEVs. EPA should therefore consider setting fleetwide minimum ZEV production requirements to achieve 20 percent ZEV sales by model year 2027, 30 percent ZEV sales by model year 2028, and 40 percent ZEV sales by model year 2029. [EPA-HQ-OAR-2019-0055-1247-A1, pp.6-7]

As manufacturers increasingly rely on ZEVs to meet the Phase 2 GHG emissions standards, manufacturers may continue to produce more-GHG-polluting internal combustion engines. Modeling shows that the currently proposed revisions to the GHG standards could result in internal combustion engine vehicles emitting more GHGs in model year 2027 than they did in model year 2017.40 For this reason, any revisions to the Phase 2 GHG emissions standards should preserve the original standard's stringency for internal combustion engine vehicles. Introducing ZEV production requirements could help to separate the regulation of ZEVs and internal combustion engines and allow EPA to better ensure that gains in ZEVs deployment do not erode the stringency of the requirements intended for internal combustion engine vehicle. [EPA-HQ-OAR-2019-0055-1247-A1, p.7]

40 Sara Kelly et al., INT'L COUNCIL ON CLEAN TRANSP., ICCT Comments on EPA's Proposed Heavy-Duty Engine and Vehicle Standards17 (May 10, 2022),

https://theicct.org/wp-content/uploads/2022/04/publicwebinar_10May2022.pdf.

Strong tailpipe emissions standards are one of the best ways to address the harmful impacts of vehicle pollution. Ultimately, EPA's current proposals fail to accelerate the transition of medium- and heavy-duty vehicles to ZEVs—readily available technology that eliminates tailpipe pollution altogether. EPA should therefore reassess its ZEV penetration rates in light of economic factors and state requirements and initiatives. [EPA-HQ-OAR-2019-0055-1247-A1, p.8]

Organization: *States of California, et al. (The States)*

The Proposed Rule would also further tighten the Phase 2 GHG standards for model year 2027 in certain segments of the heavy-duty vehicles sector based on the better-than-anticipated deployment of zero-emitting vehicles (ZEVs) in certain heavy-duty vehicle classes, especially buses and delivery vans. The States support EPA's general methodology for updating the Phase 2 GHG standards, which preserves their environmental integrity and comports with EPA's legal duties of rational decision-making. However, the States urge EPA to base its update on a more robust projection of ZEVs in the heavy-duty sector that reflects multiple States' ZEV mandates and market conditions that increasingly favor heavy-duty ZEVs. The States also encourage EPA to prioritize new GHG standards for the heavy-duty sector based on proven, cost-effective ZEV technology. [EPA-HQ-OAR-2019-0055-1255-A1, p. 3]

The States support the Proposed Rule's revisions to the HD Phase 2 GHG standards as an important step in ensuring the heavy-duty vehicles sector continues to reduce its GHG emissions. Our comments concentrate on the following three observations: (1) EPA's approach to updating to the Phase 2 standards is consistent with legal requirements and comparable agency practice for fleetwide average standards where ZEVs make up an increasing share of the real-world fleet; (2) EPA can improve the accuracy of its update by ensuring the estimated HD ZEV penetration rate reflects other States' adoption of the California Advance Clean Trucks (ACT) rule and favorable market conditions for HD ZEVs; and (3) EPA should take prompt action to develop "Phase 3" GHG standards for the heavy-duty sector based on the enormous emission-reducing potential of HD ZEVs. [EPA-HQ-OAR-2019-0055-1255-A1, p. 24]

1. Even as EPA takes initial steps to develop next-generation GHG standards based on ZEV technology, it is rational and consistent with the Clean Air Act to update Phase 2 GHG standards to ensure they remain binding on the conventional heavy-duty fleet. Indeed, it is "patently unreasonable" for agencies to ignore "dramatic[]" changes in their regulated industries. NRDC v. Herrington, 768 F.2d 1355, 1408 (D.C. Cir. 1985). The Clean Air Act, in particular, is designed so that EPA may respond to "changing circumstances and scientific developments" and "forestall . . . obsolescence." Massachusetts v. EPA, 549 U.S. 497, 532 (2007). The projections that HD ZEVs will reach cost parity with, and then achieve cost advantage over, conventional heavy-duty engines within the next three to eight years is surely one such change. It is therefore appropriate for EPA to forestall obsolescence here by adjusting the Phase 2 GHG standards to respond to increasing ZEV deployment in the heavy-duty sector. [EPA-HQ-OAR-2019-0055-1255-A1, pp. 24 - 25]

EPA's general methodology in updating the Phase 2 GHG standards is also consistent with NHTSA's recent approach in developing new fleetwide fuel economy standards for light-duty vehicles—a sector that is likewise seeing dramatic increases in ZEV sales.109 There, NHTSA projected automakers would comply with California's ZEV mandate in estimating the number of ZEVs in the baseline light-duty fleet (i.e., in the absence of new fuel economy standards).110 Doing so, NHTSA stated, "is consistent with guidance in OMB Circular A-4 directing agencies to develop analytical baselines that are as accurate as possible regarding the state of the world in the absence of the regulatory action being evaluated," in particular because baselines should "reflect other legal obligations that automakers will be meeting during this time period."111 In a similar fashion, if EPA grants California's requested waiver for its ACT rule, then EPA's baseline fleet should include at least the vehicles the heavy-duty sector will produce to comply with ACT. [EPA-HQ-OAR-2019-0055-1255-A1, p. 25]

109. See Corporate Average Fuel Economy Standards for Model Years 2024-2026 Passenger Cars and Light Trucks, 87 Fed. Reg. 25,710, 25,721 (May 2, 2022).

110. Id. at 25,744.

111. Id. Courts have upheld the inclusion of such obligations in regulatory baselines in a variety of contexts. E.g., NRDC v. Thomas, 838 F.2d 1224, 1238 (D.C. Cir. 1988) (holding, in part, that using "[State-Implementation-Plan]-required emission rates as the baseline" was "a quite reasonable interpretation" of relevant provision of Clean Air Act); Cooling Water Intake Structure Coal. v. EPA, 905 F.3d 49, 81 (2d Cir. 2018) (quoting "environmental baseline" requirements for Endangered Species Act consultations as including "the past and present impacts of all Federal, State, or private actions" and distinguishing those from impacts resulting from agencies exercising discretion); Am. Rivers v. FERC, 201 F.3d 1186, 1192 (9th Cir. 1999) (upholding agency use of facility's operations pursuant to terms and conditions of existing license as no action baseline).

2. However, the States take issue with EPA's estimated 1.5 percent penetration rate for HD ZEVs in model year 2027, which likely underestimates HD ZEV deployment. EPA derives this estimate by extrapolating the HD ZEV requirement for model year 2027 in the ACT rule to national numbers based on California's 2020 share of the heavy-duty electric vehicle market.112 This methodology omits two important factors. [EPA-HQ-OAR-2019-0055-1255-A1, p. 25]

112. 87 Fed. Reg. at 17,600 & n.858.

First, several other States have adopted or will likely adopt ACT under section 177 of the Clean Air Act. Currently, Massachusetts, New Jersey, New York, Oregon, and Washington, in addition to California, have finalized adoption of the ACT requirements.113 These States as well as the District of Columbia, Connecticut, Colorado, Hawaii, Maine, Maryland, Nevada, North Carolina, Pennsylvania, Rhode Island, Vermont, and Virginia (and the Province of Quebec) have signed a memorandum of understanding (MOU) to promote the adoption of HD ZEVs.114 A more robust and realistic estimate would determine the heavy-duty market share of at least those States that have formally adopted ACT and use this, in combination with the ACT schedule, to determine the minimum national fleet of HD ZEVs required by state law in model year 2027. This methodology would also avoid the inconsistency of modeling the heavy-duty sector to comply with one State's legal obligations, but not with other States' equally binding regulations. [EPA-HQ-OAR-2019-0055-1255-A1, p. 26]

113. 310 Code Mass. Regs. 7:40 (2021); N.J. Admin. Code §§ 7:27-31 and 33 (2021); N.Y. Comp. Codes R. & Regs., tit. 6, §§ 218-1.1, 218-2.1, 218-4.1, 218-4.2 (2021); Or. Admin. R. 340-257-0050(3) (2021); Wash. Admin. Code § 173-423-010 et seq. (2021).

114. Multi-State Medium- and Heavy-Duty Zero Emission Vehicle Mem. of Understanding (July 13, 2020; amended March 29, 2022), available at https://www.nescaum.org/documents/mhdv-zev-mou-20220329.pdf/ and attached as Exhibit 16.

Second, favorable market factors—especially fuel cost savings—are projected to make HD ZEVs increasingly attractive to buyers, with several classes achieving cost parity by 2025 or earlier.115 Indeed, these market factors are even more significant the longer historically high and volatile diesel prices continue.116 Thus, EPA should base the updated GHG standards on projected overcompliance with ACT in model year 2027. Indeed, the NREL's recent Cost Analysis projects 42 percent of heavy-duty sales will be HD ZEVs in 2030, suggesting a 2027 penetration rate significantly higher than 1.5 percent.117 EPA's preference for conservative estimates is understandable, but given the importance of preserving the Phase 2 GHG standards' integrity, EPA should base its revisions on the most accurate deployment estimates available. [EPA-HQ-OAR-2019-0055-1255-A1, p. 26]

115. 87 Fed. Reg. at 17,562.

116. U.S. Energy Information Administration, "Gasoline and Diesel Fuel Update: May 9, 2022," available at https://www.eia.gov/petroleum/gasdiesel/; ibid., "EIA expects summer U.S. real gasoline and diesel prices to be the highest since 2014" (Apr. 19, 2022), available at https://www.eia.gov/todayinenergy/detail.php?id=52098 (last accessed May 16, 2022).

117. NREL Cost Analysis, supra note 92, at 25, 61; see id. at 62 (7 percent under the most conservative ZEV technology scenario).

3. While the States support EPA's choice to focus on the integrity of Phase 2 GHG standards in this rulemaking, EPA should initiate a new rulemaking with a full record on HD ZEVs' potential to reduce GHG emissions even further. As CARB's ACT rule shows,118 and as the Proposed Rule recognizes,119 HD ZEVs are an available and cost-effective technology with enormous GHG reduction potential. In California alone, these GHG reductions translate to $1.01 billion in avoided climate-related costs from 2020 to 2040, in addition to $5.5 billion in health benefits from NOx and PM2.5 co-reductions.120 High rates of HD ZEV deployment are a critical component of States' individual plans for reaching midcentury decarbonization targets set by state law, with significant co-benefits for attaining and maintaining criteria pollutant NAAQS.121 These state decarbonization plans further support a national program for HD ZEV adoption as part of the United States' path to achieving its Paris Agreement commitments.122

Given the imperative to prevent the worst effects of climate change, and to secure GHG reductions as fast as possible, EPA should make GHG standards based on HD ZEV technology a high regulatory priority. [EPA-HQ-OAR-2019-0055-1255-A1, pp. 26 - 27]

118, CARB, Staff Report, Initial Statement of Reasons – Public Hearing to Consider the Proposed Advanced Clean Trucks Regulation, at 10-17 (Oct. 22, 2019), available at https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/isor.pdf and attached as Exhibit 17 (“ACT ISOR”); id., App’x C, Standardized Regulatory Impact Assessment, at 50-53 (Aug. 8, 2019), EPA-HQ-OAR-2019-0055-0796; see generally id., App’x E, Zero Emission Truck Market Assessment, available at https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/appe.pdf and attached as Exhibit 18.

119. 87 Fed. Reg. at 17,562 (recognizing maturity of HD ZEV technologies).

120. ACT Standardized Regulatory Impact Assessment, supra note 118, at 16-23 (using current Interagency Working Group social cost of carbon metric and 2.5 discount rate).

121. See, e.g., id. at 12, 14; Colorado Greenhouse Gas Pollution Reduction Roadmap, at 58-62 (Jan. 2021), available at https://energyoffice.colorado.gov/climate-energy/ghg-pollution-reduction-roadmap; Mass. 2050 Decarbonization Roadmap, at 39-43 (Dec. 2020), available at https://www.mass.gov/doc/ma-2050-decarbonization-roadmap/download; N.J. Dept. of Envtl. Protection, New Jersey’s Global Warming Response Act 80x50 Report, at 21-22, 28-29, 31 (Oct. 2020), available at https://www.nj.gov/dep/climatechange/docs/nj-gwra-80x50-report-2020.pdf; N.Y. State Climate Action Council, Draft Scoping Plan, at 104-106 (Jan. 2022), available at https://climate.ny.gov/-/media/Project/Climate/Files/Draft-Scoping-Plan.pdf.

122. See The United States’ Nationally Determined Contribution: A 2030 Emissions Target, at 4 (Apr. 15, 2021), available at https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/United%20States%20of%20America%20First/United%20States%20NDC%20April%2021%202021%20Final.pdf.

Organization: *Tesla, Inc. (Tesla)*

In general, EPA’s proposal fails to consider the depth and pace of electrification technology deployment that has already occurred and will be accelerated through market forces and numerous other state and federal policies. In its proposal, EPA assumes a zero-emission vehicle (ZEV) sales share of only 1.5% in key market segments in 2027.61 This assumed baseline is woefully low and cuts against many projections. Indeed, as EPA indicates, the BEV market is dynamic and changing rapidly.62 For example, NREL has found economics will drive must faster adoption with ZEV sales possibly reaching 42% of all medium- and heavy-duty trucks by 2030.63 It even projects out a scenario where ZEV sales reach >99% by 2045, and 80% of the sector transitions to ZEVs by 2050, reducing CO2 emissions by 69% from 2019.64 A new analysis views the heavy-duty haul market as 50% electrifiable right now.65 The firm ACT Research forecasted a 26% sales share of heavy-duty ZEVs nationwide in 2030.66 Yet, another found that by 2030 25% of the global fleet will be electric.67 Still other analyses have found that most 'market segments have the potential to be fully mature by 2025, with EV models available from multiple companies, including the majority of major OEMs that currently have 90% market share of the in-use fleet.'68 Further, it is predicted the paced of electrification will increase rapidly over the next decade.69 Recent sales suggest this pace of adoption is already occurring.70 [EPA-HQ-OAR-2019-0055-1219-A1, p.9]

61 87 Fed. Reg. at 17458; 87 Fed. Reg. at 17601.

62 87 Fed. Reg. at 17595.

63 NREL, Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis (March 8, 2022).

64 Id.

65 NACFE, Charting the Course for Early Truck Electrification (May 2022) (Analysis shows that approximately 65 percent of medium-duty trucks and 49 percent of heavy-duty trucks — are regularly driving short enough routes that they could be replaced with electric trucks that are on the market today) ; See also, NACFE, Electric Trucks Have Arrived: The Use Case For Heavy-Duty Regional Haul Tractors (May 2022).

66 HDT Truckinginfo, ACT: Third of Class 4-8 Vehicles to be Battery-Electric in 10 Year (June 4, 2021).

67 Fleet Owner, Disruption in trucking technology (Jan. 13, 2020).

68 MJ Bradley, Medium- & Heavy-Duty Vehicles: Market Structure, Environmental Impact, and EV Readiness (Aug. 11, 2022) at 6

69 See, Wood Mackenzie, US electric truck sales set to increase exponentially by 2025 (Aug. 10, 2020) (finding there were just over 2,000 electric trucks on US roads at the end of 2019 and project this to grow to over 54,000 by 2025); BNEF, EV Outlook 2021 (heavy-duty electric trucks become economically attractive in urban duty cycles by the mid-2020s. Megawatt-scale charging stations and the emergence of much higher energy density batteries by the late 2020s result in battery electric trucks becoming a viable option for heavy-duty long-haul operations, especially for volume-limited applications.)

70 Fleet Owner, Pace of heavy EV sales quickens with two recent deals (Mar. 22, 2022).

As DOE has documented, there are over 100 models of heavy-duty ZEVs available.71 Indeed, some OEMs predict BEV cost parity in 2025 well ahead of the proposed rule's 2027 implementation date.72 In the E.U., heavy duty manufacturers are poised for a complete phase out of legacy technology by 2040.73 [EPA-HQ-OAR-2019-0055-1219-A1, p.9]

71 DOE, Alternative Fuel Data Center, Alternative Fuel and Advanced Vehicle Search

72 See, Trucknews.com, Standalone Daimler Truck business gives corporate update as it prepares for public listing (Nov. 11, 2021) (Daimler estimating BEVs will achieve total cost of operation parity with diesel by 2025, and fuel cells by 2027.)

73 Sennder, European truck manufacturers aiming for 100% electric by 2040 (July 6, 2021).

While EPA points to a handful of manufacturer statements (and there are many more) on near term electrification plans,74 the agency did not account for the California's Advance Clean Truck (ACT) regulation and the adoption of forward-looking heavy-duty electrification policies in numerous other states.75 As EPA develops its final rule, the agency's analysis of the levels of fleet electrification and its baseline for addressing NOx emissions must take these programs into account.76 In doing so, the agency has the basis for finalizing more ambitious and protective standards than those proposed in Option 1. [EPA-HQ-OAR-2019-0055-1219-A1, pp.9-10]

74 See HDT Truckinginfo, DTNA's O'Leary on Fast-Changing Trucking Technology (Mar. 9, 2022)(Daimler North American Truck ambition is to produce 'exclusively CO2-neutral products in the U.S. by 2039' starting with the medium-duty battery electric eM2 in 2022 and the eCascadia early 2023); Inside EVs, GM to Launch All-Electric Heavy-Duty Trucks In 2035 Instead of 2040 (Jan. 10, 2022); Fleet Owner, Volvo details electric truck strategy (Oct. 13, 2021) (wants 50% of its truck sales to be electric vehicles by 2030—and 100% by 2040); See also, Iveco, Electric; MAN, Battery-electric trucks are our future (Nov. 11, 2021); Electrek, Kenworth says electric truck orders have tripled the past three months, quoting customers in 44 states (Jan.14, 2022); Navistar, Battery Electric Vehicles; Scania, Scania's commitment to battery electric vehicles (Jan. 19, 2021); See generally, Green Car Congress – Heavy Duty (highlighting many recent announcements); HDT Truckinginfo, Volta Trucks to Enter U.S. Market with Electric Class 7 (May 6, 2022); HDT Truckinginfo, Xos Unveils Two New Commercial Electric Trucks (May 10, 2022).

75 87 Fed. Reg. at 17581.

76 Id.

In addition to the marketplace announcements, regulatory environment, and federal fleet adoption driving significant electrification, cost-related issues will ensure that electrification of the heavy-duty sector occurs rapidly. To that end, EPA's proposed rule points to one 2017 report suggesting that battery costs may be a barrier to heavy duty fleet adoption.97 Further, the agency assumes costs for the Phase 2 GHG regulations still hold that per vehicle cost for BEVs represent approximately a 12% increase in tractor costs.98 Contrary to this assertion, as one analysis sums up, 'Electrification is also making inroads into heavier vehicles. In urban duty cycles, battery electric trucks of any size become the cheapest option for several use cases in the 2020s.'99 Similarly, other studies find that when considering upfront purchase price alone, by 2027 electric freight trucks and buses will be less expensive than their combustion engine counterparts in almost all categories.100 [EPA-HQ-OAR-2019-0055-1219-A1, p.12]

97 87 Fed. Reg. at 17596.

98 87 Fed. Reg. at 17602.

99 BNEF, Electric Vehicle Outlook 2021,

100 EDF, New Study Finds Rapidly Declining Costs for Zero-Emitting Freight Trucks and Buses (Feb. 10, 2022).

In assessing the pace of electrification, the agency should consider the documented and projected rapid decline in battery cell and pack costs. As DOE has recently documented, the energy density of lithium-ion batteries Increased by more than eight times between 2008 and 2020 allowing for BEVs to travel the same distance with a smaller battery pack, thus saving space, weight, and manufacturing costs.101 [EPA-HQ-OAR-2019-0055-1219-A1, p.12]

101 DOE VTO, FOTW #1234, April 18, 2022: Volumetric Energy Density of Lithium-ion Batteries Increased by More than Eight Times Between 2008 and 2020 (Apr. 18, 2022).

To the extent reductions seen in the light duty sector, the similarity in battery chemistries will carry over to the medium and heavy-duty sectors. For example, UBS reports that leading manufacturers are estimated to reach battery pack costs as low as $67/kWh between 2022 and 2024.102 Recently, others have also projected costs significantly lower than EPA's past projections. BNEF's recent estimate is that pack prices go below $100/kWh on a volume-weighted average basis by 2024, hit $58/kWH in 2030,103 and could achieve a volume-weighted average price of $45/kWh in 2035.104 The National Academies of Sciences found high-volume battery pack production would be at costs of $65-80/kWh by 2030105 and DNV-GL has predicted costs declining to $80/kWh in 2025.106 The IPCC recently concluded similarly.107 Reductions in battery costs are projected to lead to cost parity in many vehicle segments by 2025.108 Continued and expansive R&D in this sector can be expected to further drive down costs.109 Consistent with these declines, other key subsystems of BEV technology will continue see cost reductions as manufacturers scale production.110 [EPA-HQ-OAR-2019-0055-1219-A1, pp.12-13]

102 UBS, EVs Shifting into Overdrive: VW ID.3 teardown – How will electric cars re-shape the auto industry? (March 2, 2021) at 60.

103 BNEF, Electric Vehicle Outlook 2021 (June 9, 2021).

104 BNEF, Hitting the Inflection Point: Electric Vehicle Price Parity and Phasing Out Combustion Vehicle Sales in Europe (May 5, 2021).

105 NAS, Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy – 2025-2035 (March 31, 2021).

106 DNV-GL, Tesla's Battery Day and the Energy Transition (Oct. 26, 2020).

107 IPCC, AR 6, Working Group III, Climate Change 2022: Mitigation of Climate Change (date) at 10-32 (For example, according to IEA, battery pack costs could be as low as 80 USD per kWh by 2030 (IEA 2019a). In addition, there are clear trends that now vehicle manufacturers are offering vehicles with bigger batteries, greater driving ranges, higher top speeds, faster acceleration, and all size categories (Nykvist et al. 2019). In 2020 there were over 600,000 11 battery-electric buses and over 31,000 battery-electric trucks operating globally (IEA 2021a).)

108 MJ Bradley, Medium- & Heavy-Duty Vehicles: Market Structure, Environmental Impact, and EV Readiness (Aug. 11, 2022) at 7. (EVs in most market segments have the potential to achieve life-cycle cost parity with internal combustion engine vehicles by model year 2025 or earlier if M/HD battery costs follow a similar trajectory as battery costs for light-duty EVs).

109 See generally, Energy & Environment Sciences, Determinants of lithium-ion battery technology cost decline (Jan. 3, 2022).

110 See generally, ICCT, A Meta-Study of Purchase Costs for Zero-Emission Trucks (Feb. 17, 2022) (Finding, inter alia, by 2030 key subsystems can achieve up to 40% to 60% cost reduction driven by technology and manufacturing scalability).

Indeed, a recent LBNL study found that recent reductions in battery prices and improvement in energy density have made long haul electric trucking viable in the near term.111 More directly, the study concluded: ‘At the current global average battery pack price of $135 per kilowatt-hour (kWh) (realizable when procured at scale), a Class 8 electric truck with 375-mile range and operated 300 miles per day when compared to a diesel truck offers about 13% lower total cost of ownership (TCO) per mile, about 3-year payback and net present savings of about US $200,000 over a 15-year lifetime. This is achieved with only a 3% reduction in payload capacity.’112 [EPA-HQ-OAR-2019-0055-1219-A1, p.13]

111 LBNL, Why Regional and Long-Haul Trucks are Primed for Electrification Now (Mar. 15, 2021).

112 Id.

Further numerous studies have found that heavy duty BEVs outperform conventional trucks on a total cost of ownership basis.113 Tesla projects that its Semi will have energy costs that are half those of diesel, provide over $200,000 in fuel savings, and have a two-year payback period.114 Another manufacturer has found that BEVs could save fleets up to 80% on energy costs and 60% on repair.115 Yet another found that the benefits of electrifying heavy-duty truck fleets are significant with recent studies showing that operating costs for electric trucks can be between 14 and 52 percent lower and repair costs around 40 percent lower than their combustion-powered counterparts.116 CARB has found that battery-electric vehicles appear cost competitive with the established combustion technologies by 2025 in many use cases.117 Real world demonstrations have also proven this out.118 [EPA-HQ-OAR-2019-0055-1219-A1, p.13]

113 See e.g., UC Berkley, 2035 Report: Transportation: Plummeting Costs and Dramatic Improvements in Batteries Can Accelerate Our Clean Transportation Future (April 2021) at 15 (finding BEV heavy-duty trucks already hold a TCO advantage today and, for heavy-duty trucks, an EV advantage of $0.05/mi in 2020 that increases to $0.22/mi in 2030—magnified by the large number of miles traveled by this class of vehicles. In absolute terms, in 2020 this translates to a $42,800 TCO advantage of electric heavy-duty trucks, which increases to $200,000 in 2030. The TCO advantage of EVs continues to grow through 2050).

114 See Tesla, Semi.

115 Utility Dive, Lion Electric: EVs save transport firms 80% on energy, 60% on repair costs compared to diesel (Mar. 17, 2021).

116 Argonne National Lab, Comprehensive Total Cost of Ownership Quantification for Vehicles with Different Size Classes and Powertrains (April 2021).

117 CARB, Draft Advanced Clean Fleets Total Cost of Ownership Discussion Document (Sept 9, 2021) ; See also, Transport & Environment, Why the future of long-haul trucking is battery electric (Feb. 18, 2022).

118 North American Council for Freight Efficiency, Electric Trucks Have Arrived: Documenting A Real-World Electric Trucking Demonstration (Feb. 2, 2022).

In short, BEVs will offer the best compliance technology near term and dramatically decreasing costs battery costs further support that BEV deployment support a much more stringent final rule. [EPA-HQ-OAR-2019-0055-1219-A1, p.13]

Finally, the agency should be prepared to consider the role new state and federal incentives may play in deployment of heavy-duty electric vehicles. Federally, numerous heavy duty electrification grants, demonstration programs, incentives, and infrastructure incentives were included in the Infrastructure Investment and Jobs Act of 2021.119 Moreover, Congress is actively considering significant (up to 30%) purchasing incentives for heavy-duty ZEV vehicles.120 If adopted, such an incentive could also substantially increase the cadence of electrification in the trucking sector. For example, Rhodium has modeled that by 2030, a modest 10% investment tax credit for medium- and heavy-duty BEVs and an excise tax exemption for such vehicles would drive BEVs to or below TCO parity with conventional vehicles in some smaller vehicle classes and reduce the gap in others.121 [EPA-HQ-OAR-2019-0055-1219-A1, p.14]

119See, DOE, Alternative Fuel Data Center, Bipartisan Infrastructure Law (Infrastructure Investment and Jobs Act of 2021).

120 See e.g., S.1791 (117th Cong.), Fueling America's Security and Transportation with Electricity Act of 2021 (expands the tax credit for plug-in electric drive motor vehicles to include a 30% credit for additional electric transportation options capable of moving

passengers, cargo, or property and powered by an integrated, on-board electric propulsion system.); H.R. 848 (117th Cong.), Growing Renewable Energy and Efficiency Now Act of 2021, at 403.

121 Rhodium, Pathways to Build Back Better: Investing in Transportation Decarbonization (May 13, 2021).

EPA should also recognize that state incentives will create additional uptake of BEVs in the medium- and heavy-duty sector. These incentives already exist in California122, Colorado123, Connecticut124, Massachusetts125, New York126, Utah127, and Washington.128 [EPA-HQ-OAR-2019-0055-1219-A1, p.14]

122 California, HVIP, Carl Moyer, LCFS, and additional CARB programs not listed.

123 Colorado, Colorado Department of Revenue Innovative Truck Credits.

124 Connecticut, Public Act No. 22-25 (May 10, 2022).

125 Massachusetts, MOR-EV Trucks Program.

126 New York, New York Truck Voucher Incentive Program; New York City Clean Truck Program.

127 Utah, Utah Code 59-7-618.1. Tax credit related to alternative fuel heavy duty vehicles.

128 Washington, Clean Alternative Commercial Vehicle and Infrastructure Tax Credit..

Accordingly, as supported by this growing raft of data, Tesla recommends that the agency's final rule do a far better job of recognizing the expected pace and deployment of BEVs and finalize a standard that maximizes and accelerates this transition. [EPA-HQ-OAR-2019-0055-1219-A1, p.14]

Organization: *WE ACT for Environmental Justice*

The greenhouse gas segment of the rule does not reflect the urgency of the climate crisis and the disproportionate impacts it has on environmental justice communities. Moreover, it underestimates advancements in electric truck and bus technology and state policies that are already accelerating zero-emission vehicles. In particular, the California's Advanced Clean Truck (ACT) rule,21 which has been adopted by 6 other states22, including most recently Connecticut,23 and has additional states such as Maine and Maryland24 on a clear pathway to adopting the ambitious rule. This would achieve at least 50% percent of zero-emission sales in the U.S. by 2030, putting us on a pathway to 100% zero-emission medium- and heavy-duty truck sales by 2035. [EPA-HQ-OAR-2019-0055-1347-A1, pp.3-4]

21 https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks

22 https://www.bloomberg.com/news/articles/2022-01-06/how-zero-emission-laws-will-reshape-u-s-trucking

23 https://www.ctpublic.org/news/2022-05-03/connecticut-clean-air-bill-will-adopt-stricter-standards-for-certain-trucks-and-buses

24 https://www.electrictrucksnow.com/states

The EPA should utilize its authority and seize the opportunity to **strengthen and increase the stringency of the greenhouse gas standard** and spur the rapid transition to medium- and heavy-duty vehicle electrification. An analysis by ICCT shows that EPA can do so by setting minimum zero-emission production requirements for model years 2027 through 2029, utilizing an approach that would ensure the transition occurs across all vehicle segments while also prioritizing categories, such as transit and school buses that operate in areas of non-attainment and environmental justice communities (See Table 1 [footnote 27 is listed in Table 1 too). This would minimize greenhouse gasses in addition to bringing significant emissions reductions and health benefits to vulnerable children and low-income communities of color overburdened by harmful truck pollution. [EPA-HQ-OAR-2019-0055-1347-A1, p.4]

27 https://theicct.org/wp-content/uploads/2022/02/HDV-US-adapting-vehicle-emission-stds-zero-emission-commercial-truck-bus-fleet-feb22.pdf

We appreciate that the EPA has sought to revisit and tighten the Phase 2 greenhouse gas standard for model year 2027 for several subsectors, including school and transit buses, delivery trucks and short-haul tractors. However, as it stands, the proposed rule would only yield 1.5% zero-emission sales by 2027 and these market segments are already relatively mature and are expected to rapidly grow.25,26 The ACT rule would have delivered three times the zero-emission vehicles that this proposal calls for nationally by 2027. [EPA-HQ-OAR-2019-0055-1347-A1, p.4]

25 https://rmi.org/insight/high-potential-regions-for-electric-truck-deployments/

26https://www.mjbradley.com/sites/default/files/EDFMHDVEVFeasibilityReport22jul21.pdf

Organization: *World Resources Institute (WRI)*

Rapid advances in zero-emissions technology for medium- and heavy-duty vehicles have led to an array of commercially available makes and models, including for electric school buses and transit buses. This means that transforming these fleets through electrification is both possible and practical. In fact, electric school and transit buses in operation today could already meet the strongest standards proposed. Momentum on electrification has been building across these sectors, and billions of federal investment dollars soon to be available through a successfully implemented Bipartisan Infrastructure Law will further accelerate the pace. [EPA-HQ-OAR-2019-0055-1298-A1, p.2]

Adoption of electric school buses has grown considerably since the first generation of these vehicles were first deployed in 2014. While electric school buses were once limited to a handful of pilot programs, WRI’s analysis and dataset indicate that as of April 2022 more than 300 school districts around the country have been awarded, ordered or are committed to nearly 12,000 electric school buses (this total includes newly manufactured as well as repowered buses). According to this same dataset, nearly 600 buses have already been delivered or are in operation around the country today. Responding to this increased demand, manufacturers now offer more than 20 models of electric school buses, including newly manufactured and repowered options, with more expected to enter the market in the near future (to be detailed in WRI’s forthcoming U.S. electric school bus market report). The performance and reliability of these buses are also continuing to improve, as each generation of buses is more advanced than the previous. Many manufacturers are on their second or third iteration, some even further along, and the newest models have battery ranges that can serve more than 90% of school bus routes in the U.S. [EPA-HQ-OAR-2019-0055-1298-A1, pp.2-3]

Increased federal support is helping accelerate school bus electrification: funding from the American Rescue Plan awarded nearly $7 million and 23 buses to schools around the country, and $5 billion in funding from the Bipartisan Infrastructure Law will be awarded to school districts through the forthcoming Clean School Bus Program. These successes at the federal level are helping to drive positive outcomes in many states, as well. For example, New York State’s recent mandate requires all new school buses to be zero-emission by 2027 (with limited exemptions until 2029) and will provide up to $500 million to facilitate this transition through a bond act to be considered by voters later this year. At close to 50,000 vehicles, New York’s fleet is the largest of any state and represents more than 10 percent of the US school bus fleet. Adding to past investments, Governor Newsom’s budget proposal, currently being considered by the California state legislature, would allocate $1.5 billion in one-time funding available over three years to support school transportation programs with a focus on greening school bus fleets. In Colorado, the legislature has approved the allocation of $65 million to fund electric school buses across the state. [EPA-HQ-OAR-2019-0055-1298-A1, p.3]

We expect high rates of electric school bus penetration by the end of the decade. Blue Bird has seen 'unprecedented' interest in ESBs, causing a backlog of over 380 bus orders. In 2021, Navistar/IC Bus stated that they believe 30-50% of new school bus purchases will be electric by 2030. Moreover, market experts anticipate that electric buses will achieve cost parity with diesels on a lifetime total cost of ownership basis by the middle to end of this decade. [EPA-HQ-OAR-2019-0055-1298-A1, p.3]

School bus fleets aren’t the only ones transitioning to electric: as transit operators take advantage of zero-emission technology advances and available funding sources, electric transit buses continue to increase in cities and municipalities around the country as well. In the United States, more than 3,500 electric transit buses are currently in operation, representing 24% growth since the 2020 count. With up to $10 billion from the Bipartisan Infrastructure Law being made available to states and transit agencies to replace, rehabilitate, and purchase cleaner and or electric buses and related equipment and to construct bus-related facilities, the number of electric transit buses may increase rapidly. [EPA-HQ-OAR-2019-0055-1298-A1, p.3]

In short, the market is already moving; the regulatory framework should reflect and accelerate, not hinder, this progress. [EPA-HQ-OAR-2019-0055-1298-A1, p.3]

A further consideration for setting the strongest possible rule for medium- and heavy-duty vehicles is to encourage investments in electric vehicle manufacturing and charging infrastructure, creating jobs and building a more resilient and cleaner economy. Recent electric school bus investment announcements in Illinois, West Virginia, Ohio, Colorado, and the Carolinas will result in increased production capacity of electric school buses specifically, joining states like California, Michigan, and New York which are already home to a wide range of medium- and heavy-duty electric vehicle manufacturing facilities. [EPA-HQ-OAR-2019-0055-1298-A1, p.3]

Organization: *Zero Emission Transportation Association (ZETA)*

There are profound benefits to advancing heavy-duty electric vehicles (HDEVs), which EPA defines as electric vehicles in Classes 2b–8. With an average lifespan of 33 years, most heavy-duty vehicles (HDVs) spend more time and miles on the road before retirement than light-duty vehicles.2 As a result, failing to electrify these HDVs now means that fossil fuel-powered HDVs rolling off the assembly line during this rulemaking will remain on the road well beyond 2050, adding hundreds of thousands of vehicle miles and associated deadly emissions over the coming decades. [EPA-HQ-OAR-2019-0055-1283-A1, p.2]

> 2 https://energyoffice.colorado.gov/press-releases/polis-administration-releases-new-colorado-medium-and-heavy-duty-vehicle-study

Electrifying this vehicle segment represents a prime and outsized opportunity to improve public health, minimize GHG emissions, and reduce the country’s fossil fuel reliance and net energy consumption. As ZETA detailed in our white paper, 'Medium- and Heavy-Duty Electrification: Weighing the Opportunities and Barriers to Zero-Emission Fleets,'3 HDVs comprise a mere 4% of vehicles on the road, yet they disproportionately contribute to U.S. fuel consumption and resulting air pollution and climate repercussions. Buses and freight trucks alone represent 10% of all vehicle miles traveled (VMT), but they are responsible for 22% of all fuel used.4 Likewise, HDVs produce 24.4% of all emissions across the transportation sector, making them the single largest contributors to U.S. emissions of particulate matter (PM2.5), NOx, volatile organic compounds (VOC), and carbon dioxide (CO2). All of these elements are linked to long-term respiratory, cognitive, and autoimmune impairment, and HDVs’ emissions are getting worse: between 1990 and 2019, GHG emissions from heavy-duty trucks and buses grew by 93% and 162%, respectively.5 [EPA-HQ-OAR-2019-0055-1283-A1, p.2]

> 3 https://fs.hubspotusercontent00.net/hubfs/8829857/ZETA-WP-MHDV-Electrification_Opportunities-and-Barriers_Final3.pdf
>
> 4 https://www.aceee.org/sites/default/files/pdfs/t2102. pdf
>
> 5 https://www.epa.gov/greenvehicles/ archives-fast-facts-us-transportation-sector-greenhouse-gas-emissions

In its own analysis, EPA also found that HDEVs will own a 1.5% market share by 2027, which is based on a ‘business-as-usual’ scenario rather than one in which regulations and incentives push the market further towards zero-emission technologies. Using publicly available information on available HDEVs, ZETA believes that assuming business-as-usual causes a severe underestimate in adoption. Based on cutting-edge market research, our member companies’ public announcements, and other regulatory regimes, we assess that HDEV market penetration will greatly exceed 1.5%. In our fleet electrification white paper, we found that HDEVs will bring substantial economic advantages to fleet operators through total cost of ownership savings,17 in addition to HDEVs’ environmental and public health benefits.18 Batteries are the most expensive component in HDEVs, but their prices are dropping. Battery prices have already dropped 89% in real terms from $1,200 per kilowatt-hour in 2010 to $132 per kilowatt-hour in 2021.19 A continued decline in battery costs would help further reduce HDEV purchase costs in the coming years. The evidence suggests that the lower TCO of HDEVs is driving fleet electrification, and it stands to reason that further HDEV price drops will accelerate electrification. In a survey of fleet managers conducted by the Department of Energy’s National Renewable Energy Laboratory (NREL), 64% cited lower TCO as a motivation for electrifying their fleets.20 For this reason and others, NREL predicts that 42% of all MHDV sales will be MHDEV models by 2030.21 [EPA-HQ-OAR-2019-0055-1283-A1, pp.3-4]

17 https://fs.hubspotusercontent00.net/hubfs/8829857/ZETA-WP-MHDV-Electrification_Opportunities-and-Barriers_Final3.pdf

18 Ibid

19 https://about.bnef.com/blog/battery-pack-prices-fall-to-an-average-of-132-kwh-but-rising-commodity-prices-start-tobite/#_ftn1

20 https://www.aceee.org/sites/default/files/pdfs/t2102. pdf

21 https://www.nrel.gov/docs/fy22osti/82081.pdf

Likewise, a CALSTART report, ‘Zeroing in on Zero-Emission Trucks,’ assesses that HDEV sales will skyrocket in the next few years.22 According to the report, while only 20 HDEV models were on the market in 2019, 145 models are now available as of December 2021, and more models are being announced and entering production each year, as highlighted in Figure 1. CALSTART also notes that the more than 1,200 HDEVs deployed as of December 2021 are merely the beginning of a large wave of HDEV deployments: active orders show that 146,102 HDEVs will be deployed in the next few years. The diversification of HDEV models goes to show that manufacturers are recognizing and responding to market demands and that electrification is financially possible in a broad variety of HDV applications, rather than just in the ‘easy-to-electrify’ applications of just a few years ago. [EPA-HQ-OAR-2019-0055-1283-A1, p.4]

22 https://calstart.org/wp-content/uploads/2022/02/ZIO-ZETs-Report_Updated-Final-II.pdf

It is worth noting that fears about range anxiety are outsized. The average HDV travels approximately 101 miles per day;23 long-haul trucks generally have the longest routes of all HDVs, maxing out at 600 miles per day and often averaging closer to 300 miles per day, as noted in Figure 2. Considering that many HDEVs today have similar ranges, the electric models currently available can meet up to 60% of the HDV sectors' needs.24 HDEVs capable of traveling greater than the average distance of long-haul trucks are expected by the end of 2022, and HDEVs with ranges exceeding 620 miles are expected after 2023.25 [EPA-HQ-OAR-2019-0055-1283-A1, pp.4-5]

23 https://
www.edf.org/sites/default/files/documents/EDFMHDVEVFeasibilityReport22jul21.pdf

24 Ibid

25 https://calstart.org/wpcontent/uploads/2021/05/How-Zero-Emission-Heavy-Duty-Trucks-Can-Be-Part-of-theClimate-Solution.pdf

This exponential growth of the HDEV market is occurring before the timeframe in which EPA's proposed standards are finalized. CALSTART's research shows that HDEVs will achieve price parity with traditional fossil fuel-powered HDVs. In California, even in the absence of state subsidies, HDEVs will be cheaper to own and operate than fossil fuel-powered HDVs by 2030. [EPA-HQ-OAR-2019-0055-1283-A1, p.5]

That corroborates research from NREL, which found that HDEVs will be cheaper to purchase, operate, and maintain than fossil fuel-powered HDVs by 2035.26 50% of HDEVs will be cheaper by 2030—within the timeframe of EPA's rulemaking. Continuing improvements to ZEV technologies will allow HDEVs to become even cheaper and more accessible over the next decade.27 [EPA-HQ-OAR-2019-0055-1283-A1, p.5]

26
https://www.google.com/url?q=https://www.nrel.gov/docs/fy22osti/82081.pdf&sa=D&source=docs&ust=1651682526583368&usg=AOvVaw2fO_IyMdhtnFT-l4P6iJeD

27 https://www.energy.gov/articles/doe-projects-zero-emissions-medium-and-heavy-duty-electric-trucks-will-be-cheaper-diesel#:~:text=WASHINGTON%2C%20D.C.%20%E2%80%94%20The%20U.S.%20Department,diesel%2Dpowered%20combustion%20engine%20vehicles

Additionally, EPA's assessment is at odds with current fleet electrification announcements, including the projections of ZETA member companies. While these companies will submit confidential business information in their own comments, even from publicly available information, it is clear that HDEVs will surpass a 1.5% market share by 2027. [EPA-HQ-OAR-2019-0055-1283-A1, p.5]

ZETA member companies like Arrival, GreenPower Motor Company, Lion Electric, Proterra, and Tesla are all working to manufacture sufficient HDEVs to meet demand. These companies are capable of producing tens of thousands of HDEVs annually. These production capacities are proven in part by these companies' investments in new manufacturing plants like Tesla's Gigafactory in Texas, Rivian's plant in Georgia, Lion Electric's plant in Illinois, Proterra's heavy-duty battery manufacturing facility in California and South Carolina, and GreenPower Motor Company's plant in West Virginia. [EPA-HQ-OAR-2019-0055-1283-A1, p.6]

While some of these companies are just initiating production, their pending orders from customers help illustrate what the HDEV market landscape will look like in the next few years. ZETA member company Rivian's partnership with Amazon is a noteworthy example: Amazon plans to purchase 100,000 Rivian delivery vehicles produced in Rivian's manufacturing plant in Normal, Illinois.28 In addition to reducing Amazon's GHG emissions by 4 million metric tons per year by 2030, Amazon expects that these electric vehicles' fuel savings will significantly cut down the company's last-mile delivery costs. Below, you will find several examples of ZETA member companies developing, manufacturing, and delivering HDEVs across the country: [EPA-HQ-OAR-2019-0055-1283-A1, p.6]

28 https://www.forbes.com/sites/alanohnsman/2019/09/19/amazons-multibillion-dollar-bet-on-electric-delivery-vans-is-game-changer-for-startup-rivian/?sh=da6f73ed0138

- Arrival will provide up to 10,000 delivery vehicles to UPS, which includes the Large Van and XL Van. UPS also has the option to purchase up to 10,000 more delivery vehicles from Arrival. UPS is one of the world's largest fleet operators, with 125,000 delivery vehicles around the globe. 29 Arrival's delivery van is made of ultra-lightweight composite materials that reduce the vehicle's weight, contribute to lower fueling and maintenance costs, and can significantly lower the total cost of ownership when compared to internal combustion engine vehicles. In addition, UPS now drives more than 1 million miles each business day using alternative fuel vehicles, which has saved more than 60 million gallons of conventional fossil fuels since 2000. [EPA-HQ-OAR-2019-0055-1283-A1, p.6]

29 https://electrek.co/2020/01/30/ups-orders-10000-electric-delivery-vans-arrival/

- GreenPower Motor Company developed the 'battery electric automotive school transportation,' vehicle or the BEAST. The BEAST's 194-kWh battery provides a range of up to 150 miles. The vehicle is also equipped with a Thermal Management System and anticorrosive E-coating, which can operate in the harshest climates, and has a turning radius of 37.7 +/- 1.6 ft—the best out of all school bus types in the industry. [EPA-HQ-OAR-2019-0055-1283-A1, p.6]
- Lion Electric will be providing electric school buses to school districts across the country, and more than 600 are already operating throughout North America.30 Lion Electric has seven purpose-built electric models with their own chassis, bus body and truck cabin, and proprietary battery system technology. It has five new models coming out by the end of this year. [EPA-HQ-OAR-2019-0055-1283-A1, p.6]

30 https://www.prnewswire.com/news-releases/lion-electric-celebrates-10-million-miles-driven-at-act-expo-301542386.html

- Proterra's electric transit buses offer the longest drive range of any 40-foot electric bus on the market at 329 miles per charge. Proterra's offerings include transit buses, as well as technology powering school buses, delivery trucks, port equipment, construction equipment and shuttles. As a result, transit agencies across the U.S. and Canada have purchased over 850 Proterra vehicles that have driven more than 25 million miles in heavy-duty applications.31 Recently, Proterra also announced a multi-year agreement partnership with Nikola Corporation to power Nikola's Class 8 semi-trucks with Proterra's battery systems. [EPA-HQ-OAR-2019-0055-1283-A1, pp.6-7]

  31 https://www.proterra.com/about/

- Tesla will begin delivering its 'Semi' short-haul truck within the time frame of the rule, which will transform the surface shipping industry. The Semi is projected to offer a 300-mile and 500-mile range version. By lowering operating costs on high-mileage vehicles, these Semis will deliver cost savings to their fleet operators and significantly reduce pollution along interstate shipping corridors. [EPA-HQ-OAR-2019-0055-1283-A1, p.7]

A variety of other companies outside of ZETA's membership are also electrifying their HDV fleets, and a host of companies are partnering with local governments to electrify their fleets:

- FedEx is electrifying its fleet of 87,000 vehicles. It plans to buy only EVs after 2025, and its fleet will be 100% electric by 2040. FedEx says an electric fleet will cut maintenance costs in half.32 Fedex's BrightDrop models will decrease the cost of fueling by 75% compared to a fossil fuel-powered truck.33

  32 https://www.fleetequipmentmag.com/fed-ex-largest-electric-truck-purchase-zero-emission/.

  33 https://www.cnbc.com/2021/12/17/fedex-gets-first-of-500-electric-trucks-from-gms-ev-unit-in-move-to-green-logistics.html

- Walmart also plans to buy 5,000 electric vans from BrightDrop, which are expected in 2023.34 Similar to FedEx, Walmart's BrightDrop vehicles will save dramatically on operating costs.

  34 https://media.gm.com/media/us/en/gm/home.detail.html/content/Pages/news/us/en/2022/jan/ces/0105-brightdrop.html

- DHL has already electrified 20% of its fleet, and it plans to decarbonize 70% of its first- and last-mile delivery services by 2025.35

  35 https://www.dhl.com/discover/en-global/business/business-ethics/future-of-electric-vehicles

- IKEA is also electrifying all of its customer deliveries in thirty markets by 2025, and 25% of its deliveries are already electric today. IKEA believes electrifying its delivery fleet will create a competitive advantage and generate cost savings.36

  36 https://evreporter.com/gati-and-ikea/

- Finally, EV100 brings together 121 companies around the world that have committed to electrifying their fleets. By 2030, EV100's members will have electrified 5.5 million vehicles, avoiding nearly 86 million metric tons of pollution.37 In its annual report, EV100 stated that 'The business case for a transition to EVs is now stronger than ever, and the associated running costs are considerably lower than traditional internal combustion engine vehicles.' [EPA-HQ-OAR-2019-0055-1283-A1, p.7]

  37 https://www.theclimategroup.org/ev100-publications

Finally, EPA's assessment that HDEVs will achieve 1.5% market penetration by 2027 also ignores the regulatory impacts of the Advanced Clean Trucks (ACT) rule on technology advancement and adoption, which will require a 40–75% HDEV market penetration by 2035.38 17 states and the District of Columbia have signed a Joint Memorandum of Understanding that pledges to achieve a 30% HDEV market penetration by 2030 in each state, scaling toward a 100% HDEV market penetration by 2050.39 Five of these MOU states (in addition to the ACT rule's home state of California) have also adopted the ACT rule, and many more of the MOU states are expected to enact the ACT rule in the next few years.40 These MOU states represent 34% of all national HDV sales; if they all enacted the ACT rule, approximately 756,000 HDEVs would be deployed between 2024 and 2035.41 That number corresponds to more than 6% of all HDVs currently driving on America's roads, with a far higher market penetration.42 [EPA-HQ-OAR-2019-0055-1283-A1, pp.7-8]

38 https://calstart.org/wp-content/uploads/2022/02/ZIO-ZETs-Report_Updated-Final-II.pdf

39 https://ww2.arb.ca.gov/news/15-states-and-district-columbia-join-forces-accelerate-bus-and-truck-electrification

40 https://calstart.org/wp-content/uploads/2022/02/ZIO-ZETs-Report_Updated-Final-II.pdf

41 Ibid

42 https://fs.hubspotusercontent00.net/hubfs/8829857/ZETA-WP-MHDV-Electrification_Opportunities-and-Barriers_Final3.pdf

EPA's assessment similarly underestimates the impact of President Biden's executive order.43 If the HDEV market penetration is 1.5% in 2027, then the United States will drastically undershoot President Biden's transportation electrification goal. And we have already seen the introductory impacts of President Biden's executive order on electrifying the federal fleet. The General

Services Administration (GSA) is increasingly electrifying its fleet, the Department of Defense (DOD) is working to electrify some of its non-tactical vehicles, and the U.S. Postal Service (USPS) just ordered 10,019 electric delivery vehicles. These government HDEV investments will help build economies of scale for HDEV manufacturing to drive down their purchase prices, and will send clear market signals that will facilitate greater HDEV uptake in the private market. [EPA-HQ-OAR-2019-0055-1283-A1, p.8]

> 43 https://www.whitehouse.gov/briefing-room/presidential-actions/2021/08/05/executive-order-on-strengthening-american-leadership-in-clean-cars-and-trucks/

Based on market research, ZETA member companies' publicly available projections, and the current regulatory landscape, it is evident that HDEVs will achieve a much higher market share in 2027 than just 1.5%. For that reason, EPA should reconsider its analysis and enact more stringent NOx and GHG standards for the MY2027–30 period than it has proposed in Option 1. [EPA-HQ-OAR-2019-0055-1283-A1, p.8]

ZETA and our member companies stand ready to facilitate the transition to a fully electrified heavy-duty vehicle market. The HDEV market is primed to accelerate in the coming years—hundreds of thousands of vehicles have been ordered, the diversity of models available is growing exponentially, and battery prices are falling rapidly. Regulatory certainty will ensure that manufacturers continue to invest in HDEVs, which deliver marked environmental and public health benefits in addition to their reduced cost of operation and, in many cases, ownership. EPA should provide this regulatory certainty by adopting Option 1 at a minimum to reduce NOx emissions from HDVs, and EPA should increase the stringency of the MY2027–2030 GHG standards (including by eliminating the Phase 2 GHG standard's multipliers by MY2024). EPA should make this rule even more stringent than it has already proposed because it should consider the aforementioned expansion of the HDEV market and the other regulatory regimes already in place, including, most notably, the ACT rule. Issuing a stringent standard in this rulemaking will enable EPA to create strong—and environmentally and economically necessary—Phase 3 HDV rules in the coming years. [EPA-HQ-OAR-2019-0055-1283-A1, pp.9-10]

EPA Response

EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards) and may consider the comments in this section of this document in the development of that future rulemaking.

28.1.2 Proposed Standards are too Stringent and/or Should not Reopen HD GHG Phase 2

<u>Comments by Organizations</u>

Organization: *Alliance for Vehicle Efficiency (AVE)*

AVE opposes technology mandates, including Zero Emission Vehicle (ZEV) mandates. [EPA-HQ-OAR-2019-0055-1280-A1, p. 4]

AVE consistently urges regulators develop technology neutral standards. Standards based on performance are more likely to encourage broader investments into innovative technologies. A ZEV mandate signals to manufacturers that there is little incentive to invest in new engine technologies to meet future standards. [EPA-HQ-OAR-2019-0055-1280-A1, p. 4]

Organization: *Allison Transmission, Inc. (Allison)*

In proposing targeted updates to the Phase 2 Heavy-Duty GHG program, EPA has requested comment on ZEV sales projections to inform the level of GHG reductions that should be considered for MY 2027 and later year vehicles.51 EPA has also requested comment on different approaches that might be used to scale down the Advanced Technology Credit multiplier program after MY 2024. [EPA-HQ-OAR-2019-0055-1231-A1, p.23]

51 87 Fed. Reg. at 17,599.

As a component supplier, EPA's GHG standards do not directly apply to Allison. However, we hear our OEM customers' concerns about the importance of regulatory certainty to product development and share similar concerns about the precedent and disruption that re-opening the GHG Phase 2 Rule, finalized in 2016, can have to the industry. The commercial vehicle industry benefits from advanced awareness of and certainty in regulations to guide research and development and integration projects, and this foundation is important for reliable deployment of emissions reducing technology.[EPA-HQ-OAR-2019-0055-1231-A1, p.23]

Allison appreciates EPA acknowledgement of the importance to maintain four years of lead time to meet standards and appreciates the challenge EPA faces in developing GHG fleet standards based on projections of ZEV sales at this point in history where this is plenty reason for optimism, as well as a great deal of uncertainty. In this regard, however, Allison would note that EPA's analysis showed that the percentage of battery electric vehicles ("BEVs") certified for MY 2019 was 0.06 percent of the total heavy-duty vehicle market. While EPA did not supply a similar percentage for sales in MY 2020, with only 380 BEVs certified in that year versus 350 BEVs in the year prior, it would be clear that such vehicles are still a very small part of the overall heavy-duty vehicle market. Elsewhere in the proposed rule, EPA cites additional information concerning pronouncements by vehicle manufacturers and fleet operators, additional studies and economic rationale (lower total cost of ownership) to support projecting increased BEV sales in future years.52 California's various ZEV mandates are also cited. [EPA-HQ-OAR-2019-0055-1231-A1, p.23]

52 87 Fed. Reg. 17,595-7.

Based on such information, EPA is proposing an increase in vehicle (not engine-based) CO_2 emission standards which do not directly correspond to the vehicle categories used in the Phase 2 rule, resulting in an adjustment to 17 of the 33 vehicle categories defined in EPA regulations. Based on several analytical steps, EPA estimated that approximately 1.5% of heavy-duty vehicles in MY 2027 would be electric, and since these would theoretically "net out" vehicles without technology that would otherwise reduce CO_2 emissions, an overall increase in stringency of for certain vehicle categories was calculated.[EPA-HQ-OAR-2019-0055-1231-A1, p.23]

Allison believes that the Agency should consider several factors in arriving at any final increase in the stringency of Phase 2 standards. First, EPA must recognize that its methodology is not a "ground up" analysis that is of the same empirical quality as that contained in other rulemakings. The nascent nature of the BEV market does not allow for such quantification and there remain a range of uncertainties that cannot be fully quantified. In such a case, EPA should err on the side of more conservative estimates of the level of BEV market penetration that will occur five years from now.[EPA-HQ-OAR-2019-0055-1231-A1, pp.23-24]

Allison supports OEM Vehicle GHG certification by providing components, software features, and efficiency data for OEMs to use in the GEM model. Thus, a concern we hold regarding an overly aggressive ZEV sales prediction is that, should the BEV market not develop in the manner that some of the more optimistic projections indicate, OEMs would be placed in the position of seeking non-ZEV alternatives to meet more aggressive emission requirements. This situation would inevitably "trickle down" to component suppliers, increasing the pressure to quickly develop alternative CO_2 reduction technology based on conventional engines/powertrains. Concurrent elimination of Advanced Technology Credit Multipliers would only compound the difficulties OEMs and suppliers would face if ZEV adoption rates do not materialize as quickly as projected. [EPA-HQ-OAR-2019-0055-1231-A1, p.24]

In the NPRM, EPA did not propose to establish a heavy-duty ZEV mandate. At the same time, the Agency recognized the important role that ZEVs may assume in the heavy-duty sector. EPA based both the revision of Phase 2 stringencies on presumed ZEV uptake in the market as well as accounted for ZEVs with regard to the control of heavy-duty criteria pollutants, e.g., through proposing to allow the generation of NO_x emission credits by ZEVs. Therefore, under all of EPA's proposed options and alternatives, ZEVs will assume a more important place in EPA's regulation of the heavy-duty sector. ZEVS will affect the stringency of GHG and criteria pollutant standards and become an element of compliance flexibility for OEMs and indirectly, component suppliers. [EPA-HQ-OAR-2019-0055-1231-A1, p.32]

As noted in the introduction to our comments, Allison has invested in and continues to develop several lines of products for the electrification of HDVs, including Allison's emerging eGen Power® series which will be compatible with full battery electric vehicles and fuel cell vehicles as well as hybrid applications. Allison is currently engaged with OEM vehicle development programs and is supporting integration activities around it's e-Axle systems. Additionally, Allison is investing in a range of other technologies and product architectures to support the nationwide shift to electrification. Our insight into numerous OEM programs helps ensure that our program timing and pace of investments are aligned with OEM and end user requirements. [EPA-HQ-OAR-2019-0055-1231-A1, p.32]

To date, as a component supplier, Allison has not been directly regulated by CARB ZEV mandates nor would Allison be directly regulated at the federal level. But clearly any rule that is promulgated may serve as a reference point or the foundation for additional rulemakings, particularly where such are contemplated pursuant to Executive Order 14037: Strengthening American Leadership in Clean Cars and Trucks. [EPA-HQ-OAR-2019-0055-1231-A1, p.32]

Depending on how the final rules are structured at the federal and state level, even if Allison is not mandated to produce or sell ZEVs, components for ZEVs, BEVs and HEVs that Allison produces for other manufacturers may be affected by testing, certification and durability requirements and its commercial relationships with other manufacturers may be implicated. This, in turn, produces questions with regard to both compliance and regulatory flexibility (e.g., credits) that may be generated or available. Commercial issues also arise with respect to funding necessary research and development as ZEV mandates and/or other regulatory requirements or incentives are implemented and inevitably revised over time. In general, Allison favors performance-based standards that do not dictate particular technological outcomes. Emission standards should not be de facto mandates for specific technologies; rather they should be designed in a manner and within a timeframe that different technological approaches to reducing emissions can be pursued. [EPA-HQ-OAR-2019-0055-1231-A1, p.32]

Allison, as a long-time leading manufacturer of hybrid vehicle systems and like many of our competitors, is moving into components that will allow for greater electrification of the vocational vehicle fleet. But development of these systems requires substantial investment and verification of their performance, including evaluation of their durability. This necessary process means that EPA should not project broad adoption of ZEV technology across the medium- and heavy-duty fleet. And, while the Proposed Rule does not mandate the sale of any ZEV vehicles, EPA should not impose stringencies and other regulatory requirements which would result in a de facto requirement for ZEV vehicles. The vocational vehicle sector responds to the demands of its customers and Allison and other vendors are working to meet anticipated demand for ZEV and other alternatively-fueled vehicles with favorable GHG performance. EPA should be wary of producing counter-productive results by favoring one technology (ZEV) over other potential health and environmental solutions.[EPA-HQ-OAR-2019-0055-1231-A1, pp.37-38]

Organization: *American Fuel & Petrochemical Manufacturers (AFPM)*

EPA sets a relatively modest penetration rate for BETs in this rule but is taking comments on higher target levels. Higher BET penetration rates will result in a significant environmental impact that must be fully considered. Processing commodities is an energy and environmentally intensive activity and results in emissions that the agency cannot ignore, as indicated by the chart from the IEA below.10 [EPA-HQ-OAR-2019-0055-1262-A1, p.3]

10 See IEA’s Critical Minerals Report, at 17.

Increased use of BETs also creates security concerns. China has a dominant position in the global supply chain for battery production as detailed in a recent report noting '[w]idespread commercialization of EVs will only make the United States more susceptible to China's threats.' 11 Motor vehicle electrification can make the United States beholden to China and other nations that control the minerals required to manufacture EV batteries, chips, and other components.12 [EPA-HQ-OAR-2019-0055-1262-A1, p.4]

11 See Securing America's Future Energy, The Commanding Heights of Global Transportation, at 46, https://secureenergy.org/wp-content/uploads/2020/09/The-Commanding-Heights-of-Global-Transportation.pdf, last visited May. 16, 2022.

12 See https://www.visualcapitalist.com/chinas-dominance-in-clean-energy-metals/, based on data from the International Energy Administration, Executive Summary, https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/executive-summary

EPA must not ignore increased battery degradation (and earlier disposal and replacement) associated with the 'fast-charging' that is most frequently utilized to minimize the hours of charging time that would otherwise be required to place a commercial truck in service.13 Studies have shown that fast-charging a battery causes lithium plating and dendrite formation around the anode, permanently reducing its capacity. At a pack level, it can cause cells to age at different rates and pack overheating.14 Further studies of light-duty vehicles reveal that vehicle hardware improvements to enable these increased fast-charging speeds could cost approximately $1,000, assuming no change in battery size.15 [EPA-HQ-OAR-2019-0055-1262-A1, pp.4-5]

13 See Fast-charging damages electric car batteries, Univ. Calif. Riverside News (March 11, 2020), https://news.ucr.edu/articles/2020/03/11/fast-charging-damages-electric-car-batteries, last visited, May16, 2022.

14 See The International Council on Clean Transportation, Lessons Learned on Early Electric Vehicle Fast-Charging Deployments, White Paper (July 2018), at 6, https://theicct.org/sites/default/files/publications/ZEV_fast_charging_white_paper_final.pdf.

15 Id.

EPA must fully quantify the costs associated with fast-charging, including the adjustments to battery replacement schedules, for heavy-duty vehicles and seek public comment on that analysis before finalizing this proposal. [EPA-HQ-OAR-2019-0055-1262-A1, p.5]

The trucking industry's driver shortage and its impact on supply chains and the price of consumer goods has made national news. The trucking industry cannot afford to idle drivers for long periods of recharging.16 Most medium- and heavy-duty vehicles take less than 10 minutes to fuel with petroleum-based liquid fuels, but even using a supercharging rate of 350 kW,17 a BET would take over an hour. If the operator avoids supercharging to avoid degrading the battery, charging would take even longer. Long charging times adversely impact trucking productivity. The Federal Motor Carrier Safety Administration's Hours of Service regulations limit a driver's time on-duty, and increased charging time reduces the amount of time that a driver can legally operate the vehicle.18 [EPA-HQ-OAR-2019-0055-1262-A1, p.5]

16 See, e.g., Truckers are getting big pay hikes, but there's still a shortage of drivers, CNN.com (May 29, 2021), https://www.cnn.com/2021/05/29/economy/truck-driver-shortage-pay-hikes/index.html.

17 See How Does Electric Vehicle (EV) Public Charging Work?, Electrify America, https://www.electrifyamerica.com/how-ev-charging-works/., last visited, May 16, 2022.

18 See 49 CFR Part 395.

EPA must account for and seek public comment on these real-world increased labor costs and the impact on the cost of consumer goods before finalizing this proposal. [EPA-HQ-OAR-2019-0055-1262-A1, p.5]

The installation of charging stations will also require significant investment in additional transformers, distribution circuits, conductors, substations, transmission lines, dependable generating capacity, and other necessary grid upgrades. These costs can be staggering and EPA must provide an analysis of the impacts of these electricity upgrades as truck electrification increases. As an example, for modest light-duty EV penetration, the city of Sacramento determined that approximately 12,000 transformers needed to be replaced at an average cost of $7,400 each. The total investment would almost total $90 million.19 [EPA-HQ-OAR-2019-0055-1262-A1, p.5]

19 See Smart Electric Power Alliance, Utilities and Electric Vehicles: The Case for Managed Charging, 13, available at http://emotorwerks.com/images/PR/Articles/sepa-managed-charging-ev-report.pdf. last visited, May 16, 2022.

These infrastructure costs will increase ratepayer's costs if the utilities seek to include these costs in their rate-base and, separately, will require businesses and government entities that rely on BETs to make massive investments in onsite power distribution grid upgrades and charging equipment. EPA must estimate these costs and seek public comment before finalizing this proposal. [EPA-HQ-OAR-2019-0055-1262-A1, p.5]

Similarly, battery-powered trucks and buses may be uncompetitive and impractical for weight-sensitive and many mid-range or long-haul routes.20 Weight limitations would require more BETs to move an equivalent amount of cargo (as the vehicles weigh-out). Moreover, increasing truck trips would only exacerbate existing congestion at the ports. [EPA-HQ-OAR-2019-0055-1262-A1, p.6]

20 California Air Resources Board, Public Hearing to Consider the Proposed Advanced Clean Trucks Regulation, Staff Report: Initial Statement of Reasons at I-9 (Oct. 22, 2019), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/isor.pdf ('ZEVs may not be suitable for periodic towing of heavy loads which could be a problem for a vehicle with limited range capability.'), last visited, May 16, 2022.

Additionally, temperature significantly impacts battery performance and vehicle range. EPA should consider the significant and deleterious impacts that both hot and cold weather have on EV battery performance and associated charging requirements and emissions, as these issues would have a significant impact on the cost-benefit analysis supporting this proposal and a consumer's vehicle selection choice.21 [EPA-HQ-OAR-2019-0055-1262-A1, p.6]

21 See American Automobile Association (AAA), Electric Vehicle Range Testing at fig. 68 (Feb. 2019), https://www.aaa.com/AAA/common/AAR/files/AAA-Electric-Vehicle-Range-Testing-Report.pdf (Percent change in cost for 1000 miles of combined urban/highway driving relative to 75°F), last visited, May 16, 2022.

Medium-duty and heavy-duty electric trucks will increase tire wear and associated particulate matter emissions in the areas where they operate. EPA's analysis does not evaluate these emissions.22,23 [EPA-HQ-OAR-2019-0055-1262-A1, p.6]

> 22 See Jim Park, Equipment: What Will Electrification Mean for Truck Tires?, Trucking Info (Sept. 9, 2021), https://www.truckinginfo.com/10151115/what-will-electrification-mean-for-truck-tires ('Torque loads on drive tires will increase not only thanks to the higher output of electric motors compared to internal combustion engines, but also because regenerative braking will impart torsional forces on tires in the opposite direction. This will affect tire tread wear as well as sidewalls.'), last visited, May 16, 2022.
>
> 23 See International Council for Clean Transportation, Benefits of adopting California medium- and heavy-duty vehicle regulations in New York State at 6, Working Paper 2021-23 (May 2021), at 6, https://theicct.org/publications/nys-hdv-regulation-benefits-may2021 ('STI did not apply any adjustment to particulate matter tire-wear emissions.'), last visited, May 16, 2022.

EPA May Not Consider California's Advanced Clean Trucks Program

EPA relies on California's adoption of its Advanced Clean Trucks Program as evidence of a trend toward truck electrification and a substantial basis of EPA's proposal. However, these rules lack federal preemption approval39 and have not been implemented. EPA states 'these developments have demonstrated that further CO_2 emission reductions in the MY 2027 timeframe are feasible,' although no such demonstration has occurred because, again, the rules are yet to be implemented. EPA further states '[w]e also may incorporate the CARB Advanced Clean Truck (ACT) Regulation into our final rule analyses.' Footnote 90 in the Proposal states that 'EPA has received waiver requests under CAA section 209(b) from California for the Omnibus or ACT rules; EPA is currently reviewing the waiver requests for the CA Omnibus and ACT rules and may consider including these rules in our analyses for the final rule.' To do so, EPA must first satisfy its obligations under 209(b), which provides '[t]he Administrator shall, after notice and opportunity for public hearing, waive application of this section' if a list of conditions is met by the State. EPA cannot consider the implications of fully implemented California rules in its rulemaking until it approves California's waiver request and demonstrates it as 'feasible.' [EPA-HQ-OAR-2019-0055-1262-A1, p.10]

39 42 U.S.C. 7543(b)

Organization: *American Truck Dealers (ATD)*

New GHG Standards: ATD categorically opposes increases to the stringency of the Phase 2 HDE/CMV fuel economy/GHG standards applicable through MY 2027 as they would undermine the regulatory certainty that is critical to compliance. The technology-forcing Phase 2 standards resulted from a carefully coordinated joint rulemaking with the National Highway Traffic Safety Administration (NHTSA), which is primarily responsible for administering the Energy Policy and Conservation Act (EPCA), as amended by the Energy Independence and Security Act (EISA).5 Indeed, NADA suggests that it would be contrary to the intent of Congress for EPA to, on its own, revise the Phase 2 HDE/CMV fuel economy/GHG standards. Moreover, EPA's suggestion that the Phase 2 mandates should be tightened given potential HDE and CMV OEM ZEV product plans is an arbitrary and unjustified "no good deed goes unpunished" policy strategy. [EPA-HQ-OAR-2019-0055-1321-A1, p. 3]

5. Section 102 of EISA specifically mandated that NHTSA coordinate with EPA to establish fuel economy/GHG standards for medium- and heavy-duty trucks. 49 U.S.C. §32902(b)(1)(C).

In addition, while ATD does not oppose work by EPA on a new (Phase 3) fuel economy/GHG rulemaking for MYs 2030 and later, such rulemaking also must be conducted jointly with the NHTSA, consistent with the statutory authority spelled out in EPCA, as amended by EISA. [EPA-HQ-OAR-2019-0055-1321-A1, p. 3]

As discussed above, ATD urges EPA to move forward with a single set of technologically achievable and customer acceptable national HDE NOx standards for MY 2027 and later, while relegating any consideration of new HDE GHG mandates to a separate "Phase 3" rulemaking. [EPA-HQ-OAR-2019-0055-1321-A1, p. 8]

Organization: *American Trucking Associations (ATA)*

ATA has established 12 fleet Guiding Principles that should be considered in the development of HD2027 including:

• HD2027 should not serve as a mechanism to amend the Phase 2 rule that was finalized in 2016 and supported by industry stakeholders. [EPA-HQ-OAR-2019-0055-1326-A1, p. 5]

While ATA cannot address every aspect of HD2027, we are supportive of the underlying environmental objectives and several of the elements being proposed. ATA's areas of support include: Recognition that NOx reductions should align with both EPA's Phase 2 and Phase 3 greenhouse gas ("GHG") implementation milestones to afford manufacturers the necessary lead-time and ability to conduct thorough research and development to align competing regulatory objectives. [EPA-HQ-OAR-2019-0055-1326-A1, p. 3]

ATA does not support the reopening of the EPA 2016 Phase 2 rule. Reopening any final rule that was the culmination of years' worth of stakeholder discussions, input, data sharing, and negotiation is simply not good public policy. After having worked with EPA in good faith, changing a final rule mid-stream sets a bad precedent and upends the lead-time, planning, and resources necessary for manufacturers to design technologies for the future. [EPA-HQ-OAR-2019-0055-1326-A1, p. 18]

Testimony presented on Phase 2 by several stakeholders during the April 12-14 EPA public hearing encouraged the agency to not only tighten truck GHG standards in 2027, but also in years 2028 and 2029 as well. Testimony called for Phase 2 revisions to mandate zero-emission trucks. What became abundantly clear during the hearing was that none of the parties testifying in support of accelerated decarbonization efforts purchased or operated trucks nor did they run trucking companies. No testimony presented solutions as to how to pay for an accelerated "green transportation" transition. With the cost of new Class 8 electric trucks costing over $400,000 per vehicle, and fuel cell vehicles estimated to cost even more, trucking fleets simply cannot afford the up-front costs to buy new trucks that are 3-4 times more expensive than their clean diesel counterparts. [EPA-HQ-OAR-2019-0055-1326-A1, p. 18]

While it is understood that HD2027 was a convenient mechanism to modify requirements under a totally separate rulemaking, changes in circumstances not originally anticipated by the agency under Phase 2 should not warrant more stringent standards. From a purely equitable standpoint, the agency should also change the implementation of mobile source final rules that adversely impact fleet operations due to changes in circumstances as well – such as pandemics, labor and technician shortages, excessive inflationary rates, economic downturns, parts shortages, or technological inability to comply. In other words, good public policy necessitates the door swinging both ways. [EPA-HQ-OAR-2019-0055-1326-A1, p. 19]

President Biden's August 2021 Executive Order already requires the agency complete its Phase 3 rule by the summer of 2024. With initial discussions about to begin, there will be abundant opportunities for stakeholder input on further tightening truck GHG standards in 2030 and beyond. The trucking industry continues to support the pursuit of one nationwide zero-emission vehicle plan that is reasonable, logical, affordable, and the least-disruptive to not impede the nation's supply chains. [EPA-HQ-OAR-2019-0055-1326-A1, p. 19]

Organization: *Autocar, LLC (Autocar)*

In supporting the spirit of the Proposed Rule, Autocar proposes the following modifications:

1. Maintain emission standards for 2027 and beyond at current levels for small manufacturers, and provide credit opportunities for small manufacturers that are able to produce and sell trucks that meet the more stringent standards. [EPA-HQ-OAR-2019-0055-1292-A1, p. 1]

Autocar produces specialized heavy-duty vocational trucks and yard tractors used across the United States to collect and dump solid waste and recycling, sweep streets, mix and pump concrete and shunt freight at warehouses, railroads and ports. Autocar has been a leader in refuse truck industry adoption of environmentally-supportive vehicles and technologies. In recent years, at least 40% of Autocar's refuse trucks sold for use in the U.S. were built with compressed natural gas ("CNG") engines. Autocar has built and sold more than 8,000 CNG trucks. These trucks reach the country's most disadvantaged and polluted communities, and lead to lower daily emissions from mobile sources. CNG-fueled vehicles now comprise the largest portion of Autocar's refuse truck production. No other refuse truck maker's product mix reflects a higher concentration of clean-fuel burning vehicles. And while less viable in the marketplace, Autocar also produced and sold hybrid refuse vehicles, from which the Company gained additional experience in development of lower emission vehicles. [EPA-HQ-OAR-2019-0055-1292-A1, p. 2]

Over the last three years, Autocar accelerated and made great progress in its commitment to environmentally-supportive vehicles through development of an all-electric, zero-emission ("ZEV") yard tractor. The time line for bringing to market heavy-duty ZEV refuse trucks and other severe-duty applications is largely dependent on progress in heavy-duty battery development, integration with body companies and installation of charging infrastructure. Autocar is working hard to be ready with its own pieces of the puzzle so that it can incorporate those other pieces when available. Nevertheless, as further described below, Autocar faces unique challenges. [EPA-HQ-OAR-2019-0055-1292-A1, p. 2]

Those unique challenges were recognized by EPA during GHG Phase 1 and Phase 2 rulemaking. Small manufacturers were completely exempt from Phase 1. For Phase 2, Autocar worked closely with the Heavy-Duty Diesel Standards team in Ann Arbor to provide flexibilities for small manufacturers, including delayed imposition of Phase 2 standards (with incentives for early Phase 1 opt-in) and opportunities for small manufacturers to generate emissions credits during Phase 1 for use in Phase 2. When it became clear that large manufacturers would generate emissions credits across their diverse, high-volume heavy duty vehicle lines, including over-the-road trucks, and use those credits to certify their vocational trucks, the risk that small manufacturers would not be able to certify and stay in business became very real. [EPA-HQ-OAR-2019-0055-1292-A1, p. 2]

The Notice of Proposed Rulemaking (NPRM) recognizes that small business vehicle manufacturers will be disproportionately impacted by the imposition of more stringent emission standards. In general, the justification for increasing the stringency of the GHG standards for heavy-duty vehicles in 2027 is the proliferation of certain heavy duty ZEV's, which EPA anticipates will be accelerated by California's Advance Clean Trucks and Advance Clean Fleet regulations (the "California ZEV Regulations"). [EPA-HQ-OAR-2019-0055-1292-A1, p. 3]

The Proposed Rule as well as the California ZEV Regulations will impose disproportionately high burdens on a small business like Autocar, which produces small volumes of a select few product lines. The lack of product mix denies Autocar the benefit of averaging and aggregating credits. The low overall volume denies Autocar the benefit of banking credits and prevents it from spreading development and compliance costs across many vehicles. Specifically, Autocar's development and compliance costs will be concentrated within its current volume of approximately 3,000 vehicles annually. In contrast, Autocar's competitors will spread such costs across tens of thousands of vehicles and multiple product lines, and with vertical integration and robust purchasing power, the competition will gain a competitive advantage over its "small town" competitor. [EPA-HQ-OAR-2019-0055-1292-A1, p. 3]

Small manufacturers have less diverse product lines than large manufacturers. Autocar's main product lines are refuse vehicles, yard tractors, street sweepers, dump trucks and a few other severe-service applications. Unlike its large competitors, Autocar does not build chassis for any of the "targeted subcategories" (school buses, transit buses, delivery trucks and short-haul tractors) that are providing the perceived boost in ZEV demand and production. Therefore, although the GHG standards for Autocar's trucks will be more stringent under the Proposed Rule, Autocar will not benefit from any early industry shift to ZEV's. [EPA-HQ-OAR-2019-0055-1292-A1, p. 3]

Pandemic-related shortages of supply of parts and components for vehicles are challenging all manufacturers, and it is unclear how or when those problems will be resolved. However, the impact on small manufacturers is multiplied by their lower cash flows, lack of diversity of product and lower relative purchasing power. In fact, when shortages occur, suppliers allocate based on volume, which puts small manufacturers at the back of the line. [EPA-HQ-OAR-2019-0055-1292-A1, p. 3]

In particular, small manufacturers have experienced sourcing issues during ZEV development. ZEV technology suppliers are demanding large capital investments that exceed what small businesses can commit. And Autocar is not in a position to build a battery production plant or acquire whole existing ZEV technology producers, like their large competitors are. [EPA-HQ-OAR-2019-0055-1292-A1, p. 3]

Although California will compel fleets to purchase ZEV's, other states will not. And although California is attempting to develop ZEV charging infrastructure, other states are not. Therefore, small manufacturers who are compelled by the regulations to produce ZEVs may not be able to sell those vehicles, thus increasing the risk of falling short of meeting the standards. [EPA-HQ-OAR-2019-0055-1292-A1, p. 3]

Autocar does not design or manufacture its own conventional engines or transmissions. Unlike its vertically-integrated competitors, Autocar is entirely dependent on outside suppliers for these major vehicle components. [EPA-HQ-OAR-2019-0055-1292-A1, p. 4]

The same is true for batteries and many other ZEV powertrain components. Therefore, it will be more difficult for small businesses like Autocar to build trucks that meet the more stringent standards. For example, because Autocar's product lines are limited, the supply base options for ZEV components are limited, requiring more global shipments; specifically, battery cores for Autocar applications are only available from China. [EPA-HQ-OAR-2019-0055-1292-A1, p. 4]

Autocar has strong relationships with its suppliers; however, they have compliance requirements of their own, and they have much larger customers than Autocar. The market and order volumes obviously drive their decision making on investment in development. [EPA-HQ-OAR-2019-0055-1292-A1, p. 4]

Recognizing that EPA may ultimately impose emission standards even more stringent than as currently set forth in the Proposed Rule, Autocar offers a few simple modifications to the

Proposed Rule to alleviate the competitive advantage that more stringent GHG emission standards bestow upon large manufacturers. [EPA-HQ-OAR-2019-0055-1292-A1, p. 5]

First, EPA should maintain emission standards for 2027 and beyond at current levels for small manufacturers, and provide credit opportunities for small manufacturers that are able to produce and sell trucks that meet the more stringent standards. That way, small manufacturers that do not share the benefit of the ZEV development and sales that are prompting the changes to the standards will meet the original 2027 standards and be incentivized to continue development to earn credits. [EPA-HQ-OAR-2019-0055-1292-A1, p. 5]

Small manufacturers are uniquely impacted by emission standards and changes to emission standards. Autocar requests that EPA maintain emission standards for 2027 and beyond at current levels for small manufacturers, and provide credit opportunities for small manufacturers that are able to produce and sell trucks that meet the more stringent standards. An extension of the interim provisions for credit generation for CNG trucks will help small business keep up with credit generation by their large competitors. [EPA-HQ-OAR-2019-0055-1292-A1, p. 6]

As set forth in the NPRM, EPA set the existing heavy-duty GHG Phase 2 standards at levels that would require all conventional vehicles to install varying combinations of emission-reducing technologies (the degree and types of technology can differ, with some vehicles that have less being offset by others with more), leading to emissions reductions. In Autocar's experience, no large manufacturers are offering these "Phase 2 technologies" on their vocational vehicles other than neutral-idle, and the other technologies are not viable or not available for purchase in the vocational market. For example:

- Vehicle Speed Limiter – Most of Autocar's trucks run in the Urban cycle. Vehicle speed limiting has little to no effect in these duty cycles. [EPA-HQ-OAR-2019-0055-1292-A1, pp. 4 - 5]

- Start-Stop – Autocar's engine supplier does not currently offer this technology and does not intend to offer it with Autocar's engines in the future. As such, this technology is not currently available to use in compliance. [EPA-HQ-OAR-2019-0055-1292-A1, p. 5]

- Automatic Engine Shutdown – Autocar's engine supplier currently offers this technology only for tractor engines and specifically excludes vocational engines. They do not plan to extend to vocational applications, in part due to Autocar being the only manufacturer requesting this option. [EPA-HQ-OAR-2019-0055-1292-A1, p. 5]

- Tire Pressure Monitoring – During our launch of tire pressure monitoring, customers experienced various challenges with implementation of this technology, so TPMS has not been launched successfully to date. Autocar's development of solutions to make this successful in the vocational market is ongoing, but currently there is not path to solve the customer implementation issues. It is unclear whether this technology will be available for Phase 2 certification. Further, tire pressure technologies have little impact on reducing GHG emissions, so the return on investment for manufacturers and customers is hard to justify. [EPA-HQ-OAR-2019-0055-1292-A1, p. 5]

Based on Autocar's observations in the market, large manufacturers are using credits earned on non-vocational vehicles to meet Phase 2 standards on their vocational vehicles, rather than installing Phase 2 technologies, which makes it unlikely that engine manufacturers will bring them to market. It is unclear whether Autocar and other small manufacturers will have earned enough credits on vocational vehicles in Phase 1 to get them through Phase 2. But it is clear that fleet owners are not interested in purchasing the added cost and weight of many of the Phase 2 technologies. [EPA-HQ-OAR-2019-0055-1292-A1, p. 5]

Organization: *Clean Energy (CE)*

<u>Near-Zero Trucks are the Only Alternative Deployable on a Large-Scale</u> [EPA-HQ-OAR-2019-0055-1350-A1, p.2]

Heavy-duty near-zero trucks are capable of ranges exceeding 600 miles and refuel in about 5 to 7 minutes. Electric trucks are significantly constrained by their limited range of roughly 150 miles or less2. This significant barrier to viability is further compounded by recharging times that can exceed three hours3. Oregon Trucking Association President Jana Jarvis recently stated, *'Then you think about having to stop and recharge — if there was a charging infrastructure and if there was enough grid capacity. And both of those are questions today. You start thinking about doing that every couple hundred miles and you realize the inefficiencies the trucking industry would be subject to by conversion to electric vehicles.4'* [EPA-HQ-OAR-2019-0055-1350-A1, p.2]

2 https://www.electrive.com/2022/01/07/kenworth-presents-first-class-8-electric-truck/#:~:text=The%20vehicle%20is%20equipped%20with,at%20up%20to%20120%20kW.

3 https://www.fleetequipmentmag.com/kenworth-class-8-battery-electric-t680e-available-order/

4 M. Samayoa, OPB.org, Zero emissions trucks could be soon be required in Oregon (Nov. 15, 2021); https://www.opb.org/article/2021/11/15/zero-emissions-trucks-could-soon-be-required-in-oregon/

These significant performance restrictions in turn require, in most cases, two electric trucks to replace the work of one diesel. This key factor appears to be ignored in cost-comparisons and emission comparisons, but they have significant implications. This reality makes the cost of replacing a single diesel truck with electric power at around $1 million whereas a near-zero truck can be purchased for approximately $170,000 depending on its configuration. [EPA-HQ-OAR-2019-0055-1350-A1, p.2]

In a November 2021 interview, Daimler Truck CEO, Martin Daum stated, *'The first truth is, in heavy duty commercial vehicles you need such a huge amount of energy, meaning you need such large batteries, that such a truck always will cost significantly more than a combustion engine powered truck.'*5 This problem is further compounded by the rising costs of the batteries themselves. The chief executive of Benchmark Mineral Intelligence in October of 2021 told Reuters, 'The market may have to reposition itself for a period of rising battery cell prices, a new phenomenon for an industry conditioned to expect year-on-year falls.'6 While we have been hearing about heavy-duty EV trucks for years, the reason you do not see them being deployed, outside of demonstration projects, is they face a triple layered barrier to adoption consisting of severely limited range, long recharging times and the need, in most cases, of purchasing two EV trucks for every diesel replaced. [EPA-HQ-OAR-2019-0055-1350-A1, p.2]

5 Meghana Kandra, 'Diamler CEO Talks About Advancements in Heavy Electric Duty Truck', https://www.cnbc.com/2021/11/12/too-risky-to-not-use-battery-and-hydrogen-tech-daimler-truck-ceo.html, November 13th, 2021.

6 Pratima Desai, 'High Lithium Costs Start To Feed Into Prices of China EV Batteries', https://www.reuters.com/technology/high-lithium-costs-start-feed-into-prices-china-ev-batteries-bmi-2021-10-29/, October 29th, 2021.

California's HVIP program is a great illustration of the real-world effects of this massive barrier. The HVIP program has provided over half a billion dollars of vouchers specifically for electric powered trucks, but 97 percent of those vouchers have not been redeemed.7 As the EV industry works to navigate significant hurdles, near-zero engines are being deployed. UPS is in the process of purchasing 6,000 new natural gas trucks and has signed an agreement to purchase 250 million gallon equivalents of RNG.8 New regulatory support for large-scale deployments of near-zero trucks is in-line with the Biden Administrations 'Long Term Strategy' for achieving net-zero emissions. The plan states that the Administration will 'prioritize clean fuels like carbon-free hydrogen and sustainable biofuels where electrification is challenged.'9 [EPA-HQ-OAR-2019-0055-1350-A1, p.3]

7 Impact - Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project | California HVIP, May 15, 2022

8 https://about.ups.com/sg/en/our-stories/innovation-driven/renewable-natural-gas-is-an-important-part-of-ups-strategy-to-in.html

9 https://www.whitehouse.gov/wp-content/uploads/2021/10/US-Long-Term-Strategy.pdf

The Southern California air basin is the most challenged attainment zone in the United States in terms of air quality. Wayne Nastri, Executive Director of the Southern California Air Quality Management District stated in an August 2021 letter, *'There are multiple reasons why, despite manufacturer promises to the contrary, as a practical matter ZE heavy-duty trucks are not available today. First, while there appear to be multiple heavy-duty ZE truck models available for order, getting these vehicles delivered in a timely manner is an entirely different matter. Second, there are ongoing concerns regarding whether ZE trucks can meet needed duty-cycles.*

*Third, there is currently a dearth of charging infrastructure and concerns regarding sufficient power supply needed to support widespread electrification.'*11 [EPA-HQ-OAR-2019-0055-1350-A1, p.3]

11 August 3, 2021 Letter From Wayne Nastri to Environmental Justice and Environmental Health Partners.

Organization: *ClearFlame Engine Technologies (ClearFlame), Remora, and SixWheel*

With respect to reducing greenhouse gas (GHG) emissions from heavy-duty vehicles and engines, we strongly believe that EPA should establish fuel-neutral, technology-neutral, performance-based standards and incentives that allow all effective technologies to be recognized for their contributions. Further, we urge the Agency to avoid prescribing specific fuels, power sources, or technologies that engine and vehicle companies must use to meet the Proposal's emissions standards or take advantage of its incentives. [EPA-HQ-OAR-2019-0055-1329-A2, p. 2]

We must work to reduce emissions from vehicles that are on the road now and until we reach this goal. Furthermore, the urgency of the climate crisis demands that all solutions are pursued. Any technology that can deliver near-zero emission transportation at scale in the coming decade should have a pathway in EPA regulations. [EPA-HQ-OAR-2019-0055-1329-A2, p. 3]

100% zero-emission vehicles are always the ideal solution. However, given the urgency to decarbonize the entire transportation sector to net-zero levels by mid-century and to reduce GHGs as much as possible this decade, near-zero emission vehicles must be a necessary part of the solution. The EPA acknowledges the difficulty of extended-range battery electric vehicles (BEVs) and fuel cell electric vehicles (FCEVs) (Federal Register, p. 17562). Industry members are keenly aware of these difficulties. Innovation will be necessary to achieve long-term HDV emissions goals. The EPA, thus, must design regulations with room for near-zero emissions solutions. [EPA-HQ-OAR-2019-0055-1329-A2, p. 3]

We object to any sales mandate that is only for BEVs or FCEVs. Such mandates will stifle innovation. They will also reduce the overall GHG emissions reductions that will result from finalizing this Proposal by limiting the future market to only a limited set of technology solutions. Instead, EPA should encourage innovators to pursue all viable solutions in case any one solution does not work out. Thus, we strongly urge EPA to avoid mandates of specific technologies, whether in the Advanced Technology Incentive Program, in federal versions of the Advanced Clean Truck and Advanced Clean Fleet rules, and otherwise. [EPA-HQ-OAR-2019-0055-1329-A2, p. 3]

The included three (3) technologies offer pathways to carbon negative transportation. In other words, we may be able to turn vehicles into carbon removal devices — through a bioenergy with carbon capture & storage (BECCS) pathway. These offer perhaps the most feasible path to the Administration's Department of Energy EarthShot Initiative for carbon removal under $100/ton. We must ensure all transformative solutions are given the opportunity to develop. [EPA-HQ-OAR-2019-0055-1329-A2, p. 3]

ClearFlame, Remora, and SixWheel are developing effective emissions-reduction technologies for one of the hardest-to-decarbonize sectors. These developers must be supported and given a pathway in regulations – not shut out. [EPA-HQ-OAR-2019-0055-1329-A2, p. 3]

The EPA's own history shows the risk of prematurely "picking winners." In the early 2000s, EPA tried to drive the market place towards using NOx adsorbers to meet the 2007 and 2010 NOx standards. The market ultimately determined that Selective Catalytic Reduction (SCR) was a more cost-effective and vastly preferred strategy. [EPA-HQ-OAR-2019-0055-1329-A2, p.. 3 - 4]

As you update the Agency's Phase 2 GHG standards for certain heavy-duty vehicles and as you develop EPA's expected proposal for new Phase 3 GHG standards that will apply to all heavy-duty engines and vehicles, we strongly urge you to adapt EPA's successful fuel-neutral, technology-neutral "systems approach" to reducing greenhouse gas (GHG) emissions from all of the nation's heavy-duty engines and vehicles. [EPA-HQ-OAR-2019-0055-1261-A1, p. 3]

An innovation-driven, all-of-the-above approach will lead to more rapid carbon mitigation than pre-selecting particular technologies. The current Proposal includes provisions that reward BEVs and FCEVs that are not available to other technologies, including but not limited to ours. This approach will delay –and ultimately reduce – the overall GHG benefits of the program, an unintended consequence with real-world climate impacts. [EPA-HQ-OAR-2019-0055-1261-A1, p. 3]

We strongly urge EPA to revise these provisions in its final rule to enable all technologies to qualify under these provisions, thereby sending a market signal that encourages all innovations that may achieve the same – or even greater – emissions benefits when upstream and other indirect emissions are considered, at greater speed, scale, and/or cost-effectiveness. [EPA-HQ-OAR-2019-0055-1261-A1, p. 3]

We strongly urge EPA to revise its definition of "Fuel" and other provisions that will be necessary to ensure that a ClearFlame engine can be certified and operate using any high-blend ethanol or biofuel, including E85 and E98. [EPA-HQ-OAR-2019-0055-1261-A1, p. 3]

The Proposal lists ethanol only as a blend option for gasoline. It is critical that EPA sends the right market signal here – that an ethanol-fueled compression-ignition engine can receive the appropriate EPA certification and any incentives that it qualifies for, by virtue of its emissions performance. [EPA-HQ-OAR-2019-0055-1261-A1, p. 3]

EPA Should Maintain its Historic Fuel-Neutral, Technology-Agnostic Performance-Based Approach in the Proposal's Final Rule and Next Year's Expected Phase 3 GHG Proposal.

For the reasons outlined above, a fuel-neutral, technology-neutral, "systems approach" is still critically necessary – both for this Proposal and for next year's expected proposal to reduce GHGs from all heavy-duty engines and vehicles. [EPA-HQ-OAR-2019-0055-1261-A1, p. 4]

Here are just a few reasons why: [EPA-HQ-OAR-2019-0055-1261-A1, p. 4]

First, diesel engines will continue to emit a significant portion of the transportation sector's NOx and GHG emissions inventories in 2050. Even in states that have adopted California's Advanced Clean Truck Rule, up to 60% of the truck tractor sales market will still be diesel in 2035.5 These engines are likely to remain on the roads for decades thereafter. In other words, diesel engines that are sold in 2035 will still be in use deep into mid-century. [EPA-HQ-OAR-2019-0055-1261-A1, p. 4]

5. California's Advanced Clean Truck Rule, which has been adopted by New York and other states, requires 55% of Class 2b-3 truck sales, 75% of Class 4 – 8 straight truck sales, and 40% of truck tractor sales to be zero-emission by 2035.

Second, EPA's Heavy-Duty Highway Engine and Vehicle Rule of 20016 (the "2001 Diesel Rule") showed that a fuel-neutral, technology-neutral, performance-based "systems approach" reduced emissions and related health harms at scale, faster and most cost-effectively that any approach that picked specific technology winners. Indeed, when the 2001 Diesel Rule was finalized, it was widely anticipated that NOx adsorbers would be the "technology winner" that would enable diesel engines to meet the NOx standard in that rule. A competing technology, Selective Catalytic Reduction (SCR), was considered impractical and unlikely to succeed, due to the logistical hurdles posed by the need for SCR-equipped engines to use urea to operate cleanly. By 2010, SCR had become the industry standard, and NOx adsorbers never reached widespread use in the heavy-duty truck market. The lesson from that rule is clear: despite pressure to anoint NOx adsorbers as the technology "winner," the final Rule was drafted in a fuel-neutral, technology-neutral, performance-based manner, which enabled the market to innovate and then shift quickly to a technology solution that enabled implementation at scale, in the most cost-effective and fastest way possible, within a decade. [EPA-HQ-OAR-2019-0055-1261-A1, p. 5]

6. EPA, Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements, Regulatory Announcement, accessed on May 15, 2002 at https://nepis.epa.gov/Exe/ZyPDF.cgi/P1001CXZ.PDF?Dockey=P1001CXZ.PDF.

We encourage the EPA to establish objective and transparent emissions-based criteria that qualify a technology as zero or near-zero emissions. Any and all technologies that demonstrate proper emissions reductions should be able to qualify. It is essential for market fairness and to send the appropriate market signal to technology developers. [EPA-HQ-OAR-2019-0055-1329-A2, p. 4]

In sum, we strongly urge EPA to adopt a final NOx and GHG program that is open to all demonstrated, cost-effective emissions-reduction solutions. Doing so is critical to achieve near-term and long-term goals. [EPA-HQ-OAR-2019-0055-1329-A2, p. 4]

It is important to avoid unnecessarily limiting innovation at this stage of decarbonization. Encouraging and rewarding innovation will be necessary to reduce emissions in hard-to-decarbonize sectors like heavy-duty transportation. Such an open approach should also yield technology development benefits that pay dividends later when EPA seeks to decarbonize the non-road diesel sector. [EPA-HQ-OAR-2019-0055-1329-A2, p. 4]

Ever since the first federal vehicle emission standards for heavy-duty engines were adopted, EPA has correctly assumed that compression-ignition engines would be fueled by diesel fuel. This assumption predates those first emission standards, and has been appropriate for more than a century. Indeed, most people simply call these engines “diesel engines,” and most people probably have never even heard the phrase “compression-ignition.” For most engines over this time, the diesel fuel powering these engines was a petroleum product; in recent years, biodiesel and renewable diesel has entered the fuel market, and those fuels have been integrated into EPA’s fuel and vehicle emissions regulatory architecture. [EPA-HQ-OAR-2019-0055-1261-A1, p. 8]

Similarly, EPA has historically assumed that ethanol would only be used in spark-ignition engines. Again, this has been the correct assumption for decades. Even within this Proposal, EPA considers the impacts of ethanol blends on the cost of emission control aftertreatment devices used in spark-ignition engines10 and discusses ethanol only in the context of current and proposed test procedures for spark-ignition engines.11 [EPA-HQ-OAR-2019-0055-1261-A1, p. 8]

10 See Proposal, at 17488.

11 See, e.g., Proposal at 17490, 17491, 17631, 17703, 17849, and 17866.

It is now time to update these assumptions, and to integrate the use of ethanol in a compression-ignition engine into the policy architecture that will govern future heavy-duty engines and vehicles. Thus, ClearFlame strongly urges EPA to finalize this Proposal in a way that explicitly anticipates that future compression-ignition engines may operate on high-blend ethanol fuels (e.g., E85 or E98). [EPA-HQ-OAR-2019-0055-1261-A1, p. 9]

As we have stated above, ethanol can play a major role in decarbonizing the hard-to-electrify segments of the highway and nonroad diesel engine and vehicle markets. In order for this to happen, EPA must remove any uncertainty surrounding whether or not ethanol can be used to certify future compression-ignition engines or whether this fuel must be used thereafter throughout the useful life of such future engines. [EPA-HQ-OAR-2019-0055-1261-A1, p. 9]

In addition, we ask EPA to add “ethanol” to the general categories of fuels that are included in the agency’s definition of “Fuel Type.”12 Currently, the Proposal lists gasoline blended with 10 percent ethanol as merely one example of a fuel grade with the gasoline fuel type, just as premium and regular gasoline are listed. Instead, we request that EPA adds an Ethanol fuel type to list of general categories of fuels, alongside diesel fuel, gasoline, and natural gas. Within this fuel type, we request that EPA include both E85 and E98 as fuel grades that can be used for certification and other purposes. 13 [EPA-HQ-OAR-2019-0055-1261-A1, p. 9]

12 See Proposal, at 17724.

13 See Table 1 to Paragraph (b)(4) of Section 1036.530 – Reference Fuel Properties and related discussion. This table and discussion does list high-blend ethanol, but does not specify whether E98 can be used. This should be corrected in the final rule. See Proposal, pp. 17703-17704.

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

In this and all emissions-related rulemaking efforts, EPA should seek to provide certainty and stability for manufacturers, who must invest billions of dollars in developing product and market strategies that comply with the Agency's rules. Further, EPA's vehicle emissions regulations should seek to smooth and incentivize the transition to ZEVs wherever possible. EPA's proposed updates to the Phase 2 GHG program are, however, contrary to both of these principles. [EPA-HQ-OAR-2019-0055-1168-A1, p.112]

Daimler Trucks supported EPA's existing Phase 2 GHG standards during all phases of their development and implementation to date. We believe that the current Phase 2 standards incentivize manufacturers to develop more fuel-efficient vehicles across a broad variety of applications, while allowing broad flexibility to choose the best combination of technologies to reach these strict standards. [EPA-HQ-OAR-2019-0055-1168-A1, p.112]

Manufacturers have been developing strategies and technologies to reach the Phase 2 GHG targets since at least 2016, when the EPA first adopted the rule. Manufacturers develop a roadmap of product offerings to comply with these rules well ahead of time. In fact, Daimler Truck has strategies in place today to target compliance with the GHG Phase 2 rule beyond 2027, and has already made significant investment in the necessary development paths to achieve this goal. [EPA-HQ-OAR-2019-0055-1168-A1, p.112]

During the previous administration, Daimler Truck, EMA, and other industry stakeholders voiced their support to leave the existing GHG Phase 2 standards in place. When presented with an opportunity to consider revising these standards for less stringency, industry continued to express their support for the standards as written. We argued that we were committed to reaching the fuel economy targets we had agreed to, and that we believed we were doing our part to address climate change. [EPA-HQ-OAR-2019-0055-1168-A1, p.112]

We believed then—and we believe now—that the environment and the industry are best served by predictable, achievable standards. To reach our eventual goal of carbon-neutral heavy duty transportation, we will have to invest billions of dollars, collectively, in new technology. We cannot do that effectively without predictable rules and stability on the scale that EPA and industry originally envisioned in the Phase 2 rule. [EPA-HQ-OAR-2019-0055-1168-A1, p.112]

Industry and the environment, together, will suffer in an atmosphere of political influence on climate regulation. If regulations change with the political winds, and the rules are rewritten every four to eight years under different presidential administrations, industry will not be able to predict market conditions to invest the massive amount of money necessary to reach these ambitious goals. [EPA-HQ-OAR-2019-0055-1168-A1, pp.112-113]

While industry supported maintaining the existing standards during the previous administration, rather than advocating for relaxed standards, EPA, under the current administration, is proposing to revise these standards to increase their stringency further than originally set. This threatens to upend the cooperative nature of the rulemaking process and risks encouraging stakeholders to push for whatever ground they can gain when the political situation allows. [EPA-HQ-OAR-2019-0055-1168-A1, p.113]

Unexpected changes now to the Phase 2 regulatory program will also threaten to undermine the investments that manufacturers have made in reliance on the standards that EPA set years ago.126 Daimler Truck has invested very significantly in developing ZEVs, in part, to comply with the GHG Phase 2 rules. EPA threatens to undercut that investment by changing the rule and devaluing those ZEVs for the purpose of GHG compliance. [EPA-HQ-OAR-2019-0055-1168-A1, p.113]

126 As the Supreme Court has explained, when an agency changes course, it must be 'cognizant that longstanding policies may have ‘engendered serious reliance interests that must be taken into account,' as it would be 'arbitrary and capricious to ignore such matters.' Department of Homeland Security v. Regents of the University of California, 140 S.Ct. 1891, 1913 (2020) (citations omitted).

In addition to proposing to increase the stringency of certain CO_2 emission standards promulgated in the 2016 Phase 2 GHG Final Rule starting in MY 2027, EPA notes that it is also considering whether to establish more stringent standards beyond MY 2027, specifically in MY 2028 and MY 2029, using the sales-weighed projection methodology discussed in Section XI.C.1 of the Proposed Rule.127 The Agency requests comment on the appropriate stringency and supporting data for ‘each of those model years’ and ‘whether to finalize such an increase in stringency for those model years’ standards in a one-step (single MY) or multi-step (multiple MY approach.’128 EPA appears to be requesting comment on future incremental changes to applicable CO_2 standards, potentially on a year-by-year basis. If EPA were to finalize such changes, it would undermine the notion of stability in emission standard-setting that is enshrined in CAA Section 202(a)(3)(C). While perhaps not technically required for CO_2 standards, the three year standard applicability requirement in Section 202(a)(3)(C) is informed by considerations of predictability and stability, and recognizes the minimum amount of time it takes for industry to develop, validate, and fine-tune their products to ensure EPA’s standards can be met over a number of years. Daimler Truck urges EPA to keep this principle of stability in mind as it looks ahead to setting CO_2 standards for future model years. Just as rapid increases in criteria pollutant stringency can disrupt technological development, changes in CO_2 stringency that are close in time would undermine the progress of incremental advances that are needed to produce ZEVs of the future. [EPA-HQ-OAR-2019-0055-1168-A1, pp.113-114]

127 See Proposed Rule, 87 Fed. Reg. at 17,599.

128 Id.

EPA proposes to tighten CO_2 standards for certain vocational vehicle and tractor subcategories on the basis that ZEV penetration is expected to be higher than the EPA accounted for during the original Phase 2 rulemaking. EPA bases this assumption on marketing materials from various OEMs, the existence of small, initial fleets, and on other state level rulemaking efforts—such as California's Advanced Clean Trucks (ACT) program and potential state opt-in efforts. [EPA-HQ-OAR-2019-0055-1168-A1, p.114]

The mass adoption of ZEVs is by no means certain, thus any assumptions about ZEV penetration rates are purely speculative. Today, in 2022, very few commercial ZEVs are in operation—and while we expect significant adoption in certain applications, rates in all of the categories that EPA considers are less certain. While California's ACT rule forces manufacturers to sell ZEVs, and other states consider following suit, these rules do not ensure successful adoption on the scale that EPA appears to assume. Sufficient charging facilities and grid infrastructure to support these projections do not exist, and it is not clear when they will. Daimler Truck has significant concerns with the ACT rule, and believes it will not result in as many ZEV sales as projected - especially since many fleets do not purchase or register their vehicles in California. [EPA-HQ-OAR-2019-0055-1168-A1, p.114]

EPA is considering increased CO2 stringency for certain applications before manufacturers have even completed reporting on their first model year's CO2 credit accumulation. In other words, bases its projections are speculative, and the Agency has not, in fact, evaluated whether manufacturers are on track to comply with the Phase 2 program in its current state, as it has only just come into effect. Further, EPA's proposal to increase CO2 stringency is made in tandem with proposals that will limit manufacturers' ability to improve CO2 emissions performance—namely, the proposed new, stringent NOx standards will require less fuel-efficient engines to comply (or, at least, will limit fuel efficiency improvements that could otherwise be made). EPA must evaluate the actual landscape and feasibility of manufacturers complying with new, tighter CO2 standards, before making any adjustments. [EPA-HQ-OAR-2019-0055-1168-A1, p.114]

Further, EPA fails to evaluate whether the other technologies that were projected during the original Phase 2 rulemaking have reached the penetration targets the Agency expected—and if, accordingly, Phase 2 standard stringency should, in fact, be *decreased*. For example, Daimler Truck does not believe that market adoption of technologies such as automatic shutdown, neutral idle, low rolling resistance tires, or stop-start have kept pace with EPA's projected penetration rates at the time of the Phase 2 rulemaking. Arguably, this means that lower-than-expected penetration rates for EPA's expected GHG reduction technologies should result in a relaxation of the standards. The Agency is unlikely, however, to take such an approach. EPA made rules that allowed manufacturers to comply through a variety of strategies, and it would upend those reliance interests for EPA to change the rules now that manufacturers have deployed those strategies. [EPA-HQ-OAR-2019-0055-1168-A1, p.114]

The commercial ZEV market is at a critical tipping point; the next decade will determine whether ZEVs are a niche product, or whether they revolutionize the commercial truck market. Increased ZEV sales now offer the opportunity to increase market acceptance, spur the development of infrastructure, and trigger a cascade effect that will dramatically increase ZEV penetration. Such a shift is not, however, guaranteed; it is dependent on adequate infrastructure to make the vehicles functional, sufficient financial incentives to make the vehicles affordable, and adequate investment from OEMs to ensure broad, successful product availability. [EPA-HQ-OAR-2019-0055-1168-A1, p.115]

To that end, we believe that all regulatory proposals that impact vehicle emissions or fuel economy should be considered in the light of their effect on ZEV adoption rate. All rules must seek to incentivize ZEVs, or risk slowing their adoption. Instead, EPA's proposal forces OEMs to invest in further improvements to conventional vehicles, redirecting development funding that would otherwise be spent on ZEV programs—developing new zero-emissions platforms and applications. [EPA-HQ-OAR-2019-0055-1168-A1, p.115]

To avoid the disincentives described above and the threats to regulatory stability that would have adverse effects on ZEV penetration, we recommend the following: 1. EPA should not change the GHG Phase 2 standards in MY 2027. 2. EPA should not adjust credit multipliers, or otherwise limit, the value of ZEVs under the GHG Phase 2 program. 3. EPA should evaluate ZEV penetration rates, the adoption rates of various GHG-reducing technologies, and the actual feasibility of further improvements, and work towards a strong GHG Phase 3 rule that prioritizes a smooth transition to ZEVs, while minimizing the diminishing returns of further investments in conventional vehicles. [EPA-HQ-OAR-2019-0055-1168-A1, p.115]

Daimler Truck has very aggressive ZEV penetration targets, and we are investing dramatically in trucks, batteries, fuel cells, chargers, infrastructure, and more. We are clearly committed to the GHG emission reduction goals of the Paris Climate Agreement, and—as noted by EPA in the Proposed Rule—aim for all of our new vehicles in North America, Europe, and Japan to be CO2-neutral ('tank-to-wheel') by 2039.129 [EPA-HQ-OAR-2019-0055-1168-A1, p.116]

129 See 'Daimler Trucks & Buses targets completely CO2-neutral fleet of new vehicles by 2039 in key regions' https://media.daimlertruck.com/marsMediaSite/ko/en/44764260.

Mass adoption of ZEVs in the commercial truck space is not, however, certain. ZEV technology is in a nascent state and is rapidly developing. Commercial trucks are a tool for businesses to do work with—and businesses will not invest in these capital-intensive vehicles if their investment is not cost-effective. We believe that the following three factors are key to ZEV adoption:

1. ***Vehicle Products.*** The vehicles must have sufficient technical capabilities to meet duty cycle demands in a variety of applications and must be readily available for purchase.
2. ***Infrastructure.*** There must be adequate charging and fueling stations.
3. ***Cost Parity.*** There must be a favorable total cost of ownership for ZEVs as compared to conventional vehicles. [EPA-HQ-OAR-2019-0055-1168-A1, pp.116-117]

If any of these three factors is not in place, ZEV transition will be unsuccessful. Daimler Truck is investing to improve the capability of our ZEV products, is partnering to develop infrastructure, and is working to make our products more affordable every day. However, we cannot do this alone. We believe the regulatory climate must actively support ZEVs. Unfortunately, the Proposed Rule does not advance these factors, and in the case of the 'Vehicle Products' and 'Cost Parity' factors, actively detracts from them. [EPA-HQ-OAR-2019-0055-1168-A1, p.117]

EPA’s proposal serves to add significant cost and uncertainty to ZEVs: the proposed durability, useful life, and warranty requirements will add significant direct and indirect costs to ZEVs, which will hurt their cost position as compared to diesel vehicles. To meet the proposed requirements, manufacturers will be forced to take regulatory risk for vehicles that emit no NOx or CO2 at all. This risk will need to be accounted for in the price of the vehicle, and will discourage manufacturers from pursuing aggressive deployment strategies. [EPA-HQ-OAR-2019-0055-1168-A1, p.117]

EPA’s ZEV proposals must also be read against the backdrop of its questionable legal authority to regulate ZEVs at all, given that they do not emit air pollutants and thus, by definition, have no emission-related components subject to EPA’s CAA Title II jurisdiction.130 [EPA-HQ-OAR-2019-0055-1168-A1, p.117]

130 See 42 U.S.C. 7521(a) (authorizing EPA to prescribe standards 'applicable to the emission of any air pollutant' from new motor vehicles or engines which 'cause, or contribute to, air pollution,' and providing no regulatory authority with respect to vehicles that do not emit air pollutants).

Organization: *Eaton Vehicle Group (Eaton)*

We are not advocating for additional CO2 reductions based on certain categories to reflect penetration of battery electric vehicles, as this amounts to predicting technology winners. However, should the Agency adopt such an approach, given the significant funding for school and transit buses, we recommend that the CO2 standards for those categories should reflect at least the volumes driven by the Infrastructure and Jobs Investment Act. For example, in our estimates, Federal funding will drive approximately 5,000 school buses per year which is equivalent to roughly 20% of the school bus production. 20% zero emissions buses would be equivalent to an average of 217 g/ton-mile in that category, significantly lower than the proposed reduction from 271 to 267 g/ton-mile. [EPA-HQ-OAR-2019-0055-1252-A1, p.5]

We recommend instead that the EPA calculates the national fleet impact of both electrical trucks and the simultaneous lower CO2 and NOx of internal combustion powertrains, and perhaps adjust the 2027 GHG standards to reflect the then-current state of technology. The assumption that only California ACT will account for electrical vehicles is undercounting the realistic expected market dynamics, as illustrated by the school bus federal funding program above [EPA-HQ-OAR-2019-0055-1252-A1, p.6]

Agency Request / Topic: In Section XI, we request comment in a number of areas related to the proposed updates to the HD GHG Phase 2 program for certain heavy-duty vehicles that are shifting to zero-emission vehicles. We are considering whether it would be appropriate in the final rule to increase the stringency of the standards even more than what we propose. Therefore, we request information on heavy-duty electric vehicle sales projections, including for what HD vehicle types, to help inform our HD electric vehicle sales projections in the MY 2024 through MY 2029 timeframe [EPA-HQ-OAR-2019-0055-1252-A1, p.10]

Eaton Comment Strategy / Materials: While Eaton is not opposed to realistically adjust the Phase II GHG standards in 2027 to account for electrification, we are not strong advocates either. We believe that electrification rates are hard to predict because of uncertainties in the adoption of ACT in California, the adoption of the NESCAUM MOU states, any other states or localities adopting similar mandates and the dynamics induced by significant federal aid in some sectors (e.g., school and transit buses through IIJA). We would advise the EPA to also calculate the simultaneous NOx and CO2 reductions for conventional powertrains affected by the NOx rule, as well as potential HD Hybrids in the vocational space. However, we also recognize that revising the GHG standards for 2027 is overly complex. As an example, the calculation methodology in the NPRM has already been invalidated for school buses by the IIJA $5B funding of EV school buses drives a 20% market share, that would in effect reduce the proposed standard to 217 g/ton-mile rather than the proposed 267 g/ton-mile under an approximately 2% EV market share assumption. [EPA-HQ-OAR-2019-0055-1252-A1, pp.10-11]

Agency Request / Topic: In addition, we request comment under this proposal on how EPA can best consider the potential for ZEV technology to significantly reduce air pollution from the heavy-duty vehicle sector, including whether and how to consider including specific sales requirements for HD ZEVs. [EPA-HQ-OAR-2019-0055-1252-A1, p.11]

Eaton Comment Strategy / Materials: Eaton does not have a position on this topic, especially as the EPA authority to impose ZEV quotas seems fragile, and in general, Eaton believes in technology neutral regulations that let the market find the best solutions [EPA-HQ-OAR-2019-0055-1252-A1, p.11]

Organization: *International Union, United Automobile, Aerospace & International Union, United Automobile, Aerospace & Agricultural Implement Workers of America - UAW Region 1A*

We are also concerned about the proposed rules attempts to add new certification, warranty and useful life requirements to zero emission vehicles. This will add cost to ZEV and delay their deployment. All of these have the potential to adversely impact Redford Township, Michigan. [EPA-HQ-OAR-2019-0055-1062-A1, p.1]

To that end, we are concerned by the precedent of re-opening the GHG Phase 2 final rule to increase the stringency for 17 out of 33 subcategories of vehicles. Stability and regulatory certainty are crucial to encouraging investment in domestic manufacturing that creates quality union jobs. Reopening finalized rules, whether it is to make rules more stringent or less stringent, undermines that certainty and could create a cycle of constantly changing regulations depending on who is in power and changes in our economy. [EPA-HQ-OAR-2019-0055-1138-A1, p.3]

Organization: *Maine Department of Environmental Protection (Department)*

EPA’s proposal, which increases GHG stringency requirements for certain vehicle classes by 1.5%, will reduce cumulative class 4-8 heavy-duty vehicle emissions by only 0.4% from 2027-205022 and could paradoxically result in greater GHG emissions if ZEV crediting provisions are retained. The Department recommends revising the proposal to preserve the original Phase II

GHG stringency requirements for internal combustion engine vehicles and phasing out ZEV crediting towards GHGs as soon as feasible. [EPA-HQ-OAR-2019-0055-1288-A1, pp.8-9]

Organization: *Mayer Automotive LLC*

The Biden administration has lost touch with what is good for OUR country. We need someone who REALLY cares about this country to lead us forward ! The new green deal is a farce ! I know that at this point we cannot make it without fossil fuels. [EPA-HQ-OAR-2019-0055-1018, p.1]

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

In Section XI, EPA requests comments in a number of areas related to the proposed updates to the HD GHG Phase 2 program for certain heavy-duty vehicles that are shifting to zero-emission vehicles. EPA is considering whether it would be appropriate in the final rule to increase the stringency of the standards even more than what EPA proposes. [EPA-HQ-OAR-2019-0055-1322-A1, p. 9]

MEMA opposes a national ZEV mandate and recommends continuing with a technology neutral, performance-based HD GHG standards approach as we have today. BEV penetration levels may reach higher levels faster or slower than expected. Therefore, MEMA recommends separate GHG requirements for ICE vehicles rather than the entire fleet (including BEVs and FCEVs) to avoid unintended backsliding and lowering of technology deployment on internal combustion engine heavy-duty vehicles. In addition, if BEVs and ICEs are combined in the fleet averages and BEV forecasts are off the mark, the result will lead to significant regulatory uncertainty. [EPA-HQ-OAR-2019-0055-1322-A1, p. 9]

Regarding more stringent standards beyond MY 2027 - specifically in MY 2028 and MY 2029 using the methodology described in Section XI.C.1, MEMA believes that these forecasts will be quite volatile and uncertain. Therefore, we don’t want an optimistic or incorrect ZEV forecast to distort the market in the future. Establishing regulatory certainty is very important to the supply base that is developing the necessary advanced emissions technologies. [EPA-HQ-OAR-2019-0055-1322-A1, p. 9]

Organization: *National Association of Chemical Distributors (NACD)*

This rule also revisits EPA’s final rule on GHG emissions published October 25, 2016, proposing to impose more stringent GHG emissions on MY2027 than what was originally established. This shift would set a dangerous precedent, disincentivizing manufacturers and others in the industry to plan farther into the future, as there would be no certainty that set EPA standards will not be changed before they are eventually implemented. [EPA-HQ-OAR-2019-0055-1279-A1, p. 5]

The current Phase 2 GHG standards have gone through a full comment process and their implementation has already begun. Moving the goalposts midway through Phase 2’s execution to change what is required of MY2027 would disregard the input and careful considerations that went into the 2016 rule. NACD recommends that the EPA continue with the current Phase 2 GHG standards. [EPA-HQ-OAR-2019-0055-1279-A1, p. 5]

Organization: *Navistar, Inc. (Navistar)*

Changes to the Phase 2 GHG standards are disruptive, unnecessary, and premature. Navistar has relied on the certainty of the existing GHG standards in product planning, engineering, and manufacturing compliant diesel and ZEV trucks and buses. Navistar joined the industry is protecting the GHG 2 framework from the previous Administration to keep in place the regulatory lead time for product planning. EPA’s assumption that manufacturers’ sales of ZEVs due in part to California’s Advanced Clean Truck rule fails to properly consider the charging and refueling infrastructure necessary to enable the continued development of the ZEV truck market, necessary purchase incentives to encourage early adoption, and technology costs. A transition of the trucking industry to ZEVs requires regulatory consistency and certainty. EPA’s proposal to change the Phase 2 GHG standards at this time will undermine manufacturers’ product decisions made years ago and pick winners and loser amongst vehicle manufacturers based off of their market vehicle classifications. **A criteria emissions change in the same year as a long planned-for change in GHG emissions standards is challenging enough, but when uncertainty is introduced into the 2027 requirements in both the criteria and GHG emissions standards, it becomes untenable.** Navistar urges EPA not to reopen the previously approved Phase 2 GHG regulation as part this proposed low-NOx rule, but rather to address such changes in the forthcoming Phase 3 GHG rulemaking. [EPA-HQ-OAR-2019-0055-1318-A1, p. 6]

Organization: *NTEA - The Association for the Work Truck Industry*

In addition to the proposed NOx changes, the EPA is also proposing to re-open the GHG (greenhouse gas) Phase 2 rule. [EPA-HQ-OAR-2019-0055-1164-A1, p. 2]

Re-opening the finalized GHG Phase 2 rules would undermine the regulatory stability manufacturers need in order to develop their products. It would effectively penalize engine manufacturers for their ongoing efforts to assure compliance with the existing 2024 and 2027 GHG standards. Additionally, changing the GHG rules would put manufacturers in the position of trying to develop technologies to reduce NOx and meet increased GHG standards simultaneously – while also trying to introduce ZEV’s to the market. [EPA-HQ-OAR-2019-0055-1164-A1, p. 3]

Organization: *PACCAR, Inc (PACCAR)*

However, PACCAR does not support re-opening the GHG Phase 2 rule, specifically with respect to the standards set to take effect in MY 2027. [EPA-HQ-OAR-2019-0055-1346-A1, p.3]

PACCAR has relied on the certainty of the Phase 2 rule’s progressively more stringent GHG standards to design our Zero-Emission Vehicles (‘ZEVs’) and accelerate their deployment. EPA sought to incentivize that accelerated deployment of ZEV trucks by providing enhanced emission credits, and EPA should not reopen the Phase 2 rule to change the ZEV credit framework simply because the incentives worked. PACCAR therefore supports the single step low-NOx standard in MY 2027 that would enable OEMs to comply with the next generation of compression ignition engine NOx standards, while at the same time focusing on ensuring a zero emission future for 2030 and beyond. [EPA-HQ-OAR-2019-0055-1346-A1, p.3]

PACCAR summarizes below the major issues that EPA should take into account as it moves forward with this rulemaking: PACCAR does not support the re-opening of the GHG Phase 2 rule, specifically because the standards are set to take effect in MY2027. [EPA-HQ-OAR-2019-0055-1346-A1, p.61]

Organization: *Port of Seattle, Port of Tacoma, and Northwest Seaport Alliance (NWSA)*

However, transitioning the fleet of more than 4,000 mostly diesel-powered drayage trucks that serves the NWSA gateway to zero-emission vehicles will be as challenging as it is urgent. As noted in the proposed rule, zero-emission Class 8 trucks – battery electric and hydrogen fuel cell vehicles – are being produced, but in this region, they remain limited in number and prohibitively expensive – roughly 8 to 10 times what the average drayage truck driver serving our gateway currently pays for a used diesel truck on the second- or third-hand market. In addition, charging and fueling infrastructure for zero-emission trucks is virtually nonexistent here. This large gap between the current situation and our zero-emission vision is daunting, especially for our network of drayage service providers, which consists mostly of independent owner-operators and small trucking companies, including many minority-owned businesses and drivers-of-color. About 20 percent of the trucking companies with which we partner have fewer than five trucks, nearly 40 percent have fewer than 20, and about 60 percent have fewer than 30. These companies are highly sensitive to significant changes in the cost and convenience of doing business, and the risks associated with adopting new technologies. [EPA-HQ-OAR-2019-0055-1312-A1, pp.1-2]

Currently, zero-emission trucks are much more expensive than new diesel trucks, in terms of both purchase price and total cost-of-ownership (TCO). According to an analysis by the California Air Resources Board (CARB), battery electric trucks could have a lower TCO than new diesel trucks by 2030, and hydrogen fuel cell trucks could be approaching cost parity as well. However, as noted earlier, a significant percentage of the drayage trucks serving the NWSA's terminals are purchased on the second- or third-hand markets, and there is considerable uncertainty as to when used zero-emission trucks will be available and cost-competitive for our drayage truckers and fleet operators. [EPA-HQ-OAR-2019-0055-1312-A1, p.2]

Financial incentives to purchase newer trucks: As noted, many of our drayage truck owner/operators are new Americans and people of color, and many of the trucks serving our terminals are purchased on second- or third-hand markets. To ensure that emission reductions are realized, EPA should consider direct financial incentives such as rebates, no-cost or low-cost loans, and a national scrapping program like those the NWSA and other ports around the country have implemented. [EPA-HQ-OAR-2019-0055-1312-A1, p.3]

Grants for electric charging and alternative fueling infrastructure: We are pleased the Biden Administration and Congress approved historic funding for creating a nationwide network of electric charging and alternative fueling stations as well as dedicated funding to study reducing truck emissions at port facilities. The EPA should continue to work with the departments of Energy and Transportation and others to offer grants and technical assistance focused on developing this charging and fueling infrastructure in and around industrial areas and along freight corridors where heavy-duty trucks operate. This will facilitate the uptake of zero- and near-zero emission heavy duty trucks. [EPA-HQ-OAR-2019-0055-1312-A1, p.3]

Temporary waivers to the Buy America(n) requirements: The requirement that projects seeking federal transportation funding must meet Buy America(n) rules is proving to be a significant barrier to accelerating the deployment of zero-emission heavy duty vehicles and equipment in our region. None of the manufacturers of heavy-duty trucks and cargo-handling equipment with whom we have spoken meet the Buy America(n) requirements—including Us manufacturers. This means that zero-emission technology demonstrations are not eligible for federal transportation funding without a waiver and in our experience to date, such waivers are difficult and time-consuming to apply for and secure. We encourage the Biden Administration to adopt a position of flexibility with regard to limited-duration waivers over the next few years to help meet emissions reduction goals and to provide time for US manufacturers to achieve the scale needed to meet the demand for zero- and near-zero emissions cargo handling equipment and make their production lines compliant with Buy America requirements. [EPA-HQ-OAR-2019-0055-1312-A1, p.3]

Organization: *Retail Industry Leaders Association (RILA)*

- RILA notes that the HD ZEVs can weigh substantially more than otherwise equivalent non-ZEVs, due to the weight of high-capacity battery packs. This increased weight, along with the anticipated increase in market share for HD ZEVs may lead to a notable increase in average weight for the average HD vehicle which might reduce vehicle payload capacity due to maximum vehicle weight limits. RILA suggests that EPA and other departments or agencies consider conducting a study to identify the anticipated increase in total weight of the HD ZEVs and the potential resulting impact on highway performance standards. [EPA-HQ-OAR-2019-0055-1189-A2, p.8]

Organization: *SEAM Group*

However, it has concerns regarding the amount of time needed to deploy the charging infrastructure support the electrification of small to large commercial fleets at the levels required under the proposed rule. As an installer of EV charging stations, SEAM Group has experience with lead times for the EV charging station (EVSE) hardware, permitting, installation, and utility energization. The aggressive timeline proposed here may not be realistic or possible based on the current market conditions. Most sites for heavy duty chargers will require that DC Fast Chargers be installed, which then necessitates the purchase of a transformer as well as switchgear in most instances. The lead time on each of these pieces is currently around 52 weeks (1 year). As both light duty and heavy duty vehicles will be electrifying at a high rate in the coming years, we can anticipate that even longer timelines may result. This is not likely to let up in the coming years, meaning that a key component to deploying electricity to a site to support the aggressive fleet electrification goals at EPA may not be readily available. Utility engagement will also be key to this process, as utilities will need to be alerted as soon as possible to the potential demand for electricity within their service territories required to service heavy duty fleets. Depending on the utility and the number of vehicles that need to be electrified, there could be significant upgrades required (e.g., new substations, new power lines), which could also cause significant delays. Again, we support fleet electrification; however, the deployment of these vehicles must go hand in hand with the deployment of charging infrastructure. [EPA-HQ-OAR-2019-0055-2574, p.1]

Organization: *State Soybean Associations*

With this Proposal, EPA plans to increase the stringency of the Phase 2 GHG emissions standards for heavy-duty vehicles through MY 2027, making revisions to the standards initially issued in 2016. The Agency explains in the Proposed Rule that the move toward increased stringency is premised on the projected increase in the penetration rate of EVs into the heavy-duty vehicle market. [EPA-HQ-OAR-2019-0055-2035-A1, p.1]

The Proposed Rule specifically seeks comment on the projected EV heavy-duty vehicle penetration rate for MY 2027. While the project penetration rate in the proposed rule is 1.5%, the agency seeks 'comment and additional supporting information and data on higher penetration rates, which could serve as the basis for the increase in the stringency of the CO2 standards for specific Phase 2 vehicle subcategories.'1 Without commenting on what the appropriate EV projected penetration rate should be, we urge EPA to stick to standards that can be met by considering only tailpipe vehicles. [EPA-HQ-OAR-2019-0055-2035-A1, p.2]

1 87 Fed. Reg. 17414, 17419 (Mar. 28, 2022)

EPA also lists several indicators as support for this projection, such as an agreement between a number of states ‘establishing goals to increase the heavy-duty electric vehicle market,’ along with multiple actions taken by the California, including the state’s Zero Emission Vehicle (‘ZEV’) sales mandate and the California Air Resources Board’s (‘CARB’s’) Advanced Clean Trucks analysis projecting future heavy-duty EV sales in California. [EPA-HQ-OAR-2019-0055-2035-A1, pp.1-2]

The State Soybean Associations do not object to an increase in EVs in the heavy-duty market, and certainly do not object to increasing the stringency of EPA’s Phase 2 GHG emissions standards. We do take issue, however, with EPA’s over-reliance on electrification as a means to meet the administration’s decarbonization goals, and its misuse of Clean Air Act authorities to set emission standards that are unachievable with internal combustion engines. Although Clean Air Act ('CAA') Section 202(a) authorizes EPA to issue tailpipe emissions standards for the transportation sector, EVs are not tailpipe vehicles; accordingly, they are not contemplated under 202(a) and therefore should not be considered in a 202(a) standards rulemaking. Moreover, the Proposal requires either EVs or credits trading in order for fleets to maintain compliance, which is impermissibly preferential one kind of technology over others. [EPA-HQ-OAR-2019-0055-2035-A1, p.2]

Organization: *Toyota Motor North America, Inc. (Toyota)*

EPA has indicated that it is not considering a HD ZEV mandate at this time. Toyota supports this approach. A ZEV mandate for light-duty vehicles exists in California and other states that have adopted California's regulations. In addition, other federal regulations such as EPA's light-duty greenhouse gas (GHG) regulations and NHTSA's related Corporate Average Fuel Economy (CAFE) regulations are compelling a greater need for light-duty zero-emission technologies. Achieving these existing regulations requires complementary market-development and sustainment measures, including infrastructure investments for electric vehicle charging and hydrogen refueling, critical mineral supply chain development, and a robust system to recycle end-of-life vehicle batteries. Adding a Federal HD vehicle mandate on top of existing light-duty mandates will exacerbate each of these challenges and could put successful compliance with ZEV mandates in both sectors in jeopardy [EPA-HQ-OAR-2019-0055-1224-A1, pp. 1-2]

Organization: *Truck and Engine Manufacturers Association (EMA)*

In order to ensure the adoption of fully achievable and cost-effective HDOH low-NOx regulations, and notwithstanding our broader agreement, the Agency should revise the proposed standards in the following manner: The current Phase 2 GHG standards should not be revised. The Phase 2 standards appropriately incentivized manufacturers to accelerate the deployment of ZEV trucks. Now, the Agency is proposing to tighten the Phase 2 standards solely because manufacturers deployed ZEVs as they were incentivized to do. That is fundamentally unfair. Manufacturers have relied on the stability of the Phase 2 provisions to formulate their product plans out to 2027 and beyond. When other stakeholders sought to undo the Agency's GHG standards, EMA and its members defended them. If, as the Agency is indicating, final rules really are not final, but are instead subject to unilateral revision by the Agency (in this instance because the rule's incentives worked!), the resulting precedent for undermining the regulatory certainty of "final rules" will yield very adverse consequences each time a new Administration takes office. The Agency should not open this type of Pandora's Box. No federal agency should feel unilaterally empowered to move the regulatory finish line well after the regulated industry's march toward compliance has begun. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 7 - 8]

With respect to the proposed "reopening" of the current Phase 2 GHG standards, specifically the standards set to take effect in MY 2027, the Agency simply should not do that. OEMs have relied on the certainty of those progressively more stringent GHG standards in designing their engine platforms and vehicle upgrades, and in accelerating their deployment of ZEV trucks where feasible. Indeed, the Agency sought to incentivize that accelerated deployment of ZEV trucks by providing for enhanced emission credits. [EPA-HQ-OAR-2019-0055-1203-A1, p. 14]

But now, really for no other reason than the incentives worked to encourage the manufacture and sale of ZEV trucks in certain applications, the Agency is proposing to tighten the Phase 2 GHG standards by 1.5% in 2027, to, in effect, take back the credits that led to the intended increased deployment of ZEV trucks in the first place. It is the type of blatant renege that would never be allowed in commerce, and it should not be a practice of the federal government. [EPA-HQ-OAR-2019-0055-1203-A1, p. 14]

The Agency's proposed undoing of its prior regulatory commitments is even more egregious in this case since, unlike other stakeholders in other regulated sectors, EMA and its members defended and sought to preserve the Phase 2 standards when the prior Administration was looking to reduce those standards across the board. Yet now the Agency is poised to engage in the same type of activity — re-trading previously-adopted emission standards — that environmental advocates bemoaned only a few years ago. [EPA-HQ-OAR-2019-0055-1203-A1, p. 14]

If the Agency persists in moving the regulatory goalposts after the underlying rules were set and OEMs' compliance efforts were well underway, the precedent will not be lost on anyone. Henceforth, all "final" regulations will be deemed open to fresh debate and revision anytime a new Administration is sworn-in. Not all of those revisions will trend in the same direction. Stated differently, if the Agency insists on eliminating the assurances that heretofore accompanied final rules, that same lack of assurance is just as likely to burden the Agency in the future. The Agency should not include Phase 2 revisions in this low-NOx rule, but instead should leave the development of enhanced GHG requirements to the imminent "Phase 3" rulemaking that is earmarked for that specific purpose. [EPA-HQ-OAR-2019-0055-1203-A1, p. 14]

EMA's earlier comments discuss why the Agency should not unilaterally reopen the Phase 2 GHG standards, and how the proposed low-NOx standards will negatively impact CO2 emissions and will increase the technical challenges of meeting the Phase 2 GHG standards in 2027. In short, there is no sound policy or technical basis for the Agency to re-trade the terms of the final Phase 2 regulations at this juncture. To do so would jeopardize all future "final rules." Beyond this critical issue impacting what "final" rules will mean going forward, other more detailed aspects of the Agency's proposed "reopening" nonetheless warrant additional comment. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 104 - 105]

The August 2016 Regulatory Announcement that accompanied the release of the Phase 2 GHG rule proclaimed that the "technology-advancing Phase 2 program goes beyond the successful Phase 1 program, with standards based not only on currently available technologies but emerging technologies that are not yet in widespread use." (See, EPA-420-F-16-044.) The preamble to the final rule similarly stated that "Phase 2 will include technology-advancing standards that will phase in over the long-term (through model year 2027) to result in an ambitious, yet achievable program that will allow manufacturers to meet the standards through a mix of different technologies at reasonable cost." (See, 81 FR 73481.) Nowhere in the Phase 2 final rule did the Agency indicate that the technology-forcing standards were subject to change if the Agency later felt so inclined. [EPA-HQ-OAR-2019-0055-1203-A1, p. 105]

Since 2016, manufacturers have been preparing to implement the stringent 2027 standards, and the interim standards for model years 2021 and 2024. Manufacturers have developed the necessary engine and vehicle technologies, and they have established production and sales plans to achieve compliance with the increasingly stringent regulatory steps in the Phase 2 GHG program. As the Agency predicted, the Phase 2 program has spurred innovation, and manufacturers have met that challenge by developing and deploying the technologies needed to implement the first step of the Phase 2 rule last year. And with the second step of Phase 2 less than twenty months away, manufacturers are working to deploy the additional technologies necessary to meet those more stringent second-step standards, and then to meet the third and most stringent step of the program less than four years from now. It is clear, then, that manufactures are working diligently to implement the Phase 2 program in a successful and cost-effective manner, just as they committed to do. [EPA-HQ-OAR-2019-0055-1203-A1, p. 105]

In addition, EPA has already begun work on a Phase 3 GHG program, planning to release a proposed rule next year, and a final rule in 2024 that will be effective with model year 2030. The Phase 3 GHG rule will provide the minimally reasonable three years of regulatory stability after implementation of the final step of the Phase 2 GHG program in 2027, and will adopt even more stringent GHG requirements to help transition the industry to ZEVs. Thus, it is also clear that manufacturers face additional technology-forcing challenges to further reduce GHG emissions. [EPA-HQ-OAR-2019-0055-1203-A1, p. 105]

Notwithstanding the aggressive pace and cadence of the HDOH GHG rulemakings, and the corollary technology developments and deployments, the Agency has included in this low-NOx rulemaking a proposal to “reopen” the Phase 2 GHG program midstream. That reopening proposal is being made in spite of the fact that the new NOx standards that are the focus of the rulemaking will greatly impact manufacturers’ ability to comply with the existing GHG standards, and seemingly ignores the Phase 3 GHG rulemaking that already is underway. Such regulatory destabilization, undermining manufacturers’ ability to comply with the requirements, should not be the practice of EPA. If final rules are, in fact, no longer final, the regulatory landscape will be changed in ways that will have very serious repercussions. [EPA-HQ-OAR-2019-0055-1203-A1, p. 105]

To justify the proposed re-trading of the Phase 2 GHG program, the Agency broadly speculates about where the diverse and complicated market for medium- and heavy-duty ZEVs is headed. But in that speculation, the Agency fails to take into account the three separate challenges that must be addressed simultaneously to successfully grow the market for medium- and heavy-duty ZEVs. First, manufacturers must develop diverse ZEV products that will meet their customers’ needs. Second, those customers must be prepared to purchase and deploy the ZEVs, and they must be able to do so in a profitable manner. And third, the most expensive and complex aspect of growing a commercial ZEV market is ensuring that robust electricity-charging and hydrogen-fueling infrastructures are in place before the ZEVs are deployed. A three-legged stool is an apt metaphor for the medium- and heavy-duty ZEV market, where available ZEV products, fleets able to profitably deploy the ZEVs, and a robust infrastructure are all three simultaneously needed to support the ZEV market. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 105 - 106]

Looking only at ZEV product development plans or marketing targets, as the Agency seems to be doing, is a myopic view of a much larger and more complex picture. Stated differently, pointing to a manufacturers’ aspiration ZEV marketing plans — something the Agency should be applauding — is not a basis for the Agency to unilaterally undermine the established regulatory structure under which this industry operates. Changing the rules halfway through the game should not be a practice of the federal government. If it becomes such, there will be no reason restraining the industry from encouraging more of the same each time a new Administration takes control. [EPA-HQ-OAR-2019-0055-1203-A1, p. 106]

Undeterred by its proposed breach of regulatory commitments, EPA points to the Advanced Clean Trucks ("ACT") rule that CARB finalized last year as conclusive evidence of significant future growth in the deployment of the medium- and heavy-duty. However, the ACT rule only includes ZEV sales targets, ignoring the other two legs of the stool. When CARB approved the ACT rule, it acknowledged that to be successful, CARB must enact regulations to mandate the purchase of ZEVs and that the State needed to build out a robust infrastructure to charge/fuel the ZEVs. (See, CARB Resolution 20-19.) Since the ACT rule will not begin mandating the sale of ZEVs in California until 2024, and the State is still working on the other two legs needed to support the ZEV sales targets, the rule remains far from a proven success. While California leads the nation is developing its medium- and heavy-duty ZEV market, additional expensive and challenging steps must be taken before anyone can honestly say that the transition of California's trucking industry to ZEVs has actually begun. [EPA-HQ-OAR-2019-0055-1203-A1, p. 106]

EPA also points to the Multi-State Zero Emission Medium and Heavy-Duty Vehicle Initiative as evidence of the growth in medium- and heavy-duty ZEVs, and as support for its newfound belief that "final rules" remain such only for industry. However, that initiative is simply a memorandum of understanding ("MOU"), by and among seventeen states and the District of Columbia, declaring that thirty percent of the sales of medium- and heavy-duty trucks in each jurisdiction should be ZEVs by 2030, and 100 percent by 2050. Similar to CARB's ACT rule (but without any regulatory teeth), the MOU ignores the need for fleets to purchase ZEVs or the more challenging and expensive, but absolutely necessary, build-out of electricity-charging and hydrogen-fueling infrastructures to support the ZEVs. Without wholistically addressing the development of the medium- and heavy-duty ZEV market, the MOU is merely an unsupported aspirational proclamation. [EPA-HQ-OAR-2019-0055-1203-A1, p. 106]

The Agency further points to ZEV prototype and demonstration projects as establishing the "feasibility and durability of the technology for specific applications." (See, 87 FR 17595.) But what is left unsaid is whether the projects demonstrate that the ZEVs complete the work demanded by each trucking business with a competitive total cost of ownership. Commercial vehicles are purchased by businesses for the sole purpose of providing a financial return on the investment in the new vehicle. To invest in a ZEV, the fleet must be able to predict that the vehicle will have a competitive total cost of ownership over other available technologies. Right now, ZEVs have much higher acquisition costs than other technologies, they have lower utility (i.e., the ability to get the job done), and they have lower resale values. Additionally, fleets must invest in new maintenance facilities and parts inventories to support ZEVs, and they must make substantial investments to build out and maintain the necessary charging/fueling infrastructure. Until ZEVs are proven to provide a competitive total cost of ownership for trucking businesses on all of those fronts, they will remain nothing more than a niche market. To be sure, manufacturers are working hard and investing billions to overcome those obstacles, but those efforts do not warrant new interim GHG standards just because EPA feels the need for a new "win." The Phase 3 rule — not this rulemaking — is the regulatory mechanism for helping to deliver on all parties' aspirational ZEV targets. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 106 - 107]

The NPRM acknowledges the diverse nature of commercial vehicle applications by pointing to the high adoption rates for zero-emission transit buses and school buses. Those narrow applications are highly suitable for ZEVs deployments for various reasons, including that they are operated by government entities instead of for-profit businesses. However, those two applications cannot be used to prove that the diverse private commercial vehicle market is on the cusp of a wholesale transition to ZEVs. Long-haul tractor-semitrailer combination vehicles, concrete mixers, and snowplows are just a few examples of applications that present much greater challenges to the successful deployment of ZEVs. Any realistic assessment of the thousands of unique commercial vehicle applications would conclude that a tremendous amount of effort and resources still remains to be applied to successfully initiate a broad-based transition of the nation's commercial trucking industry to ZEVs. [EPA-HQ-OAR-2019-0055-1203-A1, p. 107]

Nonetheless, EPA highlights the high numbers of ZEV deployments in school and transit bus applications as supposed evidence that when the Phase 2 GHG rule was finalized it underestimated the growth of ZEVs. But again, successful ZEV adoption in those two highly suitable but narrow applications should not be used as evidence that the Phase 2 GHG rule underestimated the growth of ZEV across the board. Certainly, it should not be used to justify increasing the stringency of the "final" GHG standards for more than half of the vehicle subcategories in the Phase 2 GHG rule, nor should those narrow examples be used to reduce the Advanced Technology Credits in the rule. [EPA-HQ-OAR-2019-0055-1203-A1, p. 107]

The Agency's speculation that it underestimated the growth of ZEVs is not well-founded. Even if it were, it does not justify changing the final Phase 2 rule after manufacturers have established their technology and product plans to meet the rule. Furthermore, regulations as complex and the Phase 2 GHG rule are never perfect. For example, the rule assumes significant GHG reduction benefits from manufacturers deploying electric accessories, a benefit that can only be achieved by increasing the voltage of the electrical system. However, that cannot be cost-effectively accomplished unless a significant portion of the industry also converts to the higher voltage, so accessories can be sold in high volumes. While there has been a great deal of discussion about converting medium- and heavy-duty trucks from 12 V to 48 V, that upgrade is not expected to be realized this decade. As such, manufacturers cannot expect to see any penetration of electric accessories, even though the rule assumed significant adoption by 2027. Because the industry is converting to 48 V slower than EPA assumed when it finalized the Phase 2 GHG rule, manufacturers must deploy other technologies to meet the standards. [EPA-HQ-OAR-2019-0055-1203-A1, p. 108]

The Phase 2 GHG rule also assumed that manufacturers would deploy advanced transmission shift strategies and show those benefits with powertrain certification testing. While manufacturers indeed are deploying advanced shift strategies to make their trucks operate more efficiently (i.e., with lower GHG emissions), they are unable to get credit for that technology when certifying trucks to the Phase 2 GHG regulations. The powertrain certification test procedures are extremely complicated and so far unvalidated. Manufacturers are working with EPA to clarify the procedures so they can conduct powertrain testing consistently and with confidence, but that process is likely to take months or years to complete, and in the meantime, manufacturers have no way of earning GHG credits for the advanced shift strategies they are deploying. [EPA-HQ-OAR-2019-0055-1203-A1, p. 108]

The Phase 2 GHG rule also overestimated the willingness of trucking fleets to accept tamper-resistant automatic engine shutdown systems. The rule assumes that a vast majority of trucks would be built with that technology by 2027, yet even though all manufacturers have the technology available, almost no fleets are willing to accept it. Similar to the other situations where the Phase 2 rule over-estimated the adoption of a technology, in order to meet the current Phase 2 standards, manufacturers must deploy technologies other than tamper-resistant automatic engine shutdown systems. Thus, notwithstanding the other clear examples of the Agency's overestimations of available GHG-reducing options, EPA is pointing to one potential under-estimation in the Phase 2 rulemaking as supposed justification for recasting what final rules really mean. There is no good faith justification for that. [EPA-HQ-OAR-2019-0055-1203-A1, p. 108]

In sum, EPA incorrectly points to speculative ZEV adoption rates to support the assertion that the Phase 2 GHG rule underestimated the growth of medium- and heavy-duty ZEVs, and that such an assumed underestimation justifies reopening the Phase 2 GHG standards. The actual deployment of ZEVs (not predictions or aspirations) simply does not support increasing the stringency of the Phase 2 GHG rule. To the contrary, verifiable sales data would support deceasing the stringency due to the rule's overestimation of the adoption of conventional vehicle technologies. [EPA-HQ-OAR-2019-0055-1203-A1, p. 108]

More important than estimation errors in a complex rulemaking, manufacturers need regulatory stability and predictability – now and with future Administrations – to be able to develop the needed technologies and establish the necessary productions and sales plans to comply with the rule. Accordingly, EPA should not reopen the Phase 2 GHG rule; it is a misguided proposal that is wholly unsupported by the relevant facts and the dictates of good government policy. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 108 - 109]

As discussed above, ZEVs are beginning to emerge in the medium- and heavy-duty trucking industry, yet many significant challenges remain for manufacturers, fleets, utilities, governments, and other stakeholders before we can point to the beginning of a broad-based transition of the industry to ZEVs. While aspirations are quite high right now, a great deal of work remains before trucking fleets will be willing to make the significant and long-term investments needed to begin transitioning to ZEVs in a meaningful way. At this time, most medium- and heavy-duty ZEVs in service are prototypes or demonstration units that are a long way from providing trucking businesses with the competitive total cost of ownership that they need to justify beginning the process of converting to ZEVs. [EPA-HQ-OAR-2019-0055-1203-A1, p. 109]

EPA has developed the proposed new ZEV certification, durability, useful life, and warranty provisions without any consultation with the manufacturers that are expected to implement them. History has shown that such unilateral development of complex vehicle certification procedures rarely leads to implementable and successful regulatory requirements. Although it is unfortunate that industry would be starting with the unilateral proposal included in the NPRM, we request that EPA commit to collaborating with manufacturers to identify a workable path forward for the certification and compliance requirements for credit-generating ZEVs. Considering the limited time before a final rule, and the complexity and novelty of ZEV certification and compliance requirements, we believe an interim approach may be the only realistic path forward. An interim solution could be fashioned to meet EPA's needs while not burdening ZEVs with excessive costs and regulatory requirements. If we can identify an appropriate interim approach, a long-term solution could then be developed as part of the Phase 3 GHG rulemaking. That rulemaking is a more appropriate forum for the in-depth data analyses and technical discussions needed to establish workable and effective long-term ZEV certification and compliance requirements. [EPA-HQ-OAR-2019-0055-1203-A1, p. 109]

EMA is evaluating the role that low-carbon fuels can play to reduce GHG emissions impacts from the multiple engine product sectors. Low-carbon fuels provide the opportunity to effect very significant near-term CO2 reductions because, to the extent that they are available as "drop-in" fuels, they can improve emissions from existing fleets without the need for additional technological advancements or the time for market adoption and phase-in. This opportunity can be scaled quickly, limited only by the fuel supply and the fuels' compatibility with the engine and aftertreatment systems in which they would be used. EMA is very interested in the potential for the widespread use of low carbon fuels. Steps will have to be taken, however, to improve and enforce the quality of those fuels to ensure market success. [EPA-HQ-OAR-2019-0055-1203-A1, p. 137]

Organization: *U.S. Chamber of Commerce*

We have concerns about provisions proposed in the rule that would modify the current Phase 2 GHG requirements, which have been in place since 2016. Such changes, if made final, would increase investment uncertainty and erode confidence in private-public partnerships that have helped successfully implement this program. While each business may view the particular impacts of these proposed changes through different lenses, changing provisions that were agreed to years ago would create a moving regulatory target and send mixed signals to the market. The proposed rule does not adequately account for such impacts. [EPA-HQ-OAR-2019-0055-1245-A1, p. 10]

Although significant changes to regulatory programs have occurred across a range of EPA and other federal agency programs during the last few administrations, EPA's medium- and heavy-duty GHG requirements have remained constant following the issuance of the 2016 final rulemaking.16 This is in no large part due to the commitment by companies to invest and meet the 2016 standards. [EPA-HQ-OAR-2019-0055-1245-A1, p. 10]

> 16. Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles— Phase 2, 81 Fed. Reg. 73478, October 25, 2016.

Companies are continuing to innovate and bring GHG-reducing technologies, fuels, and other solutions to the medium- and heavy-duty marketplace. EPA may be able to achieve additional GHG emissions reductions through incentives for advanced biofuels, such as biodiesel or renewable diesel, under the Renewable Fuel Standard program. As renewable diesel is a drop-in diesel fuel substitute, it has the potential to reduce GHGs from this mobile source sector without adding significant costs. Aside from this type of incentive, making unanticipated changes to the previously settled phase 2 GHG standards—ahead of EPA's next phase of GHG standards updates— would remove some of the stability needed by businesses to invest in this market segment. [EPA-HQ-OAR-2019-0055-1245-A1, pp. 10 - 11]

Organization: *Valero Energy Corporation*

The American Transportation Research Institute ('ATRI') made similar findings in a report issued this month:2 the trucking industry can decrease GHG emissions through a variety of vehicle types. Among other findings, the report concludes that based on a lifecycle analysis, Class 8 BEV production results in more than six times the carbon dioxide ('CO2') emissions as compared with a Class 8 ICEV due to the size and replacement cycle of the lithium-ion battery required to power a long-haul BEV. The analysis concludes with the following figure and the statement that there are three truck types (ICEV, BEV, and fuel cell electric vehicle ('FCEV')) that have a pathway for lowering CO2 emissions. Indeed, ICEVs with renewable diesel have a better emissions profile than the electric vehicles. [EPA-HQ-OAR-2019-0055-1328-A2, pp.3-4]

2 'Understanding the CO2 Impacts of Zero-Emissions Trucks: A Comparative Life-Cycle Analysis of Battery Electric, Hydrogen Fuel Cell and Traditional Diesel Trucks,' prepared by the American Transportation Research Institute (May 2022).

EPA acknowledges in the Notice of Proposed Rulemaking (NPRM) that 'projecting the production levels of conventional and electric HD vehicles in MY 2027 and beyond is challenging'.3 However, EPA should not move forward on the basis of an inadequate analysis and questionable data. EPA is proposing new Model Year ('MY') 2027 standards based on the premise that something has changed since the original rulemaking, yet EPA does not document or quantify any change in the proposal other than the issuance of Executive Orders directing EPA to reconsider its previously established standards in favor of electrification. If EPA does not have the data to establish a sound basis for estimating MY 2027 HDV and electric vehicle ('EV') production, then EPA is not ready to proceed with this rulemaking and should not try to use the estimate to justify the lowering of emission standards. [EPA-HQ-OAR-2019-0055-1328-A2 ,p.4]

3 87 FR 17600

As the basis for its estimate of the total number of HD vehicle sales in MY 2027, EPA relies on:

- Analysis performed by CARB under the Advanced Clean Trucks ('ACT') rulemaking to project future HD vehicle sales in California,
- ZEV sales mandate established by CARB as projection of future EV sales in California,
- Data published by International Council on Clean Transportation ('ICCT') to establish a ratio between EV sales in California and EV sales in the remainder of the U.S., and
- HD vehicle sales projections from previous EPA rulemaking to project future sales in the remainder of the U.S. [EPA-HQ-OAR-2019-0055-1328-A2, pp.4-5]

Concerns relating to EPA's projection include the following:

1. EPA's projection of HD engine and vehicle sales relies on data from 2017 and earlier and does not account for significant changes that could impact sales. EPA uses outdated

forecasts of future HD vehicle sales, relying on analyses performed by CARB in the ACT rulemaking and by EPA in the HD GHG Phase 2 rulemaking. 4' 5 The COVID-19 pandemic alone has significantly impacted the way the U.S. lives, works and moves as well as how goods are bought, sold, and delivered, rendering any pre-pandemic forecasts of MY 2027 sales obsolete. [EPA-HQ-OAR-2019-0055-1328-A2, p.5]

4 CARB, 'Advanced Clean Trucks Regulation Standardized Regulatory Impact Assessment', August 2019. The CARB analysis was based on sales projections in CARB's EMFAC2017 emission inventory model.

5 U.S. EPA. 'Regulatory Impact Analysis: Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium and Heavy-Duty Engines and Vehicles -Phase 2.' Table 7-55. Page 7-49. April 2016.

2. EPA relies on ZEV mandates in California to project EV growth in the rest of the U.S., assuming that HD EV sales in the U.S. will experience the same rate of growth as has been mandated by law in California. It should be noted that California's ZEV sales targets are highly aspirational mandates and not projections based on actual sales performance. It should further be noted that the California mandates have been adjusted several times over the life of the program to reflect a reality that could not keep up with the aggressive targets. In the midst of record inflation, unprecedented supply chain disruptions and critical concerns about the availability, cost and foreign dependence of minerals needed for EV batteries, it is irresponsible of EPA to assume the U.S. will experience growth in FID EV sales based on expectations regarding mandated growth in California. [EPA-HQ-OAR-2019-0055-1328-A2, p.5]

3. EPA misinterprets and misrepresents data by CARB and ICCT

- a. EPA estimates that 20% of Class 4-8 and 15% of Class 7-8 Tractor sales in California will be ZEV in MY 2027, based on ACT sales requirements. The ACT sales requirements are more nuanced than EPA interprets or applies them. The incorporation of weight class modifiers means that one auto manufacturer might be able to comply with fewer ZEV sales, and another might need more. EPA has not demonstrated, nor is it reasonable to assume that compliance with California's ACT sales requirements will translate to 20% of Class 4-8 and 15% of Class 7-8 Tractor sales in California being ZEV in MY 2027.
- b. Based on a fact sheet published by the ICCT, EPA estimates that new HD EV sales in California in MY 2027 will represent 42% of new HD EV sales in the U.S.6 Data presented in the ICCT fact sheet refer to total ZEVs sold to-date (through 2020), not to new ZEV sales in 2020. It is not reasonable to assume that the ratio of HD EV stock (as of 2020) in CA to the remaining 49 states would be the same as the ratio of HD EV MY 2027 sales in CA to the remaining 49 states. Further, EPA concludes from the ICCT fact sheet that 'approximately 42 percent of the heavy-duty electric vehicle sales in the U.S. are in California.' Thus, EPA's ratio of sales is incorrect. EPA cannot assume that 42 percent of sales will occur in California. The ICCT fact sheet actually states 'to date, 42% of zero emission commercial vehicles sold in the United States and Canada have gone to fleets in California.' [EPA-HQ-OAR-2019-0055-1328-A2, pp.5-6]

6 ICCT, 'Fact Sheet North America: Zero-emission bus and truck market in the United States and Canada: A 2020 Update', May 2021

Valero has independently conducted lifecycle analysis that shows the differences in GHG emissions resulting from use of renewable fuels as well as how different sources of electricity can reduce the benefits from EV adoption. The carbon intensity of electricity generation can vary dramatically depending on the fuel source. In setting national standards, EPA should not naively assume that increased electrical demand will be satisfied with low-carbon sources; EPA must account for variable sources of electrical generation, and should avoid setting a vehicle standard that may paradoxically increase electricity generation from energy sources of high carbon intensity. For Class 8 trucks, for example, Valero's analysis shows that an ICEV fueled with renewable diesel reduces lifecycle GHG emissions by almost 70 percent and a renewable diesel fueled FLEV achieves even greater lifecycle emission reductions, achieving emission reductions comparable to the cleanest BEV and FCEV. Note that BEVs powered by Wyoming power stations, which are over 80 percent coal-fired, have lifecycle GHG emissions more than 30 percent higher than ULSD fueled ICEVs. [EPA-HQ-OAR-2019-0055-1328-A2, p.7]

Furthermore, EPA has not accounted for how increasing incentives or mandates for electrification of HD engines and vehicles will exacerbate the supply chain problems identified in comments on the LD GHG rule and the environmental and national security problems associated with the supply issues related to battery production. EPA projected that the LD GHG rule finalized at the end of 2021 will result in doubling the electric vehicle fleet in a four-year period. EPA has not addressed in this proposal how such increased demand for electricity for LD vehicles and increased infrastructure demand for LD vehicles could affect the supply and reliability of electricity and infrastructure for HD engines and vehicles. [EPA-HQ-OAR-2019-0055-1328-A2, p.7]

As in the LD GHG rule, EPA has not accounted for the findings in a recent IEA report that 'today's mineral supply and investment plans fall short of what is needed to transform the energy sector, raising the risk of delayed or more expensive energy transitions.'10 EPA should evaluate the impact of limited supplies of raw materials needed to support increased electrical generation and battery manufacture, as well as the current chip shortage, will have on the HD EV market. In assessing mineral availability issues related to HD vehicle batteries, it should be noted that the quantity of minerals necessary to manufacture a HD vehicle battery is orders of magnitude greater than LD vehicle batteries (as noted above, the ATRI report assesses carbon emissions resulting from production of a 8.5 ton lithium-ion Class 8 vehicle battery). As noted above, EPA's EV market evaluation is wholly inadequate because it is outdated and relies on assumptions derived from state mandates rather than factual data. [EPA-HQ-OAR-2019-0055-1328-A2 ,p.7]

10 lEA (2021), The Role of Critical Minerals in Clean Energy Transitions, https://www.iea.org/reports/the-role-ofcritical- minerals-in-clean-energy-transitions.

Organization: *Volvo Group*

The Volvo Group is fully aligned with EMA's comments opposing the reopening of the Phase 2 regulation. As EMA noted, the Volvo Group has relied on the expected regulatory certainty to balance our investments in engine and vehicle technologies to provide GHG improvements, while also meeting the need for electrification of key vehicle models. We were able to perform this balancing act based on the stringency steps as finalized in 2016, along with the Advanced Technology credit multiplier used to incentivize development and sales of heavy-duty "all-electric" vehicles, otherwise known as battery electric vehicles, or BEVs. The Volvo Group and EMA cited this same need for regulatory certainty in opposing a review of the Phase 2 regulation during the previous administration, a review that likely would have had the effect of weakening the regulation, as was attempted with the light-duty regulation. [EPA-HQ-OAR-2019-0055-1324-A1, p. 7]

Globally, Volvo Trucks, Renault Trucks, Mack Trucks, Volvo Bus and Nova Bus offer heavy-duty on-road commercial ZEVs in regional short haul, urban pick-up and delivery, light construction (on-road short haul), and transit bus applications. In the United States, Volvo Trucks offers the VNR Electric BEV in regional short haul and local delivery tractor and box truck applications with a range up to 275 miles, Mack Trucks offers the LR Electric low-entry cab-over refuse truck with a range up to 100 on-the-job miles, and Nova Bus offers its LFSe and LFSe+ with a range up to 290 miles. All these models are available for purchase and delivery today; these are not just prototypes or preorder opportunities. [EPA-HQ-OAR-2019-0055-1324-A1, p. 7]

The Volvo Group is committed to transitioning to a carbon-neutral future as rapidly as possible. We foresee that future primarily relying on zero-emission BEV and fuel-cell electric vehicles (FCEV) and have set aggressive targets of 35% of global vehicles sales to be zero-emissions by 2030, and 100% fossil free by 2040. However, there are factors outside of our control that must be in place for us to meet these very lofty, yet achievable, goals, including: grid readiness, sufficient charging and refueling infrastructure, purchase incentives to address cost competitiveness in the early days of the market, and customer acceptance. [EPA-HQ-OAR-2019-0055-1324-A1, p. 7]

If any revision must be made, the agency should make that revision in the transition to the Phase 3 heavy-duty greenhouse gas regulation. [EPA-HQ-OAR-2019-0055-1324-A1, p. 8]

In conclusion, the Volvo Group believes the following principles must be reflected in the final regulation: a respect for completeness of data, economic consequences of the regulation (including increased technology costs and workforce implications), and the many factors outside of OEM control affecting the speed of ZEV penetrations in the marketplace. [EPA-HQ-OAR-2019-0055-1324-A1, p. 10]

Organization: *Walmart*

EPA should take a full and robust market view in revising Phase 2 GHG standards and potential Phase 3 standards based on market conditions, cost-effectiveness, diverse stakeholder input and infrastructure needs. [EPA-HQ-OAR-2019-0055-1191-A2, p. 2]

In the proposed rule, EPA seeks to increase the stringency of the current Phase 2 GHG standard for select vehicle types for MY2027 and after. This adjustment is based on analysis that indicates that these specific vehicle types, which include delivery vans, are more quickly transitioning to electric-based power due to market and public policy factors.5 [EPA-HQ-OAR-2019-0055-1191-A2, p. 2]

5. https://www.govinfo.gov/content/pkg/FR-2022-03-28/pdf/2022-04934.pdf

We encourage EPA to take a full and robust view of the market demand and policy developments incentivizing growing demand for these vehicle types in MY2027 and after, and to set an appropriate regulatory signal that reflects realistic technology and infrastructure conditions, motivating action by manufacturers to meet the compliance and demand-side needs, while further driving down purchase costs. [EPA-HQ-OAR-2019-0055-1191-A2, p. 2]

Robust inter-agency collaboration is critical to ensuring that incentives are aligned across the government and deliver a smooth transition to lower- and zero-emissions technologies for heavy duty vehicles. [EPA-HQ-OAR-2019-0055-1191-A2, p. 3]

For example, there is a concern that the weight of batteries in MHDVs will trigger weight limits that can affect payload efficiency and route optimization, which is an important short- and medium-term tool for reducing GHG and NOx emissions. Walmart encourages consideration of additional weight allowances to account for the difference between near-zero and zero-emission vehicles and diesel engines. [EPA-HQ-OAR-2019-0055-1191-A2, p. 3]

It will be valuable for EPA to consult and coordinate with other key federal agencies that regulate heavy duty vehicles to identify a full range of complementary actions that can accelerate adoption of these technologies. [EPA-HQ-OAR-2019-0055-1191-A2, p. 3]

Organization: *Westport Fuels Systems (WFS)*

Conversely, H2 ICEs are much less sensitive to purity. This not only decreases risks for fleet operators, and potentially leads to lower costs, it also eases the expansion of refueling infrastructure. This is especially true where interstate hubs are working to enable the development of an interconnected hydrogen network. As such, H2 ICEs would be able to offtake hydrogen from diverse sources, including through repurposed natural gas infrastructure, which FCEVs would not. [EPA-HQ-OAR-2019-0055-1278-A1, p.5]

There is a clear case for hydrogen fueled ICEs in road freight, and while many industry players are considering pure hydrogen with spark ignition (SI) combustion technology, the application of

Westport Fuel Systems HPDI technology overcomes some of the limitations of SI H2 ICEs. [EPA-HQ-OAR-2019-0055-1278-A1, p.5]

Despite their varying stages of development, the pathway for H2 ICEs is well understood, being based on existing ICE manufacturing routes. Hydrogen refueling infrastructure deployment is far more likely to be the critical timing path to commercialization.[EPA-HQ-OAR-2019-0055-1278-A1, p.5]

22 International Council on Clean Transportation

EPA Response

EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards) and may consider the comments in this section of this document in the development of that future rulemaking.

28.2 Advanced Technology Credit Adjustments

Comments by Organizations

Organization: *Advanced Engine Systems Institute (AESI)*

The existing ZEV credit multipliers contained in the Phase II GHG rule are far too generous and should be phased out quickly. These multipliers will diminish real CO2 reductions from diesel trucks and hurt the sale of electric trucks. [EPA-HQ-OAR-2019-0055-1281-A1, p. 3]

Organization: *Allison Transmission, Inc. (Allison)*

Allison has invested in fuel efficiency solutions for conventional vehicles that are already in production. These systems could assist OEMs in need of fleet average GHG improvements apart from credits generated through ZEVs. [EPA-HQ-OAR-2019-0055-1231-A1, p.24]

- For example, Fuel Sense 2.0 is a software package that can reduce conventional engines CO2 up to 6% with more impact in urban and multi-purpose applications. [EPA-HQ-OAR-2019-0055-1231-A1, p.24]

- Also, the Allison on-highway transmission portfolio is currently compatible with lower carbon-intensity alternative fuels like natural gas or propane; Allison is also planning for integration of more alternative fuel options in the future. [EPA-HQ-OAR-2019-0055-1231-A1, p.24]

- Allison's eGen Flex™ hybrid systems reduce CO2 in transit bus up to 25%.53 While EPA's proposal focuses on BEVs, hybrid systems can serve as a bridge solution for transit agencies that do not yet have charging infrastructure or workforce readiness established to support full ZEV transition. Among other benefits, these systems result in reduced CO2 emissions while helping to familiarize transit agencies with high voltage systems. [EPA-HQ-OAR-2019-0055-1231-A1, p.24]

We would suggest that, in principle, if EPA seeks to bring ZEV closer to its real-world CO2 impact by reducing multipliers, EPA should also review opportunities to bring non-ZEV CO2 reduction technologies to closer to real-world emissions credit, so that OEM and end-user customers have a variety of ZEV and non-ZEV pathways to achieve CO2 fleet compliance. Consistent with EPA's rationale (wherein it believes that retaining current multipliers could have counter-productive results, allowing continual production of higher-emitting vehicles) EPA could alternatively review how non-ZEV technology paths can receive appropriate credit mirroring real-world CO2 reduction across commercial vehicle.[EPA-HQ-OAR-2019-0055-1231-A1, p.24]

EPA can do this by better integrating non-ZEV CO2 reduction technology and considering a way to include real world customer drive cycles into the GEM model. Some fuel-savings technologies are not best represented on certification cycles (steady state 55-65 mph and ARB transient). A singular focus on quantifying potential market uptake of ZEVs does not represent the whole picture regarding how OEMs will lower GHG emissions fleetwide and an overemphasis on reductions achievable through ZEV technology risks private sector investment (and gains) that can be made across various non-ZEV platforms. In fact, the direction of EPA's Phase 2 analysis risks overreliance on ZEVs and could result in at least implicit pressure for OEMs to pursue ZEVs as the sole methodology for meeting more stringent standards with respect to this rulemaking and other rules that are part of the Biden Administration's articulated agenda.54 [EPA-HQ-OAR-2019-0055-1231-A1, pp.24-25]

54 Executive Order 14037.

EPA should place greater emphasis on fuel savings technologies are already in production to reduce CO2 emissions. In the context of this rulemaking, it should not be presumed that better integration of "conventional" technologies would detract from the longer-term development of ZEV technology, resulting in less overall emission reductions. To the contrary, EPA has already projected that the TCO for ZEV technologies will soon reach parity with compression ignition ("CI") and spark ignition ("SI") technologies.55 All other things being equal, the commercial heavy-duty market will invariably select lower-cost options. But an over emphasis on ZEV acquisition as the primary means to reduce fleetwide CO2 emissions could leave near-term reductions in CO2 emissions effectively "on the table" or result in an inefficient allocation of resources if the cost-per-ton of emission reduction from ZEV vehicles remains higher longer than EPA projections. In short, EPA should not promulgate a regulatory structure and presumption that would serve to detract from multiple technologies that are able to efficiently reduce CO2 emissions. [EPA-HQ-OAR-2019-0055-1231-A1, p.25]

55 87 Fed. Reg. at 17,562.

Commercial vehicles differ from passenger cars because components and features are used across a wide range of vehicles and vocations. Often, the perception of fuel savings value varies greatly depending on the end vehicle being produced. In the commercial context, end users of vocational vehicles are often reluctant to accept efficiency features if they perceive that there is a risk that the feature will reduce productivity of the vehicle. While vocational vehicle purchasers are highly motivated to reduce operating costs through fuel savings, an overriding concern for most commercial buyers is that the vehicle they are buying will be reliable and able to perform the work required of it. This results in a continuing challenge for OEMs to make new, more efficient configurations widely accepted in the market. [EPA-HQ-OAR-2019-0055-1231-A1, p.25]

EPA should therefore consider crediting methodologies that would make it easier for OEMs to apply CO2 technology for GHG credits across a wide range of vehicle configurations. And this effort should be accompanied by additional review of the duty cycles used for the certification of different vehicle types. [EPA-HQ-OAR-2019-0055-1231-A1, p.25]

- Vocational applications like transit bus with lower average speed, more frequent stops, and technology advancements such as hybrid with all-electric-range can realize greater CO2 benefits than reflected in GEM model. This results in an underestimation resulting CO2 emissions. [EPA-HQ-OAR-2019-0055-1231-A1, p.25]
    - Specifically, eGen Flex™ hybrid systems can realize up to a 25 reduction in CO2 emissions, yet this performance is not recognized in GEM. Hybrid drive cycles include engine-off run time which is entirely out of scope of the current certification cycles. Transit agencies can use of geofencing, green EV zones, and Engine Start Stop features to increase percentage of operating time where vehicle is moving, but engine is off. [EPA-HQ-OAR-2019-0055-1231-A1, p.26]
    - GEM model does not capture such effects when modeling CO2 reduction because GEM model instead reflects a mix of high speed 55-65 mph steady state cycles and ARB transient, compared with Manhattan cycle with top speeds of 25 mph. Neither custom chassis certification nor powertrain testing certification include certification cycles that reflect the real-world operation of transit buses or other unique drive cycles [EPA-HQ-OAR-2019-0055-1231-A1, p.26]

- Allison's Neutral at Stop Standard feature is another example of a fuel efficiency feature that reduces conventional CO2 emissions but does not have this benefit reflected in OEM GEM score. [EPA-HQ-OAR-2019-0055-1231-A1, p.26]
    - GEM's neutral idle capability recognizes only torque reduction at idle that is equivalent to true neutral, and thus, Neutral Idle is incorporated in GEM with a binary yes-no selection. It is unfair to allow no benefit in the GEM logic to OEMs utilizing such features as Neutral at Stop Standard which utilizes approximately 70% torque reduction at idle to show efficiency gains at a partial credit of the GEM Neutral-Idle feature, while optimizing vocational productivity and therefore increasing adoption rates by end users. [EPA-HQ-OAR-2019-0055-1231-A1, p.26]
    - EPA could change Neutral-idle technology within GEM to recognize this CO2 reduction with a high-medium-no setting, or it would be possible to use off-cycle technology credit, however, clear requirements and definitions are needed to assign an approved partial credit. EPA could address this crediting issue within

the context of this rulemaking and the broad request for comments that EPA has solicited. [EPA-HQ-OAR-2019-0055-1231-A1, p.26]

- A third example exists with respect to DynActive™ Shifting
  - This feature is specified by end-users desiring fuel savings. But advanced shifting strategies are currently not a technology improvement option for vocational customers in the GEM model. EPA should therefore consider this technology for inclusion in GEM with a high-regular-no setting of efficiency bias input to reflect the different levels vocational customers set to balance their productivity needs with reduced fuel usage.
  - This feature utilizes an algorithm to learn the engine's torque curve, allowing shifting decisions to be made to maximize performance when performance is needed, all while delivering fuel economy benefit when there is opportunity (part throttle, light weight, downhill operation, etc.). [EPA-HQ-OAR-2019-0055-1231-A1, p.26]

Other vendors to OEMs may have additional technologies that are similarly-situated. But the main argument is that EPA should not ignore technological innovations for conventional powertrains during the period of many years that it will take to transition to ZEV technology. While some of these technologies will be adopted through market forces and stricter GHG requirements, non-engine GHG technology cannot benefit under regulatory protocols that rely on measured reductions in engine-out CO2 emissions. Rather, even if the technology provides an actual reduction in CO2 emissions, the technology can only be properly incentivized if it is credited within GEM itself. That crucial difference dictates a different approach in the heavy-duty sector versus the light-duty sector where treadmill tailpipe testing of exhaust emissions explicitly recognizes multiple vehicle technologies that result in lower CO2 emissions. In effect, the GEM model, while necessary for the Phase 2 program given limited chassis-testing, also acts as final arbiter of whether a specific technology will be favored in the marketplace. Whether through GEM or a different mechanism, EPA should expand the ability to measure and credit GHG reductions apart from the zero g/mile credit given to ZEVs.56 [EPA-HQ-OAR-2019-0055-1231-A1, p.27]

56 87 Fed. Reg. at 17,557.

Organization: *American Council for an Energy Efficient Economy (ACEEE)*

The Advanced Vehicle Technology Credit endangers the emissions reductions from the standards, even with proposed stringency increases, and should be eliminated as quickly as possible. This credit was planned for a much less mature EV market than we have now. Based on currently expected EV sales, the credits would allow substantially worse fleetwide GHG performance than the nominal stringency of the Phase 2 standards would indicate. [EPA-HQ-OAR-2019-0055-2852-A1, p.7]

Table 3 shows the effects of the existing credit on the current and proposed rule stringencies for class 4-5 light heavy-duty vocational vehicles3, which saw their effective stringency changed the least as a result of increased rates of electrification, and therefore represent a conservative estimate of the potential loss in stringency resulting from the credits. The methodology ACEEE used to arrive at these estimates is explained in Appendix B. As the table shows, even with the lowest plausible EV sales shares in 2027, the existing advanced technology credits would lead to effective standards far weaker than the nominal Phase 2 standards for MY 2027, with effective emissions limits for ICEs lower than even the MY 2021 standards. Figure XI-1 of the NPRM quantifies this in terms of emissions and shows that the minimum expected nationwide EV sales would result in an increase of over 30,000,000 Mg of GHG emissions. [EPA-HQ-OAR-2019-0055-2852-A1, p.8]

3 The division between light heavy-duty vocation vehicles is different in the ACT sale requirements and federal emission rules. This table ignores any averaging between Light Heavy-Duty vehicles which have different ACT sale requirements.

EPA requested comment on three options to limit these adverse effects of this credit. ACEEE believes option 3, the complete phase-out of the credit by MY 2027, is the best of the options offered to mitigate the harm of the credit and ensure continued improvement in ICVs, as shown in Table 4. However, option 3 alone would be insufficient to address the problem. We suggest that EPA also exclude any vehicle certified for ACT compliance and sold in any ACT adopting state, from eligibility for this credit, effectively combining proposed options 1 and 3. This will ensure that manufacturers' compliance with state regulations does not result in reduced emissions benefits of the federal rule. [EPA-HQ-OAR-2019-0055-2852-A1, p.9]

EPA should both phase out the Advanced Vehicle Technology Credit program, by MY 2027, and also immediately exclude any vehicle certified for compliance with the Advanced Clean Truck Act, and sold in an adopting state, from eligibility for this credit. [EPA-HQ-OAR-2019-0055-2852-A1, p.10]

Organization: *American Fuel & Petrochemical Manufacturers (AFPM)*

EPA's Heavy-Duty GHG Phase 2 program currently provides multipliers of 3.5, 4.5, and 5.5 for Hybrid Electric Vehicles, Battery Electric Vehicles, and Fuel Cell Electric Vehicles, respectively. These multipliers further misrepresent the actual emissions, arbitrarily distort the benefits analysis, and are not authorized by the Clean Air Act or any other federal statute. In discussing the technology credit multipliers, EPA admits the program is not technologically neutral and that the technologies receiving the multiplier credits are not cost-effective. The agency states, '[t]he HD GHG Phase 2 advanced technology credit multipliers represent a tradeoff between encouraging a new technology that could have significant benefits well beyond what is required under the standards and providing credits that do not reflect real world reductions in emissions which in effect allow for emissions increases by other engines and vehicles.'31 EPA has offered for comment several options in the rule to either reduce, cap or phase out the multipliers through 2027 and the Agency includes no multipliers beginning in 2028. These Agency efforts to reduce, cap or phase out these multipliers acknowledges that the policy is unlawful, not necessary anymore, and not good policy to cost-effectively reduce emissions. [EPA-HQ-OAR-2019-0055-1262-A1, p.8]

31 87 Fed Reg. 17603 (March 28, 2022)

The use of 'EV Multipliers' is arbitrary and capricious because it reduces the effectiveness of the Proposal's greenhouse gas limits and increases costs to regulated parties and consumers without any corresponding benefit to health, safety, or public welfare. EV multipliers increase the net amount of greenhouse gas emitted both in the short term, by diluting the standards, and in the long term, because they discourage innovations in ICE technology. [EPA-HQ-OAR-2019-0055-1262-A1, p.9]

The use of the multiplier simply creates a financial windfall for a specific mobile source technology, by granting credits that are not a logical outgrowth from the actions taken by the regulated entities. EPA continues picking technology winners and losers through this process. The market and consumer choices should drive decision making. EPA states in the Proposal that there is a much larger effort by manufacturers in the most recent years to produce BETs. If that is the case as EPA outlines, then there is no additional economic incentive for multipliers that continue to distort the market. [EPA-HQ-OAR-2019-0055-1262-A1, p.9]

Organization: *California Air Resources Board (CARB)*

The NPRM requested comment for how to revise the Phase 2 ATC multiplier used by a manufacturer for BEV in 2024 through 2027 MYs and proposed three different approaches. CARB staff supports U.S. EPA in reducing the number of incentive credits produced by electric vehicles in the 2024 through 2027 MYs. CARB staff agrees and supports U.S. EPA's proposed first approach of not allowing ATC multipliers for 2024 through 2027 MY electric vehicles that are certified to ACT regulations (including California and any other section 177 states that adopt CARB's ACT regulation). Starting in the 2024 MY, CARB's ACT regulation will require 5 to 9 percent of total HD vehicles sales to be ZEVs. These HD ZEVs would continue to be considered zero grams CO2 per ton-mile emissions and receive significant credits reflective of the difference between the applicable CO2 emission standard and zero grams emissions. Hence, there would be no need for the ATC multiplier incentive on those ACT-certified vehicles. [EPA-HQ-OAR-2019-0055-1186-A2, p.83]

CARB staff agrees with U.S. EPA that HD electric vehicles certified to the federal program for new vehicles sold outside of California, and not subject to California standards in other states under Section 177, would continue receiving some type of ATC multipliers for the federal program. However, CARB staff urges U.S. EPA to reduce and phase-out the magnitude of the ATC multipliers over a period of MYs following the U.S. EPA's calculation approach in their third proposed approach, in combination with the first proposed approach to not allow the ATC multiplier for HD ZEVs certified to CARB's ACT regulation. As discussed in the NPRM, electric vehicle costs have been decreasing substantially since the federal Phase 2 adoption in 2016 due to the increase in battery electric learning and production levels. It is appropriate to adjust the ACT multipliers to account for the decreased electric vehicle costs as shown in Table XI-14 in the NPRM, where the proposed multipliers are 4.5, 3.5, 3.0, 2.0, and 1.5 in the 2023, 2024, 2025, 2026, and 2027 MYs, respectively, instead of the current multiplier of 4.5 for the 2024 through 2027 MYs. [EPA-HQ-OAR-2019-0055-1186-A2, pp.83-84]

Organization: *Ceres BICEP (Business for Innovative Climate and Energy Policy) Network*

In addition, in order to prevent increased emissions, EPA should preserve the Phase 2 stringency requirements for ICE vehicles and phase out advanced technology credit multipliers as soon as feasible. Finally, a recent Ceres analysis [https://www.ceres.org/resources/reports/electrifying-american-trucking-promise-and-challenges] concluded that, while shifting to electric vehicles increasingly makes economic sense for manufacturers and suppliers, as well as fleet owners and shippers, a federal ZEV mandate and fleet purchasing requirements, similar to California's Advanced Clean Truck (ACT)1 and Advanced Clean Fleet (ACF) standards, will be necessary to accelerate this transition at the rate and scale necessary to meet climate goals, and to ensure the global competitiveness of the U.S. truck industry. Accordingly, we urge you to adopt a ZEV mandate consistent with the targets outlined above. [EPA-HQ-OAR-2019-0055-2714-A1, pp.1-2]

> 1 The ACT has drawn significant business and investor support. Importantly, given that MHDVs are the largest source of nitrogen oxides (NOx) in the transportation sector, it is critical to strengthen the proposed NOx standards.

Organization*: Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

EPA must also revise its proposal to provide credit multipliers to plug-in hybrid, all-electric, and FCEVs. Because credit multipliers erode emissions reductions, they are not warranted for ZEVs that will already be produced as a result of state-level and other requirements and commitments (and thus need no incentive). [EPA-HQ-OAR-2019-0055-1302-A1, p.8]

EPA must reconsider its proposal on advanced technology credit multipliers to avoid diluting the GHG standards by providing unnecessary incentives to HD ZEVs that will be built even under a business-as-usual scenario. The 2016 Phase 2 GHG rule provides credit multipliers to plug-in hybrid (3.5X), all-electric vehicles (4.5X), and fuel cell vehicles (5.5X) to incentivize the deployment of advanced technologies. 87 Fed. Reg. at 17,594. When Phase 2 was finalized, EPA concluded that these technologies were important to achieving significant future emissions reductions in the HD sector, but were unlikely to be adopted in the market without additional incentives. Id. at 17,603. However, as described above in Section III.A, EPA's pessimism was mistaken. In 2016, EPA found that there was only one manufacturer that had certified an all-electric HDV, 87 Fed. Reg. at 17,603, but that number ballooned to 52 in MY 2020.248 Commenters agree with the Agency's conclusion that 'credit multipliers…may no longer be appropriate' and could 'reduc[e] the effective stringency of the existing MY 2024 through 2027 standards.' 87 Fed. Reg. at 17,603. In fact, EPA warns that at 8.5% ZEV penetration, *all* of the projected reductions from Phase 2 would be lost due to the credits. Id. at 17,604. [EPA-HQ-OAR-2019-0055-1302-A1, pp.66-67]

248 EPA, Memo to Docket, HD 2027 Proposed Changes to Heavy-Duty Greenhouse Gas Emissions 2 (Nov. 2021).

EPA proposes three options to reduce the impact of the credit multipliers on the stringency of the standards. Id. at 17,605–07. The first, precluding the multipliers from being utilized by ZEVs certified in California, inappropriately omits ZEVs that are required to be sold in other states that have adopted the ACT rule or other binding requirements. If a state already requires a certain percentage of HD sales to be ZEVs, those vehicles should be reflected in the baseline and should not accrue credit multipliers. [EPA-HQ-OAR-2019-0055-1302-A1, p.67]

The second option would cap the number of credits a manufacturer could receive, precluding credit multipliers to ZEVs sold *above* a certain threshold. This seems to turn EPA's original balancing on its head. EPA describes its rationale for credits: The HD GHG Phase 2 advanced technology credit multipliers represent a tradeoff between encouraging a new technology that could have significant benefits well beyond what is required under the standards and providing credits that do not reflect real world reductions in emissions which in effect allow for emissions increases by other engines and vehicles. [EPA-HQ-OAR-2019-0055-1302-A1, p.67]

Id. at 17,603. The intention of the credit multipliers is to encourage technology deployment and emissions reductions that would not occur without the incentive; therefore, it should be those additional ZEVs that receive a credit multiplier, not the ones that would be produced under a business-as-usual scenario. Every credit multiplier will lessen the emissions reductions required of conventional vehicles, and therefore should only be available for HD ZEVs that are actually incentivized. This approach, however, would require an accurate assessment of the baseline. As noted above, Commenters' assessment indicates that HD ZEV penetration will be at least 8–11% by 2027 and 19–27% by 2030. If a manufacturer is incentivized by the credits to produce more ZEVs than business-as-usual, only then should credits be available in the 2024–2027 timeframe. [EPA-HQ-OAR-2019-0055-1302-A1, p.67]

The final proposed option provides no rationale based on incentivizing additional ZEVs, but merely attempts to phase out the credit multipliers in an orderly fashion. HD ZEVs that would be built anyway—as the analysis in Section III indicates—should not be eligible for credit multipliers. Commenters recommend phasing out multipliers for these vehicles as expeditiously as possible. [EPA-HQ-OAR-2019-0055-1302-A1, p.67]

Organization: *Coalition for Clean Air*

The greenhouse gas credit multipliers for ZEVs proposed in the rule are overly generous, reducing the effectiveness of existing EPA regulations to reduce GHGs in the heavy-duty sector. [EPA-HQ-OAR-2019-0055-1139-A1, p.2]

Organization: *Consumer Reports (CR)*

EPA should eliminate credit multipliers for ZEVs to ensure incentives do not limit the effectiveness of the rule. [EPA-HQ-OAR-2019-0055-1285-A1, p.2]

EPA is proposing to adjust its credit system for heavy-duty vehicles to reduce the number of incentive credits produced by electric vehicle manufacturers in MY 2024-2027. We agree with the need to reduce these credits. Currently manufacturers can earn large advanced technology credit multipliers for CO2 emissions.60 Such multipliers were intended to encourage early action and technological innovation but have ultimately reduced the stringency of the existing GHG standards, largely due to the unforeseen growth in the HDV ZEV market.61 Any adjustments to this program should eliminate credits to prevent this outcome. A credit program should not result in backsliding of emissions reductions expected from ICEs. [EPA-HQ-OAR-2019-0055-1285-A1, p.10]

60 87 F.R. 17603.

61 Id.

EPA is proposing three approaches to reduce the number of incentive credits: (1) excluding EVs certified to meet California's ACT Rule from earning federal credits; (2) establishing an advanced technology cap; and (3) establishing a transitional credit cap. We agree with EPA's proposal to exclude EVs built to satisfy California's ACT requirement from the federal advanced technology credit incentive program. However, this cannot be the only adjustment to the program as it would still leave in place significant multipliers that could lead to backsliding. EPA's advanced technology cap proposal does little to address the issue of backsliding: It leaves in place multipliers that are too high, and, when the cap is reached, still allows for the accrual of credits. As with the current programs, this will lead to too many credits and hamper the effectiveness of the GHG standard. EPA's transitional credit cap proposal at least reduces the multipliers over time, and ultimately phases out multipliers. CR agrees that phasing out these multipliers is important. EPA should phase out these multipliers by 2024 or as soon as possible. While multipliers can be seen as a trade-off for encouraging early innovation and adoption of new technologies, this trade-off cannot come at the cost of an ineffective rule. [EPA-HQ-OAR-2019-0055-1285-A1, p.10]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

EPA developed the Phase 2 program with flexibilities in mind, making it apparent that manufacturers could choose many paths to comply, including meeting their requirements in part by adopting ZEVs. Now that manufacturers are doing so, EPA proposes to remove this compliance path. Rather than create disincentives for ZEV adoption, EPA should continue to allow the flexibilities that rewarded such adoption in its original Phase 2 program. [EPA-HQ-OAR-2019-0055-1168-A1, p.113]

EPA also considers reducing the effect of ZEVs on manufactures' ability to achieve GHG compliance—either by reducing the ZEV multipliers for GHG credits, or by capping their overall effect. This directly reduces the value of ZEV programs to OEMs. If manufacturers no longer have the option of meeting their compliance obligations, in part, with ZEVs, they will be forced to direct resources towards further development of conventional vehicles. If one ZEV today has a credit multiplier of 4.5x, and EPA's rulemaking eliminates that multiplier, or reduces its value, this will directly dis-incentivize production of that ZEV. [EPA-HQ-OAR-2019-0055-1168-A1, p.115]

EPA's proposed regulatory approach risks the ZEV future that we all support. The Proposed Rule seeks to encourage investment in conventional technologies, which have limited returns at increasing costs—instead of focusing on the future technologies that will enable our transition to carbon-neutral transportation. [EPA-HQ-OAR-2019-0055-1168-A1, p.115]

Organization: *Eaton Vehicle Group (Eaton)*

However, continued multipliers for electric trucks may in fact dilute the progress in conventional technology while also dampening high penetration rates of electric trucks. [EPA-HQ-OAR-2019-0055-1252-A1, p.5]

5. **Regulations should be technology-neutral with flexibilities built in, but the EPA should also recognize the local nature of NOx and PM emissions versus the global impact of GHG.** Electrical vehicles have unclear upstream emissions, but zero tailpipe NOx. Including electrical vehicles in averaging engine NOx emissions may significantly dilute the local NOx benefits in non-attainment zones, while increasing emissions elsewhere. [EPA-HQ-OAR-2019-0055-1252-A1, p.6]

Fundamentally, we believe that GHG emissions ought to be averaged over both Diesel and electrical vehicles for two reasons: GHG is a global pollutant and thus only the fleet-level emissions are significant, and GHG emissions are in fact vehicle attributes. Thus, we agree a vehicle manufacturer should be able to average GHG emissions across its vehicle fleets, which is already allowed by the GHG rule. We agree that the actual penetration of electric vehicles, further spurred by both market demand and the proposed CARB ACT rule do not warrant multipliers going forward. The Agency has proposed three means to sunset the multipliers, but all three have disadvantages. [EPA-HQ-OAR-2019-0055-1252-A1, p.6]

• Excepting vehicles covered by California ACT certification but allowing multipliers above runs counter to the intent of multipliers – to stimulate a non-exiting technology. Furthermore, there is uncertainty in the ACT rule implementation in California, as well as how many of the NESCAUM MOU states would adopt that rule and what other zero-emissions mandates other states might adopt. This approach is in fact a state-by-state approach that has unpredictable consequences and will in fact hinder planning and deployment. [EPA-HQ-OAR-2019-0055-1252-A1, p.6]

• In a market with increasing pull for electrical vehicles, both due to economic drivers, as well as a patchwork of local and state regulations, it is not clear what a credit cap for multipliers achieves. Again, a cap can have unpredicted consequences, such as providing an incentive to reach the cap, and then a disincentive to electrification after the cap is reached. [EPA-HQ-OAR-2019-0055-1252-A1, p.6]

• Finally, the annual reduction of the multipliers seems to be slow and will produce a very high number of credits in the early years, that could in fact slow progress towards electrification in that timeframe or can slow progress on diesel powertrains, ending up with a higher-than-expected number of high CO2 emissions trucks. There is a significant risk that this approach will also slow down the real GHG reductions under the current Phase II program. [EPA-HQ-OAR-2019-0055-1252-A1, p.6]

Given the fast uptake of electrical vehicles driven by market dynamics, a patchwork of local and state restrictions and incentives, and the significant federal funding programs, we believe that the multipliers ought to be sunset significantly faster, so that they do not end up distorting both the market and the real GHG emissions. We would recommend decreasing the 4.0 multiplier in decrements of 1.0 units over the next 3 years, or faster. [EPA-HQ-OAR-2019-0055-1252-A1, p.6]

Agency Request / Topic: We are also interested in stakeholder input that supports changes to the advanced technology credit multiplier approach under consideration [EPA-HQ-OAR-2019-0055-1252-A1, p.11]

Eaton Comment Strategy / Materials: At this point in the EV adoption cycle, as well as all the market forces accelerating the adoption, the credit multipliers are on path to distort the market and the real GHG. We recommend a rapid reduction of the multipliers from 4.0 to 1.0 over the span of 2-3 years. [EPA-HQ-OAR-2019-0055-1252-A1, p.11]

Organization: *Elders Climate Action*

We urge the Agency to scrap the credit scheme as the primary strategy for inducing the sale of zero emission HDVs, and instead adopt the schedule for the sale of HDVs contained in the CARB ACT rule. The effect of such an approach would not “induce” production and sale of BEV HDVs, but require their production and sale. With such a requirement in place, manufacturers would no longer need credits to serve as an incentive for producing and selling zero emission HDVs. [EPA-HQ-OAR-2019-0055-1218-A1, p. 13]

Organization: *Environmental Defense Fund (EDF)*

In the Proposal, EPA sought comment on how to treat Advanced Technology Credits produced by EVs for the Phase 2 standards.94 While EDF supports programs that incentivize increased ZEV deployment, EPA should not allow credit multipliers in the vehicle segments targeted for increased ZEV deployment. As the agency correctly notes in the Proposal, multiplier credits allow for 'backsliding of emission reductions expected from internal combustion engine vehicles.'95 In the Proposal, EPA notes that at 8.5 percent ZEV penetration credits would result in the loss of all of the projected reductions from Phase 2.96 The path to ZEV deployment levels of 80 percent ZEV sales of school and transit buses by 2029 and 40 percent ZEV sales by 2029 for new Classes 4-7 vehicles and Class 8 short-haul tractors in 2029 will result in high levels of ZEV deployment in MY 2024-2027 – indeed, even in its most conservative scenario, ERM projects over 6 percent ZEVs in 2024. [EPA-HQ-OAR-2019-0055-1265-A1, p.21]

94 87 Fed. Reg 17,603.

95 Id. at 17,604.

96 Id.

EPA should not allow credit multipliers for these segments, Classes 4-7 vehicles, and Class 8 short-haul tractors, that are targeted for increased ZEV deployment. ZEVs will continue to have 0 grams CO2 per ton-mile emissions, but additional multiplier credits are not necessary and will undermine the emissions reductions required to meet the standards. Additionally, there will be significant deployment of ZEVs as a result of the Advanced Clean Truck rule. California, Oregon, Washington, New York, New Jersey, and Massachusetts have adopted the rule and several other states are in the process or committed to adopting the rule.97 ACT will require 9%, 11% and 13% ZEV sales of Class 4-8 vehicles for MYs 2024-2027 respectively.98 Accordingly, it is critical that EPA not provide credit multipliers to ensure that the contemplated ZEV targets are actually achieved and the reductions from their deployment are assured. [EPA-HQ-OAR-2019-0055-1265-A1, p.21]

97 See supra at fn 59.

98 CARB, Advanced Clean Trucks Regulation Final Regulation Order: ZEV Sales Percentage Schedule at 5, Table A-1 (March 15, 2021), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/fro2.pdf.

Organization: *Environmental Protection Network (EPN)*

With respect to multipliers for EVs in the GHG program, EPN agrees that the current approach is no longer appropriate. The transition to EVs is already underway and is expected to increase. In the near-term, the increase in production will continue to reduce the “cost differential between EVs and conventional vehicles,” and the emissions effects of the multipliers reduces “the effective stringency of the existing MY 2024 through 2027 standards.” See 59 Fed. Reg. at 17603. [EPA-HQ-OAR-2019-0055-1233-A1, p. 3]

EPN believes multipliers for EVs should not be allowed after MY 2026. The stringency of the standard in MY 2027 already accounts for the use of EVs, and multipliers are no longer appropriate as incentives. The standard is the incentive in this case. Prior to MY 2027, any EPA projections of EV penetration rate will more than likely be lower than what the industry and market will produce. That is the nature of the fluid situation in these near-term years, where positive but currently unexpected progress is likely to result from an industry that is investing its expertise and large resources towards this goal. Given this, EPA should err on the side of larger, not smaller, reductions in the level of the multipliers. [EPA-HQ-OAR-2019-0055-1233-A1, p. 3]

Organization: *Ford Motor Company (Ford)*

To ensure an equitable phase-out of the Battery-Electric Vehicle (BEV) Advanced Technology credits after 2024 model year, we recommend that EPA adopt the proposal which gradually phases-out the Advanced Technology multipliers between the 2025 and 2028 model years. The proposed option to disallow BEVs certified in California from receiving the Advanced Technology multipliers would potentially be applied unequally across manufacturers. Manufacturer with greater percentages of sales in California would be impacted more. Similarly, the option to apply an absolute Advanced Technology credit cap could create an un-level playing field. Manufacturers that sell more BEVs would be eligible for the Advanced Technology credits for a smaller percentage of their fleet. [EPA-HQ-OAR-2019-0055-1300-A1, p. 4]

Organization: *General Motors LLC (GM)*

EPA proposes to incorporate by reference regulations and test procedures in many cases that are unclear, duplicative, or are not yet final. [EPA-HQ-OAR-2019-0055-1246-A1, p.5]

For instance, EPA proposes to incorporate the CARB Advanced Clean Trucks (ACT)10 by reference, and to account for vehicles qualifying for ZEV credits under the ACT differently than other ZEVs. The Advanced Clean Trucks regulation says that manufacturers earn a ZEV credit when the zero emissions vehicle is "sold to the ultimate purchaser" in the state, which is currently understood to be different than when a vehicle is "produced and delivered for sale". Many questions remain about how to practically count vehicles and transactions that qualify for the ACT ZEV credit, especially considering common business practices in the medium-duty and heavy-duty markets. It is unclear what accounting and reporting practices EPA would interpret as correct, and if this would or would not be aligned with CARB now, or in the future. The acceptable accounting and reporting practices to earn ZEV credits under the ACT program remain unclear at the time of this letter. [EPA-HQ-OAR-2019-0055-1246-A1, pp.5-6]

10 https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/fro2.pdf

Incorporating standards by reference that are not finalized, unclear, or duplicative adds uncertainty to what is expected in a finalized regulation, and often increases the burden to industry to comply with standards. GM encourages EPA to not incorporate by reference regulations and test procedures that are unclear, potentially duplicative, or not finalized. [EPA-HQ-OAR-2019-0055-1246-A1, p.6]

Organization: *International Council on Clean Transportation (ICCT)*

The EPA proposal does not preserve the original stringency of the Phase II GHG rule. For example, the proposal makes no change to existing Advanced Technology Credit multipliers, which originally were intended to stimulate the production of zero-emission vehicles and achieve a 15% overall improvement in efficiency of internal combustion engine vehicles. Since the adoption of the original Phase II rule, six states have adopted requirements for the sale of zero-emission trucks, which would generate Advanced Technology Credits. These credits no longer serve as an incentive when states require manufacturers to produce zero emission vehicles. A total of 17 states and the District of Columbia have signed a multi-state memorandum of understanding pledging to secure at least 30% zero-emission truck sales in 2030, creating the likelihood of additional Advanced Technology Credits. In their current form, the credits are poised to seriously undermine any originally intended improvements in the efficiency of internal combustion engine vehicles as more states adopt zero-emission sales requirements, and as the federal government works to stimulate or require the purchase of zero-emission vehicles. We estimate that even under scenarios with moderate ZEV deployment, ICE vehicles would not need to attain any of the reductions originally envisioned by Phase II in model year 2027. [EPA-HQ-OAR-2019-0055-1211-A1, p. 5]

RECOMMENDATION: We recommend EPA not permit manufacturers to generate Advanced Technology Credits from sales of ZEVs in states where they are subject to zero-emission truck and bus sales or purchase requirements, which currently include California, New York, New Jersey, Massachusetts, Oregon, and Washington state. Additional states who have joined together under a Multi-state Memorandum of Understanding are expected to adopt similar requirements, and we recommend their ZEV sales also not be permitted to generate ZEV credits. [EPA-HQ-OAR-2019-0055-1211-A1, p. 5] RECOMMENDATION: We recommend EPA eliminate Advanced Technology Credit multipliers in model year 2024, or as soon as feasible. [EPA-HQ-OAR-2019-0055-1211-A1, p. 5]

Under the EPA's proposal, retaining Advanced Technology Credits until model year 2028 poses a serious risk of delaying improvements in ICE efficiency and allowing the future production of less efficient and higher emitting ICE vehicles than those sold today. [EPA-HQ-OAR-2019-0055-1211-A1, p. 33]

Even under a conservative scenario in which MOU states adopt the ACT but ZEV deployment does not increase in the rest of the country, Advanced Technology Credits would allow MY 2027 ICE vehicles to emit 17% more under the EPA's proposed standards than without these super credits. Shown in Table 12, ACT adoption in MOU states under the EPA's proposed standards would allow model year 2027 emissions that are on average 3% higher than in model year 2017 if emissions are allowed to increase or backslide. Our analysis is optimistic in that it assumes that average ICE efficiency does not backslide, as shown in Table 13. Even so, under this assumption, removing Advanced Technology Credits would reduce cumulative well-to-wheel 2024–2050 CO_2 emissions by 195 Mt, or 1.4%, with moderate ZEV deployment under the MOU ZEV pathway. Because of state policies requiring the sale of heavy-duty ZEVs, these additional CO_2 emissions would be permitted without necessarily incentivizing additional ZEV deployment beyond state requirements. [EPA-HQ-OAR-2019-0055-1211-A1, pp. 33 - 34]

We recommend EPA remove Advanced Technology Credit multipliers starting in model year 2024 or as early as feasible. [EPA-HQ-OAR-2019-0055-1211-A1, p. 34]

We encourage EPA to consider whether additional CO_2 emissions allowed by these super credits under the current proposal would serve to incentivize ZEV deployment beyond what is already required by state or federal policies. We caution that if EPA were to set a cap on Advanced Technology Credits per manufacturer, which could retain incentives for small manufacturers and heavy-duty vehicles with low ZEV penetration, EPA still consider not allowing manufacturers to generate Advanced Technology Credits where they are subject to state or federal ZEV sales requirements. Since currently adopted state policies are technology-neutral, not strictly requiring either battery-electric or fuel-cell vehicle sales, we recommend EPA remove all Advanced Technology Credit multipliers. [EPA-HQ-OAR-2019-0055-1211-A1, p. 34]

Organization: *International Union, United Automobile, Aerospace and Agricultural Implement Workers of America (UAW)*

Additionally, regulatory credits play an important role in incentivizing the deployment of new and otherwise cost-prohibitive technologies, particularly when the industry is working to meet ambitious new regulations and provide industry with multiple technology pathways for reducing emissions. Maintaining technological flexibility can also guard against barriers to ZEV deployment that are out of the control of manufacturers, such as consumer willingness to purchase ZEVs or supply chain issues that limit manufacturers' ability to produce the required number of ZEVs. Finally, we have concerns that reducing regulatory credits for advanced technologies would reduce the incentive to produce battery electric or fuel cell vehicles and fail to reward companies for deploying more costly technologies in the heavy-duty sector. [EPA-HQ-OAR-2019-0055-1138-A1, p.3]

Organization: *Maine Department of Environmental Protection (Department)*

EPA's proposal, which increases GHG stringency requirements for certain vehicle classes by 1.5%, will reduce cumulative class 4-8 heavy-duty vehicle emissions by only 0.4% from 2027-205022 and could paradoxically result in greater GHG emissions if ZEV crediting provisions are retained. The Department recommends revising the proposal to preserve the original Phase II GHG stringency requirements for internal combustion engine vehicles and phasing out ZEV crediting towards GHGs as soon as feasible. [EPA-HQ-OAR-2019-0055-1288-A1, pp.8-9]

22 International Council on Clean Transportation

Organization: *Manufacturers of Emission Controls Association (MECA)*

EPA is proposing to revise the HD Phase 2 GHG standards for MY 2027 vehicles in order to take into account the larger proportion of electric vehicles that are projected to be sold out to MY 2030. The original Phase 2 regulation did not take electric vehicle penetration into account when setting the standards, so many proponents of this revision cite the ability to meet lower GHG targets than originally proposed. MECA agrees with the change to vehicle standards proposed by EPA based on projected electric vehicle sales. For the same reason, we support EPA's decision to phase out GHG credit multipliers for battery electric vehicles. CARB's Advanced Clean Trucks (ACT) Regulation is expected to lead to significant penetration of electric and fuel cell vehicles in California as well as several Section 177 states. [EPA-HQ-OAR-2019-0055-1320-A1, p.29]

The early introductory use of incentives can promote innovative technologies that can be disadvantaged by lack of customer exposure and experience. However, in order for a technology to be a sustainable and durable solution, it must demonstrate the ability to compete on the same basis with other technologies to allow consumers the choice that meets their needs while meeting performance based standards. Analyses by ICCT and researchers at Carnegie Mellon have shown that extended use of super credits in the light-duty sector has resulted in the unintended consequence of increased emissions from the non-ZEV fleet as it is allowed to emit more under a fleet average regulatory structure that includes averaging, banking and trading provisions [46]

[47]. Given the current number of heavy-duty electric vehicle model offerings, declining costs of these vehicles and projected sales, large credits to OEMs are not needed to incentivize production. Similar to the light-duty sector, an over-incentivized credit scheme for heavy-duty ZEVs will instead result in erosion of ZEV sales and thus the benefits anticipated by the standards, especially when the upstream emissions from electricity generation are considered [48]. [EPA-HQ-OAR-2019-0055-1320-A1, p.29]

[46] N. Lutsey, 'Integrating electric vehicles within U.S. and European efficiency regulations,' 2017.

[47] A. Jenn, I. L. Azevedo and J. J. Michalek, 'Alternative-fuel-vehicle policy interactions increase U.S. greenhouse gas emissions,' Transportation Research Part A: Policy and Practice, vol. 124, pp. 396-407, 2019.

[48] R. Minjares and J. Hannon, 'Adapting US heavy-duty vehicle emission standards to support a zero-emission commercial truck and bus fleet,' 2022.

MECA supports two changes to ZEV advanced technology multiplier credits that will help to strengthen the proposal. First, EPA should eliminate advanced technology multiplier credits for ZEVs sold into California and all states that have adopted California's Advanced Clean Trucks Regulation, which requires year-over-year increasing sales requirements of advanced technology vehicles subject to the credits. Second, EPA should phase out the current advanced technology multiplier credits such that no multiplier exists as soon as practicable and no later than from MY 2027. [EPA-HQ-OAR-2019-0055-1320-A1, p.30]

Finally, we support continued progress in reducing the GHG footprint from HD vehicles by considering the combination of technologies and fuels to enable stringent GHG standards. EPA staff should reconsider the generous credit provisions with respect to NOx credits and ZEV credit multipliers in light of the numerous OEM announcements of market introductions of EV trucks. Furthermore, stringent CO2 standards being adopted in other global markets, such as Europe, will drive electric truck technology in the US into the market. All of these factors should be considered when revising the Phase 2 vehicle GHG limits and credit considerations. An underestimation of the EV penetration in light of generous credits could significantly increase emissions of NOx and CO2 from combustion powered trucks. Our industry is prepared to do its part and deliver cost-effective and durable advanced emission control and efficiency technologies to the heavy-duty sector to assist in simultaneously achieving lower GHG and NOx emissions, while also meeting other criterial pollutant standards. [EPA-HQ-OAR-2019-0055-1320-A1, p.34]

Organization: *Mass Comment Campaign sponsored by Environment America (11,390)*

The greenhouse gas (GHG) emissions performance standard should be designed to push truck manufacturers to accelerate the transition to zero-emission electric trucks and buses. As written, EPA's proposal is far too weak and will allow truck manufacturers to keep producing dirty diesel trucks. [EPA-HQ-OAR-2019-0055-1611-A1, p.1]

Electric trucks and buses are already available today and vehicle manufacturers have the technology to meet stronger standards. Many recent analyses have shown that fully zero-emission trucks will be cheaper to purchase and operate than diesel trucks within the timeframe of these standards. Environment America supports eliminating credits and multipliers, and implementing a GHG standard that will put the truck and bus market on a path to 100% zero-emission sales by 2035. [EPA-HQ-OAR-2019-0055-1611-A1, p.2]

Organization: *Moving Forward Network (MFN)*

Finally, EPA notes that "advanced technology credit multipliers for CO2 emissions in HD GHG Phase 2 may no longer be appropriate based on [the agency's] current understanding of the [heavy-duty] market." We agree and urge EPA to under no circumstances extend multipliers beyond their currently expected MY 2027 phaseout and would even recommend an earlier than MY 2027 phaseout, since industry has shown that the technology needed to meet the proposed MY 2031 standards already exists today. For example, Eaton – a power management company – has already demonstrated that diesel emission reduction technologies for NOx emissions are already showing compliance with MY 2031 standards and is doing so at minimal cost and with GHG reduction benefits too.197 In addition, EPA should exclude any vehicles certified under the Advanced Clean Trucks (ACT) program and sold in an ACT state (California and any other state that has adopted the ACT or in the future adopts the ACT) from eligibility for the multiplier program. [EPA-HQ-OAR-2019-0055-1277-A1, p. 59]

197. In a series of private meetings, Eaton Technology gave a presentation titled 'Eaton Technology and Test Results for Future Regulations,' where they shared test results that demonstrated that diesel emission reduction technologies for NOx emissions are already showing compliance with the proposed standards for MY 2031. The private meeting that we took part in that is referenced in these comments occurred on April 26, 2022.

Organization: *Navistar, Inc. (Navistar)*

In the proposed rule, EPA is requesting comment on the following three approaches that would reduce the number of incentive credits produced by ZEVs in the MY 2024 through MY 2027 timeframe: (1) credit multiplier approach for ZEVs certified to meet California's ACT Rule; (2) advance technology credit cap approach; and (3) a transitional credit cap approach. 87 Fed. Reg. at 17603. California's ACT rule was adopted in 2020, and requires manufacturers to sell a certain percentage of zero emission heavy-duty vehicles for each model year, starting in MY 2024. Several states have followed suit and issued proposals to adopt California's ACT rule under CAA section 177, and it is anticipated more states may follow with similar proposals. [EPA-HQ-OAR-2019-0055-1318-A1, p. 6]

Under the first proposed approach, EPA would treat all ZEVs certified in California in the MY 2024 through MY 2027 timeframe differently than the vehicles certified outside of California. Under this approach, the MY 2024 through MY 2027 ZEVs certified in California would not receive the advanced technology credit multiplier that currently exists. 87 Fed. Reg. at 17605. EPA's proposed approach is unclear in that it does not address a scenario where a manufacturer sells more ZEVs than required under the California ACT rule. Navistar urges EPA to allow manufacturers to receive the advanced technology credit multiplier for ZEVs sold in excess of the applicable ACT rule requirements. [EPA-HQ-OAR-2019-0055-1318-A1, pp. 6 - 7]

As noted above, several states have issued proposals to adopt California's ACT rule under CAA section 177. EPA's proposed rule would seek to eliminate advanced technology credit multipliers for ZEVs sold in states that adopt California's ACT rule. The significance of EPA's proposal cannot be properly evaluated, because the proposal rests on future uncertain actions of states. This uncertainty undermines the continued development of the ZEV truck market. [EPA-HQ-OAR-2019-0055-1318-A1, p. 7]

Organization: *Natural Gas Vehicles for America (NGVAmerica)*

It is also clear that regulatory incentives for electric vehicles have been disproportionately favorable to that technology (e.g., ignoring upstream emissions, providing sales multipliers, allowing credit trading from low-mileage vehicles to high-mileage vehicles, providing credits for fueling station capacity - not actual fuel use or emission reductions). [EPA-HQ-OAR-2019-0055-1330-A1, p.11]

Organization: *Retail Industry Leaders Association (RILA)*

While MDHD ZEV technology is accelerating, RILA recommends a market-oriented approach to GHG credit multipliers, extending these multipliers past the MY2027 timeframe to encourage further maturation of EV vehicle technology. RILA also recommends a ramp down of credits instead of a hard cut off, in order to prevent potential 'pre-buy' spikes in demand at the end of MY2027. Extending and ramping down these multipliers will further ensure removal of market barriers to their further adoption. [EPA-HQ-OAR-2019-0055-1189-A2, p.7]

Looking forward, RILA additionally welcomes working with EPA on the MY2030 plan for GHG reductions from all types of MHD vehicles. [EPA-HQ-OAR-2019-0055-1189-A2, p.8]

Organization: *Rivian Automotive, LLC (Rivian)*

We also urge EPA to strengthen any GHG standard by phasing out multipliers for advanced technology vehicles. According to the agency, when originally designed the HD GHG Phase 2 multipliers represented a "tradeoff"—a needed economic inducement to develop new technologies but at the cost of effectively allowing for emissions increases by other engines and vehicles.15 EPA now rightly notes that the market has changed considerably since 2012 with levels of innovation and state policy leadership the federal government did not foresee. Rivian agrees that the multipliers "may no longer be appropriate."16 In fact, it would be imprudent for EPA to sustain the advanced technology vehicle multipliers in any form to avoid back-sliding. This standard should phase out all GHG multipliers for advanced technology vehicles. [EPA-HQ-OAR-2019-0055-1229-A1, p.5]

15 Id. at 17,603.

16 Id. at 17,604.

The agency proposes three potential approaches to reforming the GHG program's credit multipliers. These include eliminating multipliers for ZEV trucks and buses certified specifically in California in MY2024-2027, pursuant to its ACT requirement; a multiplier cap; and stepping down the multiplier value until its eventual sunset in MY2027. These alternatives all move in the right direction and of the three the latter option—phasing out the multiplier—appears most appropriate. [EPA-HQ-OAR-2019-0055-1229-A1, pp.5-6]

However, even this option fails to reflect the state of ZEV truck and bus development, as well as the degree of incentivization already built into the state-level regulatory landscape. Between the diversity of ZEV truck and bus offerings slated for launch in the near future and the ACT, we question whether the additional incentive a multiplier creates is still worth the environmental costs. Moreover, EPA determined the feasibility of the GHG standard "through the evaluation of conventional technologies" alone, indicating that the multipliers could erode overall GHG reductions if they remain in place to any extent.17 Eliminating the multiplier would also be administratively simplest. Rivian encourages EPA to sunset all truck advanced technology GHG multipliers in MY2024. [EPA-HQ-OAR-2019-0055-1229-A1, p.6]

17 Id. at 17,606.

Organization: *Southern Environmental Law Center (SELC)*

Moreover, to advance these goals, the credit systems used in the nitrogen oxides (NOx) and GHG emissions standards must be properly tailored to ensure the regulations result in cleaner internal combustion engines and meaningful deployment of ZEV technology beyond the forecasted baseline. [EPA-HQ-OAR-2019-0055-1247-A1, pp.1-2]

Under the revised Phase 2 GHG emissions standards, EPA should phase out super crediting of ZEVs in 2024 or as soon as feasible. EPA currently proposes to apply advanced technology credit multipliers until model year 2028,43 but this type of incentive is not needed given the growth of the ZEV market. Additionally, EPA should review its treatment of CO2 emissions credits for ZEVs that are required as part of manufacturers' compliance with the ACT regulation. As noted by EPA, these vehicles 'would still receive significant credits reflective of the difference between the applicable CO2 emission standard and zero grams' CO2 per ton-mile emissions.44 Allowing these vehicles to generate federal CO2 emissions credits would serve as a compliance giveaway to manufacturers since they will be required to provide these ZEVs under the ACT regulations. This makes no sense. At a minimum, these vehicles should not receive an advanced technology credit incentive under the Phase 2 GHG standards. [EPA-HQ-OAR-2019-0055-1247-A1, p.8]

43 Id. at 17607.

44 Id. at 17605.

EPA should also adjust the NOx and CO2 emissions credit systems to ensure that these compliance flexibilities do not unnecessarily dilute the stringency of the standards. [EPA-HQ-OAR-2019-0055-1247-A1, p.8]

Organization: *Tesla, Inc. (Tesla)*

Tesla, even though being the largest light-duty BEV manufacturer, supports eliminating advanced technology multipliers to ensure overall program integrity and supports firmly establishing a one-for-one credit ratio that is a more rational and transparent compliance mechanism and creates actual BEV vehicle deployment, thereby enabling deeper emission reduction targets. [EPA-HQ-OAR-2019-0055-1219-A1, p.18]

Furthermore, each of the options for reforming the existing credit multipliers presented by EPA all have substantial weakness. The first option would provide multipliers to those BEV sales in non-ACT states.146 This creates a disincentive for states to adopt ACT and move more aggressively with a regulatory framework that will yield greater GHG reductions. [EPA-HQ-OAR-2019-0055-1219-A1, p.18]

146 87 Fed. Reg. at 17605.

Similarly, the option to use multipliers and then cap credit use is equally flawed. Under this architecture, manufacturers will likely deploy ZEVs to maximize generation of multiplier credits up to the 1% cap limit but move no further.147 In the E.U, a similar 'Super Credit' multiplier exists for light duty vehicles which emit <50g CO_2/km, which can be earned from 2020-2022 inclusive. In the *first year* of the Super Credit eligibility, eight out of ten manufacturers reached the cap.148 This was achieved by aggressive sales practices (pricing and preregistrations) to capture the maximum value of the credits up to the cap, and then halting further sales once the cap was reached. [EPA-HQ-OAR-2019-0055-1219-A1, pp.18-19]

147 Id.

148 ICCT, CO2 emissions from new passenger cars in Europe: Car manufacturers' performance in 2020 (August 2021) at 4, Table 1.

The final option is the transitional credit approach proposing an extended phase down of the multiplier.149 This would delay actual deployment and incent less delivery of real vehicles for more credits. [EPA-HQ-OAR-2019-0055-1219-A1, p.19]

149 87 Fed. Reg. at 17606

As the technology has been now commercialized at scale, each BEV manufactured already contributes to achieving the GHG targets by making each manufacturers' fleet more efficient. All the enhanced multiplier does is weaken the stringency of the standard with no further delivery of an actual ZEV and little further technology development benefit will arise from this new incentive.150 [EPA-HQ-OAR-2019-0055-1219-A1, p.19]

150 See e.g., ICCT, Fixing the Broken Super Credits Scheme of the Proposed HDV Co2 Standards (Dec. 3, 2018) (Although super credits help make fleet electrification more cost-effective, they erode the intended environmental benefits of the CO2 standards, and their use amounts to poor environmental policy.)

Organization: *Truck and Engine Manufacturers Association (EMA)*

It is important to note that EPA included the advanced technology incentives at the urging of CARB. CARB advocated to EPA that the "credits are still needed to promote the wide-spread adoption of advanced technologies in the medium- and heavy-duty sectors, which CARB believes is essential to meeting our GHG and criteria pollutant goals." (See, Letter from CARB to EPA and NHTSA, June 16, 2016.) Based on a detailed analysis of the costs of BEVs and FCEVs, the letter also stated that credits alone will not be enough to incentivize production of the technologies, concluding that the costs exceed the benefits of the credits even before factoring in the ZEV infrastructure costs. CARB's analysis remains accurate; to spur ZEV production, the credit incentives must be part of a broader suite of incentive and infrastructure funding. EPA should continue to follow that advice, as the Agency did during the "finalization" of the Phase 2 GHG rulemaking. [EPA-HQ-OAR-2019-0055-1203-A1, p. 107]

Organization: *U.S. Partnership for Education for Sustainable Development and National Clean Energy Workforce Alliance*

[*From Hearing Testimony*, *April 13, 2022*, *Debra Rowe*] So because low NOx and electric trucks are already available and cost-effective, the proposed credits and multipliers, these are giveaways. They just allow for the dirtiest trucks to continue to be sold, and that really should be eliminated. The benefits are obvious. I suggest you make these changes because they are so logical and smart. [EPA-HQ-OAR-2019-0055-2867]

Organization: *Volvo Group*

Given that these enabling factors are outside of EPA's control as well, we foresee the need for continued regulatory incentives, such as the advanced technology credit multipliers, to allow manufacturers to continue to develop and sell zero-emission vehicles into existing and new market segments. [EPA-HQ-OAR-2019-0055-1324-A1, p . 8]

Organization: *Walmart*

We also recommend a ramp down of credits instead of hard cut off to prevent a 'pre-buy' spike in demand at the end of CY2027. [EPA-HQ-OAR-2019-0055-1191-A2, p. 2]

We recommend extending GHG credit multipliers past the CY2027 timeframe to encourage further maturation of EV vehicle technology. [EPA-HQ-OAR-2019-0055-1191-A2, p. 2]

Organization: *WE ACT for Environmental Justice*

Moreover, we also recommend phasing out the zero-emission credit multipliers in 2024 or eliminating them as soon as possible. As with the NOx emission credits, these multipliers erode the greenhouse gas standard as electric trucks are currently ready, available, and cost-effective. These credit multipliers are fundamentally giveaways for the highest-polluters in the engine manufacturing industry and will continue to allow the dirtiest medium- and heavy-duty vehicles to pollute for decades. [EPA-HQ-OAR-2019-0055-1347-A1, p.5]

Organization: *Zero Emission Transportation Association (ZETA)*

Similarly, ZETA recommends that EPA also phase out the Phase 2 GHG standard's multipliers for advanced technology vehicles by MY2027 at the latest, as proposed**.** We encourage EPA to remove these multipliers by MY2024. HDEV technology has progressed rapidly since 2012, and HDEVs will soon penetrate the market to a much greater degree than was previously anticipated. EPA has recognized that multipliers present a tradeoff between driving emissions reduction and incentivizing new technology. Based on the technology available today, multipliers are no longer required to incentivize HDEV technology investments, and a more stringent GHG standard would most effectively drive HDEV adoption and, in turn, emissions reduction. [EPA-HQ-OAR-2019-0055-1283-A1, p.9]

EPA Response

EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards) and may consider the comments in this section of this document in the development of that future rulemaking.

28.3 Costs of proposed HD GHG program

Comments by Organizations

Organization: *Environmental Defense Fund (EDF) (1265 and 2855)*

Many commercial truck and bus segments are primed for a near term transition to electrification – the technology has been proven and the benefits outweigh the costs now or in the very near term. A recent study conducted by Roush Industries for Environmental Defense Fund evaluated both the upfront and ongoing costs of electrifying several types of medium and heavy-duty vehicles that are commonly used in urban areas, including transit buses, school buses, garbage trucks, shuttle buses and delivery trucks.47 These vehicles tend to be concentrated in urban areas where average trip distances are shorter and health and pollution impacts are of most concern, making them particularly important opportunities for early electrification deployment. The study found that, when considering upfront purchase price alone, by 2027 electric freight trucks and buses will be less expensive than their combustion engine counterparts in nearly all categories. Electric vehicles will also be less expensive on a total cost of ownership basis in all categories in the same timeframe. [EPA-HQ-OAR-2019-0055-1265-A1, p.10]

> 47 Vishnu Nair, Sawyer Stone, Gary Rogers, Sajit Pillai. 2022. Medium and Heavy-Duty Electrification Costs for MY 2027- 2030, Roush Industries for Environmental Defense Fund. See http://blogs.edf.org/climate411/files/2022/02/EDF-MDHD-Electrification-v1.6_20220209.pdf

The Roush study developed projections for upfront costs and total cost of ownership for electric vehicles in years 2027 to 2030 and compared those costs to equivalent internal combustion vehicles that meet EPA Greenhouse Gas Phase 1 and 2 rules, as well as California Low NOx regulations. The study determined the total cost of ownership for all financial aspects of ownership, including vehicle purchase cost of either an internal combustion engine or electric freight truck or bus, fuel or energy costs, charging or fueling infrastructure costs, maintenance costs, and vehicle mid-life refresh if applicable. It focused exclusively on the direct financial costs and savings related to vehicle ownership and did not include the substantial health and welfare benefits associated with switching to electric trucks. [EPA-HQ-OAR-2019-0055-1265-A1, p.10]

The study found decreasing upfront costs for electric freight trucks and buses, driven largely by steeply decreasing battery costs. It also concluded that in 2027, electric vehicle costs will be less than internal combustion vehicles costs over the life of the vehicle, largely because maintenance and energy costs will be lower. Total cost of ownership parity will occur immediately for some segments evaluated and very quickly for the rest. [EPA-HQ-OAR-2019-0055-1265-A1, p.10]

Roush's findings have been confirmed in other recently released reports. The National Renewable Energy Lab (NREL) looked at all classes and segments of medium- and heavy-duty vehicles and concluded that with continued improvements in vehicle and fuel technologies, ZEVs can reach TCO parity with diesel vehicles as early as 2026 for some applications and no later than 2035 for all segments, including long-haul trucks.48 The study also concludes that 42 percent of all medium- and heavy-duty truck sales and 100 percent of bus sales will be ZEVs by 2030. [EPA-HQ-OAR-2019-0055-1265-A1, p.11]

48 Muratori, Matteo et al. 'Decarbonizing Medium- and Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis.' NREL Transforming Energy. March 2022. https://www.nrel.gov/docs/fy22osti/82081.pdf.

While Roush did not study Class 8 short haul (day cab) tractors, this segment is also ripe for near-term electrification. These tractors pull trailers and typically drive less than 250 miles per day, returning to a hub each night where they could charge. NREL estimates that these tractors will reach TCO parity with their diesel counterparts by 2025.49 And a recent study by the North American Council for Freight Efficiency (NACFE) concluded that a BEV short haul tractor purchased today will save more than $9,000 annually on fuel costs compared to a diesel truck.50 [EPA-HQ-OAR-2019-0055-1265-A1, p.11]

49 Chad Hunter, Michael Penev, Evan Reznicek, Jason Lustbader, Alicia Birky, and Chen Zhang. 2021. Spatial and Temporal Analysis of the Total Cost of Ownership for Class 8 Tractors and Class 4 Parcel Delivery Trucks, Nation Renewable Energy Lab, Technical Report. https://www.nrel.gov/docs/fy21osti/71796.pdf

50 North American Council for Freight Efficiency. 2022. Electric Trucks Have Arrived: The Use Case for Heavy-Duty Regional Haul Tractors. https://nacfe.org/heavy-duty-regional-haul-tractors/

Cost parity projections are also being confirmed by leading heavy-duty truck and bus manufacturers. Navistar noted recently that long haul trucks will reach cost parity with diesel by

2027 with all other heavy-duty vehicles reaching cost parity before 2025.51 Daimler anticipates total cost of ownership of its BEVs to reach parity with traditional diesel vehicles by 2025.52 [EPA-HQ-OAR-2019-0055-1265-A1, p.11]

51 Navistar President and CEO, Mathias Carlbaum, presentation at the Advanced Clean Transportation (ACT) Expo, Long Beach, CA (May 9-11, 2022).

52 Deborah Lockridge, 'What Does Daimler Truck Spin-off Mean for North America?,' Trucking Info (November 11, 2021). https://www.truckinginfo.com/10155922/what-does-daimler-truck-spin-off-mean-for-north-america

EPA Response

EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards) and may consider the comments in this section of this document in the development of that future rulemaking.

28.4 Benefits of proposed HD GHG Phase 2

Comments by Organizations

Organization: Brooke S.

These new standards are not enough.

We have the technology and political leadership now to pass more aggressive policies on the transportation industry to stop climate change. We cannot afford to wait. We cannot afford to move slowly. [EPA-HQ-OAR-2019-1033]

Why must we stop producing high emitting heavy-duty vehicles?

Heavy-duty trucks stay on the road much longer than cars. While cars might stay on the road until they reach 200,000 miles, trucks keep driving until around 750,000 miles. This means that heavy-duty trucks are on the roads for an average of 15 years. Right now in the United States, medium and heavy duty trucks account for only 5 percent of vehicles on the road but 24 percent of transportation emissions. The emissions produced by trucks put on the roads now will continue long after policy changes eventually mandate low emitting trucks. With the effects of truck production decisions today still being felt 15 years from now, we cannot afford to move slowly when creating regulations to keep new high emitting trucks from joining fleets. [EPA-HQ-OAR-2019-1033]

Are heavy-duty electric vehicles economically feasible?

A major obstacle in the adoption of heavy-duty electric vehicles is sticker shock. We cannot generally expect purchasers to choose more expensive options just because they are better for the environment. We have the technology to produce heavy-duty electric vehicles, but they are expensive. With the current cost of production and materials, the cost of a new electric truck can be two or three times that of a conventional truck. However, this cost comparison does not tell the whole story.

Fleet managers and individual truck drivers consider Total Cost of Ownership (TCO). Overtime, the decrease in maintenance and fuel costs will effectively decrease the cost the truck. Today, medium-duty electric trucks have achieved TCO numbers that match those of conventional medium-duty trucks. Therefore, for local delivery trucks and buses, electric vehicles are already economically feasible. They are perfect for urban and regional uses due to their smaller batteries and the benefits they get from regenerative braking technology with frequent stops. Electric heavy-duty trucks, however, are expected to reach TCO parity in 2030. As developments in technology and production scale decrease costs, electric heavy-duty trucks will become the most economic option. Initially, though, governments must provide subsidies to incentivize more immediate adoption of electric heavy-duty trucks for the sake of our planet. These initial subsidies would increase investment into electric heavy-duty trucks and move them towards TCO parity more rapidly. [EPA-HQ-OAR-2019-1033]

Do we have the infrastructure to support electric big rigs?

Policies promoting the adoption of electric heavy-duty vehicles will be ineffective if we do not have the infrastructure for long-haul truckers to recharge their vehicles. The charging infrastructure and electric vehicle production must be developed in unison with one another. Policies aiding in the development of one goal will make the other easier to achieve. Many grants, loans, and incentive programs have already been implemented to develop the charging infrastructure needed to make electric big rigs a reality. These include the California Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP), the Diesel Emission Reduction Act (DERA) Program, Electric Vehicle Charging incentives provided by governments and utilities, and Federal and State Laws and Incentives. These programs, joined with policies that mandate more electric heavy-duty vehicles, push investment in charging infrastructure. [EPA-HQ-OAR-2019-1033]

Why the urgency?

Climate change is happening and it’s too late to reverse some of the damage we have already done to our planet. It is not too late, however, to mitigate the worst effects of climate changing by limiting our emissions and preventing further global warming. We must act now. Years spent putting off significant climate change policies will result in increasingly devastating effects of global warming.

We might never be able to pass the necessarily aggressive climate change policies without at least some political opposition. However, actions addressing climate change are possible under the current administration. We have a president and leadership interested in addressing climate change. We must act quickly to pass important policies like stricter emissions standards in the transportation sector and increased investment in the infrastructure needed to make electric vehicles of all sizes economically feasible. We don’t know what the future political climate will look like. We cannot afford to make minimal progress towards emissions reductions goals and hope the next administration will take more aggressive action. This proposed rule is a small step in the right direction, but it’s not enough. I urge the EPA to propose a new rule with more substantial regulations to push us towards a decarbonized future. [EPA-HQ-OAR-2019-1033]

Organization: *CALSTART*

Several studies demonstrate the expected benefits of deploying zero-emission trucks and buses (Busch, 2020). CARB estimated that the ACT would reduce NOx emissions by 5,301 tons per year, PM2.5 by 144 tons per year, and GHG emissions by 2.9 million metric tons per year in California in 2040 (CARB, 2019a). From 2020-2040, CARB estimated these emission reductions would avoid 943 premature deaths and 778 hospitalizations and emergency room visits at a valuation of $8.9 billion in health benefits. Avoided GHG emissions provide an additional $1.7 billion in savings related to the social costs of global warming emissions at a 2.5 percent discount rate. CARB estimated the ACT will provide additional savings of $5.9 billion in California related to vehicle purchases and operation (higher vehicle purchase costs offset by significant savings in fuel and maintenance). [EPA-HQ-OAR-2019-0055-1313-A1, pp.5-6]

In addition to zero tailpipe emissions, battery and fuel cell electric vehicles offer significant reductions in global warming emissions compared to combustion vehicles. As shown in Figure 2 below, with the average sources of electricity in the US, heavy-duty electric vehicles reduce global warming emissions by approximately 50 to 80 percent depending on a vehicle's average speed over the course of its trip (O'Dea, 2019). Emissions associated with charging electric vehicles will continue to decline as lowercarbon sources of electricity are required to be deployed through state laws. Heavy-duty fuel cell electric vehicles also offer emission reductions compared to vehicles fueled with diesel. For hydrogen generated from steam-reforming of methane, a fuel cell transit bus, for example, has life cycle GHG emissions 40 percent lower than a comparable diesel transit bus (Union of Concerned Scientists, 2016). Using hydrogen generated from electrolysis of water using renewable electricity will provide significantly lower life cycle GHG emissions. [EPA-HQ-OAR-2019-0055-1313-A1, p.6]

Organization: *Ceres BICEP (Business for Innovative Climate and Energy Policy) Network*

Strong truck standards are also necessary to ensure that we meet climate goals. A recent [ICCT analysis](https://theicct.org/publication/zevs-global-transition-benefits-mar22/) (https://theicct.org/publication/zevs-global-transition-benefits-mar22/) found that a target of 100% zero-emission sales of medium- and heavy-duty trucks (MHDVs) by 2040 would be consistent with limiting warming to less than 2°C (although higher sales would be necessary to limit warning to 1.5°C). The GHG standards should ensure a trajectory consistent with 100% ZEV MHDV sales by 2040 at the latest, and 50% ZEV MHDV sales by 2030. [EPA-HQ-OAR-2019-0055-2714-A1, p.1]

The urgency of taking action on climate has never been so clear; upon release of the most recent April 2022 IPCC report, working group co-chair Jim Skea warned that "It's now or never, if we want to limit global warming to 1.5°C."1 Global HDV GHG emissions, which are second only to passenger vehicles in the transportation sector, are projected to exceed light-duty vehicle emissions by 2025 based on current trajectories.2 A rapid transition to ZEVs is necessary to meet climate goals. A recent ICCT analysis found that a goal of 45% zero-emission sales in 2030 in the U.S. heavy-duty vehicle sector would be consistent with limiting warming to less than 2°C, although higher sales would be necessary to limit warning to 1.5°C. However, EPA projects a zero-emission vehicle (ZEV) sales share of 1.5% in key market segments in 2027, which falls far short of what is needed to meet climate goals as well as current state regulatory requirements. [EPA-HQ-OAR-2019-0055-2714-A3, p.1]

1 'The evidence is clear: the time for action is now. We can halve emissions by 2030.' The Intergovernmental Panel on Climate Change (IPCC). April 4, 2022.

2 Dale Hall, Yihao Xie, Ray Minjares, Nic Lutsey, and Drew Kodjak. 'Decarbonizing road transport by 2050: Effective policies to accelerate the transition to zero-emission vehicles.' International Council on Clean Transportation. December 2021.

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

EPA's cost-benefit analysis should include a quantification of the rule's climate benefits based on the social cost of greenhouse gases (SC-GHG). Commenters' proposed improvements to EPA's criteria pollutant and GHG proposals would deliver increased climate benefits by incorporating and driving zero-emission technologies across the heavy-duty sector, and EPA must consider these additional benefits in finalizing the standards. [EPA-HQ-OAR-2019-0055-1302-A1, pp.67-68]

EPA has previously found that sales impacts from heavy-duty standards were too uncertain to quantify, and Commenters believe that continued uncertainty cautions against attempting to quantify them as part of this rulemaking's Regulatory Impact Analysis. Despite this continued uncertainty, Commenters agree with EPA that the adverse sales impacts, if any, from Option 1 (including pre-buy and low-buy effects) are likely to be minimal and short lived. [EPA-HQ-OAR-2019-0055-1302-A1, p.68]

The federal government has quantified the climate impacts of proposed regulations for more than a decade, since the Ninth Circuit Court of Appeals held in 2008 that the National Highway Traffic Safety Administration (NHTSA) had acted arbitrarily and capriciously by failing to do so when assessing the costs and benefits of various alternative fuel-economy standards. See Center for Biological Diversity v. NHTSA, 538 F.3d 1172, 1201 (9th Cir. 2008) (finding 'no evidence to support NHTSA's conclusion that the appropriate course was not to monetize or quantify the value of carbon emissions reduction at all'). [EPA-HQ-OAR-2019-0055-1302-A1, p.68]

As Commenters and others have previously explained,249 and as EPA and NHTSA both recently determined,250 the best available and most appropriate values for estimating monetized climate impacts are the interim estimates published in February 2021 by the federal government's Interagency Working Group on the Social Cost of Greenhouse Gases (IWG).251 Although the IWG's interim estimates are widely acknowledged to be significant underestimates,252 they remain appropriate representations of the lower bound of potential climate impacts and have been applied in dozens of previous rulemakings253 and their use has been upheld by federal courts.254 [EPA-HQ-OAR-2019-0055-1302-A1, p.68]

249 See Comments of Center for Climate and Energy Solutions et al. on Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards, 86 Fed. Reg. 43,736

(Aug. 10, 2021) (Docket No.
EPA-HQ-OAR-2021-0208-0268).

250 See EPA, Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards, 86 Fed. Reg. 74,434, 74,504 (Dec. 30, 2021) (determining that the interim estimates, 'while likely an underestimate, are the best currently available SC-GHG estimates,' and that they remained 'appropriate for use in estimating the global social benefits of [GHG] emission reductions expected from this final rule'); NHTSA, Corporate Average Fuel Economy Standards for Model Years 2024–2026 Passenger Cars and Light Trucks, 84 Fed. Reg. 25,710, 25,724 (May 2, 2022) (determining that the IWG values 'are based on the best available science and economics and are the most appropriate values to focus on in the analysis of this rule,' even though they 'likely significantly underestimate the full benefits to social welfare of reducing greenhouse gas pollution').

251 See IWG, Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide—Interim Estimates Under Executive Order 13,990 (2021), https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.

252 See, e.g., id. at 4 (acknowledging that current social cost valuations 'likely underestimate societal damages from [greenhouse gas] emissions'); Richard L. Revesz et al., Improve Economic Models of Climate Change, 508 Nature 173 (2014) (explaining that the IWG's values, though methodically rigorous and highly useful, are very likely underestimates).

253 Peter Howard & Jason Schwartz, Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon, 42 Colum. J. Envt'l L. 203, 270–84 (2017) (listing all uses through mid-2016).

254 Zero Zone v. Dept. of Energy, 832 F.3d 654, 679 (7th Cir. 2016)

In the Proposal, EPA requested comment on 'how to address the climate benefits' of the proposed rule, noting that a federal district court had issued an injunction against the use of the IWG's interim estimates by EPA and other defendants. 86 Fed. Reg. at 17,608 & n.888. See Louisiana v. Biden, Order, No. 2:21-CV-01074, ECF No. 99 (W.D. La. Feb. 11, 2022). However, the Fifth Circuit Court of Appeals has since stayed that injunction, Louisiana v. Biden, Order, No. 22-30087, Doc. No. 00516242341 (5th Cir. Mar. 16, 2022), meaning there is currently no reason for EPA to depart from its historical and preferred approach of monetizing climate impacts using the IWG's interim estimates. Indeed, NHTSA has already returned to using the interim estimates, finding them to be 'more accurate and reasonable' than other values. NHTSA, Corporate Average Fuel Economy Standards for Model Years 2024–2026 Passenger Cars and Light Trucks, 87 Fed. Reg. 25,710, 25,724 (May 2, 2022). [EPA-HQ-OAR-2019-0055-1302-A1, p.69]

Commenters encourage EPA to follow the approach that NHTSA recently took in finalizing its Light-Duty Vehicle Corporate Average Fuel Economy Standards for Model Years 2024–2026. In that rulemaking, NHTSA explicitly stated its independent determination that although the IWG interim estimates significantly underestimate the full benefits of GHG emissions reductions, they remain the best available values. Id. at 25,724–25. Critically, NHTSA provided additional justification for adopting a global damages valuation and for combining climate effects discounted at an appropriate consumption-based rate with other costs and benefits discounted at a capital-based rate. Id. at 25,879–80. NHTSA then used the IWG's interim estimates and recommended discount rates in the agency's main cost-benefit analysis. Id. at 25,724. However, NHTSA also conducted sensitivity analyses using additional discount rates, as well as the SC-GHG estimates it used in 2020 (which attempted to exclude global climate impacts), while cautioning that the 2020 values 'do not reflect the best available science and economics for estimating climate effects.' Id. NHTSA then determined that 'even if NHTSA's cost-benefit analysis applied the misleadingly low SC-GHG estimates from the 2020 rule, which severely underestimate the impacts of climate effects on U.S. citizens,' the results would not change the agency's determination that the final standards were 'the maximum feasible under its statutory authority.' Id. By taking a similar approach in this rulemaking, EPA can protect against challenges to the Agency's application of the SC-GHG, as well as confirm that strengthening the standards as Commenters propose will deliver meaningful net benefits to society under a range of analytical assumptions. [EPA-HQ-OAR-2019-0055-1302-A1, p.69]

Organization: *ClearFlame Engine Technologies (ClearFlame)*

Third, it should not be a given that a BEV or FCEV will always be the lowest-GHG option or the lowest cost option to reach a particular GHG goal. Upstream grid emissions vary widely in the United States, and we are decades away from a grid that is 100% renewable. While we are impressed by the progress being made to electrify transit and school buses and other urban truck niches that operate on short routes and rely on a home base to recharge, significant questions about the ability of BEVs and FCEVs to meet the operating needs of long-haul fleets remain unanswered and are likely to remain so for years to come. [EPA-HQ-OAR-2019-0055-1261-A1, p. 5]

By opening the proposed BEV and FCEV provisions (e.g., sales-weighted averages of projected emissions) to all vehicles or vehicle/fuel systems that meet fuel-neutral, technology-neutral performance criteria, EPA will accelerate innovation, and the result will be deeper, more cost-effective GHG reductions across the entire heavy-duty vehicle market. Certainly, EPA should not pick technology "winners" by adopting any form of sales mandate when finalizing this Proposal or proposing next year's expected Phase 3 GHG standards. [EPA-HQ-OAR-2019-0055-1261-A1, p. 5]

Recently, Gladstein, Neandross & Associates (GNA) published a white paper that found that the ClearFlame system could provide lower GHG emissions, lower total cost of ownership (TCO), and lower cost per mile than comparable BEV, FCEV, and other systems.7 Findings of the GNA study include: [EPA-HQ-OAR-2019-0055-1261-A1, p. 5]

7. Gladstein, Neandross & Associates, ClearFlame TCO and Emissions Study, May 2022, summarized and accessed on May 15, 2022 at https://www.clearflameengines.com/press-release/independent-study-confirms-cost-savings-emissions-advantages-for-heavy-duty-trucks-

running-clearflames-engine-modification-technology/. To download the full study, visit https://www.clearflameengines.com/white-paper/tco-study/.

Findings of the GNA study include: ClearFlame-enabled trucks are expected to have the lowest TCO when compared with diesel, natural gas, electric, and hydrogen platforms. [EPA-HQ-OAR-2019-0055-1261-A1, p. 6]

Findings of the GNA study include: ClearFlame's cost per mile is expected to be substantially lower than electric and hydrogen platforms—40% less than electric and 30% less than hydrogen. [EPA-HQ-OAR-2019-0055-1261-A1, p. 6]

Findings of the GNA study include: ClearFlame engines can provide a quick and cost-effective path to substantial reductions of GHG and other tailpipe emissions compared to other sustainable fuels and technologies, whose practical challenges, such as cost, range, infrastructure, and fuel availability, have slowed adoption. [EPA-HQ-OAR-2019-0055-1261-A1, p. 6]

Findings of the GNA study include: ClearFlame engines are estimated to provide a 42% lifecycle carbon reduction compared with diesel, as well as approximately 22% lower GHG than BEVs, based on the national average grid mix. [EPA-HQ-OAR-2019-0055-1261-A1, p. 6]

This TCO analysis was conducted when diesel fuel's national average was $3.48 per gallon in October 2021 (i.e., it predates our currently escalated fuel prices). The analysis found that ClearFlame-enabled trucks would have a lower TCO than diesel by $0.08 per mile, lower than natural gas by $0.09 per mile, lower than electric by $0.97 per mile, and lower than hydrogen platforms by $0.61 per mile. [EPA-HQ-OAR-2019-0055-1261-A1, p. 6]

The report also highlights the potential for even greater GHG reductions using other feed sources developed by the ethanol industry with lower carbon intensities. For instance, further improvement to ethanol production processes—such as utilizing more corn fiber and stover, or adding carbon capture to production facilities—would result in GHG emissions reductions of 69-83% compared with diesel, depending on the region. [EPA-HQ-OAR-2019-0055-1261-A1, p. 6]

Considering these findings, we urge EPA to take a systems approach to certifying ClearFlame engines (or any other engine that can guarantee that a non-petroleum biofuel will be used throughout useful life). When an OEM seeks to certify a ClearFlame-equipped engine as a ZEV or near-ZEV, EPA should treat the engine and the fuel as a single system, thereby granting credit for that engine's overall emissions performance, rather than just considering the engine's tailpipe emissions. Similarly, EPA should consider the upstream grid or other emissions impacts on any BEV or FCEV systems. Doing this across the board will better reflect the real-world emissions benefit of all vehicle/fuel/power systems. Equally important, it will provide a market signal and incentive to the biofuels community to find ways to reduce the direct and indirect GHG impacts of their fuels in order to compete successfully with BEVs, FCEVs, and any other technologies that emerge. [EPA-HQ-OAR-2019-0055-1261-A1, p. 6]

We acknowledge that today's systems approach may be more complicated than simply removing sulfur or choosing among a small number of competing emission control technologies. However, this approach is even more important now, given the wide range of potential upstream or indirect GHG emissions from all types of vehicles, whether fueled by electricity, hydrogen, biofuels, or diesel. Indeed, as we evolve towards a market that includes vehicles powered by all of these options, evaluating and integrating the full upstream, indirect, and other lifecycle emissions impacts of our full vehicle/fuel/power systems will become even more important to ensuring that real world emissions meet our environmental goals. [EPA-HQ-OAR-2019-0055-1261-A1, p. 7]

The Biden Administration's Net Zero Plan Will Require Increased Use of Renewable Biofuels to Replace Petroleum Diesel—and this Proposal Can Help Achieve that Goal. [EPA-HQ-OAR-2019-0055-1261-A1, p. 7]

The Biden administration's bold plan to reach net zero GHG emissions by 2050 will require many strategies to succeed.8 [EPA-HQ-OAR-2019-0055-1261-A1, p. 7]

8. The Long-Term Strategy of the United States: Pathways to Net Zero Greenhouse Gas Emissions by 2050, November 2021. Accessed on May 15, 2022 at https://www.whitehouse.gov/wp-content/uploads/2021/10/US-Long-Term-Strategy.pdf

Given that diesel engines will be in widespread use until at least midcentury, it is clear that the Biden administration's Net Zero plan cannot succeed without a significant shift from petroleum diesel to renewable liquid biofuels. Such a strategy is necessary as a critical complement to the Biden administration's electrification strategies. [EPA-HQ-OAR-2019-0055-1261-A1, p. 7]

The White House recognizes the importance of a strong, comprehensive GHG strategy that includes aggressive action to replace petroleum diesel fuel with low-carbon, renewable biofuels. Indeed, the White House's Net Zero plan assumes that we will need roughly a gigaton of GHG reductions by decarbonizing the liquid fuels that will still be used in 2050 as a complementary strategy to its ambitious electrification goal. [EPA-HQ-OAR-2019-0055-1261-A1, p. 7]

We estimate that this gigaton of GHG reductions is equivalent to approximately 90 billion gallons of diesel fuel or its equivalent. This is more than twice our annual highway diesel consumption. In other words, the Biden administration's Net Zero plan anticipates that overall use of diesel fuel (or its renewable substitutes) will continue to grow for years to come, even as parts of the heavy-duty sector increasingly move towards electrification. Meeting this goal will require a tenfold increase in our use of renewable biofuels. Perhaps for this reason, President Biden recently said, "You simply can't get to net zero by 2050 without biofuels."9 [EPA-HQ-OAR-2019-0055-1261-A1, p. 7]

9. Statement of President Joseph R. Biden, April 12, 2022. Accessed on May 15, 2022 at: https://www.whitehouse.gov/briefing-room/speeches-remarks/2022/04/12/remarks-by-president-biden-on-lowering-energy-costs-for-working-families/

By aiming to reduce the GHG emissions of the entire fuel/power/vehicle "system," EPA's Clean Trucks Plan can help ensure that the White House's Net Zero plan will be successful. Such an approach will incentivize accelerated scaling of all low-carbon-fuel based solutions by sending the right market signal, rather than sending the signal that a future of targeted electrification in certain vehicle niches, combined with millions of diesel trucks and buses continuing to operate on petroleum diesel fuel, will somehow be sufficient to reach Net Zero. [EPA-HQ-OAR-2019-0055-1261-A1, pp. 7 - 8]

To be clear, ClearFlame is committed to supporting all contributions to meeting our Net Zero goals. Thus, we share the administration's excitement about the many promising developments in the electric vehicle industry recently, including in the light-duty vehicle sector and those segments of the heavy-duty sector that are the best candidates for electrification at scale, such as school and transit buses, urban delivery vehicles, and short-haul tractors. [EPA-HQ-OAR-2019-0055-1261-A1, p. 8]

But electric school buses, transit buses, grocery delivery vans, and package delivery trucks will not get us to the Net Zero goal. EPA's GHG rules should contribute to the Net Zero goal by encouraging innovation that can decarbonize all heavy-duty vehicles and engines, not just those that are most appropriate for battery or fuel cell electrification. [EPA-HQ-OAR-2019-0055-1261-A1, p. 8]

In sum, EPA has had more than 50 years of success using a fuel-neutral, technology-neutral approach that rewards innovation, cost-effectiveness, and the ability to scale quickly. This approach has led to deeper emissions reductions, faster and more cost-effectively and at greater scale than any technology-specific federal or state program that has "picked winners." [EPA-HQ-OAR-2019-0055-1261-A1, p. 8]

Organization: *Energy Innovation, LLC*

Modeling from numerous studies concur strong tailpipe standards can effectively reduce GHG emissions from the transportation sector and put the U.S. on a climate-stable path. For example, modeling from Energy Innovation's Energy Policy Simulator, as shown in Figure 1, demonstrates widespread deployment of ZEVs for light- medium and heavy-duty vehicles, powered by a clean grid and in conjunction with other policies, would reduce U.S. GHG emissions to net zero by 2050, limiting warming to 1.5°C. [EPA-HQ-OAR-2019-0055-1310-A1, p.2]

The dark purple wedge, 'Passenger EV Sales Standard + Clean Trucks,' reflects a 100 percent EV new sales target for light-duty vehicles by 2035 and a 100 percent EV new sales target for heavy-duty vehicles by 2045.vii [EPA-HQ-OAR-2019-0055-1310-A1, p.3]

vii Robbie Orvis and Megan Mahajan, A 1.5°C NDC for Climate Leadership for the United States, Energy Innovation, April 2021, 4, https://energyinnovation.org/wp-content/uploads/2021/04/A-1.5-C-Pathway-to-Climate-Leadership-for-The-United-States_NDC-update-2.pdf.

An analysis conducted by the Lawrence Berkeley National Laboratory supports similar findings, as shown in Figure 2.viii [EPA-HQ-OAR-2019-0055-1310-A1, p.3] viii Illustrative Strategies for the United States to Achieve 50% Emissions Reduction by 2030, Lawrence Berkeley National Laboratory, April 2021, 11, https://eta-publications.lbl.gov/sites/default/files/us_50_percent_ndc_memo_finalap.pdf.

A recent study by the International Council on Clean Transportation (ICCT) also shows a 2030 target of 45 percent zero-emissions sales would put the U.S. heavy-duty sector on a path to limit warming to 2°C (more ambitious sales targets would be needed to align with a 1.5°C warming limit). That would translate to a 50 percent zero emission sales target for rigid trucks in model year 2030, combined with a 30 percent target for tractor-trailers and a 100 percent target for buses, as shown in Figure 3.ix [EPA-HQ-OAR-2019-0055-1310-A1, p.3]

ix Claire Buysse, Sara Kelly, and Ray Minjares, Racing to Zero: The Ambition We Need for Zero-Emission Heavy-Duty Vehicles in the United States, The International Council on Clean Transportation, April 8, 2022, https://theicct.org/racing-to-zero-hdv-us-apr22/.

Although the heavy-duty sector lags behind the light-duty sector in terms of EV availability and cost declines, the adoption of a stronger GHG tailpipe standard could stimulate more investment and innovation to jumpstart transformation in the HDT sector. Well-designed performance standards can leverage the pace of technology advancement and send clear market signals that spur the private sector to accelerate HDEVs sales. This relationship between regulatory standards and market advancements is explained in Energy Innovation’s book, Designing Climate Solutions: Demand signals, stimulated by performance standards, provide investment opportunities for private companies to fund research and development in new technologies. With strong performance standards and a clear timeline over which they will become more stringent, companies have a strong incentive to invest in innovation. The best example of this is electric vehicles, widely recognized as critical to global efforts to decarbonize transportation. Effective performance standards push EV deployment forward…[and] create the short-term conditions necessary for lower-cost options to emerge.x [EPA-HQ-OAR-2019-0055-1310-A1, p.4]

Energy Innovation, Energy Policy Solutions, 'Performance Standards,' from Hal Harvey, Designing Climate Soutions: A Policy Guide for Low-Carbon Energy, Chapter 2, 2018, https://energypolicy.solutions/energy-policy-design/performance-standards/

Organization: *Institute for Policy Integrity at New York University School of Law (Policy Integrity)*

EPA should quantify the benefits of reducing greenhouse gases. EPA should quantify any expected reductions in greenhouse gas emissions from the Proposed Rule and monetize the benefits of such reduction using the social cost of greenhouse gases. [EPA-HQ-OAR-2019-0055-1256-A1, p. 2]

While the Proposed Rule is focused on reducing the emissions of particulate matter and nitrogen oxides from the heavy-duty trucks, the necessary vehicle improvements may also reduce greenhouse gas emissions. However, EPA does not quantify greenhouse gas emission reductions for any of the alternatives considered. EPA has expertise in estimating greenhouse gas emissions from changes in vehicle standards and should apply that expertise here. If EPA believes the greenhouse gas effects are too small to warrant quantification, it should explain that. [EPA-HQ-OAR-2019-0055-1256-A1, p. 26]

EPA should not only quantify greenhouse gas emissions (or emission reductions) in the Proposed Rule, but also monetize the climate effects of those changes in greenhouse gases. EPA has used the social cost of greenhouse gases many times in the past to monetize the climate effects of its proposed regulations, and so should have no problem applying the tool here.142 The social cost of greenhouse gases can be applied to any volume of emissions and is useful for comparing climate impacts to other monetized costs and benefits.143 [EPA-HQ-OAR-2019-0055-1256-A1, p. 26]

142. See, e.g., 86 Fed. Reg. 74,434, 74,444 tbl.4, n.b (Dec. 30, 2021) (explaining how the agency monetized the benefits of reducing greenhouse gas emissions in its final light-duty vehicle greenhouse gas emission standards for MY 2023-26).

143. See generally Inst. for Pol'y Integrity et al., Joint Comments on the Consideration of the Social Cost of Greenhouse Gases in Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards (Sept. 27, 2021), https://policyintegrity.org/documents/Joint_SCC_Comments_on_EPA_Cars_Rule.pdf.

Policy Integrity and several other groups submitted joint comments to EPA on its light- and medium-duty vehicle emissions that focus on the social cost of greenhouse gases.144 These comments (attached) highlight the appropriate methodology and rationale that EPA should use in the Final Rule. [EPA-HQ-OAR-2019-0055-1256-A1, p. 26]

144. Id.

Organization: *International Council on Clean Transportation (ICCT)*

Human-induced climate change has already caused widespread damages to humans and ecosystems, globally and in North America.22 At the current rate of CO2 emissions, the remaining carbon budget for a 67% chance of limiting warming to 1.5 degrees Celsius will be exhausted as early as 2030.23 Yet under currently adopted policies, global CO2 emissions from on-road vehicles are projected to continue growing through 2050.24 [EPA-HQ-OAR-2019-0055-1211-A1, p. 25]

22."Observed impacts from climate change: B.1", https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf

23. https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_SummaryForPolicymakers.pdf

24.https://theicct.org/wp-content/uploads/2022/03/Accelerated-ZEV-transition-wp-final.pdf

The U.S. has a responsibility to lead—not lag—in GHG mitigation efforts. The U.S. is the second largest emitter of CO2 presently and accounts for 23% of cumulative CO2 emitted since

1850.25 Yet under currently adopted policies, CO_2 emissions from on-road vehicles in the U.S. are projected to decline only one-third by 2050—far short of the 40%–60% reduction by 2030 and near-zero emissions by 2050 that are required for compatibility with 1.5°C.26 [EPA-HQ-OAR-2019-0055-1211-A1, p. 25]

25. https://ourworldindata.org/co2-emissions and https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_SummaryForPolicymakers.pdf

26. https://theicct.org/wp-content/uploads/2022/03/Accelerated-ZEV-transition-wp-final.pdf

The current trajectory of the U.S. HDV sector is not sustainable for other reasons: continued reliance on oil poses a risk to national security and exposes consumers and freight operators to high energy price volatility. In 2021, the U.S. was a net exporter of petroleum but still imported 8.47 million barrels per day, including 11% from OPEC countries and 8% from Russia.27 The transport sector accounts for two-thirds of U.S. end use petroleum consumption,28 and within transport, HDVs are the second largest source of oil demand.29 If EPA sets stringent GHG standards for HDVs that significantly accelerate ZEV uptake, these standards will have a co-benefit of insulating the U.S. HDV sector from oil price volatility. [EPA-HQ-OAR-2019-0055-1211-A1, p. 25]

27. https://www.eia.gov/tools/faqs/faq.php?id=727&t=6

28. https://www.eia.gov/energyexplained/oil-and-petroleum-products/use-of-oil.php

29. https://www.bts.gov/content/fuel-consumption-mode-transportation-1

ICCT modeling has found that accelerating the transition to zero-emission vehicles could put the U.S. onroad vehicle fleet on a pathway consistent with limiting warming to below 2°C.30 We have not yet identified a pathway consistent with limiting warming to 1.5°C, indicating that even the most ambitious actions under consideration would need to be augmented to maintain a chance of limiting warming to 1.5°C. Accelerating ZEV uptake in the HDV sector would also produce significant air quality and public health co-benefits,31 especially in communities that are disproportionately impacted by HDV pollution. Combined, a strategy to reduce HDV tailpipe NOx emissions by at least 90% (through the NOx standards) and increase ZEV uptake in line with reaching 100% zero-emission HDV sales as soon as 2035 (through the GHG standards) could avoid $5.7 million in health damages annually in 2035, including 46% in overburdened and underserved communities that meet select environmental justice criteria. [EPA-HQ-OAR-2019-0055-1211-A1, p. 25]

30. https://theicct.org/wp-content/uploads/2022/03/Accelerated-ZEV-transition-wp-final.pdf

31. https://www.2035report.com/transportation/

Substantial reductions in heavy-duty vehicle GHG emissions are needed before 2030 to align with domestic climate goals. [EPA-HQ-OAR-2019-0055-1211-A1, p. 26]

The Biden administration has set a goal of reducing economy-wide greenhouse gas emissions by 50%–52% from 2005 levels in 2030.32 Transportation represented 29% of U.S. greenhouse gas emissions in 2019, a quarter of which are attributable to on-road HDVs.33 Achieving the Biden administration's climate target within the U.S. HDV sector in 2030 would mean reducing emissions by roughly 54% from 2019 levels.34 [EPA-HQ-OAR-2019-0055-1211-A1, p. 26]

32. The White House, "Fact Sheet: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies."

33. US EPA, "U.S. Transportation Sector Greenhouse Gas Emissions: 1990–2019."

34. US EPA, "Inventory of U.S. Greenhouse Gas Emissions and Sinks."

Limiting global warming to below 2°C would require the U.S. HDV sector to mitigate its projected cumulative CO2 emissions through 2050 by roughly 4 Gt.35 [EPA-HQ-OAR-2019-0055-1211-A1, p. 26]

35. Sen and Miller, "Emissions Reduction Benefits of a Faster, Global Transition to Zero-Emission Vehicles."

Previous ICCT modeling has found that the U.S. could achieve this level of mitigation by accelerating ZEV uptake to account for at least 45% of HDV sales by 2030 and 100% no later than 2040. Compatibility with a 1.5°C target would require greater ambition.36 [EPA-HQ-OAR-2019-0055-1211-A1, p. 26]

36. Sen and Miller.

We find EPA's current proposal is inadequate to reduce HDV emissions in line with the Biden administration's economy-wide 2030 target, resulting in annual well-to-wheel CO2 emissions that are 7.5% above 2005 levels. [EPA-HQ-OAR-2019-0055-1211-A1, p. 28]

We evaluated EPA's proposed revisions to Phase II GHG standards in combination with currently adopted state policies that require the purchase or sale of zero-emission heavy-duty vehicles. Our analysis finds that, under this scenario, annual well-to-wheel CO2 emissions in 2030 would be just 2.0% below 2019 levels and 7.5% above 2005 levels. By 2050, we estimate that annual emissions will rebound to 2.1% above 2019 levels (Figure 10). When compared to the most ambitious scenario we considered for ZEV uptake, we find U.S. HDV CO2 emissions would decrease 17.6% from 2019 levels by 2030, or 9.6% from 2005 levels. This scenario would achieve a 50% decrease from 2005 levels by 2042. This would reduce the need for other sectors to decrease emissions by more than 50% to make up for the shortfall in the HDV sector. [EPA-HQ-OAR-2019-0055-1211-A1, p. 28]

EPA's proposal will reduce CO2 emissions very little compared to current policies, with lifetime CO2 emissions of model years 2027–2030 just 0.5% lower and model years 2027–2050 just 0.6% lower. [EPA-HQ-OAR-2019-0055-1211-A1, p. 29]

Our analysis demonstrates that the EPA's proposed updates to the Phase II GHG standards lead to an emissions scenario nearly indistinguishable from the original rule. We estimate EPA's proposed revisions to existing Phase II GHG standards would lead MY2027 vehicles to emit 0.1% less CO2 cumulatively over their lifetimes. In 2030, we estimate that annual well-to-wheel CO2 emissions from Class 4–8 U.S. HDVs would be 525 Mt under both the original rule and EPA's proposed revisions, with a less than 0.2% difference between the original rule and the proposed updates. Cumulatively through 2050 under the original Phase II standards, all MY 2027 and later vehicles would emit 8.6 Gt of CO2, with only a 53 Mt reduction under EPA's proposed revisions (Table 10). [EPA-HQ-OAR-2019-0055-1211-A1, p. 29]

Failing to preserve Phase II stringency for ICE vehicles would reduce CO2 benefits by 0.2–0.5 Gt of CO2 emissions from model year 2027 and later vehicles, depending on the level of ZEV ambition. [EPA-HQ-OAR-2019-0055-1211-A1, p. 29]

If ICE vehicles are instead subject to EPA's proposed updates to the Phase II standards, represented in our Proposal policy scenario, cumulative emissions benefits of the Alternative 1 ZEV pathway would be reduced by 0.3 Gt, achieving only a 3.3 Gt reduction from current policies. For Alternatives 1 and 2, cumulative emissions benefits would similarly be 0.2–0.3 Gt lower. If national ZEV deployment were to be driven only by MOU state adoption of the ACT regulation, 0.5 Gt cumulative emissions benefits would be lost due to reduced ICE standard stringency under the EPA's Proposal relative to the ICCT policy scenario. (Figure 12) [EPA-HQ-OAR-2019-0055-1211-A1, p. 29]

Organization: *Metropolitan Washington Air Quality Committee (MWAQC) et al.*

Finally, GHG emissions from the transportation sector are one of the major contributors of GHGs in the metropolitan Washington region. Tightening of the "Phase 2" GHG emissions standards for several heavy-duty categories would facilitate progress towards our long-term climate goals, which include a 50 percent greenhouse gas emission reduction below 2005 levels by 2030 and an 80 percent reduction below 2005 levels by 2050. It would also accelerate the adoption of zero emission vehicles in the region's heavy-duty fleet, which is one of COG's legislative priorities. [EPA-HQ-OAR-2019-0055-0996-A1, p. 2]

Organization: *National Coalition for Advanced Transportation (NCAT)*

The benefits of zero emissions vehicles are important in the medium and heavy-duty vehicle space because diesel truck and bus emissions disproportionately harm low-income communities and communities of color.26 And a number of states are requiring that electric vehicle infrastructure be deployed in disadvantaged communities to ensure that those communities can reap the environmental and public health benefits of these technologies.27 [[EPA-HQ-OAR-2019-0055-1290-A1, p. 6]

26. M.A. Demetillo, et al., 'Space-Based Observational Constraints on NO2 Air Pollution Inequality From Diesel Traffic in Major US Cities,' Geophysical Research Letters (2021), available at https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2021GL094333.

27. Matthew Goetz, Ryan Levandowski, James Bradbury, & Grace Van Horn, M.J. Bradley & Associates & Georgetown Climate Center, Towards Equitable and Transformative Investments in Electric Vehicle Charging Infrastructure (Mar. 2021) at 22-23, available at https://www.georgetownclimate.org/files/report/Towards%20Equitable%20and%20Transformative%20Investments%20in%20EV%20Charging%20Infrastructure.pdf.

Electric vehicles will provide substantial benefits for the management of the electric grid. By improving utilization of the existing power grid and spreading fixed costs over a larger base of sales, electric vehicle use can benefit not just electric vehicle owners, but other electricity consumers as well. For instance, transportation electrification can benefit all customers by putting downward pressure on electricity rates, as fixed costs are spread over a larger base of kWh sold. [EPA-HQ-OAR-2019-0055-1290-A1, p. 6]

Although electric vehicles are expected to increase the demand for electricity,28 they are also a valuable grid resource that can be used to help manage the time and intensity of energy consumption, which helps lower electricity bills and helps avoid otherwise necessary upgrades to the electric grid, and will likely—in the future—facilitate storing energy and transferring it back to buildings or the grid.29 Many utilities are switching to time of use (TOU) rates that price energy based on the day, time, and season.30 As of March 2020, about half of U.S. investor-owned utilities had optional TOU rates.31 These can be used separately or in addition to residential TOU rates to incentivize electric vehicle customers to charge at off-peak times when it is cheaper and also beneficial for the grid.32 Another form of smart charging involves vehicles being plugged in but not charging until they receive a signal from the grid indicating that demand has declined.33 These technologies have benefits for electric vehicle fleet owners and grid managers, but also for all customers whose rates could decline as electric vehicles help to shift demand.34 California recently undertook a major study of vehicle-to-grid integration—encompassing TOU rates and using electric vehicle batteries as distributed energy resources—and is now working to implement the report's 92 policy recommendations in order to realize the benefits of electric vehicle integration.35 [EPA-HQ-OAR-2019-0055-1290-A1, p. 7]

28. Demand is expected to increase 60% in California by 2045. Southern California Edison, Reimagining the Grid (Dec. 2020) at 1, available at https://download.newsroom.edison.com/create_memory_file/?f_id=5fcfb5f62cfac23b06eb7d39&content_verified=True. Rocky Mountain Institute estimates that there would be a 25% increase in annual electricity demand if all light duty vehicles were electrified. Robert Walton, UtilityDive, '2021 Outlook: The Future of Electric Vehicle Charging Is Bidirectional — But the Future Isn't Here Yet,' https://www.utilitydive.com/news/2021-outlook-the-future-of-electric-vehicle-charging-is-bidirectionalbu/592957/ (Jan. 12, 2021).

29. Anne C. Mulkern, Energy News Network, 'California Looks to Electric Vehicles for Grid Stability,' https://energynews.us/2021/03/23/california-looks-to-electric-vehicles-for-grid-stability/ (Mar. 23, 2021).

30. Enel, 'Everything EV Drivers Should Know About Time-Of-Use Energy Rates,' https://evcharging.enelx.com/resources/blog/624-everything-ev-drivers-should-know-about-time-of-useenergy-rates (Apr. 28, 2020).

31. Id.

32. See, e.g., Appalachian Power, 'Virginia Off-Peak Charging,' https://www.appalachianpower.com/clean-energy/electric-cars/virginia-off-peak (last visited Sept. 27, 2021).

33. See, e.g., International Renewable Energy Agency, Electric-Vehicle Smart Charging (2019), available at https://irena.org/-/media/Files/IRENA/Agency/Publication/2019/Sep/IRENA_EV_smart_charging_2019.pdf?la=en&hash=E77FAB7422226D29931E8469698C709EFC13EDB2.

34. Harper, McAndrews, & Byrnett, supra note 59, at 21.

35. CPUC, Final Report of the California Joint Agencies Vehicle-Grid Integration Working Group (June 30, 2020), https://gridworks.org/wp-content/uploads/2020/07/VGI-Working-Group-Final-Report-6.30.20.pdf. Consistent with the study's recommendations, utilities in California – including NCAT members Southern California Edison and Pacific Gas & Electric – have proposed a number of large-scale pilots to accelerate technologies and business models that will, among other things, promote the use of electric vehicle charging for load modifying demand response and resource adequacy efforts and the advance opportunities to use bidirectional flow from electric vehicles for buildings, microgrids, and the grid. SCE Advice Letter Filing AK 4542-E, https://library.sce.com/content/dam/scedoclib/public/regulatory/filings/pending/electric/ELECTRIC_4542-E.pdf (July 15, 2021); PG&E Advice Letter 6259-E, https://www.pge.com/tariffs/assets/pdf/adviceletter/ELEC_6259-E.pdf (July 15, 2021).

Electric vehicle charging is also increasingly connected to and supported by renewable energy. TOU rates can be coordinated with renewable energy availability, like in Charge Forward, NCAT member PG&E and BMW's pilot program that helped consumer to delay charging to align with renewable energy.36 NCAT member Southern California Edison also introduced a TOU rate connected to renewable energy availability,37 and has implemented demand response programs through its Charge Ready infrastructure programs that demonstrate how electric vehicle charging load can be shifted to absorb midday excess renewable generation that may otherwise be curtailed.38 NCAT member EVgo, a fast-charging network, powers its 800-charger network using 100% renewable energy.39 [EPA-HQ-OAR-2019-0055-1290-A1, p. 8]

36. Robert Walton, 'PG&E, BMW smart-charging pilot highlights potential for electric vehicles as grid resource,' https://www.utilitydive.com/news/pge-bmw-smart-charging-pilot-highlights-potential-forelectric-vehicles-a/600958/ (June 1, 2021).

37. Southern California Edison, 'Rate Options for Clean Energy Technology,' https://www.sce.com/residential/rates/electric-vehicle-plans (last visited Sept. 24, 2021); Lori Bird & Norma Hutchinson, World Resources Institute, '4 Emerging Ways to Pair Electric Vehicles and Renewable Energy,' https://www.wri.org/insights/4-emerging-ways-pair-electric-vehicles-andrenewable-energy (Nov. 19, 2019).

38. CPUC, 'Transportation Electrification Programs Overview,' at 13, https://www.law.berkeley.edu/wpcontent/uploads/2019/06/Session-3-CPUC-Transportation-Electrification-Activities.pdf.

39. EVgo, 'About EVgo,' https://www.evgo.com/about/ (last visited Sept. 18, 2021).

Several utilities including the Sacramento Municipal Utility District (SMUD) have active Vehicle-to-Grid (V2G) research and development projects planned or in progress including both electric school buses and light duty electric vehicles. V2G figures prominently in SMUD's 2030 Zero Carbon Plan pursuant to which SMUD is planning to eliminate its fossil fuel based generation assets by 2030 and could expect over 250 MW/400 MWh of energy storage from V2G. [EPA-HQ-OAR-2019-0055-1290-A1, p. 8]

Organization: *States of California, et al. (The States)*

The States agree that HD ZEVs are rapidly becoming an important presence within the heavy-duty vehicles sector, especially in those vocational categories identified by EPA.97 EPA's proposed initial response to this transition—to tighten the Phase 2 GHG standards to ensure they remain binding on the conventional diesel fleet—is sound and consistent with good rulemaking.98 The proposed approach, in itself, does nothing to accelerate or promote HD ZEV deployment, but only preserves the environmental integrity of EPA's existing Phase 2 standards, which were premised on emission-reduction technologies other than ZEV technology.99 Nevertheless, EPA has invited comment on "the potential for ZEV technology to significantly reduce air pollution from the heavy-duty vehicle sector" as it prepares for future GHG standards for light-duty and heavy-duty vehicles.100 [EPA-HQ-OAR-2019-0055-1255-A1, pp. 22 - 23]

97. 87 Fed. Reg. at 17,598.

98. Id.

99. Id. at 17,594.

100. Id. at 17,593.

The States welcome EPA's proactive consideration of ZEV technology for future GHG standards. The current Phase 2 GHG standards are an important element of the United States' strategy to stave off the worst effects of climate change, which are caused by anthropogenic emissions of GHGs.101 "Elevated concentrations of GHGs have been warming the planet, leading to changes in the Earth's climate including changes in the frequency and intensity of heat waves, precipitation, and extreme weather events, rising seas, and retreating snow and ice. The changes taking place in the atmosphere as a result of the well-documented buildup of GHGs due to human activities are changing the climate at a pace and in a way that threatens human health, society, and the natural environment."102 As EPA recognizes, the transportation sector is now the largest U.S. source of GHG emissions, with heavy-duty vehicles contributing 23 percent of the United States' transportation emissions.103 [EPA-HQ-OAR-2019-0055-1255-A1, p. 23]

101. See, e.g., Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards, 86 Fed. Reg. 74,434, 74,489 (Dec. 30, 2021).

102. Id.; see also Intergovernmental Panel on Climate Change (IPCC), Climate Change 2022: Impacts, Adaption and Vulnerability, Summary for Policymakers, at 11 (H.-O. Portner & D. Roberts, eds. 2022) ("Impacts, Adaptation, and Vulnerability") (surveying medium-to-high confidence attributions of extreme weather, wildfires, heat-related deaths, and ecosystem loss to greenhouse gas emissions from human activities), attached as Exhibit 13.

103. 87 Fed. Reg. at 17,592.

The States are already experiencing grievous effects from climate change, which, as described above, are expected to escalate without sharp reductions in GHG emissions.104 Our residents have lost property, been displaced from homes, endured respiratory illness and other health impacts, and even been killed as a result of severe weather events exacerbated by climate change.105 Often these impacts are disproportionately borne by communities with high poverty rates, communities of color, and indigenous peoples.106 Rising average temperatures, shrinking mountain snowpack, warmer storms, wildfires, and higher sea levels also harm our economies, infrastructure, and public services.107 These impacts require long-term, resource-intensive adaptation planning and costly disaster response by all levels of government and the private sector. The U.S. Global Change Research Program's 2017-2018 Fourth National Climate Assessment projects more extreme-weather impacts for every region of the United States, including major damage to agriculture, coastal industries, utility grids, transportation networks, air quality, and human health, from coastal flooding, heat waves, drought, and wildfires, as well as from the spread of tree-killing and disease-carrying pests.108 Action to reduce GHGs from all major-emitting sectors, including the heavy-duty vehicles sector, is imperative. [EPA-HQ-OAR-2019-0055-1255-A1, pp. 23 - 24]

104. U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II: Report-in-Brief, at 11-19 (D.R. Reidmiller et al. eds., 2018) ("NCA4 Report-in-Brief") (summarizing ongoing and projected impacts to United States from climate change), attached as Exhibit 14; see also IPCC, Impacts, Adaptation, and Vulnerability, at 11-22 (describing ongoing global climate change impacts and projecting near-, mid-, and long-term impacts, particularly from unpredictable cascading and compounded disruptions); IPCC, Climate Change 2022: Mitigation of Climate Change, Summary for Policymakers, at SPM-7, SPM-14 to 19 (2022) ("Mitigation") (finding reductions of GHGs is occurring too slowly to limit global warming to even 2°C and such a goal requires unprecedented accelerations in reductions), attached as Exhibit 15.

105. NCA4 Report-in-Brief, at 82-83, 98-103, 115-62 (surveying national losses of coastal property and air quality deterioration and summarizing impacts to health, property, and ecosystems by U.S. region).

106. NCA4 Report-in-Brief, at 82-83, 103-106; see also IPCC, Impacts, Adaptation and Vulnerability, at 14-15 (identifying especially vulnerable communities globally).

107. NCA4 Report-in-Brief, at 67-68, 70-72, 82-83, 85-91, 93-96.

108. NCA4 Report-in-Brief, at 11-19; see also id. at 102 (by shifting from a high-emissions scenario to a low-emissions scenario, “thousands of American lives could be saved and hundreds of billions of dollars in health-related economic benefits gained each year” (emphasis added)).

Organization: *Tesla, Inc. (Tesla)*

For the U.S. to meet its decarbonization goals and to mitigate the public health and welfare impacts from climate change, EPA’s proposal should be amended to meet increasingly more stringent regulatory requirements that incentivize all vehicle manufacturers to rapidly scale up delivery of high-quality BEVs. As previously described, BEV technology in the medium- and heavy-duty vehicle classes is increasing at a rapid pace. Indeed, under Phase 1 of the GHG regulations advanced conventional and BEV heavy duty technology have already established a sizeable manufacturer GHG credit bank.145 The presence of a large bank of credits can dampen the uptake of best emission control technology and delay broader deployment of BEVs. Accordingly, in amending the current Phase 2 GHG regulations, EPA should ensure the changes eliminate this possibility. [EPA-HQ-OAR-2019-0055-1219-A1, p.18]

145 See EPA, Phase 1 EPA Heavy-Duty Vehicle and Engine Greenhouse Gas Emissions Compliance Report (Model Years 2014- 18) (Oct. 2021). See also, Union of Concerned Scientists, Verdict on First US Fuel Economy and Emissions Program for Trucks: Success? (Nov. 5. 2021).

Organization: *University of California, Berkeley, The Goldman School, Center for Environmental Policy*

We have reviewed EPA’s proposed NOx and GHG Tailpipe Emission Standards for Heavy Duty Vehicles for MY 2027-2029. We have conducted a high level modeling exercise to contrast the EPA proposed standard with an alternative proposal (hypothesized for modeling purposes) that would be in line with President Biden’s goal (announced at the Glasgow Climate Summit) of reaching economy-wide net-zero GHG emissions by 2050 (hereinafter referred to as the “President’s climate commitment” scenario). We find that the difference between the two proposals is significant: The President’s climate commitment scenario is found to save $1 trillion more than EPA’s proposed standard by 2050. With this substantial difference in mind, we urge EPA to set more stringent, climate-consistent HDV GHG emission standards, including at least 20% zero emission requirement in new truck sales by 2027 and 50% by 2030. These requirements would credibly put us on the path to meet the President’s climate commitment. [EPA-HQ-OAR-2019-0055-1327-A1, p. 1]

Our work shows that electrifying trucking can have substantial economic benefits over diesel trucking, particularly when electricity tariffs are structured to facilitate off-peak charging. Given these recent findings, and President Biden's commitment to achieve deep decarbonization, we conducted this preliminary analysis to investigate the impact of a climate-consistent HDV emissions standard. [EPA-HQ-OAR-2019-0055-1327-A1, pp. 1 - 2]

We find the differences between the President's climate commitment scenario and the current EPA proposal to be notable across many elements of analysis:

Cost: While EPA proposed standard would save money compared to business-as-usual diesel scenarios, the net present cost of the EPA proposed standard is $1.5 trillion more by 2050 than that of the President's climate commitment scenario. This figure includes carbon pollution costs reflecting the social cost of carbon as well as air pollution damages; however, even when omitting pollution costs, the proposed EPA standard still costs $1 trillion more than the alternative. [EPA-HQ-OAR-2019-0055-1327-A1, p. 2]

ICE trucks on the road: The proposed EPA standard will leave a significant portion of today's internal combustion engine (ICE; gas- and diesel-powered) trucks on the road through 2050 and will fall to meet the President's climate commitment. With the EPA Proposed rules, because of the slow stock turnover of trucks (average life of ~12-15 years or so), nearly 57% of the on-road truck stock would still be diesel powered by 2050. In contrast, in the President's Climate Commitment consistent case, which models all new truck sales to be electric by 2035, only about 7% of the truck stock in 2050 would be diesel powered, while ~93% would be electric. [EPA-HQ-OAR-2019-0055-1327-A1, p .2]

Carbon emissions: The EPA proposed rules would reduce the CO_2 emissions from trucks only by 10% by 2035 and 33% by 2050, relative to the 2020 levels. By contrast, the President's Climate Commitment scenario slashes CO_2 emissions from trucks (including electricity used by trucks for charging) by 50% in 2035—putting this sector on a path to meet its share of the net-zero emissions (a90% reduction in 2050, relative to 2020 levels). [EPA-HQ-OAR-2019-0055-1327-A1, p. 2]

In light of these preliminary results, we urge EPA to rigorously evaluate and consider adopting a more stringent, climate-consistent truck emission standard, including at least 20% zero emission requirement in new truck sales by 2027 and 50% by 2030. This would credibly put us on the path to meet the President's climate commitment. Such regulations are critical to provide a clear signal to the private sector and utilities to rapidly build out production capabilities and charging infrastructure. [EPA-HQ-OAR-2019-0055-1327-A1, p. 4]

Organization: *Wisconsin Department of Natural Resources (WDNR)*

In addition to the necessary NOx reductions, EPA's rule also advances Wisconsin's efforts to reduce GHG emissions and address climate change. Onroad heavy-duty vehicles were responsible for about 10.2 million metric tons of CO_2 equivalent (MMCO2E), or 7% of the state's total GHG emissions inventory in 2018.2 Given the state lacks the authority to address GHG emissions from vehicles and other mobile sources, EPA's action to update the Phase 2

GHG program to ensure it remains representative of the current market conditions in the heavy-duty sector and achieves the most emission reductions possible needed to make progress on this goal. [EPA-HQ-OAR-2019-0055-1162-A1, p. 2]

2. Wisconsin 2021 Greenhouse Gas Emissions Inventory Report, https://widnr.widen.net/view/pdf/o9xmpot5x7/AM610.pdf?t_download=true

***Organization**: World Resources Institute*

EPA studies confirm that medium- and heavy-duty vehicles also generate 23 percent of the transportation sector's greenhouse gas emissions (GHG), contributing to the severity of climate change impacts, including heat waves, drought, sea level rise, extreme climate and weather events, coastal flooding, and wildfires. Some populations may be especially vulnerable to these and other climate change impacts, including low-income communities, people with disabilities, people of color, and Indigenous populations. Furthermore, studies (such as the recent 'Zeroing in on Healthy Air' from the American Lung Association) show that regulations and policies designed to reduce GHG emissions, such as through accelerating electric transportation, will have the added benefit of reducing other forms of pollution, such as air toxics and particular matter, that impact public health and disproportionately impact overburdened communities. [EPA-HQ-OAR-2019-0055-1298-A1, p.2]

EPA Response

EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards) and may consider the comments in this section of this document in the development of that future rulemaking.

28.5 Other comments on proposed changes to HD Phase 2 GHG program

Comments by Organizations

***Organization:** Allison Transmission, Inc. (Allison)*

Allison would suggest that for the four vehicle types that EPA expects to electrify rapidly (i.e., school bus, transit bus, short-haul tractor, and delivery truck) EPA consider options that would simplify the GHG certification process as noted in previous section regarding better GEM integration of non-ZEV CO2 features, rather than add additional testing burdens associated with powertrain certification. [EPA-HQ-OAR-2019-0055-1231-A1, p.27]

Allison recognizes that powertrain certification can be used to measure CO2 reductions associated with a variety of different features. At the same time, Allison's experience is that it has been challenging to broadly undertake powertrain testing/certification at a reasonable cost given the number of different systems that may be supplied to OEMs. Apart from the capital and recurring costs stemming from obtaining and operating powertrain testing equipment, other elements of EPA regulations, like selective enforcement audits, impose additional indirect costs that may be experienced over multiple years. See Appendix 1. There are additional complications to sharing costs and commercializing powertrain certification for non-vertically integrated manufacturers. [EPA-HQ-OAR-2019-0055-1231-A1, p.27]

In the vocational vehicle sector, this challenge becomes even greater given the wide range of customer needs which drive a variety of vehicle configurations. Lower volumes for some applications make it challenging to address the overhead associated with such testing. Allison recommends that simpler methods be explored, including those involving the testing of standalone components and/or a further build-out of the GEM model to incorporate incremental CO2 reductions. [EPA-HQ-OAR-2019-0055-1231-A1, p.27]

Additionally, it is clear that EPA and CARB will increasingly need to consider not only tailpipe and avoided GHG emissions, but also upstream components to the GHG profile of heavy-duty ZEVs. As EPA is well aware, the overall emissions impact of a ZEV is tied to the carbon content of the electricity used to charge its batteries; such content will vary across different areas of the country, resulting in very real differences in net climate benefits. These differences can be very substantial, varying from 12 grams of CO2 per kilowatt hour (“kWh")to 2.23 lbs. per kWh.69 While this rulemaking does not address this issue and the relative effect of upstream emissions from electricity generation is not a current, major concern given the relatively low penetration of ZEVs in the heavy-duty sector, by EPA’s own estimates this effect will increase over time. EPA should therefore more proactively discuss this issue going-forward during the series of rulemakings that are currently part of its agenda in the HDV sector. [EPA-HQ-OAR-2019-0055-1231-A1, p.33]

> 69 Nationwide, CO2 emissions per kilowatt-hour (“kWh”) averaged 0.85 lbs./kWh in 2020. But the rate varied from near-zero for certain forms of energy (e.g., from 48 gCO2eq/kWh for solar, 24gCO2eq/kWh for hydropower and 12gCO2eq/kWh for nuclear) as compared with 2.23 lbs./kWh for coal-fired power plants. See, e.g., eia.gov/tools/faqs; www.hydropower.org.

Beyond scope of Clean Air Act, ZEVs also face numerous other environmental issues, including the extent of recovery of battery materials, recyclability, and closed loop systems. Battery material reclamation is a very important consideration for the long-term sustainability of ZEV. [EPA-HQ-OAR-2019-0055-1231-A1, p.33]

While all of these issues may not be able to be addressed pursuant to the Agency’s Clean Air Act authority, these impacts have associated costs and cannot be ignored over the long-term. Proactively discussing such issues would aid the vehicle manufacturing sector in planning for future design and sourcing agreements early within vehicle development cycles. Such an assessment should be performed prior to adoption of any explicit or implicit ZEV targets; EPA should not in this rulemaking attempt to align final regulations with the measures and timing contained in the CARB HD Omnibus regulation or the CARB Advanced Clean Trucks regulation. [EPA-HQ-OAR-2019-0055-1231-A1, p.33]

- These include the need for reasonable access to energy and fueling infrastructure where a transition to different systems to power commercial vehicles is contemplated. Either explicit or implicit mandates for certain vehicle types cannot be reasonably achieved unless there is corresponding availability of the necessary fueling infrastructure. [EPA-HQ-OAR-2019-0055-1231-A1, p.34]

In the comments above, Allison has referenced several areas where EPA's Proposed Rule could be improved. Specifically, with respect to the interrelationship of EPA and CARB standards, Allison would offer several additional comments and perspectives: [EPA-HQ-OAR-2019-0055-1231-A1, p.35]

- CARB's Omnibus NOx standards post MY 2027 are based on assumptions concerning certain alternative fuels and the electric grid; but these assumptions may or may not prove out over the next few years and choosing one technology pathway like ZEVs could realistically constrain participation by other technologies and emerging alternative fuels in the heavy-duty sector. Again, Allison would urge EPA to continue promulgating standards that may be achieved by a variety of different technological approaches and, consistent with its CAA authority, only promulgate standards that appropriately consider costs as well as allow for a sufficient timeframe for necessary research, development and demonstration. [EPA-HQ-OAR-2019-0055-1231-A1, pp.35-36]
- The CARB HD Omnibus Rule utilizes standards and measures that are meant to address regional air quality concerns. The standards also require coordination with supporting infrastructure. Such coordination is inherently more feasible to take in a regional context, which is more capable of supporting and targeting infrastructure development for ZEV deployments, necessary alternative fuels and fueling capacity. Such efforts are likely impracticable and potentially unattainable at the federal level within the same timeframes. Several factors distinguish California's efforts from EPA capability in this area:
    - From a practical standpoint, California has exhibited unwavering support for statewide greenhouse gas reductions and electrification goals and incentives for the transportation sector. Starting with approval of the Global Warming Solutions Act of 2006, California has developed a legal and regulatory framework to enable a noteworthy push to accelerate ZEV technology. In more recent rulemakings, ZEV technology has become a primary focus for efforts in the mobile source sector.
    - In this effort, CARB has conducted multiple workshops and engaged in extensive coordination with the California Energy Commission to plan the infrastructure development necessary to support ZEVs at an accelerated pace. While there are currently some federal efforts in this area, including through passage of the 2021 infrastructure package,72 similar efforts do not exist throughout the United States at the same level of legal/regulatory commitment or public funding. [EPA-HQ-OAR-2019-0055-1231-A1, p.36]

72 Infrastructure Investment and Jobs Act, Pub. L. 117-58.

- CARB HD Omnibus NOx standards post 2027 are based on certain alternative fuels and grid assumptions considered at the time of rulemaking. As a result, these standards may not consider the benefits of other emerging alternative fuels that could be applied to heavy duty internal combustion engines as a tool to achieve near-term criteria air pollutant and long-term CO2 reduction goals in vehicle applications that resist electrification. They also may not fully consider the need to leverage existing infrastructure when transitioning to stricter standards. Given these limitations, variation from the structure of CARB regulatory requirements is both justified and necessary. [EPA-HQ-OAR-2019-0055-1231-A1, p.36]

- Otherwise, one of the reasons that the CARB HD Omnibus Rule may be able to achieve its aggressive standards and implementation schedule is by leveraging federally certified engines through allowable exemptions that serve to mitigate impacts to end-user productivity (e,g., numerous exemptions were included by CARB in the final rule because transit, motorcoach, refuse, and heavy haul end-users provided information that justified additional flexibility. Again, the state's ability to take particular regulatory approach to reducing emissions does not mean that similar approaches are justified or workable at a federal level. [EPA-HQ-OAR-2019-0055-1231-A1, pp.36-37]

Organization: *American Automotive Policy Council (AAPC)*

The EPA HD Engine notice of proposed rulemaking includes provisions for using credits to meet fleet requirements. Averaging Banking and Trading (ABT) credits are an important flexibility for manufacturers to meet stringent emissions standards. [EPA-HQ-OAR-2019-0055-1293-A1, p. 1]

Flexibilities to earn credits and to move credits between years and product applications are helpful for manufacturers. Quick changes to production and product plans often result in stranded capital and disruptions to the supply chain and manufacturing workforce. Depending on the product lineup and lifecycle position of their product portfolio, a manufacturer may not have the ability to respond to large changes in stringency immediately, with limited lead time. Alternatively, a manufacturer may be able to transition quickly in one part of its business, but not immediately in another. Manufacturers are more likely to be able to respond to stringent regulations with adjustments to their portfolios over time, and an ABT program with sufficient flexibilities can help manufacturers smoothly transition to stringent regulations. EPA should consider adding flexibilities to trade credits between certification classes, such as light-heavy and medium-heavy, for criteria emissions and GHG. [Also in Section 13. EPA-HQ-OAR-2019-0055-1293-A1, p. 1]

Organization: *American Fuel & Petrochemical Manufacturers (AFPM)*

Although AFPM supports emissions reductions and efficiency, its members believe there is a better way to do it than an indirect mandate of battery electric trucks (BETs). A recent technical assessment confirms that trucks powered with advanced internal combustion technology, coupled with the growing production of renewable diesel and biodiesel that meets the ASTM D-6751 standard, delivers earlier and more cost-effective air quality and GHG reduction benefits than a battery electric truck-centric approach.2 [EPA-HQ-OAR-2019-0055-1262-A1, p.1]

2 See Ramboll US Consulting, Inc., Multi-Technology Pathways to Achieve California's Air Quality and Greenhouse Gas Goals: Heavy-Heavy-Duty Truck Case Study (Feb. 1, 2021), prepared for Western States Petroleum Association and appended to WSPA, Comments on Advanced Clean Fleets (ACF) Regulation March Workshops (April 17, 2021), https://www.arb.ca.gov/lists/com-attach/36-acf-comments-ws-UCdTJlUkAzFVDFMy.pdf

First, EPA must apply a thorough life-cycle analysis when considering GHG tailpipe emissions. [EPA-HQ-OAR-2019-0055-1262-A1, p.2]

A metric ton of carbon has the same impact on climate change regardless of where it is emitted in a vehicle's lifecycle. Some vehicles incur a significant upfront carbon penalty during the manufacturing process and utilize carbon emitted by the power sector. Others have smaller upfront carbon impact but emit at the tailpipe. Only through a lifecycle analysis (LCA) can EPA properly evaluate the tradeoffs and ensure it is achieving its objective of cost-effective carbon emissions reductions from HD trucks. A proper LCA should be based on sound science, account for each vehicle's lifetime emissions regardless of powertrain, including emissions associated with its production, recharging/refueling, drivetrain/battery replacements, required infrastructure modifications, and end of life disposal options. Emphasizing only tailpipe emissions results in a distorted view of the actual environmental impacts of vehicle technologies that generate emissions elsewhere in the production of the vehicle or the generation the energy used for vehicle operation. If EPA intends to reduce motor vehicle emissions in a cost-effective and transparent manner, it should evaluate emissions on a lifecycle basis. [EPA-HQ-OAR-2019-0055-1262-A1, p.2]

Although, tailpipe emissions are the most obvious emissions from new motor vehicles or their engines, a rule that effectively mandates BETs will cause additional emissions from electricity generation. Similarly, EPA must recognize that requiring BETs causes additional GHG emissions relating to battery mining, production, and disposal or recycling. Without LCA, the Agency cannot reasonably assess the stringency or GHG reduction benefits of its proposed standards, nor can it reasonably assess the costs and benefits; thus, EPA cannot assure that its standards appropriately and justifiably protect public health or welfare without LCA. The absence of LCA of BETs in this context amounts to EPA ignoring an issue of central relevance to the problem it is trying to solve and is therefore arbitrary and capricious. [EPA-HQ-OAR-2019-0055-1262-A1, p.2]

Second, EPA must remain technology neutral when setting NOx and GHG emissions standards for heavy-duty trucks. [EPA-HQ-OAR-2019-0055-1262-A1, p.2]

Third, the agency has no authority to set standards that can only be achieved through fleet averaging and emissions trading. [EPA-HQ-OAR-2019-0055-1262-A1, p.2]

Finally, the Proposal's GHG provisions are reliant upon California's Advanced Clean Truck rule for significant BET sales even though there is no California waiver in place for Heavy Duty (HD) trucks. EPA is acting arbitrarily in depending on a preempted California standard to demonstrate regulatory achievability. [EPA-HQ-OAR-2019-0055-1262-A1, p.2]

Heavy duty trucks can be used for more than a million miles, and this will mean that for BETs, there will be several battery replacements during their lifetime. The battery is the energy storage media on the vehicle, just as the fuel is on a diesel ICE (internal combustion engine) vehicle. [EPA-HQ-OAR-2019-0055-1262-A1, p.2]

The analysis included in the Proposal does not assume battery replacements and essentially ignores an issue of key importance to the problem EPA is working to resolve. Lithium-ion batteries are made from critical minerals including cobalt, graphite, lithium, nickel, and manganese. Electric vehicles (EVs) require six times the mineral inputs of traditional internal combustion engines.3 One study suggests that the extraction and processing of critical minerals are responsible for approximately 20 percent of the GHG emissions associated with battery production.4 A typical light-duty lithium EV battery weighs about 1,000 pounds. While there are dozens of variations, a typical battery contains around 25 pounds of lithium, 30 pounds of cobalt, 60 pounds of nickel, 110 pounds of graphite, and 90 pounds of copper. Since ore grades vary, acquiring these five elements to produce a single battery requires mining about 90,000 pounds of ore.5 Roughly 90,000 pounds of ore requires digging and moving between 200,000 and over 1,500,000 pounds of earth, a rough average of more than 500,000 pounds per battery.6 These numbers are significantly higher for heavy-duty EV batteries. Further, the International Energy Agency (IEA) pins the average GHG intensity for production of lithium carbonate at around 5 metric tons of Carbon Dioxide Equivalent (CO_2e) emitted per ton of metal, and approximately 15 CO_2e metric tons per ton of cobalt sulfate.7 The mining of minerals for BETs typically occurs in countries where environmental, health, and safety precautions are significantly less stringent than those in the U.S.8,9 [EPA-HQ-OAR-2019-0055-1262-A1, p.3]

3 See IEA's Critical Minerals Report at 28, https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf.

4 Kim et al., Cradle-to-Gate Emissions from a Commercial Electric Vehicle Li-Ion Battery: A Comparative Analysis, Environ. Sci. Technol 50 (2016), pp. 7715-7722. See also Volvo, Carbon footprint report: Volvo C40 Recharge at 5, https://www.volvocars.com/images/v/-/media/Market-Assets/INTL/Applications/DotCom/PDF/C40/Volvo-C40-Recharge-LCA-report.pdf ('The accumulated emissions from the Materials production and refining, Li-ion battery modules and Volvo Cars manufacturing phases of C40 Recharge are nearly 70 per cent higher than for XC40 ICE.'). The Volvo report notes that production of the Li-ion battery modules account for 30 percent of the footprint of the C40 Recharge. Id. at 6.

5 See Mark Mills, Mines, Minerals, and 'Green' Energy: A Reality Check, The Manhattan Institute (July 9, 2020), https://www.manhattan-institute.org/mines-minerals-and-green-energy-reality-check., last visited, May 16, 2022.

6 Id.

7 See IEA's Critical Minerals Report, at 195.

8 See IEA's Critical Minerals Report. See also Securing America's Future Energy, The Commanding Heights of Global Transportation (2020), https://secureenergy.org/the-commanding-heights-of-global-transportation-2/,https://secureenergy.org/the-commanding-heights-of-global-transportation-2/, last visited, May 16, 2022.

9 In addition to GHG emissions, such mining activities are also responsible for PM emissions, NOx emissions, and other air pollutant emissions.

Finally, EPA's proposal does not consider whether there are any safety concerns with adopting standards that force a shift toward BETs. Section 202 of the Clean Air Act requires the Administrator to consider whether any 'device, system, or element of design will cause or contribute to an unreasonable risk to public health, welfare, or safety in its operation or function.' EPA's failure to include this analysis on these issues as they relate to heavy-duty BETs is arbitrary and capricious. EPA must conduct such an assessment and seek comment from the public. [EPA-HQ-OAR-2019-0055-1262-A1, p.6]

Policies that allow various technologies24 to compete in the marketplace can and should be developed to achieve the goal of cost-effective GHG emissions reductions. Mandating the use of a particular technology stifles innovation, for example the benefits of renewable diesel in not only new engines but the on-road fleet. Renewable diesel is promising because it is chemically identical to petroleum diesel and can deliver GHG reductions of 50 to 90 percent depending upon feedstock.25 On a lifecycle basis, a new diesel truck running on renewable diesel emits fewer GHGs than a battery powered truck, while retaining refueling convenience and infrastructure.26,27 Renewable diesel is becoming more widely available as new production facilities are built.28 Subject to renewable feedstock availability, this advanced fuel will build on past successes29 in improving air quality and lowering carbon emissions at a much lower cost than electrification. In addition, research studies30 have also shown that paraffinic fuels such as renewable diesel reduce criteria pollutants emitted from the engines. These reductions are measurable and significant but diminish after gases pass through vehicle aftertreatment systems typically found on post-2010 MY vehicles. However, there are still benefits to the existing fleet of pre-2010 vehicles. [EPA-HQ-OAR-2019-0055-1262-A1, p.7]

24 E.g., battery electric vehicles, hybrids and efficient gasoline and diesel vehicles, biofuels, natural gas, and hydrogen.

25 See Reduced emissions, Neste.com https://www.neste.com/products/all-products/renewable-road-transport/reduced-emissions#fe233267, last visited, May 16, 2022.

26 Id. Renewable diesel is produced through various thermochemical processes such as hydrotreating, gasification, and pyrolysis. Because it is made from waste and biobased materials, using renewable diesel does not release any new carbon dioxide (CO_2) into the atmosphere.

27 See discussion Section II.A.2. infra.

28 The U.S. Environmental Protection Agency (EPA) Electronic Moderated Transaction System for renewable fuel indicates that the United States consumed over 900 million gallons in 2019. Renewable diesel output in the United States has increased nearly 15 percent over the last year and close to 20 renewable diesel projects at refineries are underway, including one that will be the world's largest renewable fuel plant.

29 Diesel engines using compression-ignition (CI) combustion are presently the most efficient engines for MHDVs, with progress evident for further reductions in CO2 and fuel consumption, and NOx emissions. Supported by the U.S. Department of Energy's SuperTruck initiative, demonstration of 55 percent peak engine efficiency in a research vehicle environment may occur in the next few years. Spark-ignition (SI) engines continue to evolve and improve, with potential to reach more than 40 percent peak brake thermal efficiency while still achieving stringent criteria emissions with relatively low-cost aftertreatment. See 'Summary,' National Academies of Sciences, Engineering, and Medicine, Reducing Fuel Consumption and Greenhouse Gas Emissions of Medium- and Heavy-Duty Vehicles, Phase Two: Final Report (2020), https://doi.org/10.17226/25542.

30 CARB Assessment of the Emissions from the Use of Biodiesel as a Motor Vehicle Fuel in California 'Biodiesel Characterization and NOx Mitigation Study.'

EPA must utilize technological neutrality in setting engine warranty requirements. In this rule, EPA proposes to significantly expand the regulatory useful life and emission warranty requirements for diesel truck engines, along with associated costs, but does not treat EV truck powertrains similarly, creating unequal regulatory treatment for different technologies, and ultimately shifting the significant hidden cost of battery replacement to the truck operator. It is unreasonable for EPA to ignore similar expansions of the regulatory useful life and emission warranties for EVs. EPA bases its proposed tightening of GHG emission limits on a transition to EVs despite EV batteries being dependent on large cross-subsidies from buyers of gasoline and diesel vehicles. EPA cites no authority to adopt standards that force buyers of specific drivetrains (e.g., diesel engines) to fund large cross-subsidies to buyers of other drivetrains (e.g., electric motors), without any notice to the public of these transfers, nor any requirement for these payments to be disclosed by auto or truck manufacturers and retailers. EPA must cite such authority and seek public comment before buyers of diesel trucks in West Virginia, for example, unknowingly are forced to subsidize buyers of electric trucks in California. EPA also fails to account for a significant cross-subsidy from utility ratepayers to pay for electric infrastructure upgrades for EV infrastructure and a large subsidy from federal and state taxpayers through EV tax incentives. EPA must estimate these costs and seek public comment. [EPA-HQ-OAR-2019-0055-1262-A1, pp.7-8]

Simply put, production multipliers for BETs are not authorized under the CAA. By including multipliers, the use of the multiplier provides manufacturers with compliance credits that exceed the emissions reduced. EPA originally proposed these changes under Section 202(a) of the CAA.32 Nothing in Section 202(a) of the CAA provides EPA with the authority to utilize factually inaccurate multipliers to assure compliance with the standards. In fact, Section 202(a) of the CAA contains language that is inconsistent with the use of multipliers. The statute instructs the Administrator to prescribe, by regulation, 'standards applicable to the emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines, which in his judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare.’33 [EPA-HQ-OAR-2019-0055-1262-A1, p.8]

32 42 U.S.C. 7521(a).

33 Id.

The statute also states the regulations 'shall contain standards which reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology.'34 The reliance on multipliers is a de facto concession that it has set a standard that is not achievable [EPA-HQ-OAR-2019-0055-1262-A1, pp.8-9]

34 Id.

Rather than continuing the use of unlawful multipliers, EPA should promulgate standards that are achievable and cost-effective as required by the CAA. [EPA-HQ-OAR-2019-0055-1262-A1, p.9]

Although emissions trading can be a valuable tool in reducing cost through a market-based mechanism, EPA lacks the statutory authority here to utilize fleetwide emissions trading as the basis to set underlying emission standards and to force an economy-wide transition from the internal combustion engine to the electric powertrain.35,36 Liquid fuels and the internal combustion engine are the centerpieces of Title II of the CAA. Surely, if Congress contemplated giving EPA the authority to set standards that could not be achieved without averaging emissions from electric vehicles whose primary emissions occur upstream, it would have provided EPA with that specific authority. This is a major policy shift that Congress must directly address. To this point Congress has not authorized this authority. To the contrary, the terms of Section 202(a), which require emission standards to be 'applicable to' vehicles and engines for their useful lives, and numerous other provisions of Title II make clear that emission standards under Section 202 must be vehicle-specific, and not fleetwide standards achievable only through emissions averaging and trading.37 When Congress wants to create an average standard applicable to manufacturers, or to authorize emissions trading, it says so.38 [EPA-HQ-OAR-2019-0055-1262-A1, pp.9-10]

35 AFPM does not take a position in these comments on any other emissions trading program.

36 AFPM notes that EPA is requesting comment on expanding the embedded BET percentage as part of this rulemaking, which is undoubtedly a major question that Congress should speak to.

37 See, e.g., 7522, 7524, 7525, 7541.

> 38 See 49 U.S.C. 32902(a) (requiring DOT to 'prescribe by regulation average fuel economy standards for automobiles manufactured by a manufacturer' in a given model year and directing that '[e]ach standard shall be the maximum feasible average fuel economy level that the Secretary decides the manufacturers can achieve in that model year'). See also e.g., 7545(k)(7); 7545(o)(2)(A)(ii)(II)(cc), 7545(o)(5)(A) (credits for renewable fuels); 7586(f) (credits for centrally fueled fleets); 7589(d) (California pilot test program).

EPA cannot include electric trucks in establishing motor vehicle tailpipe standards especially within the same vehicle classes as heavy-duty ICE engines. BETs do not have engines, therefore if EPA is required to establish emission standards for BETs, the Agency must do so as part of a separate classification. This can be achieved by weight rating within that separate BET classification, as heavier BETs have different emissions profiles than lighter BETs. [EPA-HQ-OAR-2019-0055-1262-A1, p.10]

Although Congress has not authorized emissions trading between ICEVs and BETs as a basis for setting emissions standards, if EPA finalizes this aspect of the proposal, it must adopt a scientifically-sound approach to such emissions trading. The current approach is arbitrary and capricious in that it turns its back on EPA's own understanding of real-world emissions. To remedy this, there must be a full accounting of the lifecycle of each vehicle that is part of the trading program emissions (see Battery Components (section IA) above regarding the inclusion of GHG emissions from BET battery production and replacements). Sound science also requires that EPA eliminate all multipliers that distort the calculation of each vehicle's emissions. [EPA-HQ-OAR-2019-0055-1262-A1, p.10]

Organization: *American Petroleum Institute (API)*

All technologies should be compared on an equal footing when developing transportation policies.

API and its members commit to delivering solutions that improve air quality and reduce the risks of climate change while meeting society's energy needs. We support global action that drives greenhouse gas (GHG) emissions reductions and economic development. Market-based policies are an effective means to drive competition and innovation to address current and future energy needs. Based on this principle, we encourage EPA to adopt technology-neutral regulatory policies that facilitate a level playing field for all vehicle, fuel and related infrastructure technologies where innovation, competitive markets and consumer choice will drive emissions reductions and also meet policy objectives. [EPA-HQ-OAR-2019-0055-1171-A1, p.2]

A holistic federal transportation policy that utilizes technology neutral, carbon intensity-based fuel and vehicle standards will enable improvements in air quality and drive immediate reductions in GHG emissions for the entire vehicle fleet.

Liquid fuels can provide near-term, significant emission reductions from the on-road vehicle fleet in a policy framework that includes technology neutral, performance-based and complementary standards for fuels, vehicles, and infrastructure. Utilizing a well-to-wheels vehicle approach for GHG emissions accounting across all fuel-vehicle pathways allows direct comparisons of internal combustion engines (i.e., gasoline, diesel, or natural gas), battery electric, hydrogen, and hybrid technologies. [EPA-HQ-OAR-2019-0055-1171-A1, p.2]

API supports federal policy that establishes 1) a technology neutral, carbon intensity-based fuel standard in gCO2/MJ for the motor fuel pool that declines over time and 2) a well-to-wheels vehicle standard in gCO2/mile that incorporates the GHG benefits brought about by the fuel standard as it continues to encourage efficiency improvements in the certification of new vehicles. [EPA-HQ-OAR-2019-0055-1171-A1, p.2]

Instead of making 'targeted' adjustments for specific, end-use applications designed to incentivize future adoption of a specific technology, EPA should focus on strategies to broadly encourage increased deployment of commercially available technologies to meet near-term air quality goals and greenhouse gas reduction. A recent Guidehouse Insights study notes that '*20% of the [medium/heavy-duty vehicle] market is poorly positioned for decarbonization*' because of operational, performance and technology adoption constraints that pose challenges for policy focused on a single technology.5 In addition, a technical assessment prepared by Ramboll US Consulting Inc. suggests that the expanded penetration of vehicles equipped with low NOx technologies, coupled with increased usage of renewable liquid and gaseous fuels (e.g., renewable diesel and renewable natural gas), offers significantly lower carbon intensity pathways that could deliver earlier and more cost-effective air quality and GHG reduction benefits than that possible via a single technology focus.6 [EPA-HQ-OAR-2019-0055-1171-A1, pp.2-3]

5 See Guidehouse Insights, 'The Easiest and Hardest Commercial Vehicles to Decarbonize,' prepared for The Fuels Institute, April 2022, https://www.fuelsinstitute.org/Research/Reports/Decarbonizing-Medium-and-Heavy-Duty-Vehicles/Med-Heavy-Duty.pdf

6 See Ramboll US Consulting, Inc., 'Multi-Technology Pathways to Achieve California's Air Quality and Greenhouse Gas Goals: Heavy-Heavy-Duty Truck Case Study,' February 1, 2021, prepared for Western States Petroleum Association and appended to WSPA, 'Comments on Advanced Clean Fleets (ACF) Regulation March Workshops,' April 17, 2021 https://www.arb.ca.gov/lists/com-attach/36-acf-comments-ws-UCdTJlUkAzFVDFMy.pdf

Only providing incentives for the electrification of future heavy-duty vehicles distorts the market and ignores the 'near-zero' technology options that: (a) are currently commercially available; (b) offer significant emission reductions; (c) are cost-effective; and (d) are feasible across a broad spectrum of end-uses. [EPA-HQ-OAR-2019-0055-1171-A1, p.3]

Renewable diesel (RD), which is chemically identical to petroleum diesel, is one such low carbon intensity fuel technology option that is readily available and has seen increasing usage, especially in California.7 Renewable diesel fuels have the potential to offer significant emission reductions when compared to petroleum-based diesel, particularly for one of its largest end-use applications: heavy-duty vehicles and engines. Data from the California Air Resources Board (CARB) suggests we could see reductions in lifecycle GHG emissions in the range of 40% to 80%.8 9 EPA also recently estimated that the production of renewable diesel from canola oil using a hydrotreating process could reduce lifecycle GHG emissions by 63 – 69% on average relative to a petroleum diesel baseline.10 These emission reductions for the on-road heavy-duty fleet could be further accelerated through action by EPA and other government agencies (e.g., the Federal Trade Commission) to revise and update the language in existing labeling, certification, and recordkeeping requirements for renewable diesel that currently acts as a disincentive for its use. This is consistent with the Renewable Diesel and Sustainable Aviation Fuel Parity Act of 2022 which seeks to remove labeling requirements for renewable diesel that meet or exceed ASTM D975.11 Maintaining the current labeling requirements to disclose the percentage, within one percent, of renewable diesel is not informative to end- users from a vehicle performance or emissions perceptive and only serves to restrict efficient distribution. [EPA-HQ-OAR-2019-0055-1171-A1, p.3]

8 California Air Resources Board, Petroleum Diesel Carbon Intensity: Low Carbon Fuel Standard Regulation, Table 7-1

9 California Air Resources Board: LCFS Pathways Certified Carbon Intensities (accessed April 28, 2022)

10 See EPA Proposed Rule -Renewable Fuel Standard Program: Canola Oil Pathways to Renewable Diesel, Jet Fuel, Naphtha, Liquefied Petroleum Gas and Heating Oil, Table II.C.12-1 in 87 Federal Register 22839 (April 18, 2022)

11 See S.3038, Renewable Diesel and Sustainable Aviation Fuel Parity Act of 2022, introduced in the US Senate, April 7, 2022

Organization: *Autocar, LLC (Autocar)*

In supporting the spirit of the Proposed Rule, Autocar proposes the following modifications: Ensure the extension of provisions for generation of emission credits for natural gas-fueled vocational vehicles in §1037.150(y)(3), and extend the life of such credits indefinitely. [EPA-HQ-OAR-2019-0055-1292-A1, p. 1]

Second, EPA should extend the provisions for generation of emission credits for natural gas-fueled vocational vehicles in §1037.150(y)(3), and extend the life of such credits indefinitely. Autocar and other small manufacturers should continue to earn extra credits for selling market-ready environmentally-friendly CNG trucks while they continue to develop ZEV's. The credits earned may put them on a more even playing field with regard to meeting Phase 2 standards and beyond. [EPA-HQ-OAR-2019-0055-1292-A1, pp. 5 - 6]

Organization: *California Air Resources Board (CARB)*

CARB's Draft 2022 State Strategy for the State Implementation Plan (SIP)148 describes the need for federal action to expand use of HD ZEVs. The Strategy includes a draft SIP commitment for CARB staff to advocate for U.S. EPA to promulgate HD ZEV requirements in order to reduce NOx emissions in the South Coast in 2037. The Strategy envisions U.S. EPA adopting new more stringent GHG standards for medium- and HD vehicles that would apply to new heavy-duty trucks sold nationwide. [EPA-HQ-OAR-2019-0055-1186-A2, p.84]

148 https://ww2.arb.ca.gov/sites/default/files/2022-01/Draft_2022_State_SIP_Strategy.pdf

Based on discussions with U.S. EPA staff, CARB staff believes U.S. EPA is planning on a revision to the Phase 2 GHG standards, i.e., the Phase 3 GHG standards, with an anticipated proposal date of Spring 2023. CARB staff is supportive of U.S. EPA adopting stringent Phase 3 GHG standards. HD vehicles are an important contributor to GHG emissions. In order to meet the urgent need to address climate change and achieve carbon neutrality, CARB staff encourages U.S. EPA to propose Phase 3 GHG standards that aggressively drive HD ZEV penetration. HD ZEV uptake rates and timelines required by U.S. EPA standards should match those in CARB's ACT and the upcoming Advanced Clean Fleets regulations.149 CARB supports any efforts U.S. EPA can take as part of the current proposed rule to advance HD ZEV adoption. [EPA-HQ-OAR-2019-0055-1186-A2, p.84]

149 https://ww2.arb.ca.gov/our-work/programs/advanced-clean-fleets

Organization: Edwin J. Ward

The proposed standards are incentivizing manufacturers to develop technology that will be useless with coming state ZEV requirements

The final issue I must address is the looming elephant in the room of widespread vehicle electrification. Although light-duty vehicles currently constitute almost the entirety of the zero-emissions vehicle market, a ZEV future is very much on the near horizon for heavy-duty vehicles as well. Nevertheless, EPA's proposed rulemaking for updated heavy-duty vehicle emissions standards focuses primarily on impacts to local air pollution instead of impacts on climate change. This is a mistake. The 2015 Paris Agreement, of which the United States is a signatory, binds our country to taking steps to reduce greenhouse gas emissions and limit global average temperature increases to below at least 2°C and preferably 1.5°C.17 In advancement of the Paris Agreement, President Biden signed Executive Order 14008 in 2021 which directs each department and agency, including EPA, to take part in a government-wide approach to solving the climate crisis.[18] Reducing and eliminating greenhouse gas emissions from heavy-duty vehicles is of utmost importance as transportation now accounts for a plurality of U.S. greenhouse gas emissions.[19] [EPA-HQ-OAR-2019-0055-1050]

Furthermore, the impacts of climate change will not be borne equally by all Americans. Researchers have found that communities of color, which are already disproportionately impacted by air pollution, are the most vulnerable to heatwaves and extreme weather events.[20] EPA's concerns with the effects of criteria pollutants from heavy-duty vehicles on environmental justice communities are admirable, but EPA also has a duty to protect those same communities from climate change, which itself is also exacerbated by heavy-duty vehicle emissions. Executive Order 12898 directs all federal agencies to incorporate environmental justice into their decision-making, and failing to address the effects of emissions on climate change (and thus environmental justice communities) is a dereliction of EPA's duty under EO 12898.[21] EPA should move forward with a rule that all heavy-duty vehicles sold after 2045 must be zero emissions vehicles. [EPA-HQ-OAR-2019-0055-1050]

Beyond the effects of vehicle emissions on climate change and environmental justice, the rationale for moving forward with a ban on heavy-duty non-ZEVs by 2045 is also simply practical. The eulogy for the internal combustion engine has already been written, and countries around the world have adopted cut-off dates for light, medium, and heavy-duty vehicles. In the United States, California and New York have both moved to mandate that no new heavy-duty non-ZEVs can be sold after 2045.[22] Manufacturers have already responded by racing to design and deploy ZEV versions of their heavy-duty vehicles, including Tesla,[23] Volvo,[24] and Mack Trucks.[25] [EPA-HQ-OAR-2019-0055-1050]

For many manufacturers, the writing for ZEVs is on the wall. Rapid technology improvements and cost reductions in both battery and hydrogen fuel cell technologies make a gradual phaseout of internal combustion engines over the next two decades the most prudent way forward for our climate and for manufacturers' bottom lines. EPA's proposed rules would require a 60% reduction in NOx emissions by 2045. That's an impressive reduction in a potent air pollutant, but by that date, any internal combustion engine vehicle meeting those rules wouldn't even be eligible for sale in California, New York, and countless other countries. It is likely that even more state governments will adopt the 2045 cutoff date in the coming years. [EPA-HQ-OAR-2019-0055-1050]

EPA's proposed rules require manufacturers to invest heavily in a technology that will be essentially worthless for a huge chunk of potential buyers. Perhaps EPA is hoping that the opportunity cost of developing new diesel engines will persuade manufacturers to develop ZEVs instead? If that is the agency's hope, then why still allow manufacturers to invest in and sell non-ZEV vehicles at all? EPA can and should propose rules to wean vehicle manufacturers off of climate-polluting engines and incentivize them to invest in ZEV technologies like batteries, hydrogen fuel cells, and even trolleytrucks. [EPA-HQ-OAR-2019-0055-1050]

[Conclusion] For the long term, EPA should establish a hard cut-off date of 2045 for the sale of any heavy-duty non-zero emissions vehicle. This date will give manufacturers time to adjust, will bring the federal government in line with New York and California, and will help environmental justice communities already suffering from the effects of air pollution from being more at risk from climate change. [EPA-HQ-OAR-2019-0055-1050]

[17] Paris Agreement to the United Nations Framework Convention on Climate Change, Dec. 12, 2015, T.I.A.S. No. 16-1104

[18] Tackling the Climate Crisis at Home and Abroad, 86 Fed. Reg. 7619, 7619-7633 (Jan. 27, 2021).
[19] U.S. ENERGY INFO. AGENCY, WHERE GREENHOUSE GASES COME FROM (May 21, 2021), https://www.eia.gov/energyexplained/energy-and-the-environment/where-greenhouse-gases-come-from.php. [20] Renee Cho, *Why Climate Change is an Environmental Justice Issue*, STATE OF THE PLANET (Sept. 22, 2020), https://news.climate.columbia.edu/2020/09/22/climate-change-environmental-justice/.
[21] Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 59 FR 7629, 7629-7633 (Feb. 16, 1994).

[22] Kathy Hochul, *In Advance of Climate Week 2021, Governor Hochul Announces New Actions to Make New York's Transportation Sector Greener, Reduce Climate-Altering Emissions*, (Sept. 8, 2021), https://www.governor.ny.gov/news/advance-climate-week-2021-governor-hochul-announces-new-actions-make- new-yorks-transportation.
[23] TESLA, *Semi*, https://www.tesla.com/semi (last visited Apr. 30, 2022).

[24] VOLVO TRUCKS USA, *The Volvo VNR Electric*, https://www.volvotrucks.us/trucks/vnr-electric/ (last visited Apr. 30, 2022).
[25] MACK TRUCKS, *LR Electric*, https://www.macktrucks.com/trucks/lr-electric/ (last visited Apr. 30, 2022).

Organization: *Ford Motor Company (Ford)*

The Greenhouse Gas regulations do not currently allow trading of engine-based CO2 credits between averaging sets (e.g., between Light Heavy-Duty and Medium Heavy-Duty Diesel engines). This restriction is unnecessary and can drive costly investments for manufacturers who would otherwise be looking to invest in the advanced technology powertrains of the future (electric, fuel cell, etc.). A manufacturer with a single engine (which could be used to meet both the newly proposed NOx standards as well as the more stringent proposed GEM-based vehicle CO2 standards) could be forced to develop or purchase separate light-heavy-duty and medium-heavy-duty diesel engines simply to meet the “normalized to work” engine CO2 standards of both segments. This would not yield any additional GHG or NOx emission benefits. Ford recommends that EPA remove the restriction on trading of engine-based GHG credits between service classes or, at a minimum, allow trading in cases where engines and emission systems are substantially the same (e.g., displacement, combustion system design, emissions controls including aftertreatment chemistry and loading, etc.). This change would have no negative impact on fleet NOx or CO2 emissions and would enable manufacturers to more efficiently invest in the powertrains of the future. [EPA-HQ-OAR-2019-0055-1300-A1, p. 5]

Organization: *Manufacturers of Emission Controls Association (MECA)*

EPA recognized the GHG reduction benefits of auxiliary power units (APUs) during the promulgation of the heavy-duty Phase II regulation. APUs utilize a small diesel engine to operate driver comfort systems rather than overnight idling of the main engine on Class 8 sleeper trucks. One APU manufacturer advertises savings of $428 per month when using a diesel fueled APU to supply auxiliary power compared to idling class 8 engine (2000 hr./yr. at $3/gallon fuel). Due to the quick return on investment from the fuel savings, APUs are quite popular with production volumes in the 25K to 40K units per year. [EPA-HQ-OAR-2019-0055-1320-A1, p.30]

At the same time, EPA also understood that APU engine standards are less stringent than those for on-highway trucks. Permitting trucks with the latest engine and aftertreatment technology to employ APUs to reduce GHGs during idling would result in increased PM emissions unless DPFs were installed on the APUs. CARB has verified at least three diesel particulate filter models for APUs at the Level 3 designation (> 85% reduction) since 2008. These DPFs can be installed on Carrier, Proventia and Thermo King APUs, resulting in the production of more than 10,000 DPF equipped APUs for the California market. Therefore, EPA finalized stringent PM emission limits in the Phase II Heavy Duty GHG Rule for all Auxiliary Power Units (APUs) installed on new model year 2024 or later tractors. The agency noted that DPFs are viewed as the likely 'emission control hardware' necessary to meet the standard. [EPA-HQ-OAR-2019-0055-1320-A1, p.30]

MECA has learned that EPA has agreed with an interpretation of the Phase 2 requirements that an APU would not need to include a DPF if an OEM did not install the APU on a new tractor at the factory. The vast majority of APUs are installed at the dealer/distributor after the truck is sold when the vehicle owner requests an APU option. This presents a 'loophole' in the Phase 2 regulation by allowing an APU manufacturer to claim that the tractors are no longer 'new' and thus avoid installation of a DPF. Given the incremental cost of approximately $1800 as referenced in the heavy-duty Phase 2 RIA, the tractor's owner has a strong incentive to install an APU without the DPF at the dealer rather than having the DPF equipped APU installed at the truck assembly plant. [EPA-HQ-OAR-2019-0055-1320-A1, p.30]

The current practice in the market of circumventing the intent of the rule will have significant consequences for both human health and GHG emissions, resulting in more than 75 metric tons (MT) of excess PM emissions with serious public health consequences, particularly for frontline communities. It is reasonable to assume that the APU will operate on average for 2000 hours per year. EPA's MOVES model estimates that APUs without DPFs emit 0.96 grams PM per hour while APUs with DPFs emit 0.02 grams PM per hour. The difference in emissions of 0.94 g/hr results in approximately 1880 grams of PM per year per APU. If 40,000 new APUs are sold each year, this would result in an additional 75.2 MT/yr of PM. This difference in PM emissions will have a significant negative impact on human health and air quality. [EPA-HQ-OAR-2019-0055-1320-A1, pp.30-31]

When CARB promulgated their rules for requiring DPFs on APUs, they applied it to 2007 and later trucks. Their intent was clear – with DPFs being installed as the latest technology to reduce PM on the tractor drive engine, it would be counter-productive to allow APUs on the same vehicle to operate without a DPF since this would emit more PM than the main engine with a DPF. It is our view that EPA clearly intended in 40CFR 1039.699 to follow the same logic, requiring DPFs to be installed on all APUs starting in MY 2024, and that this interpretation by the APU certificate holders creates an unintended 'loophole' with significant public health, environmental equity and climate change impacts. We ask EPA to include language in the Phase 2 provisions in the Clean Trucks Regulation that would remediate this issue and ensure all APUs are equipped with DPFs when installed on MY 2024 and later on-highway HD trucks. [EPA-HQ-OAR-2019-0055-1320-A1, p.31]

Organization: *Natural Gas Vehicles for America (NGVAmerica)*

The emissions impact of battery materials and battery production are not inconsequential. An ATRI study released this month 'found that while electric trucks have no direct tailpipe emissions, CO_2 production associated with vehicle, battery and electricity production would only result in a 30 percent decrease in CO_2 emissions when compared to a standard diesel truck.'14 According to ATRI, 'the marginal environmental benefits of electric trucks are due, in large part, to lithium-ion battery production – which generates more than six times the carbon of diesel truck production.' A story published by Politico included this significant datapoint: 'a thousand-pound electric car battery requires the moving of 500,000 pounds of earth in the course of mining.'15 The Financial Times has reported that 'between 5 and 15 tonnes of CO_2 are produced per tonne of lithium extracted. This is equal to the total electric usage of between 1 and 2 U.S. homes for a whole year.'16 [EPA-HQ-OAR-2019-0055-1330-A1, p.7]

14 https://truckingresearch.org/2022/05/03/understanding-the-co2-impacts-of-zero-emission-trucks/

15 'The Major Problems Blocking America's Electric Car Future,' Politico, August 31, 2021

16 'Financial Times, October 5, 2021. Available at: https://ig.ft.com/electric-car/

Organization: *Neste US, Inc*

The Rule Over-Emphasizes the Importance of Electric Vehicles

The Proposed Rule would increase the stringency of the 2016 Phase 2 GHG emissions standards for certain categories of heavy-duty trucks for MY 2027. The rule cites 'a number of manufacturers producing fully electric heavy-duty vehicles in a number of applications,' California's adoption of an 'Advanced Clean Trucks program that includes a manufacturers sales requirement for zero-emission truck sales,' and 'a Memorandum of Understanding establishing goals to increase the heavy-duty electric vehicle market' between a number of states as support for the premise that the outlook is improving for heavy-duty EVs and that GHG emissions standards therefore should increase in stringency.1 Neste supports the increased stringency of GHG emissions standards, but questions EPA's assessment of the benefits and limitations of EVs and cautions against full reliance on the increased prevalence of EVs. [EPA-HQ-OAR-2019-0055-1225-A1, p.1]

1 87 Fed. Reg. 17414, 17419 (Mar. 28, 2022)

Emissions standards should not favor one technology over others when regulating tailpipe emissions, and should ensure the standards are achievable by internal combustion engines as well [EPA-HQ-OAR-2019-0055-1225-A1, p.3]

The Proposed Rule projects an EV heavy-duty vehicle penetration rate of 1.5% for MY 2027, but requests 'comment and additional supporting information and data on higher penetration rates, which could serve as the basis for the increase in the stringency of the CO2 standards for specific Phase 2 vehicle subcategories.'2 Neste has no comment on whether the projected EV penetration rate should be higher (or lower). Rather, Neste objects to EPA's decision to increase the stringency of standards in such a way that depends on the existence of EVs and therefore impermissibly prefers one technology over others. [EPA-HQ-OAR-2019-0055-1225-A1, p.3]

2 Id.

Moreover, EPA's heavy-duty vehicle rules are intended to regulate tailpipe emissions. EVs are not tailpipe vehicles and are therefore not contemplated by the regulatory scheme and should not be included when calculating the appropriate stringency of tailpipe emissions reduction standards. [EPA-HQ-OAR-2019-0055-1225-A1, p.3]

Increased prevalence of EVs is not required for the reduction of GHG and NOx emissions. As demonstrated by the recent CARB scoping plan, EPA's goals can still be met by using the existing fleet and deploying multiple strategies and technologies, most notably replacing fossil diesel with renewable diesel. [EPA-HQ-OAR-2019-0055-1225-A1, p.3]

Organization: *Oshkosh Corporation*

EPA requests comments on multiple aspects of the Proposed Rule related to the emission credit ABT programs for heavy duty trucks. Oshkosh generally supports the ABT provisions and views them as this as an important tool for incentivizing the introduction of EV and other advanced technologies. In past rulemakings, EPA has significantly limited the ability of manufacturers to carry over legacy credits for vocational trucks certified under the Phase 2 GHG custom chassis provisions. As a result, in the move from Phase 1 to Phase 2 GHG programs, Oshkosh's CO2 credit bank was effectively eliminated, thus constraining the Company's ability to use earned emission credits. The current rulemaking presents an opportunity to obtain a different result. To this end, Oshkosh is pleased to provide these comments regarding EPA's ABT proposals: [EPA-HQ-OAR-2019-0055-1226-A1, p. 5]

To provide further incentives for EV development, Oshkosh also requests that EPA ensure harmonization of NOx and CO2 credit programs for heavy-duty vehicles. In general, we request that EPA modify existing credit ABT programs to (1) allow credit transport across all heavy-duty engine/vehicle families; (2) allow a credit life of 10 years for credits generated by EV, FCEV and hybrid technologies; and (3) guard existing credit banks to enable carry over of legacy credits to future programs. [EPA-HQ-OAR-2019-0055-1226-A1, p. 6] [Also appears in Section 13.1 and 13.5.1 of this document]

Organization: Ray Pingle

[*From Hearing Testimony*, *April 12*, *2022*, *Ray Pingle*] The transition from combustion engine, heavy-duty vehicles to 100-percent zero-emission vehicles is the ultimate end goal to reducing toxic air pollution and GHGs. The EPA must do everything it can now to achieve this objective. A fundamental assumption that EPA will use in crafting its final rule is the forecast number of ZEVs feasible in the coming years. It must increase dramatically from its current outdated forecast with only 1.5 percent of medium heavy-duty vehicle sales being ZEVs by 2027. Five additional states have adopted California's act rule, representing 20 percent of medium-, heavy-duty vehicles nationally. This rule requires 15 to 20 percent of sales to be ZEVs in 2027. This will have a dramatic impact nationally, and momentum is growing in additional states as they adopt policies, incentives, and support structures to promote increasing medium-, heavy-duty vehicles. A March 2022 NREL study entitled, "Decarbonizing Medium-, Heavy-Duty On-Road Vehicles Cost Analysis," states, "Assuming economics drive adoption, ZEV sales could reach 42 percent of all medium-, heavy-duty trucks by 2030, reflecting lower combined vehicle purchase and operating costs." We would encourage the EPA also to consider the recommendations from the International Council for Clean Transportation in its February 2022 briefing paper, entitled: "Adapting U.S. Heavy-Duty Vehicle Emission Standards to Support a Zero-Emission Commercial Truck and Bus Fleet." Zero-emission vehicles are technically and economically ready today in the use cases where the majority of vehicles are currently deployed. In California, the HVIP Financial Incentive Program has approved over 160 zero-emission vehicles with multiple vendors in each class, from Class 2b to Class 8 semi-tractors. ZEV truck demand is significant and growing. Many companies have announced commitments to transition their fleets to zero-emission vehicles, including Amazon, American Airlines, Best Buy, DHL, IKEA, Walmart, and many, many more. We cannot wait for the Phase 3 GHG rulemaking until 2030 to seriously address how to increase the ZEV fleet. We need to begin now in the Phase 2 GHG part of the rule to boldly drive the necessary and feasible significant transition possess. [EPA-HQ-OAR-2019-0055-2867]

Organization: *State Soybean Associations*

Additionally, the proposal overemphasizes the benefits of EVs while overlooking their negative impacts. Specifically, EPA fails to adequately account for the lifecycle emissions associated with EVs, including the significant upstream emissions resulting from charging batteries. [EPA-HQ-OAR-2019-0055-2035-A1, p.3] [Also included in Section 19.2 of this document]

Moreover, EPA fails to acknowledge that electrification is not the most economically or technologically feasible option for achieving its desired emission reductions. As CARB has recognized in its 2022 Draft Scoping Plan Update, which recognizes the importance of continued use of liquid fuels, the 'transition to complete ZEV technology will not happen overnight. ICE vehicles from legacy fleets will remain on the road for some time, even after all new vehicle sales have transitioned to ZEV technology.'3 For that reason, CARB concluded that, '[i]n addition to building the production and distribution infrastructure for zero-carbon fuels, the state must continue to support low-carbon liquid fuels during this period of transition….'4 [EPA-HQ-OAR-2019-0055-2035-A1, p.3] [Also included in Section 3.10 of this document]

3 Cal. Air Resources Bd., '2022 Draft Scoping Plan Update' (May 10, 2022), at 152.

4 Id.

Given the significant benefits associated with renewable fuels and the uncertainties regarding the benefits of EVs, EPA should not favor EVs over other vehicles that can run on renewable fuels in planning for the decarbonization of the U.S. transportation sector. [EPA-HQ-OAR-2019-0055-2035-A1, p.3] [Also included in Section 3.10 of this document]

Organization: *Valeria Trujilo Aguilar*

Vehicles and Advocate for Electrification through Market Incentives

EPA’s authority under the Clean Air Act and Executive Order No 14037 delegates the responsibility of regulating air pollutants emitted from mobile sources and directs the agency to consider setting new NOx standards as well as updating existing GHG emissions standards for HDV17. The reduction of GHG emissions in new HDV MY 2027 under the proposed rule, the EPA should consider all market information on zero-emissions HDV technologies as well as the potential benefits of an accelerated transition through the electrification of HDV sector. [EPA-HQ-OAR-2019-0055-1223]

17 87 FR 17414

Heavy-duty vehicles are significant source of local air pollution and GHG emissions. According to Chandler et al. and the California Air Resources Board (CARB), HDV accounts for 7% of total global warming emissions in California and estimates that this figure will likely increase over the next 30 years18. HDV are the single largest source of NOx in California estimated at 33% and produces more PM than all the state’s power plants combined estimated at 23 tons per day and 7 tons per day respectively19. Likewise, according to the Colorado Department of Transportation medium-and heavy-duty vehicles represents the second-largest source of GHG emissions in the transportation sector, contributing 22% of on-road GHG emissions despite being less than 10% of all Colorado vehicles20. [EPA-HQ-OAR-2019-0055-1223]

18 Sara Chandler, Joel Espino, and Jimmy O'Dea, "Delivering Opportunity: How Electric Buses and Trucks Can Create Jobs and Improve Public Health in California", Union of Concerned Scientists, The Greenlining Institute, October 2016, Updated May 2017, accessed May 15, 2022, https://www.ucsusa.org/sites/default/files/attach/2016/10/UCS-Electric-Buses-Report.pdf.

19 Sara Chandler, Joel Espino, and Jimmy O'Dea, "Delivering Opportunity: How Electric Buses and Trucks Can Create Jobs and Improve Public Health in California", Union of Concerned Scientists, The Greenlining Institute, October 2016, Updated May 2017, accessed May 15, 2022, https://www.ucsusa.org/sites/default/files/attach/2016/10/UCS-Electric-Buses-Report.pdf.

20 "Polis Administration's Clean Truck Strategy Would Reduce Pollution, Save Money", News, March 4, 2022, accessed May 16, 2022, https://www.codot.gov/news/2022/march/polis-clean-truck-strategy-reduces-pollution.

In response to the EPA's request to comment in States' interest in shifting to zero emissions HDV. Colorado under the Polis administration released a multi-agency state strategy draft on March 4, 2022, to encourage the adoption of clean trucks21. The clean truck strategy is composed of initiatives to improve air quality, reduce emissions, provide financial savings for businesses, and alleviate environmental justice concerns22. Medium- and Heavy-Duty Vehicle Study found that an accelerated transition to zero-emission vehicles could reduce GHG emissions of MHDV by 45% to 59%, reduce NOx emissions 54% to 93%, and reduce particulate matter emissions 53% to 68% below 2005 levels by 205023. These initiatives provide evidence that the market for ZEV in the HDV sector is likely to rapidly develop as a response to an increase in demand for these vehicles which will result in a decrease in the price of ZE-HDV and increase is cost-effectiveness. [EPA-HQ-OAR-2019-0055-1223]

21 "Polis Administration's Clean Truck Strategy Would Reduce Pollution, Save Money", News, March 4, 2022, accessed May 16, 2022, https://www.codot.gov/news/2022/march/polis-clean-truck-strategy-reduces-pollution.

22 "Polis Administration's Clean Truck Strategy Would Reduce Pollution, Save Money", News, March 4, 2022, accessed May 16, 2022, https://www.codot.gov/news/2022/march/polis-clean-truck-strategy-reduces-pollution.

23 "Polis Administration's Clean Truck Strategy Would Reduce Pollution, Save Money", News, March 4, 2022, accessed May 16, 2022, https://www.codot.gov/news/2022/march/polis-clean-truck-strategy-reduces-pollution.

Tesla announced that it intends to offer a fully electric, Class 8 HD semi by late 2020s equipped with top-of-the-line performance and safety features24. Tesla estimates that the electric costs are half of those of diesel, promising fewer systems to maintain and providing owners with $200,000+ fuel savings and a two-year payback period25. The Tesla semi is available for reservation at tesla.com/semi which provides more evidence on ZE HDV market readiness and its cost-effectiveness against traditional diesel and gasoline substitutes. Low variable cost of driving on electricity will likely outweigh the slightly higher upfront cost of its competitors. Thus, stronger GHG emission standards for traditional HDVs will serve as an economic incentive for corporations to adopt more environmentally friendly and cost-effective alternatives which aligns with the goal of CO2 emission reductions, NOX reductions, and PM reductions as well as improve air quality yielding human health and environmental welfare benefits. [EPA-HQ-OAR-2019-0055-1223]

24 “Semi”, Tesla, accessed May 16, 2022, https://www.tesla.com/semi.
25 “Semi”, Tesla, accessed May 16, 2022, https://www.tesla.com/semi.

Purchasing decisions are solely based on costs, incentives provided by the CTI program directly lowers the costs of transition and drives adoption. Early action credits proposed in CTI drives deployment and sales directly influencing the reduction of NOx emissions from this sector prior to 2027. [EPA-HQ-OAR-2019-0055-1223]

[I] advocate for the use of market incentives to accelerate the adoption of ZE technologies in the HDV sector. Public health and welfare benefits in terms of improved air quality and the transition to ZE infrastructure far outweigh the costs of the proposed regulatory rule. [EPA-HQ-OAR-2019-0055-1223]

Organization: *Valero Energy Corporation****:*** *Valero Energy Corporation*

Clean Air Act (CAA) 202(a)(3)(A) requires EPA to set vehicle emission standards that are ‘achievable through the application of technology which the Administrator determines will be available ..., giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology.’ EPA's proposal establishes GHG emission standards that are not achievable through application of technology that will be available, and EPA has not conducted a rational analysis to determine otherwise. Instead, EPA postulates a ‘significant transition’ within the nationwide heavy-duty (‘HD’) engine and vehicle fleet, in which internal combustion engine vehicles (‘ICEV’) will be replaced by battery electric vehicles (‘BEV’). EPA proposes standards that move toward electrifying the HD fleet by establishing a program that relies on credits and multipliers to incentivize development of BEV, then allowing manufacturers to employ various averaging, banking and trading ‘flexibilities’ to comply. Furthermore, the proposed standards together with the final rule in place for light-duty (‘LD’) vehicles impair the statutory mandates in the Clean Air Act for renewable fuels. [EPA-HQ-OAR-2019-0055-1328-A2, p.1]

EPA purports to act in furtherance of Executive Order 14037, but the order itself limits EPA to action that is ‘appropriate and consistent with applicable law’ (emphasis added below):

Sec. 3. Heavy-Duty Engines and Vehicles Multi-Pollutant Standards for 2027 and Later.

(a) The Administrator of the EPA shall, *as appropriate and consistent with applicable law, consider beginning work* on a rulemaking under the Clean Air Act to establish new oxides of nitrogen standards for heavy duty engines and vehicles beginning with model year 2027 and extending through and including at least model year 2030.

(b) The Administrator of the EPA shall, *as appropriate and consistent with applicable law,* and in consideration of the role that zero-emission heavy-duty vehicles might have in reducing emissions from certain market segments, *consider updating* the existing greenhouse gas emissions standards [EPA-HQ-OAR-2019-0055-1328-A2, p.2]

For the first time, EPA's proposed standards move the HD engine and vehicle sector toward standards that could be met by the sector only through emissions trading. In embarking on a path that imposes monumental costs, huge societal changes, an intractable dependence on foreign adversaries, and a myriad of environmental hazards, EPA ignores or disadvantages competing technology enhancements that are far more likely to produce emissions reductions at less cost and with far less disruption and risk to national security and energy independence, such as carbon sequestration, on-board emissions capture, and increased use of low-carbon biofuels, as expressly mandated by the Renewable Fuel Standard. [EPA-HQ-OAR-2019-0055-1328-A2, p.2]

EPA's proposal exceeds its statutory authority. EPA's declarations that this is an ‘historic opportunity,’ ‘the early stages of a significant transition in the history of the heavy-duty on highway sector,’ underscore the aspirational policy underlying the proposed rulemaking. Meanwhile, EPA fails to provide data regarding technology that will be available to achieve the proposed standards, considering the statutory factors of cost, energy, and safety. Absent reasonable and fair consideration and inclusion of all available technologies and fuels, EPA's proposal and the more stringent requirements on which EPA seeks comment are not achievable or available on a commercial scale. EPA arbitrarily relies on the credit and multiplier system to advantage one technology despite evidence of higher lifecycle emissions for that technology. [EPA-HQ-OAR-2019-0055-1328-A2, p.2]

The ‘historic transition’ is not one by manufacturers or consumers but by EPA's significant (but silent) re-interpretation of statutory authority to grant the Agency power to engineer the nation's HD fleet. Historically, to the extent manufacturers were allowed to comply with tailpipe standards using averaging, banking and trading (‘ABT’) emission credits, the effect on overall emissions and other environmental impacts was little to none, because the vehicles producing the credits and debits largely used similar technology and had similar lifecycle emissions profiles. Yet now EPA's emissions ABT system for vehicle standards goes beyond merely facilitating compliance flexibility; it is designed to force adoption of a single technology by rendering a shift to a single technology the only realistic means to achieve compliance. EPA has not demonstrated that the standards that EPA intends to move toward are achievable or available by the average vehicles and engines in this category. EPA appears to be relying on compliance through ABT, particularly since EPA seeks comment on whether market availability of zero-emission vehicles (‘ZEV’) would support more stringent standards. With these standards, EPA is changing the ABT from a compliance tool that allowed manufacturers some flexibility in meeting demand to be a tool that allows EPA to engineer a significant transition of the HD vehicle fleet to electric vehicles. [EPA-HQ-OAR-2019-0055-1328-A2, p.2]

EPA notes that in 2016, EPA projected no market penetration for electric vehicles in this sector. EPA now assumes the power to impose standards that can be met only by dramatically enhancing the credit value of BEVs and presumes that doing so will result in significantly increased market share for these vehicles. Even if EPA had statutory authority to do this, it would be arbitrary to ignore the impact of the resulting increase in overall emissions and the environmental, health, and security impacts from this 'historic' proposal. [EPA-HQ-OAR-2019-0055-1328-A2, pp.2-3]

Whether EPA may or should leverage a compliance flexibility tool to begin forcing electrification of the United States HD vehicle fleet is a major policy question with enormous potential economic and emissions consequences. Neither Section 202 nor any other provision of the Clean Air Act provides EPA that authority. Congress did not authorize EPA or any other agency in the Executive Branch to force electrification of the HD vehicle fleet. On the contrary, CAA 202 provides for EPA to promulgate vehicle emission standards that are achievable and available. Under any interpretation of the CAA, EPA lacks authority to enact standards that force electrification of the heavy-duty vehicle fleet. Because the standards EPA proposes would significantly alter the national economy, industry, environment, society, and national security, the changes present a major question on which express and clear Congressional delegation is required. Congress has not made such a determination, and the EPA is not the proper or authorized forum for making a decision with such widespread ramifications on areas outside EPA's control or expertise. [EPA-HQ-OAR-2019-0055-1328-A2, p.3]

EPA not only lacks authority to force the Executive Branch's preferred policy outcome by setting vehicle emission standards that clearly are neither achievable nor available, it also has a direct and conflicting mandate under the Renewable Fuel Standard to achieve greenhouse gas emissions from the transportation fleet by promoting increased production of renewable fuels. [EPA-HQ-OAR-2019-0055-1328-A2, p.3]

As provided by the Energy Independence and Security Act of 2007 (EISA), which was adopted with the express purpose of promoting domestic renewable fuel production in order to enhance domestic energy security while reducing emissions of greenhouse gases in the transportation sector, the Clean Air Act mandates increasing volumes of renewable fuel to be used in the transportation sector. EPA's final LD GHG standards and the proposed HD standards undermine these express Congressional mandates. EPA's failure to give fair and full consideration for technologies that use liquid fuels is inconsistent with Congressional directives to achieve reductions in mobile source GHG emissions by increasing volumes of renewable fuel used in the domestic transportation fleet. [EPA-HQ-OAR-2019-0055-1328-A2, p.3]

Finally, by making a policy choice to favor electric vehicles, EPA discourages innovation and investment in alternative technologies that would reduce GHG emissions associated with liquid fuels, such as on-board CO2 capture and blue hydrogen. Instead, EPA's proposal inappropriately favors a technology that may result in higher GHG emissions as well as higher costs for operation and other negative consequences. Incentives for electric vehicles, coupled with the absence of incentives or fair treatment for vehicles using lower-carbon fuels, arbitrarily subsidizes the electric vehicle industry and unfairly disadvantages potential opportunities for greater GHG emissions reductions in the liquid fuel market. [EPA-HQ-OAR-2019-0055-1328-A2, p.7]

EPA is required to consider impacts on endangered species of any action that may affect a listed species or any critical habitat for a listed species. In the proposal, however, EPA does not mention consideration of impacts on endangered species or any consultation required by the Endangered Species Act. EPA's proposal to shift the heavy-duty engine/vehicle market to electric vehicles should account for the emissions expected from production of electric vehicles, batteries, and the electricity for the vehicles, including the harm to endangered species from mines, windmills, and solar fields as well as the environmental impacts from any new mineral extraction facilities, including open-pit and subsea mining, as well as mineral processing and battery manufacturing facilities. [EPA-HQ-OAR-2019-0055-1328-A2, p.8]

EPA's cost-benefit analysis understates the costs of electric vehicles and grossly overstates the benefits by failing to account for the true emissions from electric vehicles. EPA's analysis does not account for the increased costs of electric reliability, increased costs to the electricity infrastructure, the loss of valuable fuel infrastructure already in place, the cost increase to consumers in not only vehicle costs that will be passed on in the prices of goods and services but also the cost increases from the increased demand on minerals that are also needed for other industrial and consumer goods. EPA's analysis of cost and market readiness for EVs does not consider the chip shortage that has been evident for at least a year, nor does it account for short term mitigation of minerals availability and battery costs. [EPA-HQ-OAR-2019-0055-1328-A2, p.8]

In conclusion, EPA's authority under the Clean Air Act to set standards for heavy-duty engines and vehicles does not allow EPA to set standards to engineer a transition in the sector to adopt one technology. EPA has overlooked the opportunity to recognize and encourage development of liquid fuels that have inherently lower carbon intensities as well as opportunities to encourage offsets of GHG emissions. Emerging technologies involving carbon capture, efficiency, and blends of low carbon fuel components could result in substantially lower overall GHG emissions and could be implemented sooner than electric vehicles for this category of vehicles. EPA's design of a GHG standard in a way that fails to properly identify the actual emissions associated with all vehicles (upstream energy emissions and pollution from production) passes up the opportunity to maximize emission reductions and will arbitrarily limit innovation and discourage investment in important developing technologies. Finally, by focusing only on tailpipe emissions and by putting its thumb on the scale in favor of electric vehicle development, EPA has failed to properly consider the full costs and benefits of its rulemaking such as the environmental, social, and economic impacts associated with increased electricity demand and increased mineral mining and processing. EPA's approach may very well lead to higher overall GHG emissions at almost certainly the highest cost for GHG reductions. [EPA-HQ-OAR-2019-0055-1328-A2, p.9]

Organization: *Walmart*

We believe EPA’s regulatory actions provide a valuable signal to the market that can accelerate the innovation and supply of zero and near-zero emissions vehicles to meet the demand for zero emissions vehicles from companies like Walmart.6 We have previously expressed high-level support for EPA's Phase 2 GHG standards and believe a Phase 3 standard for MY2030 and after can function as a critical national standard. [EPA-HQ-OAR-2019-0055-1191-A2, p. 2]

6. https://www.linkedin.com/pulse/heres-how-policy-can-design-reliable-resilient-zero-emissions-cortes/?trackingId=dYIkXNwhfe21D0RIT5Avrw%3D%3D

It is essential to design a Phase 3 standard that aligns climate outcomes with market and operational realities. A standard should unlock viable, emissions-reducing technology at a pace that is cost-effective and based on an independent analysis of market supply and demand conditions and projections, necessary grid and fueling infrastructure needs, and the operational realities of medium- and heavy-duty vehicle (MHDV) fleets. [EPA-HQ-OAR-2019-0055-1191-A2, p. 3]

Additionally, it will be important for EPA to consider how a Phase 3 standard can align and build consistency across the various states that have initiated zero emissions sales standards. One national standard is ideal for national operators to help mitigate the complexity of competing policy requirements while leveraging economies of scale. [EPA-HQ-OAR-2019-0055-1191-A2, p. 3]

Organization: *Westport Fuels Systems (WFS)*

Key WFS commentary/observation highlights include:

- The lowest cost of CO2 abatement is through ICE options, powered by HPDI fuel system technology, representing the most cost-effective pathway to deep decarbonization of road freight. Incentive programs should include high-efficiency, low-cost, low-carbon ICE solutions such as that offered by the HPDI fuel system. [EPA-HQ-OAR-2019-0055-1278-A1, p.6]

EPA Response

EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards) and may consider the comments in this section of this document in the development of that future rulemaking.

A commenter claimed that EPA failed to consider this rule's impacts on endangered species or any consultation required by the Endangered Species Act (ESA). The commenter focused on the impacts associated with electric vehicles, including the upstream impacts associated with producing and using such vehicles.

EPA disagrees that the agency must consider the rule's impacts on endangered species and, to the extent the commenter asserts ESA consultation is required, disagrees that EPA must conduct ESA consultation for multiple independent reasons. First, the commenter failed to raise this issue with reasonable specificity as required by the Clean Air Act. See CAA section 307(d)(7)(B). The commenter failed to articulate which portion of the proposal the commenter is concerned about, how that portion of the proposal may affect listed species or critical habitat, or why EPA has discretion to consider impacts to listed species or critical habitat.

Second, to the extent that the commenter's ESA concern was specific to GHG standards, this comment is beyond the scope of this final rule. As noted above, we are not taking final action at this time on the proposed GHG standards. *See also WildEarth Guardians v. EPA*, 759 F.3d 1196, 1207-08 (10th Cir. 2014) (holding that the scope of ESA consultation is limited to the scope of EPA's final action).

Third, Section 7(a)(2) of the ESA requires federal agencies, in consultation with the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service (collectively, "the Services"), to ensure that actions agencies authorize, fund, or carry out are not likely to jeopardize the continued existence of federally listed endangered or threatened species or result in the destruction or adverse modification of designated critical habitat of such species. Contrary to the commenter's suggestion, the final rule does not authorize, fund, or carry out the production or use of electric vehicles, or *a fortiori*, upstream activities like mining, mineral processing, wind and solar energy production, and battery production. As we explain in preamble Section and section 3 of this document, the final criteria pollutant standards do not mandate and are not premised on increasing the production or use of electric vehicles. Therefore, the potential species-related impacts referenced by the commenter are not caused by this final action, and there is no need for EPA to assess any such impacts.

Fourth, the ESA's consultation requirement applies only to actions where there is discretionary federal involvement or control. 50 CFR 402.03; *see also Nat'l Ass'n of Home Builders v. Defs. of Wildlife*, 551 U.S. 644, 669 (2007); *Sierra Club v. EPA*, 353 F.3d 976, 992 (D.C. Cir. 2004). As we explain in preamble Sections I and III, the final standards are justified by EPA's assessment of the relevant statutory factors in CAA section 202(a)(3)(A), which directs EPA to set certain emission standards that reflect the greatest degree of emission reduction achievable through the application of technology that will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of the technology. This provision does not grant EPA authority to weaken the standard, based on impacts to listed species or their critical habitats. Since EPA lacks discretion to modify the standard based on species-related impacts, the consultation requirement does not apply.

29 Other amendments HD highway engines and vehicles

29.1 Alternate standards for specialty vehicles

Comments by Organizations

Organization: *Oshkosh Corporation*

Oshkosh also requests that EPA enhance OBD flexibility for heavy-duty BEV, Fuel Cell Electric Vehicle (FCEV), hybrid, and range-extending configurations by codifying a volume-based OBD exemption for engines to be used in such applications. Such an exemption would apply once the current alternate standards for specialty vehicles (40 C.F.R. § 1037.605) sunset in MY 2027 and could allow a limited number of vehicles (e.g., up to 750 in a given model year) to meet simplified diagnostic control requirements upon making an engineering demonstration of the sufficiency of the diagnostic system. This demonstration could include vehicle sensor-based and monitoring system data to reflect the functionality of the control system. The Company submits that such a process would allow for streamlined certification of hybrid, range-extending, and potentially other specialty vehicles, thus fully capitalizing on the emission benefits of these vehicles as a substitute for conventional ICE vehicles. The requested volume-based OBD exemption could potentially align with the categories of vehicles allowed to certify under the custom-chassis provisions of the Phase 2 GHG rule, given that the latter provisions are intended to facilitate the deployment of similar low-emission technologies. [EPA-HQ-OAR-2019-0055-1226-A1, p. 4]

EPA Summary and Response

Comment Summary	EPA Response
Oshkosh requests that, once the current alternate standards for specialty vehicles sunset in MY 2027, EPA could allow a limited number of vehicles (e.g., up to 750 in a given model year) to meet simplified diagnostic control requirements upon making an engineering demonstration of the sufficiency of the diagnostic system. This streamlined certification demonstration could include vehicle sensor-based and monitoring system data to reflect the functionality of the control system. The requested volume-based OBD exemption could potentially align with the categories of vehicles allowed to certify under the custom-chassis provisions of the Phase 2 GHG rule, given that the latter provisions are intended to facilitate the deployment of similar low-emission technologies.	We appreciate the interest in developing provisions that are specifically tailored to address compliance concerns for these advanced-technology vehicles. We would need to explore these ideas further to determine whether to propose such provisions in a future rulemaking. It is not clear how the suggested provisions would apply for electric vehicles or fuel-cell vehicles.

29.2 Scope and timing for amending applications for certification

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

CARB staff proposes to allow manufacturers to submit the amending applications for certification up to 30 days before the end of the model year. [EPA-HQ-OAR-2019-0055-1186-A2, p.84]

CARB generally does not issue the Executive Order (EO) after the model year ends. If manufacturers submit the amending applications too late, there is not enough time to issue the running change EO if a running change EO is needed. [EPA-HQ-OAR-2019-0055-1186-A2, p.84]

EPA Summary and Response

Comment Summary	EPA Response
CARB staff proposes to allow manufacturers to submit the amending applications for certification up to 30 days before the end of the model year. CARB generally does not issue the Executive Order (EO) after the model year ends. If manufacturers submit the amending applications too late, there is not enough time to issue a running change EO.	The comment largely affirms EPA's proposed approach to disallow amending certificates after the end of the manufacturer's model year. We did not propose to include a separate deadline before the end of the model year for submitting amendment requests. We recommend that manufacturers submit their requests well before the end of the model year to ensure a smooth process.

29.3 Miscellaneous HD highway amendments

Comments by Organizations

Organization: *Allison Transmission, Inc. (Allison)*

- Allison appreciates that EPA defines technology in a way that gives industry greater flexibility to design architecture for OEM and end-user requirements. For example, EPA's definition of hybrids and HEVs offers the industry greater flexibility than the California PHEV definition which constrains hybrid technology down a narrow path to achieve increasing all-electric range, rather than considering other potential hybrid architectures that may be a better fit for customer and regulatory requirements. [EPA-HQ-OAR-2019-0055-1231-A1, p.35]

Organization: *American Reliance Industries Co. (ARI)*

Although not specific to ARI, ARI recognizes that other exemptions exist in 40 C.F.R. Part 1037. For example, 40 C.F.R. 1037.605 "allows vehicle manufacturers to introduce into U.S.

commerce certain new motor vehicles using engines certified to alternate emission standards specified in 40 CFR part 86 for motor vehicle engines used in specialty vehicles." In fact, 40 CFR 1037.605(d) provides an exemption that requires the following label: "THIS VEHICLE IS EXEMPT FROM GREENHOUSE GAS STANDARDS UNDER 40 CFR 1037.605." [EPA-HQ-OAR-2019-0055-1182-A1, p. 2]

As a part of the Proposed Rule, the EPA continues to acknowledge the importance of the existing exemptions by maintaining them in the rule. ARI appreciates the EPA's focus on their top priority of obtaining real world emission reductions and recognition that regulating such small manufacturing niche markets in addition to the regulations placed upon the OEM would not provide such results. Although ARI believes it is the EPA's intent not to limit the existing exemptions in Part 1037, we believe that certain modifications to 40 C.F.R. § 1037.601, which describes how 40 C.F.R. Part 1068 applies to heavy-duty vehicles, fail to account for the existence of these exemptions. After reviewing the redline edits ARI understands how this element could have been overlooked. [EPA-HQ-OAR-2019-0055-1182-A1, p. 2]

Redline changes to 1037.601:

> Subpart G - Special Compliance Provisions
> § 1037.601 - General compliance provisions.
> (a) Engine and vehicle manufacturers, as well as owners and operators of vehicles subject to the requirements of this part, and all other persons, must observe the provisions of this part, the applicable provisions of 40 CFR part 1068, and the applicable provisions of the Clean Air Act. The provisions of 40 CFR part 1068 apply for heavy-duty vehicles as specified in this part, subject to the provisions:
> (1) Except as specifically allowed by this part or 40 CFR part 1068, it is a violation of ~~§~~40 CFR 1068.101(a)(1) to introduce into U.S. commerce a tractor or vocational vehicle that is not certified to the applicable requirements of this part. Similarly, it is a violation of 40 CFR 1068.101(a)(1) to introduce into U.S. commerce a tractor or vocational vehicle containing an engine that is not certified to the applicable requirements of ~~this part and~~ 40 CFR part 86 or ~~part~~ 1036. Further, it is a violation to introduce into U.S. commerce a Phase 1 tractor containing an engine not certified for use in tractors; or to introduce into U.S. commerce a vocational vehicle containing a Light HDE or Medium HDE not certified for use in vocational vehicles. These prohibitions apply especially to the vehicle manufacturer. Note that this paragraph (a)(1) allows the use of Heavy heavy-duty tractor engines in vocational vehicles. [EPA-HQ-OAR-2019-0055-1182-A1, p. 3]

ARI Comment: ARI believes that the changes to this subsection as reflected in the first two sentences, may inadvertently confuse the scope of applicability of the existing exemptions detailed in Part 1037. We believe "similarly" was added to the beginning of the second sentence in the above excerpt in order to extend the introductory clause of the first sentence to the second sentence. However, because there is no affirmative statement that said introductory clause applies, ARI believes that it could be misinterpreted to not apply or at least create unnecessary ambiguity. We also understand why "this part and" was deleted in the second sentence as it relates to meeting certain requirements and does not relate to the existing exemptions. Nonetheless, this deletion, combined with the absense of clear application of the first sentences introductory clause, could be interpreted to limit the applicability of the exemptions of this Part. ARI believes that the EPA should consider alternative wording to avoid such a misinterpretation and maintain the original applicability of the exemptions as established by the existing rule. [EPA-HQ-OAR-2019-0055-1182-A1, p. 3]

ARI believes that two simple alternatives could be applied to amend this section to resolve the above-described concern. Below are two "redlined" versions which ARI believes would both enact the EPA's intent and prevent future misinterpretations. [EPA-HQ-OAR-2019-0055-1182-A1, p. 3]

First alternative:

> § 1037.601 - General compliance provisions.
> (a) ***
> (1) Except as specifically allowed by this part of 40 CFR part 1068, it is a violation of 40 CFR 1068.101(a)(1) to introduce into U.S. commerce a tractor or vocational vehicle that is not certified to the applicable requirements of this part. Similarly, except as specifically allowed by this part or 40 CFR part 1068, it is a violation of 40 CFR 1068.101(a)(1) to introduce into U.S. commerce a tractor or vocational vehicle containing an engine that is not certified to the applicable requirements of 40 CFR part 86 or 1036. Further, it is a violation to introduce into U.S. commerce a Phase 1 tractor containing an engine not certified for use in tractors; or to introduce into U.S. commerce a vocational vehicle containing a Light HDE or Medium HDE not certified for use in vocational vehicles. These prohibitions apply especially to the vehicle manufacturer. Note that this paragraph (a)(1) allows the use of Heavy heavy-duty tractor engines in vocational vehicles. [EPA-HQ-OAR-2019-0055-1182-A1, p. 4]

Second alternative:

> § 1037.601 - General compliance provisions.
> (a) ***
> (1) Except as specifically allowed by this part of 40 CFR part 1068, it is a violation of 40 CFR 1068.101(a)(1) to: (1) introduce into U.S. commerce a tractor or vocational vehicle that is not certified to the applicable requirements of this part; or (2) ~~Similarly, it is a violation of 40 CFR 1068.101(a)(1) to~~ introduce into U.S. commerce a tractor or vocational vehicle containing an engine that is not certified to the applicable requirements of 40 CFR part 86 or 1036. Further, it is a violation to introduce into U.S. commerce a Phase 1 tractor containing an engine not certified for use in tractors; or to introduce into U.S. commerce a vocational vehicle containing a Light HDE or Medium HDE not certified for use in vocational vehicles. These prohibitions apply especially to the vehicle manufacturer. Note that this paragraph (a)(1) allows the use of Heavy heavy-duty tractor engines in vocational vehicles. [EPA-HQ-OAR-2019-0055-1182-A1, p. 4]

Thank you for your continued recognition of the need for the existing exemptions, specifically those available to certain small manufacturers. ARI requests that the agencies adopt one of the two above alternatives to preserve the existing exemptions described under 40 C.F.R. Part 1037.

Otherwise, ARI requests that the agencies engage in additional discussions to evaluate what alternative changes would need to be made to maintain the applicability of these exemptions. [EPA-HQ-OAR-2019-0055-1182-A1, p. 4]

Organization: *California Air Resources Board (CARB)*

For the labeling requirements, consolidate the location for all the labeling requirements in one central place. This is already done for the requirements manufacturers must meet to qualify as a small business, and there are citations to applicable sections throughout. It would be beneficial to have a singular location for labeling requirements. Consolidating the regulations would make it simpler to edit language, find where labels are not meeting the requirements, and also make it clear where all labeling requirements are located. CARB staff suggests that U.S. EPA consider moving all the requirements added to 1037.135 or creating 1037.136 as 'Additional Labeling' where all the consolidated labeling requirements are posted. Please reference the below examples:

- 1037.150(c)(3)
    - Original: Manufacturers must label excluded vehicles with the following statement: 'THIS VEHICLE IS EXCLUDED UNDER 40 CFR 1037.150(c).'
    - Change: Manufacturers must label excluded vehicles as discussed in 1037.135(f)
- 1037.150(r)(3)
    - Original: Add a permanent supplemental label to the vehicle near the original manufacturer's emission control information label. On the label identify your full corporate name and include the following statement: 'THIS VEHICLE WAS MODIFIED AS ALLOWED UNDER 40 CFR 1037.150.'
    - Change: Add a permanent supplemental label to the vehicle near the original manufacturer's emission control information label. On the label put the statement from 1037.135(g)(1)
- 1037.105(h)
    - Original: Vehicles certified to these standards must include the following statement on the emission control label: 'THIS VEHICLE WAS CERTIFIED AS A [identify vehicle type as identified in Table 5 of this section] UNDER 40 CFR 1037.105(h)].' These custom-chassis standards apply as follows:
    - Change: Vehicles certified to these standards must include statement on their emission control label as outlined in 1037.135(h). These custom-chassis standards apply as follows:
- 1037.631(d)
    - Original: You must include the following additional statement on the vehicle's emission control information label under 1037.135: 'THIS VEHICLE WAS EXEMPTED UNDER 40 CFR 1037.631.'
    - Change: You must include the following additional statement on the vehicle's emission control information label under 1037.135 as described in 1037.135(i)
- 1037.622(d)(3)
    - Original: The secondary vehicle manufacturer must add a permanent supplemental label to the vehicle near the original manufacturer's emission

control information label. On the label identify your corporate name and include the statement: ‘THIS TRACTOR WAS MODIFIED UNDER 40 CFR 1037.622.’
    - Change: The secondary vehicle manufacturer must add a permanent supplemental label to the vehicle near the original manufacturer's emission control information label. That has the language found in 1037.135(j)
- 1037.630(b)(3)
    - Original: You must include the following additional statement on the vehicle's emission control information label under
      1037.135: ‘THIS VEHICLE WAS CERTIFIED AS A VOCATIONAL TRACTOR UNDER 40 CFR 1037.630.’
    - Change: You must include the statement from 1037.135(k) on the vehicle’s emission control information label under 1037.135 [EPA-HQ-OAR-2019-0055-1186-A2, pp.85-87]

List of 1037.135 Additions

- (f) - For those vehicles that are using the small business provisions as outlined in 1037.150(c), manufactures must label vehicles with the following statement: ‘THIS VEHICLE IS EXCLUDED UNDER 40 CFR 1037.150(c).’
- (g) - Secondary vehicle manufacturers that qualify as small manufacturers may convert low- and mid-roof tractors to mid- and high-roof configurations without recertification for the purpose of building a custom sleeper tractor or converting it to run on natural gas, must permanent supplemental label to the vehicle near the original manufacturer's emission control information label with the following requirements on the label:
    - (1) On the label identify your full corporate name
    - (2) Include the following statement: ‘THIS VEHICLE WAS MODIFIED AS ALLOWED UNDER 40 CFR 1037.150.’
- (h) - For Vehicles that are certifying to custom chassis the following statement on the emission control label: ‘THIS VEHICLE WAS CERTIFIED AS A [identify vehicle type as identified in 1037.105 Table 5 of this section] UNDER 40 CFR 1037.105(h)].’
- (i) - ’THIS VEHICLE WAS EXEMPTED UNDER 40 CFR 1037.631.’
- (j) - For secondary vehicle manufacturers supplemental label, follow the location requirements of 1037.622(d)(3). On the label identify your corporate name and include the statement: ‘THIS TRACTOR WAS MODIFIED UNDER 40 CFR 1037.622.’
- (k) - If your vehicle meets the requirements as set forth in 1037.630. Meet requirements of 1037.135 add the following statement to your emissions control information label: ‘THIS VEHICLE WAS CERTIFIED AS A VOCATIONAL TRACTOR UNDER 40 CFR 1037.630.’

Alternative Suggestion: Leverage the use of 1037.136 as a centralized location for all the ‘Additional Label Requirements’. [EPA-HQ-OAR-2019-0055-1186-A2, pp.87-88]

The NPRM requests comment regarding whether U.S. EPA should decrease the warranty period for medium HD vehicles in 40 CFR 1037.120 from 5 years or 100,000 miles, to five years or 50,000 miles. U.S. EPA states this amendment would ensure consistency between the warranty coverage periods between the affected vehicles and the engines powering such vehicles. [EPA-HQ-OAR-2019-0055-1186-A2, p.119]

CARB staff strongly opposes the proposed decrease in warranty coverage. As an initial matter, CARB staff notes that U.S. EPA first established the subject warranty periods in the federal Phase 1 GHG Emissions Standards and Fuel Efficiency Standards for Medium- and HDE and Vehicles (hereinafter 'Phase 1 GHG regulation'), 76 Fed. Reg. 57106 (Sep. 15, 2011). In NPRM for the Phase 1 GHG regulation, U.S. EPA stated that CAA section 207 requires vehicle manufacturers to warrant that their vehicles do not have defects that would cause such vehicles to not comply with applicable emission standards.179 CAA section 207 also imposes the requirements on engine manufacturers.180 U.S. EPA further stated that the emissions warranty requirements would, in conjunction with the proposed defects reporting requirements, serve manufacturers' interests in producing quality products and U.S. EPA's interests in ensuring quality control concerns necessitating need to repair in-use engines and vehicles would be addressed,181 and determined that the current warranty period and warranty obligations of vehicle manufacturers were consistent with the directives of CAA section 207.182 [EPA-HQ-OAR-2019-0055-1186-A2, pp.119-120]

179 75 Fed. Reg. 74152, 74273 (Nov. 30, 2010).

180 Id. at 74268.

181 Id. at 74278.

182 U.S. EPA, Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles – EPA Response to Comments for Joint Rulemaking (2011) at p. 17-104.

The NPRM provides no information or reasoning that supports a determination that decreasing the length of warranty coverage is consistent with the directives of CAA section 207. Indeed, elsewhere in this NPRM U.S. EPA acknowledges that lengthening the emissions warranty coverage for HDE will both incentivize owners to perform emissions maintenance and deter owners from tampering with emissions controls, which will collectively help maintain the benefits of the emission controls. In addition, lengthened emissions warranty periods could cause manufacturers to simplify their repair processes and better inform them of system defects.183 These considerations and justifications equally apply to the HD vehicles powered by such HDEs and therefore the proposal to reduce the warranty coverage for medium HD vehicles by 50,000 miles should be rejected. [EPA-HQ-OAR-2019-0055-1186-A2, p.120]

183 NPRM at 17505-17506.

The proposal overlooks the obvious loss of important emissions benefits resulting from the proposal, and has not set forth a rational connection between the facts found and the choice made, State Farm, 463 U.S. at 43. Moreover, in light of CARB staff's concerns, it is additionally clear U.S. EPA has failed to demonstrate that the reduction of warranty coverage is permissible under the statute, or that that there are good reasons for a shorter vehicle warranty. FCC v. Fox Television Stations, Inc., 556 U.S. 502, 515 [EPA-HQ-OAR-2019-0055-1186-A2, p.120]

The NPRM also requests comment whether U.S. EPA should 'align all warranty periods that apply for engine technologies, irrespective of the emissions they are designed to control, with the warranty periods that we finalize for criteria pollutant emission control.'184 [EPA-HQ-OAR-2019-0055-1186-A2, p.120]

184 NPRM at p. 17628.

The proposed rulemaking is primarily directed towards emissions standards and other emissions-related requirements regarding criteria pollutants emitted from new and in-use HD vehicles and the engines powering such vehicles. Although the testing and developmental data indicates that the compliance technologies that manufacturers will likely use to comply with the proposed criteria emissions standards will not adversely increase emissions of GHGs, CARB staff believes the data does not, at this time, indicate a pressing need to extend the emissions warranty periods for GHG pollutants to match the emissions warranty periods for criteria pollutants. However, CARB staff would be interested in considering this issue in more detail in the future, hopefully in conjunction with U.S. EPA. [EPA-HQ-OAR-2019-0055-1186-A2, pp.120-121]

The NPRM requests comment on whether the proposed 'misalignment' of emissions warranty periods between affected HDE and HD vehicles may present issues with respect to certification or implementation. [EPA-HQ-OAR-2019-0055-1186-A2, p.121]

CARB staff is not aware of any issues presented from the different warranty periods. The HD vehicle industry is predominately non-integrated, with a small number of engine manufacturers and a significantly larger number of vehicle manufacturers. The proposed warranty provisions appropriately require engine manufacturers to warrant components and systems installed on their engines are free from defects and workmanship that would cause such engines to not comply with applicable emissions standards for the proposed emissions warranty periods, and require vehicle manufacturers to warrant that emissions-related components they install on the vehicle are free from defects and workmanship that would cause such vehicles to not comply with applicable emissions standards for the proposed emissions warranty periods. [EPA-HQ-OAR-2019-0055-1186-A2, p.121]

HD vehicle manufacturers rely on the engine manufacturers to supply them with compliant engines, and the proposed warranty provisions appropriately acknowledge and reflect the non-integrated nature of the industry by only requiring vehicle manufacturers to warrant that the components and systems installed in vehicles are free from defects and workmanship that would cause such vehicles not to comply with applicable emissions standards for the proposed emissions warranty periods. [EPA-HQ-OAR-2019-0055-1186-A2, p.121]

No issues are presented regarding certification, because both engine and vehicle manufacturers must apply for and obtain certificates of conformance each model year, and no issues are presented with respect to implementation, as the proposed regulations clearly set forth the in-use obligations of both engine and vehicle manufacturers. Moreover, the longer emissions warranty periods for HDE, as compared to the emissions warranty periods for HD vehicles is warranted, given the extended operational lives of HDE, and given that most HDE are designed to be rebuilt after specified periods of operation.185 [EPA-HQ-OAR-2019-0055-1186-A2, p.121]

185 NPRM at pp. 17341, 17495, 17496-17499.

Organization: *Cummins Inc. (Cummins)*

EPA's new proposed provision in §1036.240(c) allows small manufacturers to use assigned DFs but does not mention small-volume families certified by other manufacturers. EPA should retain the existing provisions of §86.096-24(e)(2) allowing any manufacturer to utilize the procedures of §86.094-14 for certifying small-volume families, including the use of assigned DFs. Those provisions are used today and will continue to be needed for some families, for example, those containing alternative fuel engines. [EPA-HQ-OAR-2019-0055-1325-A1, p. 12]

Organization: *PACCAR, Inc (PACCAR)*

PACCAR respectfully requests that EPA clarify its expectations regarding off-cycle data demonstrations. Specifically, proposed 1036.240(b) provides: 'Your engine family is deemed not to comply if any emission-data engine representing that family has test results showing an official emission result or a deteriorated emission level for any pollutant that is above an applicable emission standard (including all corrections and adjustments). Similarly, your engine family is deemed not to comply if any emission-data engine representing that family has test results showing any emission level above the applicable off-cycle emission standard for any pollutant. This also applies for all test points for emission data-engines within the family used to establish deterioration factors.' [EPA-HQ-OAR-2019-0055-1346-A1, p.45]

This section of the regulation discusses DF. The emissions-data engine is only operated in a test cell, and is not intended for installation in a vehicle. This open- ended provision does not provide stakeholders with the regulatory certainty that is needed to allow them to ensure compliance and therefore should be revised. For example, the regulation should further clarify the contours of what is contemplated by 'off-cycle emission standard.' And the statement that '[y]our engine family is deemed not to comply if any emission-data engine representing that family has test results showing an official emission result or a deteriorated emission level for any pollutant that is above an applicable emission standard' could be read to suggest that DF engines would be installed and tested in on-road vehicles, which of course would be inconsistent with industry practice. PACCAR therefore requests that EPA remove this proposed provision. [EPA-HQ-OAR-2019-0055-1346-A1, pp. 45-46]

Proposed section 1036.240(c) also needs to be revised. As proposed, OEMs would be required to take into account in-use testing in calculating DF. This is not possible. DF is an aging exercise on a single emission data engine with a prescribed DF method that measures low-hour performance and deteriorated performance, from which a curve is determined. Although accepted methods are listed in 1036.240(c)(1)-(4), in-use data is not mentioned and the proposed regulation does not describe how to incorporate in-use data into DF. [EPA-HQ-OAR-2019-0055-1346-A1, p.46]

Organization: *Truck Trailers Manufacturers Association (TTMA)*

The proposed rule would make updates to EPA's Heavy-Duty Greenhouse Gas Emissions Phase 2 program. EPA relied primarily on Section 202(a) of the Clean Air Act for authority to promulgate the regulations that implement that program. See 42 U.S.C. §§ 7521, 7550. TTMA has previously challenged EPA's authority to regulate trailers and trailer manufacturers under Section 202 of the Clean Air Act, and the United States Court of Appeals for the District of Columbia recently held that EPA does not have such authority. The decision was issued in Truck Trailer Manufacturers Association, Inc., v. Environmental Protection Agency, et al., No. 16-1430 (November 12, 2021). The proposed rule updating the Phase 2 program similarly rests on Section 202 of the Clean Air Act as authority for EPA's rulemaking. See 87 Fed. Reg at 17436. However, for the reasons set forth in the D.C. Circuit's recent decision, EPA does not have authority to update Phase 2 in ways that extend to the regulation of trailers or trailer manufacturers. [EPA-HQ-OAR-2019-0055-1024-A1, p. 1]

Specifically, in the General Information section, in response to the question "Does this action apply to me?," the reference to truck trailer manufacturing (NAICS code 336212) as a regulated category lacks statutory authority. See 87 Fed Reg. at 17415. Therefore, in Section 1037.1(a) of the proposed rule, titled "Applicability," the statement that "[t]his also includes certain trailers as described in §§1037.5, 1037.150, and 1037.801" should be deleted. See 87 Fed. Reg. at 17813. Similarly, Section 1037.101(b)(2)(ii) of the proposed rule should be deleted, as it specifies that "[t]railers" comprise a group of "regulated heavy-duty vehicles." See 87 Fed. Reg. at 17814. And in Section 1068.1(a)(2) of the proposed rule, the statement that "[t]his includes trailers" should also be deleted, as the agency lacks authority to apply these regulations to trailers. See 87 Fed. Reg. at 17882. [EPA-HQ-OAR-2019-0055-1024-A1, pp. 1 - 2]

And finally, the agency should delete (1) the reference to emission-related warranty requirements for trailers found in Section 1037.120(b)(iii)&(iv), see 87 Fed. Reg. at 17816; (2) the reference to a useful life (250,000 miles) for trailers found in Section 1037.705(b), see 87 Fed. Reg. at 17837; and (3) the references to tires on non-box and box van trailers found in the definition of "low rolling resistance tire" in Section 1037.801, see 87 Fed. Reg. at 17838. [EPA-HQ-OAR-2019-0055-1024-A1, p. 2]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EMA also has concerns related to the proposed requirement under §1036.240(c) that, "Your deterioration factors must take into account any available data from in-use testing with similar engines." That requirement is at the same time too vague and overly broad, and is therefore unworkable. It is entirely unclear how manufacturers, having completed a comprehensive, very costly and controlled full useful life DF determination according to the proposed provisions, would "take into account" other "available" in-use data to adjust those results. There is no clarity as to what types of "available" data should be drawn into this analysis, or would be drawn into this analysis by the Agency, under this language. For example, would data acquired by NGOs unskilled in emissions measurement have to be taken into account? Will manufacturers be compelled to review data from field test engines that have undergone numerous component and emissions control software upgrades and incorporate NOx sensor data from these engines into the DF determination? As stated, this requirement is utterly unworkable, and should be eliminated in the final rule. [EPA-HQ-OAR-2019-0055-1203-A1, p. 112]

EPA's proposed requirements under §1036.235(a)(1) provide that a manufacturer must select an engine configuration for criteria pollutant certification testing that is "most likely to exceed (or have emissions nearer to) an applicable emission standard or FEL…" That requirement could lead to significant ambiguity in determining the selected test engine's configuration, as it is unlikely that one engine configuration would have the highest emissions for all certification cycles and all criteria pollutants. Further, EPA's proposal could result in a different configuration identification, such as a child rating, compared to existing requirements in §86.096-24(b)(3)(ii) which allow selecting "the engine that features the highest fuel feed per stroke, primarily at the speed of maximum rated torque and secondarily at rated speed." EPA should retain the existing criteria based on highest fueling in §86.096-24(b)(3)(ii) (and similarly retain the existing criteria in §86.096-24(b)(2) for Otto-cycle engines) for selecting an engine configuration for criteria pollutant certification testing. [EPA-HQ-OAR-2019-0055-1203-A1, p. 117]

Today, the test engine configuration requirements have led to a situation where some manufacturers use a different test engine configuration for criteria emissions demonstrations than the one used for GHG emissions demonstrations. Proposed §1036.235(a) requires that the data engine for GHG emissions be the same as the data engine configuration for criteria pollutants. This new requirement, as proposed, will have unintended consequences on engine GHG stringency. The engine configuration with the highest NOx, for example, on an SCR-equipped engine will likely be a lower power rating within the family, and will likely, therefore, have relatively high CO2 emissions relative to the other ratings in the family. The requirements of proposed §1036.235(a) will thereby have the effect of increasing the stringency of the GHG standards. This is the most serious consequence of the language as proposed. There could also be corollary complications with other aspects of emissions control regulations, such as DF carry-across, where factors such as highest fueling and exhaust flow (catalyst residence time) are deemed relevant. [EPA-HQ-OAR-2019-0055-1203-A1, p. 117 - 118]

EPA proposes in §1036.205(t) to include a design requirement that engine manufacturers would have to include in their installation instructions to a vehicle manufacturer (§1036.130) that would facilitate in-use testing. More specifically, the engine manufacturer would be required in those instructions to "specify how to ensure that sampling of exhaust emissions will be possible after engines are installed in equipment and placed in service. If this cannot be done by simply adding a 20-centimeter extension to the exhaust pipe, show how to sample exhaust emissions in a way that prevents diluting the exhaust sample with ambient air." [EPA-HQ-OAR-2019-0055-1203-A1, p. 133]

As an initial matter, imposing requirements on the vehicle design that go beyond those required to ensure compliance, and that instead are imposed solely to enable the rare instances that someone would want to conduct PEMS testing on a vehicle, is an unnecessary and unwarranted requirement. Compelling less than optimal designs, that could take precedence over practical installation considerations and limitations, and potentially impose higher costs, is unreasonable solely to make exhaust sampling easier than it otherwise might be. [EPA-HQ-OAR-2019-0055-1203-A1, p. 133]

EMA recommends that the provisions regarding installation instructions at §1036.130 be finalized to include a "recommended practice" with respect to vehicle design, to be followed "whenever practical." Those instructions should recommend physical characteristics of the installed design, without reference to extension dimensions or ambient air dilution, which would not be meaningful to the vehicle design and installation personnel. The resulting design recommendations should be established in a way that would facilitate PEMS testing. EMA further recommends that EPA simplify the proposed §1036.205(t) accordingly, referencing §1036.130. Finally, both provisions should refer to installation instructions, since they concern vehicles rather than equipment. [EPA-HQ-OAR-2019-0055-1203-A1, p. 134]

EMA offers the following comments on the specific OBD-related elements of the proposed regulatory text. §1036.115: "(d) Torque broadcasting. Electronically controlled engines must broadcast their speed and output shaft torque (in newton-meters). Engines may alternatively broadcast a surrogate value for determining torque. Engines must broadcast engine parameters such that they can be read with a remote device or broadcast them directly to their controller area networks. This information is necessary for testing engines in the field (see §1036.515)." EMA is confident that the engine torque and speed parameters currently used to support PEMS today should suffice for this purpose, and asks EPA to confirm this expectation. [EPA-HQ-OAR-2019-0055-1203-A1, p. 103]

In another related matter, EMA supports the Agency's tank-sizing requirements detailed in §1036.115(i). [EPA-HQ-OAR-2019-0055-1203-A1, p. 125]

EPA Summary and Response

Comment Summary	EPA Response
Allison appreciates that EPA defines technology in a way that gives industry greater flexibility to design architecture for OEM and end-user requirements. For example, EPA's definition of hybrids and HEVs offers the industry greater flexibility than the California PHEV definition which constrains hybrid technology down a narrow path to achieve increasing all-electric range.	EPA acknowledges the comment supporting the proposed rule.
ARI suggested adjusted wording for proposed changes in §1037.601(a)(1) to avoid the possibility that someone would interpret the regulation to recognize exemption provisions only for the first of two given scenarios. The comment suggested two alternative approaches to address the concern.	EPA agrees that proposed wording should be revised to more clearly recognize that the exemption provisions apply for both of the given scenarios. We have revised the paragraph in the final rule in a way that is similar to the ARI's second suggested approach.

CARB recommends consolidating labeling requirements in one central place in the regulation to make it simpler to edit language, find where labels are not meeting the requirements, and make it clear where all labeling requirements are located.	We believe the recommended approach would serve the interest of regulators at the expense of making it more difficult for companies to comply with labeling requirements. We favor the approach of describing labeling requirements in the context of the related regulatory provisions. This is particularly true where consolidated labeling specifications would include interim provisions that may apply only for a limited time. Electronic searching also makes it very easy to find all the different labeling requirements.
CARB strongly opposes EPA's consideration of decreasing the warranty period for Medium HD vehicles from 100,000 miles to 50,000 miles, which would ensure consistency between the warranty coverage periods between the affected vehicles and the engines powering such vehicles. CARB staff is not aware of any issues presented from applying different warranty periods for criteria and greenhouse gas emission standards.	We are not taking final action at this time regarding warranty periods for Medium HDV under 40 CFR 1037.120.
Cummins stated that EPA should retain the existing provision of §86.096-24(e)(2) to allow any manufacturer to certify small-volume families with an assigned deterioration factor.	We are not including in the final rule a provision for assigned deterioration factors for small families. Manufacturers have made very limited use of the existing provisions in §86.096-24(e)(2). The proposed rule included a new approach for testing to establish deterioration factors that includes a combination of engine testing and bench aging of aftertreatment components. This new approach is intended to substantially lower the cost of developing new deterioration factors. Existing provisions allowing flexibility will continue to apply—carry-across of deterioration factors for similar families in the same model year, and carry-over of deterioration factors for later model years. We expect to consider the production volumes of the families selected for in-use verification testing, both to allow for a reasonable application of testing burden and to achieve the intended verification relative to the emission impact of different engine families.

PACCAR requests that EPA remove the proposed provision in §1036.240(b) specifying that an "engine family is deemed not to comply if any emission-data engine representing that family has test results showing any emission level above the applicable off-cycle emission standard for any pollutant. PACCAR suggested that this provision is too open-ended, and could subject manufacturers to unreasonable compliance liability if an emission-data engine were installed in an in-use vehicle. PACCAR also suggested clarifying the contours of what is contemplated for demonstrating compliance with the off-cycle emission standard.	As PACCAR notes, the statement in §1036.240(b) applies for an "emission-data engine," which is defined as an engine that is tested for certification. Such an engine must comply with all applicable duty-cycle standards and off-cycle standards to be eligible for certification. We are not aware that an emission-data engine has ever been installed in an in-use vehicle. However, if that would occur, manufacturers could only perform such an installation after the certificate was issued. If measured in-use emissions exceed emission standards, EPA would generally be able to pursue a recall based on a pattern of noncompliance.
PACCAR suggested clarifying the contours of what is contemplated for demonstrating compliance with the off-cycle emission standard.	We have implemented off-cycle standards for many years in the form of Not-to-Exceed standards. We would expect to implement the new off-cycle emission standards in a similar way. In particular, EPA's Compliance Division will expect to meet regularly with manufacturers to clarify plans to demonstrate compliance with off-cycle standards. This might involve testing over some number of steady-state test points, or operation of some defined transient test segments. We have added a sentence to §1036.205 clarifying that EPA may direct manufacturers to include emission measurements representing typical engine in-use operation at a range of ambient conditions.

EMA suggested that we remove the provision in §1036.240(c) requiring manufacturers to take into account the results of in-use testing when they establish a deterioration factor for certification. That requirement is at the same time too vague and overly broad, and is therefore unworkable. It is entirely unclear how manufacturers, having completed a comprehensive, very costly and controlled full useful life DF determination according to the proposed provisions, would "take into account" other "available" in-use data to adjust those results. There is no clarity as to what types of "available" data should be drawn into this analysis, or would be drawn into this analysis by the Agency, under this language. PACCAR also suggested that we remove the provision in §1036.240(c) requiring manufacturers to take into account the results of in-use testing when they establish a deterioration factor for certification. PACCAR pointed out that they determine the deterioration factor from testing a single emission-data engine with a prescribed method, which does not reference in-use testing.	The proposed §1036.240(c) specifically directs manufacturers to "take into account any available data from in-use testing with similar engines" when the establish deterioration factors for certification. This is not necessarily intended to come into play when the manufacturer first establishes deterioration factors for certifying an engine family. As manufacturers continue to perform in-use testing throughout an engine family's useful life, it may become apparent that the original deterioration factors under-represent emissions throughout the useful life for one or more pollutants. In that case, we would expect manufacturers to use good engineering judgment to adjust deterioration factors as appropriate for future model years to ensure that the manufacturer can properly demonstrate for certification that in-use engines will meet emission standards throughout the useful life. We have adopted this same provision for several types of nonroad engines, such as those subject to standards under 40 CFR parts 1039, 1042, and 1048. We have modified the final regulation at §1036.240(c) to clarify that DF verification testing applies as specified, and that manufacturers must additionally consider in-use testing results separate from that DF verification testing.
TTMA has previously challenged EPA's authority to regulate trailers and trailer manufacturers under Section 202 of the Clean Air Act, and the United States Court of Appeals for the District of Columbia recently held that EPA does not have such authority. TTMA states that EPA should therefore remove trailers from the list of sectors affected in the preamble, and remove reference to trailers in 40 CFR parts 1037 and 1068.	We recognize the court decision vacating the Phase 2 regulations as they applied to trailers as motor vehicles. We intend to address this in a future rulemaking where we can comprehensively review the regulations to identify all the appropriate changes to remove provisions, terminology, and descriptions stating or presuming that trailers are motor vehicles. We inadvertently included trailers in the list of regulated categories and have removed trailers from this list for the final rule.

Cummins commented that EPA should revise §1036.235(a) to retain the existing criteria for selecting a test engine for demonstrating compliance with criteria emission standards based on highest fueling rate (§86.096-24(b)(2) and (b)(3)(ii)). The proposed approach instructing manufacturers to select the configuration most likely to exceed a standard could lead to significant ambiguity.	We agree with the comment and have revised the regulation accordingly.
EMA observed that the proposed §1036.235(a) would require manufacturers to perform testing for criteria and greenhouse gas standards using the same engine. EMA stated that this would be inappropriate for complying with greenhouse gas standards, with the expectation that the proposed approach would lead them to select engines with higher CO2 emissions, which would increase the stringency of the greenhouse gas standards.	We agree with the comment and have revised the regulation to more clearly allow manufacturers to select different test engines for demonstrating compliance with criteria and greenhouse gas emission standards.
EMA objected to the proposed provision in §1036.205(t) for manufacturers to confirm that their installation instructions specify how to sample exhaust emissions from an in-use configuration without diluting the exhaust sample with ambient air. EMA argued that it is unnecessary and unwarranted to impose requirements on the vehicle design that go beyond those required to ensure compliance, and that instead are imposed solely to enable the rare instances that someone would want to conduct PEMS testing on a vehicle. EMA recommended instead specifying installation instructions at §1036.130 to include a "recommended practice" with respect to vehicle design, to be followed "whenever practical." Those instructions should recommend physical characteristics of the installed design, without reference to extension dimensions or ambient air dilution, which would not be meaningful to the vehicle design and installation personnel. Design recommendations should facilitate PEMS testing. EMA recommends that EPA simplify the proposed §1036.205(t) accordingly, referencing §1036.130.	We agree with the comment. In the final rule we have changed the proposed provision in §1036.205 to remove this requirement and added a simpler requirement to include a recommended practice to the engine manufacturer's installation instructions.

EMA is confident that the engine torque and speed parameters currently used to support PEMS suffice for meeting proposed specifications for torque broadcasting in §1036.115(d).	We are retaining the requirement for torque broadcasting because it may be needed to support powertrain testing.
EMA supports the Agency's tank-sizing requirements detailed in §1036.115(i).	EPA acknowledges the comment affirming that we properly captured the substantive content from part 86 regarding the tank-sizing provisions migrated into part 1036.

30 Cross-sector issues

30.1 Confidentiality determinations

Comments by Organizations

Organization: *Alliance for Automotive Innovation (Auto Innovators)*

40 C.F.R. 1068.10 Practices for handling confidential business information.

Auto Innovators recommends that various data submitted either during certification, greenhouse gas reporting, defect reporting, or in-use testing continue to be processed through EPA's existing confidential business information (CBI) process. The existing process balances the agency's Freedom of Information Act obligations while ensuring that highly valuable competitively sensitive and trade secret information is not released. Further, that practice remains consistent with the Supreme Court's decision that, 'where commercial or financial information is both customarily and actually treated as private by its owner and provided to the government under an assurance of privacy, the information is 'confidential'' under 5 U.S.C. 552(b)(4). Food Marketing Institute v. Argus Leader Media, 139 S. Ct. 2356, 2366 (2019). [EPA-HQ-OAR-2019-0055-1303-A1, p.7]

Troublingly, EPA's proposal seeks to deprive broad and vague classes of information of confidential treatment. The proposal considers those classes of data in isolation, and disregards the fact that the structure, groupings, relationship, and organization of data can also reveal CBI. Moreover, the structure of EPA's proposal would default the agency to releasing this information without any visibility into how the agency applies its vague and broad classes, especially in instances where a document might contain a mixture of information fitting with EPA's proposed classes of remission data and information in 40 C.F.R. 1068.11(c) that would still be subject to the processes of 40 C.F.R. Part 2. [EPA-HQ-OAR-2019-0055-1303-A1, p.7]

Such regulatory change would depart from the long-standing definition of ‘emission data’ in 40 C.F.R. 2.301(a)(2) which, among other limitations, encompasses only information about the past (e.g., ‘emission which has been emitted’). [EPA-HQ-OAR-2019-0055-1303-A1, p.7]

For example, the proposal would prevent confidential treatment of ‘[c]ertification and compliance information, including information submitted in an application for a certificate of conformity that is used to assess compliance.’ This could arguably encompass the entirety of the information submitted by automakers to the EPA, given that it appears to be coterminous with the agency’s authority to obtain information from the industry. 42 U.S.C. 7525, 7541, and 7542. In other words, it is not clear what information automakers provide EPA except certification and compliance information. Next, the proposal would prevent confidential treatment of ‘[t]est information and results, including emission test results and other data from . . . any other testing to demonstrate emissions.’ While the results of a test to measure regulated pollutants may be exempt from confidential treatment once the subject vehicle was introduced into commerce, there is abundant ‘other data’ related to the emissions test that would reveal specific aspects of the vehicle design and construction, including proprietary information like software and calibrations. Yet another example is found in the proposal to prevent confidential treatment of ‘ABT credit information, including information submitted for current and future compliance demonstrations using credits under an ABT program.’ This plainly disregards the temporal limitation in 2.302(a)(2) and would be fairly understood to encompass forecasted sales volumes and product mix, which are inseparable from emissions performance in any discussion of ABT credits and compliance. [EPA-HQ-OAR-2019-0055-1303-A1, p.7]

While creating public-facing documents remains an option for regulated entities, continuing to treat data that is shared with EPA to be confidential and subject to the existing process under 40 C.F.R. Part 2 will result in fewer instances where EPA publicly releases information that is not otherwise deemed available for the public. Should the agency elect to proceed with explicitly defining classes of information subject to 40 C.F.R. Part 2, EPA should ensure that confidential information submitted regarding advanced technologies or off-cycle credits is not considered ‘emission data.’ [EPA-HQ-OAR-2019-0055-1303-A1, p.7]

Auto Innovators requests that any final regulatory changes on these and related topics be consolidated in either Part 2 or Part 1068. As proposed, the new language straddles both parts (and suggests the standard-setting part has even more pertinent provisions) and this is likely to cause confusion for industry and the agency in implementation. [EPA-HQ-OAR-2019-0055-1303-A1, p.7] Finally, Auto Innovators recommends that EPA delete the text ‘and to any information we collect from inspections, audits, or other site visits’ from the proposed lead-in to 40 C.F.R. 1068.10. Information collected from these sources should not be a part of the CBI analysis because it is not information that is ‘submitted’ but is rather information obtained on the spot by EPA. [EPA-HQ-OAR-2019-0055-1303-A1, p.8]

Organization: *California Air Resources Board (CARB)*

CARB staff supports the proposal that specified categories of information that manufacturers 'must submit under the standard-setting parts for certification, compliance oversight, and in response to certain enforcement activities would be subject to disclosure to the public without further notice.'197 CARB staff also supports the proposal 'to establish a broadly applicable set of confidential business information determinations by categories of information, through rulemaking.'198 [EPA-HQ-OAR-2019-0055-1186-A2, p.130]

197 NPRM at p. 17609.

198 NPRM at p. 17610.

These proposals are appropriate and warranted for the reasons set forth by U.S. EPA in the NPRM. They will enable U.S. EPA to more efficiently respond to freedom of information act requests, will help ensure that U.S. EPA consistently applies the proposed confidentiality determinations across the numerous categories of information it receives under specified certification, compliance, and certain enforcement programs, will provide more objective and predictable guidance for information providers and requesters, and will provide the public greater transparency regarding the certification programs. [EPA-HQ-OAR-2019-0055-1186-A2, p.130]

U.S. EPA is specifically requesting comment regarding the proposed categories of information, the confidentiality determinations of those categories, and its proposed placement of data points within the proposed categories.199 [EPA-HQ-OAR-2019-0055-1186-A2, p.131]

199 NPRM at p. 17619.

CARB staff recommends that U.S. EPA retain the proposed categories of information: (1) certification and compliance information, (2) fleet value information, (3) source family information, (4) test information and results, (5) ABT credit information, (6) production volume information, (7) defect and recall information, and (8) SEA compliance information. CARB staff concurs that although 'much of the information submitted under the standard-setting parts could be logically grouped into more than one category',200 the proposed approach of categorizing information into the proposed categories of information both appropriately describes the affected information and clarifies the proposed confidentiality determinations for each above-mentioned category of information. [EPA-HQ-OAR-2019-0055-1186-A2, p.131]

200 NPRM at 17611.

U.S. EPA is specifically requesting comment regarding every rationale presented in the confidential business information (CBI) chart for information proposed to be classified as emissions data.201 [EPA-HQ-OAR-2019-0055-1186-A2, p.131]

201 NPRM at 17611.

CARB staff supports the proposed confidentiality determinations for the proposed categories of information, including the proposed inclusion of subcategories of information, (i.e., data points) within each of the proposed categories, for the reasons expressed by U.S. EPA in pages 17611 through 17619 in the NPRM, and in the CBI chart associated with this proposal.202 [EPA-HQ-OAR-2019-0055-1186-A2, p.131]

202 'CBI Categories for All Industries All Programs' (hereinafter 'CBI Chart'), attachment to Memorandum to docket EPA–HQ–OAR-2019-0055, 'Supplemental Information for CBI Categories for All Industries and All Programs,' Zaremski, Sara. October 1, 2021, EPA-HQ-OAR-2019-0055-0765_attachment_1.

CARB staff offers the following recommendation:

- The proposal would maintain confidential treatment for the subcategories of information identified in Sections XI.A.1.i.a, XI.A.1.i.b, and XI.A.1.i.c until the product described by that information is introduced into commerce. U.S. EPA states that the introduction to commerce date is specified in an application for certification. However, the applications for certification for certain regulated products, including on-road HDEs and light-duty motor vehicles, do not appear to expressly require manufacturers to specify the date they intend to introduce certified engines into commerce (see, e.g., 40 CFR 1036.205, 86.007-21, 86.004-21, 86.094-21, 40 CFR 86.1844-01).203 CARB staff suggests that the categories of information identified in Sections XI.A.1.i.a, XI.A.1.i.b, and XI.A.1.i.c would be entitled to confidential treatment until the date the certificate of conformity for a regulated product is issued. [EPA-HQ-OAR-2019-0055-1186-A2, pp.131-132]

203 See also 40 CFR 59.623 (information required in applications for certification of portable fuel containers.)

U.S. EPA is requesting comment regarding how it can treat preliminary or superseded information supplied by manufacturers to certify products and to demonstrate compliance, to 'protect the public from incomplete or inaccurate information.'204 [EPA-HQ-OAR-2019-0055-1186-A2, p.132]

204 NPRM at p. 17618.

CARB staff suggests that, to the extent U.S. EPA is aware that requested information constitutes preliminary information, it can include an express disclaimer informing the requester of that fact. Similarly, to the extent that U.S. EPA is aware that requested information constitutes superseded information, it can include an express disclaimer informing the requester of that fact. [EPA-HQ-OAR-2019-0055-1186-A2, p.132]

Organization: *Cummins Inc. (Cummins)*

EPA proposes in §1068.11(a) that several categories of information qualify as emissions data which EPA may disclose to the public. Cummins disagrees with allowing the categories in (a)(4)-(8) to be disclosed to the public. Those categories, especially related to testing, modeling inputs (including steady-state fuel maps and other GEM engine inputs as would be required by §1036.815), ABT information, production volumes, and defect and recall information, contain sensitive and trade secret information. That information is developed at great expense and effort by the manufacturer and is not readily obtainable by others. Disclosing it publicly could give competitors insight on a manufacturer’s technical and business strategies. Cummins urges EPA not to finalize the changes to confidentiality in §1068.11(a)(4)-(8) and §1036.815. [EPA-HQ-OAR-2019-0055-1325-A1, p. 17]

EPA proposes to retain today's case-by-case confidentiality determination of other categories of information in §1068.11(c), which Cummins supports. [EPA-HQ-OAR-2019-0055-1325-A1, p. 18]

Organization: *Department of Navy, Department of Defense (DoD)*

In the preamble EPA states: "We are proposing amendments in two areas of note for the general compliance provisions in 40 CFR part 1068. First, we are proposing to take a comprehensive approach for making confidentiality determinations related to compliance information that companies submit to EPA. We are proposing to apply these provisions for all highway, nonroad, and stationary engine, vehicle, and equipment programs, as well as aircraft and portable fuel containers." [EPA-HQ-OAR-2019-0055-1222-A1, p.3]

In finalizing EPA's stated goal of a "comprehensive approach" for confidentiality determinations related to engine manufacturer compliance information submitted to EPA for all emissions standard setting provisions, DoD requests that EPA incorporate provisions to the rule to accommodate DoD national security concerns about broad availability of non-emissions technical performance data for engines used in national defense and homeland security applications. This would include but would not be limited to engines covered by exemptions found at 40 CFR 1068.225(d). [EPA-HQ-OAR-2019-0055-1222-A1, p.3]

DoD's concern is that the availability of critical data, such as fuel flow rates for engines used in military aircraft, ground vehicles and marine applications can provide a strategic advantage to foreign adversaries. This security concern also extends to key stationary engines being used as emergency generators, where knowledge of technical data for these engines would provide insight into DoD critical installation resiliency capabilities in event of actions such as a cyber-attack on commercial grid power sources. [EPA-HQ-OAR-2019-0055-1222-A1, p.3]

Recommendation: DoD requests EPA include provisions for allowing engine manufacturers to claim as confidential any engine performance data (e.g., emissions rate) that is considered "national security information". [EPA-HQ-OAR-2019-0055-1222-A1, p.3]

DoD is willing to work with EPA on specific language to include in the final rule that would address DoD's national security concern and meet EPA's intent for public availability of engine technical information. [EPA-HQ-OAR-2019-0055-1222-A1,p .3]

DoD suggests any such language be structured so the EPA would approve only those manufacturers "national security information" designation requests where that request to EPA has been endorsed by an agency of the Federal Government responsible for national defense or homeland security. This would be similar to existing EPA requirement founds at 40 CFR 1068.225(d) for case by case EPA review of national security exemptions for engines. [EPA-HQ-OAR-2019-0055-1222-A1, p.3]

Organization: *Moving Forward Network (MFN)*

While we have utilized numerous resources and the best data publicly available, we have no way to validate our estimates of the sales-weighted distribution of certified engines and the credits generated by these engines, owing to the limitations of the current confidentiality-determination process. While greater data is available under the light- and heavy-duty vehicle greenhouse gas programs, and stakeholders including state regulators and the engine manufacturers themselves have access to this engine certification data, the general public does not. [EPA-HQ-OAR-2019-0055-1277-A1, pp. 50 - 51]

Information about credits and compliance goes directly to the public's ability to assess how well the program is driving actual emissions reductions, as compared to the generation of credits from so-called flexibilities which can undercut those reductions. Transparency in such credits is critical. [EPA-HQ-OAR-2019-0055-1277-A1, p. 51]

The purported basis for concealing "Confidential Business Information" (CBI) is that it would provide competitors with an advantage. However, many of the information categories EPA has proposed eliminating confidential treatment for are already available to competitors through expensive industry databases. Manufacturers are therefore not at greater risk under the proposed relaxation of these specific categories, and it is the public who is at risk if they continue to remain in the dark under the current constraints. [EPA-HQ-OAR-2019-0055-1277-A1, p. 51]

For example, the real-world performance data provided by EPA on heavy-duty trucks187 illustrated the massive shortcomings in the current test procedures and emissions control equipment as well as the harms those vehicles posed in real-world operation, and organizations were able to sort through that data to identify systemic problems and aid in advocating for solutions.188 However, by the time this data was released, some of those dirty vehicles had been polluting communities for as many as 8 years. Moreover, there was no way to assess the health impacts of these shortfalls because while information about an individual truck and engine configuration were identified (e.g., a 2010 Ford F-650 delivery vehicle with a Cummins ISB 6.7 diesel engine), there is little information on usage or sales to extrapolate the breadth of the shortfall of emissions from these trucks. Given the breadth of data collected by the agency as part of its proposed off-cycle program and the value that such detailed data can have for communities affected on the ground by freight traffic, expanding the availability of this data collected as part of regulatory compliance, can help identify such problematic issues in a timelier manner. [EPA-HQ-OAR-2019-0055-1277-A1, p. 51]

187. https://www.epa.gov/compliance-and-fuel-economy-data/manufacturer-run-use-testing-program-data-heavy-duty-diesel-1

188. For example, https://theicct.org/publication/current-state-of-nox-emissions-from-in-use-heavy-duty-diesel-vehicles-in-theunited- states/.

By improving transparency of its datasets, EPA can also ensure that its own data is more accurate. Environmental justice communities that directly experience the emissions from these trucks and the volume of traffic from these trucks have had to hold truck counts because of outdated data being considered by the agency. Greater transparency in the assumptions being used by EPA can improve clarity to the public how valid its assumptions are (or not), and provide another check for the community to assess when EPA's assumptions are inconsistent with local freight impacts. [EPA-HQ-OAR-2019-0055-1277-A1, p. 51]

We strongly support the greater transparency that the proposed adjustments to CBI determination will have. Moving forward, we request that EPA continue to improve transparency for all of its vehicle programs regulated under the Clean Air Act, particularly on reporting more data at an engine/vehicle level to understand how individual classes, applications, and/or manufacturers may be responding to these regulations. The public deserves more information to fully understand engine and vehicle emissions performance, including for specific configurations. Currently manufacturers already have such access—it's long past time that the public does as well. [EPA-HQ-OAR-2019-0055-1277-A1, p. 51]

Organization: *Roush CleanTech (Roush)*

Roush supports the addition of the proposed 1065.410(c) language relative to use of standard electronic tools, as well as the updated disclosure and confidentiality language in part 1068. Roush would further recommend that EPA codify requirements for manufacturers to fully disclose, without claiming as confidential, all information reasonably required in order to conduct emissions testing as specified in the standard. We believe that the ability for agencies and third parties to be able to verify emissions testing results is crucial, but is typically impossible under current disclosure practices-- even such basic parameters as curb idle transmission torque are not typically disclosed in the FOI application even though it is clear this is not protected confidential business information. If manufacturers utilize non-production hardware (such as transmission or other vehicle signal simulators, non-production ECU's, etc.) and/or non-production software (such as calibrations which are modified to disable OBD faults related to vehicle testing) in order to conduct certification testing, manufacturers should be required to disclose the designs of such devices as well as provide information required for agencies or third parties to obtain the required items for testing. It is simply unacceptable that current engine test results cannot be verified by third parties. We anticipate this issue only getting worse with the new standard; for example, the new 1065.510(a) requires disabling torque output AECD's, but there is no requirement to document how the AECD's were disabled or how they would be disabled during agency or third party testing. Similarly, the new 1066.415(e)(2) requires written notification to the agency for modifications required for dynamometer testing, but no clear requirement for these to be included in the certification application. [EPA-HQ-OAR-2019-0055-1276-A1, p.5]

Organization: *S&P Global Mobility*

S&P Global Mobility supports the Environmental Protection Agency's (EPA) Notice of Proposed Rulemaking for Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards (NPRM), specifically the provisions related to production volume data being considered emissions data not subject to confidential treatment.

The EPA's proposal that production volume information is intrinsically emissions data, not Confidential Business Information (CBI), is an important step forward in providing data transparency around emissions compliance. This data is fundamental to the determination of overall fleet emissions compliance. As fleet emissions compliance values are necessarily a sales-weighted average of individual vehicle or engine certification levels, final production volumes associated with each certification group (e.g., test group) should be disclosed publicly to facilitate the transparency of compliance determinations. It is only through public access to both the emissions certification levels ***and*** the final production volumes that emissions compliance position can be replicated by concerned third-party organizations. The ability to replicate the manufacturers' compliance positions is an important part of the integrity of the EPA's mobile source emissions programs, including the Greenhouse Gas Program. [EPA-HQ-OAR-2019-0055-1273-A1, p. 1]

Public disclosure of a manufacturer's final production volume for each discrete make, model, and powertrain combination will not compromise a manufacturer's competitive position, particularly when considering year-end volumes. After the close of a model year the production volume information related to the past model year production will have become historical performance. By the time that EPA releases this data to the public it should no longer be considered CBI. The disclosure of historical production performance should not be viewed as creating commercial harm. The public interest is improved through greater transparency in assuring compliance with emissions regulations. [EPA-HQ-OAR-2019-0055-1273-A1, pp. 1 - 2]

The adoption of the policies outlined on pages 17614 and 17618 related to the publication of production volumes as emissions data, not subject to confidential treatment, is a positive development. Much of that information can currently be pieced together via third-party data sources, including S&P Global Mobility's database of vehicle technical specifications combined with sources of vehicle registration data. However, these data sources are not completely aligned with the actual data used by EPA to determine emissions compliance. Thus, without the actual production volume inputs used by EPA to compute manufacturers' emissions compliance, the true compliance position cannot be publicly replicated. We view this as a serious shortcoming which can be easily remedied through the adoption of the EPA's proposal to make public the production volume information at the conclusion of each model year. [EPA-HQ-OAR-2019-0055-1273-A1, p. 2]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EPA is proposing "to take a comprehensive approach for making confidentiality determinations related to the compliance information that companies submit to EPA." (87 FR at 17426.) More specifically, the Agency is proposing to make a series of categorical determinations that certain types of submitted compliance information will not be treated as confidential business information. The Agency also is proposing to maintain "the 40 CFR part 2" case-by-case process for making CBI determinations for all other submitted information not covered by the proposed categorial determinations of non-confidentiality. [EPA-HQ-OAR-2019-0055-1203-A1, p. 165]

EPA has categorized the types of emissions data that will be deemed subject to public disclosure, as follows:

- Certification and compliance information, which includes models and parts information, family determinants, general emission control systems information, and certificate request/requestor information;
- Fleet value information, which includes offsets, displacements, useful life, power payload tons, load factor, integrated work cycle, cycle conversion factors and test cycle, source classification, averaging set, intended application, and advanced technology ("AT") factors;
- Source family information, which includes engine family information, vehicle family information, subfamily name, engine family designation, and test group information;
- Test information and results, which include information collected during the certification process, PLT testing, in-use testing programs, and testing performed during in SEA, and which covers the actual test results themselves and the information necessary to understand those results and how the testing was conducted (including adjustments, modifications, maintenance, service hours, and detailed information regarding the recruitment and testing of in-use vehicles);
- Averaging, banking, and trading ("ABT") credit information, including banked credits, transferred credits, total credits, credit balance, and annual credit balance;
- Production volume information, which includes the total number of engines, vehicles or equipment produced;
- Defect and recall information, which includes any reported emissions data and an estimate of the defect's impacts on emissions, and the relevant information collected under the standard-setting parts, but not including the "defect investigation report;" and
- Selective enforcement audit ("SEA") compliance information, which includes family name, when and where the SEA was conducted, the number of tests conducted, test article details, how the engines were shipped and stored, and test results. (See 87 FR at pp. 17611-17618.) [EPA-HQ-OAR-2019-0055-1203-A1, pp. 16-166]

The Agency's proposal also lists a number of information categories where the confidentiality determination will continue to be made on a 40 CRR Part 2 case-by-case basis, as is the current practice. EPA describes those categories of emissions-data information, as follows:

(1) projected production and sales,

(2) production start and end dates outside of the defect and recall context,

(3) specific and detailed descriptions of the emissions control operation and function,

(4) design specifications related to aftertreatment devices,

(5) specific and detailed descriptions of auxiliary emission control devices (AECDs),

(6) plans for meeting regulatory requirements (e.g., ABT pre-production plans),

(7) procedures to determine deterioration factors and other emission adjustment factors and any information used to justify those procedures,

(8) financial information related to ABT credit transactions (including dollar amount, parties to the transaction and contract information involved) and manufacturer bond provisions (including aggregate U.S. asset holdings, financial details regarding specific assets, whether the manufacturer or importer obtains a bond, and copies of bond policies),

(9) serial numbers or other information to identify specific engines or equipment selected for testing,

(10) procedures that apply based on the manufacturers request to test engines or equipment differently than we specify in the applicable standard-setting parts,

(11) information related to testing vanadium catalysts in 40 CFR part 1065, subpart L (proposed in the NPRM),

(12) GPS data identifying the location and route for in-use emission testing,

(13) defect investigation reports — The information contained in defect investigation reports may encompass both emission data and information that may be CBI, so EPA is not proposing a determination for this report as whole. Instead, procedurally the Agency will treat those reports in accordance with the existing case-by-case determination process — and

(14) comments submitted in the “comment field” of EPA’s compliance reporting software. (See 87 FR at p. 17619.) [EPA-HQ-OAR-2019-0055-1203-A1, pp. 166-167]

EMA has a number of concerns regarding the Agency’s proposal for making generalized CBI determinations going forward. More specifically, a number of the broad categories of submitted information that the Agency proposes to treat generally as non-confidential do, in fact, include CBI that warrants protection from public disclosure. [EPA-HQ-OAR-2019-0055-1203-A1, p. 167]

The Agency’s proposed rationale for making such broad and general a priori CBI/non-CBI determinations seems to stem from the workload that the Agency needs to undertake to ensure that FOIA requests do not sweep-up or otherwise compromise CBI. But a desire to reduce the Agency’s workload is not a sufficient basis to violate manufacturer’s trade secret rights, including under the Uniform Trade Secrets Act. Moreover, to the extent that EPA acts to remove the current presumptive protections for manufacturers’ CBI claims, the Agency actually will incentivize more, not fewer, FOIA requests, as competitors would be spurred-on to discover all that they could about other OEM’s products and processes, an outcome that could have grave consequences for the industry. [EPA-HQ-OAR-2019-0055-1203-A1, p. 167]

In light of the foregoing, the Agency will need to revise its proposed categorical determinations accordingly. Set forth below is a chart that delineates EMA’s concerns in this regard. [EPA-HQ-OAR-2019-0055-1203-A1, p. 167]

Section: § 1068.11(a)(1)

Comment: This paragraph (a) applies the definition of ‘‘Emission data’’ in 40 CFR 2.301(a) for information related to engines/equipment subject to this part. ‘‘Emission data’’ cannot be treated as confidential business information and shall be available to be disclosed to the public except as specified in § 1068.10(d)(1). The following categories of information qualify as emission data, except as specified in paragraph (c) of this section:

Text: 1. Certification and compliance information, which includes models and parts information, family determinants, general emission control systems information, and certificate request/requestor information;

EMA comments: Except for the certificate requestor, all of this information is released with a Certificate of Conformity. [EPA-HQ-OAR-2019-0055-1203-A1, p. 167]

Section: § 1068.11(a)(2)

Comment: Proposed categorization as nonconfidential information

Text: 2. Fleet value information, which includes offsets, displacements, useful life, power payload tons, load factor, integrated work cycle, cycle conversion factors and test cycle, source classification, averaging set, intended application, and advanced technology (“AT”) factors;

EMA comments: All of this is public information. [EPA-HQ-OAR-2019-0055-1203-A1, p. 167]

Section: § 1068.11(a)(3)

Comment: Proposed categorization as nonconfidential information

Text: 3. Source family information, which includes engine family information, vehicle family information, subfamily name, engine family designation, and test group information;

EMA comments: All of this is public information. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 167-168]

Section: § 1068.11(a)(4)

Comment: Proposed categorization as nonconfidential information. Instead, should be handled on case-by-case basis.

Text: 4. Test information and results, which include information collected during the certification process, PLT testing, in-use testing programs, and testing performed during an SEA, and which covers the actual test results themselves and the information necessary to understand those results and how the testing was conducted (including adjustments, modifications, maintenance, service hours, and detailed information regarding the recruitment and testing of in-use vehicles);

EMA comments: This category includes very competitive CBI. [EPA-HQ-OAR-2019-0055-1203-A1, p. 168]

Section: § 1068.11(a)(5)

Comment: Proposed categorization as nonconfidential information. Instead, should be handled on case-by-case basis.

Text: 5. Averaging, banking, and trading (“ABT”) credit information, including banked credits, transferred credits, total credits, credit balance, and annual credit balance;

EMA comments: This category includes very competitive CBI [EPA-HQ-OAR-2019-0055-1203-A1, p. 168]

Section: § 1068.11(a)(6)

Comment: Proposed categorization as nonconfidential information. Instead, should be handled on case-by-case basis.

Text: 6. Production volume information, which includes the total number of engines, vehicles or equipment produced;

EMA comments: For HDOH engines, this information is released after the end of the model year. Before then, projections should remain CBI. In addition, other engine-product sectors do not disclose production volumes, and that information from those other engine-product sectors should remain CBI. [EPA-HQ-OAR-2019-0055-1203-A1, p. 168]

Section: § 1068.11(a)(7)

Comment: Proposed categorization as nonconfidential information. Instead, should be handled on case-by-case basis.

Text: 7. Defect and recall information, which includes any reported emissions data and an estimate of the defect’s impacts on emissions, and the relevant information collected under the standard-setting parts, but not including the “defect investigation report;” and

EMA comments: Emissions data are competitive CBI. [EPA-HQ-OAR-2019-0055-1203-A1, p. 168]

Section: § 1068.11(a)(8)

Comment: Proposed categorization as nonconfidential information. Instead, should be handled on case-by-case basis.

Text: 8. Selective enforcement audit (“SEA”) compliance information, which includes family name, when and where the SEA was conducted, the number of tests conducted, test article details, how the engines were shipped and stored, and test results.

EMA comments: Test results are competitive CBI. [EPA-HQ-OAR-2019-0055-1203-A1, p. 168]

Section: § 1068.11(b)(1)

Comment: (b) The following categories of information are not eligible for confidential treatment, except as specified in § 1068.10(d)(1): (d) If you submit information that is not addressed in paragraphs (a) through (c) of this section, you may claim the information as confidential. We may require you to provide us with information to substantiate your claims. If claimed, we may consider this substantiating information to be confidential to the same degree as the information for which you are requesting confidential treatment. We will make our determination based on your statements to us, the supporting information you send us, and any other available information. However, we may determine that your information is not subject to confidential treatment consistent with 40 CFR part 2 and 5 U.S.C. 552(b)(4).

Text: Published information, including information that is made available in annual and quarterly filings submitted to the U.S. Securities and Exchanges Commission, on company websites, or otherwise made publicly available by the other submitter.

EMA comments: EMA agrees. [EPA-HQ-OAR-2019-0055-1203-A1, p. 169]

Section: § 1068.11(b)(2) and § 1068.11(c)(1)

Comment: Not confidential information. The following categories of information are subject to the process for confidentiality determinations in 40 CFR part 2, as described in 40 CFR 2.301(j)(5).

Text: Observable information available to the public after the introduction to commerce date. (1)Projected sales and production volumes.

EMA comments: EMA agrees. Projected numbers should remain CBI. [EPA-HQ-OAR-2019-0055-1203-A1, p. 169]

Section: § 1068.11(c)(2)

Comment: May ask for CBI

Text: (2)Production start and end dates.

EMA comments: EMA agrees. Production dates could be competitive. [EPA-HQ-OAR-2019-0055-1203-A1, p. 169]

Section: § 1068.11(c)(3)

Comment: May ask for CBI

Text: (3) Detailed description of emission control operation and function.

EMA comments: Highly competitive CBI. [EPA-HQ-OAR-2019-0055-1203-A1, p. 169]

Section: § 1068.11(c)(4)

Comment: May ask for CBI

Text: (4) Design specifications related to aftertreatment devices.

EMA comments: Highly competitive CBI. [EPA-HQ-OAR-2019-0055-1203-A1, p. 169]

Section: § 1068.11(c)(5)

Comment: May ask for CBI

Text: (5)Description of auxiliary emission control devices (AECDs).

EMA comments: These strategies are highly sensitive CBI. [EPA-HQ-OAR-2019-0055-1203-A1, p. 169]

Section: § 1068.11(c)(6)

Comment: May ask for CBI

Text: (6) Plans for meeting regulatory requirements. For example, this applies for any projections of emission credits for the coming model year or determinations of the number of required repair facilities that are based on projected production volumes.

EMA comments: Plans should always remain CBI. [EPA-HQ-OAR-2019-0055-1203-A1, p. 169]

Section: § 1068.11(c)(7)

Comment: May ask for CBI

Text: (7) The following information related to deterioration factors and other adjustment factors: (i) Procedures to determine deterioration factors and other emission adjustment factors. (ii)Any information used to justify those procedures. (iii)Emission measurements you use to compare procedures or demonstrate that the
procedures are appropriate.

EMA comments: Emissions data are competitive CBI. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 169-170]

Section: § 1068.11(c)(8)

Comment: May ask for CBI

Text: (8) Financial information related to the following items: (i)ABT credit transactions, including dollar amount, identity of parties, and contract information. (ii)Meeting bond requirements, including aggregate U.S. asset holdings, financial details regarding specific assets, whether the manufacturer or importer obtains a bond, and copies of bond policies.

EMA comments: Financial information relating to ABT is CBI. [EPA-HQ-OAR-2019-0055-1203-A1, p. 170]

Section: § 1068.11(c)(9)

Comment: May ask for CBI

Text: (9) Serial numbers or other information to identify specific engines or equipment selected for testing.

EMA comments: EMA agrees. [EPA-HQ-OAR-2019-0055-1203-A1, p. 170]

Section: § 1068.11(c)(10)

Comment: May ask for CBI

Text: (10)Procedures that apply based on your request to test engines/equipment differently than we specify in the regulation. This applies for special and alternative test procedures. This also applies, for example, if we approve a broader or narrower zone of engine operation for not-to-exceed testing.

EMA comments: Emissions testing protocols outside the prescribed regulations can be competitive CBI. [EPA-HQ-OAR-2019-0055-1203-A1, p. 170]

Section: § 1068.11(c)(11)

Comment: May ask for CBI

Text: (11) Information related to testing vanadium catalysts in 40 CFR part 1065, subpart L.

EMA comments: EMA agrees. [EPA-HQ-OAR-2019-0055-1203-A1, p. 170]

Section: § 1068.11(c)(12)

Comment: May ask for CBI

Text: (12) GPS data identifying the location for in-use emission measurements.

EMA comments: Route information can be very competitive CBI. [EPA-HQ-OAR-2019-0055-1203-A1, p. 170]

Section: § 1068.11(c)(13)

Comment: May ask for CBI

Text: (13) Information related to possible defects that are subject to further investigation (not confirmed defects).

EMA comments: During the investigative phase these should remain CBI. [EPA-HQ-OAR-2019-0055-1203-A1, p. 170]

EPA should revise its proposal regarding future confidentiality determinations in a manner consistent with the foregoing highlighted concerns. [EPA-HQ-OAR-2019-0055-1203-A1, p. 170]

Organization: *Volkswagen Group of America, Inc., (Volkswagen) (VWGoA)*

<u>40 CFR 1068.10 General compliance provisions for highway, stationary, and nonroad programs</u>

We recommend that various data submitted either during certification, defect reporting, or In-use testing continue to be treated by the EPA as CBI unless specifically declared public by the OEM. While creating public-facing documents is possible, continuing to treat data that is shared with EPA to be confidential will lead to far fewer mistakes of potentially revealing data not otherwise deemed available for the public. [EPA-HQ-OAR-2019-0055-1296-A1, p.3]

Organization: *Volvo Group*

The Volvo Group wants to assure that test data and other vehicle, engine, powertrain, and component information not reasonably obtainable is held as confidential business information (CBI). [EPA-HQ-OAR-2019-0055-1324-A1, p. 9]

The Volvo Group is supportive of the agency's attempt to streamline the current case-by-case confidentiality determination procedure as proposed in the Clean Trucks Plan NPRM; however, we do have substantial concerns in some areas. [EPA-HQ-OAR-2019-0055-1324-A1, p. 9]

First, given the ambiguous definition of Emission data as given in 40 CFR 2.301(a)(2), it could be construed that any information provided to the Agency for certification of engines or vehicles, unless voluntarily submitted, could be considered as non-confidential, even where a determination of non-confidentiality has not been made in the proposed rule. [EPA-HQ-OAR-2019-0055-1324-A1, p. 9]

For example, an Auxiliary Emission Control Device (AECD) description covering shift strategy for an automated transmission, which is proposed to be considered indeterminate and covered under the case-by-case process, could be critical in determining the "amount, frequency, concentration, or other characteristics (to the extent related to air quality) of any emission which has been emitted by the source (or of any pollutant resulting from any emission by the source), or any combination of the foregoing" as noted in the definition of emission data from 40 CFR 2.301(a)(2)(i)(A), thus making a proprietary technology that other manufacturers have attempted to copy available for easy replication. It could also be argued that the same information could be considered emission data under 2.301(a)(2)(i)(C), which defines emission data as "A general description of the location and/or nature of the source to the extent necessary to identify the source and to distinguish it from other sources (including, to the extent necessary for such purposes, a description of the device, installation, or operation constituting the source)". [EPA-HQ-OAR-2019-0055-1324-A1, p. 9]

Additionally, it is not entirely certain whether the emission data definition applies to raw test data and results, including raw coast down data and an actual vehicle's drag coefficient (Cd) and subsequent Faltaero calculations and values, or whether it only includes the GEM inputs necessary to determine the FEL (e.g., Bin V). If the latter, it is not clear whether the emission data and subsequent confidentiality determination would apply only to the required ten vehicle configurations for each vehicle family certification application or would also apply to all possible configurations. [EPA-HQ-OAR-2019-0055-1324-A1, p. 9]

Given this, the Volvo Group requests either a revision of the 40 CFR 2.301(a)(2) definitions for clarity, or additional discussion in the preamble to the final rule and to 40 CFR 1068.11 to provide additional examples of what is, and is not, emission data under the Part 2 definition. Those items noted above (and other similar items to be identified) should then be classified as confidential under the "reasonably obtainable" provisions of 40 CFR 2.208 as allowed in 40 CFR 2.301(e). [EPA-HQ-OAR-2019-0055-1324-A1, p. 9]

Secondly, we are disappointed in EPA's lack of confidentiality determinations for specific data types. Given the potential loss of competitive advantage due to the release of proprietary information, as well as the possibility for the misleading competitive marketing use of specific test data and results, we strongly urge the Agency to make these confidentiality determinations wherever possible. [EPA-HQ-OAR-2019-0055-1324-A1, p. 10]

As an example, the Volvo Group has what we believe to be a competitive advantage using proprietary transmission shift strategies and corresponding engine control strategies that could be derived from AECD information or powertrain and fuel maps and test data. Considering those same fuel maps, a competitor could take our engine fuel map specifically calibrated to provide best fuel economy with our shift strategy and compare it to their engine fuel map in their vehicle specification with an entirely different shift strategy, resulting in a misleading advantage for their engine. [EPA-HQ-OAR-2019-0055-1324-A1, p. 10]

In conclusion, greenhouse gas certification data is not like criteria emissions data. Fuel economy is a significant part of the total cost of operation (TCO) for heavy-duty truck fleets. As such, fuel economy is a highly competitive aspect of our industry and proprietary strategies are highly guarded. Additionally, there are many different heavy-duty vehicle types and duty cycles that are not represented by the GEM calculations for which the GEM inputs could be misconstrued as providing more or less benefit for a specific customer's application. On top of this, manufacturers may utilize different strategies in certifying vehicles based on risk determinations, to include adding margin on GEM inputs to assure compliance to in-use and SEA (Selective Enforcement Audit) audits, whereas a competitor may not. [EPA-HQ-OAR-2019-0055-1324-A1, p. 10]

Thus, to avoid competitive issues, we would like to work with the Agency to develop a clear definition of proprietary information, and other required data that could be used in a misleading way to gain competitive advantage. The resultant set of information should then be determined confidential in a finalized Confidentiality Determination. Alternatively, and at a minimum, the identified information must be specified as “indeterminate” and follow the 40 CFR Part 2 ‘case-by-case” determination process. [EPA-HQ-OAR-2019-0055-1324-A1, p. 10]

Organization: *Walmart*

We believe broadcasting signals of fleet specific information must be confidential and systems should be designed to protect fleet owners and operators. [EPA-HQ-OAR-2019-0055-1191-A2, p. 4]

EPA Summary and Response

Comment ID(s): 1186 (CARB), 1277 (MFN), 1276 (Roush), 1273 (S&P)	**Response:**
Many commenters support the determination that specified categories of information are emission data and, therefore, not entitled to confidential treatment. These commenters support the increased efficiency and consistency with which these determinations will enable EPA to respond to requests under the Freedom of Information Act (FOIA). The commenters also support the greater transparency these determinations will provide in the context of EPA's certification programs. One commenter particularly supported EPA's determination that production volume is emission data, as this information is "fundamental to the determination of overall fleet emissions compliance." (EPA-HQ-OAR-2019-0055-1273-A1, at 1 (S&P)). Another commenter specifically provided support for the organization of the information at issue in the determination, stating that "the proposed approach of categorizing information into the proposed categories of information both appropriately described the affected information and clarifies the proposed confidentiality determinations for each…category of information." (EPA-HQ-OAR-2019-0055-1186-A2, at 131 (CARB)).	EPA acknowledges the commenters' support on the emission data determinations in this rulemaking.

Comment ID(s): 1303 (Auto Innovators), 1296 (VW), 1191 (Walmart), 1324 (Volvo), 1325 (Cummins), 1203 (EMA) Some commenters recommended that EPA continue using the confidentiality determination process established in 40 CFR part 2 for certain information collected during certification, greenhouse gas reporting, defect reporting, and in-use testing, including fleet specific information, fuel maps, fuel economy and GHG certification data, GEM inputs, AECD, ABT information, production volumes, defect and recall information, advanced technologies or off-cycle credits, and certain testing information. The commenters stated that applying the existing process under 40 CFR part 2 to the specified information is appropriate due to the information's sensitive, competitive and proprietary nature. Additionally, the commenters state that applying the 40 CFR part 2 process would result in fewer instances where EPA publicly releases information that is not otherwise available to the public, since the information is not reasonably obtainable by the public and disclosing it could give their competitors an unfair advantage. The commenters also asserted that this method is consistent with the Supreme Court's holding in *Food Marketing Institute v. Argus Leader Media*, 139 S.Ct. 2356, 2366 (2019).	**Response:** EPA understands the concerns raised by the commenters. However, as explained in the proposed action, EPA is determining that certain categories of information are "emissions data." Under the CAA, information that is emissions data must be publicly available and, therefore, would not be entitled to confidential treatment under the 40 CFR part 2 process. While the commenters assert that the 40 CFR part 2 process would provide greater protections for the information at issue, that is not correct. Under the 40 CFR part 2 process, affected manufacturers would be offered an opportunity to substantiate their claims of confidentiality, and EPA, after considering the substantiation responses, would determine whether the information is entitled to confidential treatment. However, if EPA determines that the information is emission data under the Clean Air Act and 40 C.F.R §2.301(a), then no further review of the information submitter's claims is necessary under 40 CFR part 2 to determine whether the information meets the requirements for confidential treatment. EPA would then issue a determination that the information is not entitled to confidential treatment and the information submitter would have no further administrative recourse to refute EPA's determination. The only remaining recourse an information submitter would have would be to seek judicial review of EPA's determination that the information is not entitled to confidential treatment because the information is emission data. As explained in the proposal for this action, EPA is electing to make such a determination for certain categories of information in advance through rulemaking. Through this notice and comment process, EPA has given affected manufacturers the opportunity to address and respond to EPA's proposed finding that the information is emission data. To this point, the commenters have failed to provide any articulated explanation for why the information at issue in	

	the proposed determinations do not constitute "emission data." Indeed, the commenters do not address the nature of the information as emission data at all, or in some instances they appear to concede the point, calling the information at issue "emission data" themselves. (See EPA-HQ-OAR-2019-0055-1203-A1 at 168, EMA supplement at 2). Because the commenters did not provide a reasoned basis to support an argument that the information is not emissions data, and for the reasons explained in preamble Section XI, EPA is proceeding with these determinations. Some commenters pointed to the decision in *Argus Leader* for the proposition that EPA should be providing an express indication about how it intends to treat submitted information. EPA notes that through this rulemaking the agency is providing such an express indication, consistent with the *Argus Leader* case. Where the government provides an express indication to the submitter prior to or at the time the information is submitted to the government that the government would publicly disclose the information, then the submitter cannot reasonably expect confidentiality of the information upon submission, and the information is not entitled to confidential treatment. Through this rule, EPA has provided such an explicit notice regarding the information specified in 40 CFR 1068.11.	

Comment ID(s): 1303 (Auto Innovators)	**Response:**
The Alliance for Automotive Innovators (Auto Innovators) described EPA's information categories as vague. Auto Innovators asserted that is unclear how EPA will apply the categories to information it receives, particularly when emission data and other data that is still subject to the 40 CFR part 2 process are submitted in a single form. Auto Innovators also asserted that the information at issue in the determinations in this rulemaking, mainly information submitted or collected for certification or compliance, "could arguably encompass the entirety if the information submitted by automakers to the EPA." EPA-HQ-OAR-2019-0055-1303-A1, at 7.	In addition to the description of the information categories provided in the preamble, EPA has also provided a list of all categories of the information addressed by this determination in the docket for this rule. EPA also identified this information by citation to the specific regulations that require submission of such information for further clarity in a document included in the docket and referenced in the proposed and final rule preambles (CBI Categories for All Industries and All Programs.xlsx). Without more specific feedback from the commenter, it is unclear how EPA can provide greater clarity as to what information is within each category subject to this determination, as the Agency has already indexed all the information it collects by category and determination. Regardless, EPA notes that when submitters provide information on forms that is emissions data along with other information that may be entitled treatment as confidential, EPA subject matter experts who respond to FOIA requests will use the list of information and apply the corresponding confidentiality determination for each field.

Comment ID(s): 1303 (Auto Innovators), 1324 (Volvo) Some commenters alleged that releasing the information according to the determinations made in this rulemaking would result in more information than that covered by the categories to be discerned by the structure, groupings, relationship, and organization of the data. For example, one commenter suggested that information requesters would be able to glean proprietary transmission shift strategies and corresponding engine control strategies from AECD information or powertrain and fuel maps and certain test data. The commenters assert that this will disadvantage them by providing their competitors with access to their proprietary information.	**Response:** Regardless of whether the information EPA is here determining to be emission data could be used to discern other, related manufacturer information, the CAA specifies that information that qualifies as emission data cannot be withheld. For example, the commenters did not dispute EPA's proposed finding that the information in section 1068.11(a) meets the definition of emission data under 40 C.F.R. §2.301(a)(2). Additionally, it is not clear how the release of the information determined in this rule to be emission data could allow competitors to glean additional information that the manufacturers claim as confidential. Lastly, it is important to highlight that EPA is not, at this time, making any determination concerning detailed AECD information (AECD documents submitted by manufacturers at the time of certification). Thus, that information remains a type of information for which EPA will continue to make emissions data or confidentiality determinations on a case-by-case basis under the 40 CFR part 2 process.

Comment ID(s): 1303 (Auto Innovators), 1203 (EMA)	Response:
One commenter stated that the emission data determinations are inconsistent with the definition of emission data in 40 CFR 2.301(a)(2), which the commenter asserts only applies to information about the past (i.e., "emission which has been emitted," 40 CFR 2.301(a)(2)). This commenter specifically raised this question with respect to ABT credit information, which includes information submitted for current and future compliance demonstrations using credits. The commenter asserts that this information could be interpreted to include forecasted sales volumes and product mix, which are inseparable from emissions performance in the context of ABT credit and compliance demonstrations. Another commenter similarly suggested that projected sales and production estimates should be maintained as confidential.	EPA does not agree that only historical data, i.e., data from the past, constitutes emissions data. As an initial matter, the commenter fails to acknowledge that the specific type of information referenced in the comment is not purely information about future emissions. ABT credits and deficits can be generated based on current, past, and future products, used for immediate compliance, or banked and used for future compliance or traded. If EPA were to adopt the narrow interpretation of "emission which has been emitted" that the commenter advocates, it would lead to confusion about the public release of certificate information, and potentially a lack of transparency about emissions contrary to the intent of CAA section 208, because during the useful life of the engine or equipment that certificate information would simultaneously provide information relevant to both the future emissions and past emissions of the source. Additionally, there are three parts to the definition of "emission data" codified in 40 CFR 2.301(a)(2)(i), and this commenter refers to only the first, 40 CFR 2.301(a)(2)(i)(A). The other two subsections under the regulatory definition of "emission data" include information relating to "emissions which, under an applicable standard or limitation, the source was authorized to emit (including, to the extent necessary for such purposes, a description of the manner or rate of operation of the source)" (e.g., future emissions that have been authorized), and information "necessary to identify the source and to distinguish it from other sources (including, to the extent necessary for such purposes, a description of the device, installation, or operation constituting the source)." The emission data definition at 40 CFR 2.301(a)(2)(ii) excludes information concerning research or information about products that have not entered into commerce. Therefore, part (i) of

	the definition is intended to cover all information submitted once the engine is offered in commerce. Moreover, the CAA is clear that emission data must be available to the public and is not entitled to confidentiality. Therefore, it is reasonable that EPA determine that information that is inseparable from emissions performance in the context of ABT credits and compliance demonstrations is not entitled to confidential treatment as emission data. Lastly, EPA has specifically excluded forecasted or projected sales information from this determination, and thus such information will remain subject to the 40 CFR part 2 process under 40 CFR 1068.11(c)(1).
Comment ID(s): 1303 (Auto Innovators) Auto Innovators requested that EPA consolidate all the emission data determinations, and other confidentiality determinations, in one part under Title 40 instead of in both 40 CFR part 2 and part 1068. Auto Innovators stated that having related regulations in multiple parts is likely to cause confusion for industry stakeholders.	**Response:** EPA understands that having regulations that relate to the same topic, in this instance the treatment of information, in more than part in the Code of Federal Regulations may potentially be confusing to regulated entities and the public. However, EPA notes that the current 40 CFR part 2 regulations are generally applicable for CAA purposes, whereas the 40 CFR part 1068 regulations are specific to information related to mobile sources. EPA is modifying 40 CFR part 2 with a provision that clearly refers the reader to the 40 CFR part 1068 regulations. We anticipate that this cross reference will be sufficient to alert industry stakeholders about the interrelationship of the relevant 40 CFR part 2 and part 1068 regulations.

Comment ID(s): 1303 (Auto Innovators)	**Response:**
Auto Innovators requested that information collected from inspections, audits, or other site visits be excluded from the information determined to be emission data in this rulemaking. The commenter stated that, because this information is not submitted to the Agency, but is instead collected "on the spot" by EPA, it should not be included in the confidentiality determination in this rulemaking.	The CAA does not distinguish between information that is submitted by a regulated party and information that EPA collects through inspections, audits, or other site visits. Section 208(a) and (b) provide EPA with authority to obtain information by a variety of methods. Section 208(c) expressly provides that such information shall be available to the public if it is emissions data. EPA treats the information it has, regardless of how it was obtained, according to the nature of that information (e.g., whether it is emission data, trade secrets, etc.). Information EPA has collected during inspections, audits, or other site visits may qualify as emission data, and if so would not be entitled to confidential treatment. EPA has provided an extensive spreadsheet of the information it obtains, the information category it falls under, and whether it is emission data or otherwise not entitled to confidential treatment, in the docket for this rule (CBI Categories for All Industries and All Programs.xlsx).

Comment ID(s): 1186 (CARB), The California Air Resource Board (CARB) provided feedback on EPA's proposal to maintain confidential treatment for the subcategories of information identified in preamble Sections XI.A.1.i.a, XI.A.1.i.b, and XI.A.1.i.c until the product described by that information is introduced into commerce. CARB highlighted that the introduction to commerce date is not specified in all applications for certification. For example, applications for certification for on-road heavy-duty engines and light-duty motor vehicles, do not appear to expressly require manufacturers to specify the date they intend to introduce certified engines into commerce (see, e.g., 40 CFR 1036.205, 86.007-21, 86.004-21, 86.094-21, 86.1844-01; see also 40 CFR 59.623). CARB suggested that the categories of information identified above should be entitled to confidential treatment until the date the certificate of conformity for a regulated product is issued.	**Response:** EPA agrees with the commenter. Generally, EPA does receive an introduction-into-commerce date with an application for a certificate of conformity, even in cases where it is not required. However, when an application for certification does not specify an introduction-into-commerce date, or in situations where introduction into commerce occurs before the certificate is issued, EPA will apply the provisions related to confidentiality determinations in 40 CFR 1068.11 based on the date the certificate is issued.
Comment ID(s): 1186 (CARB), CARB suggested that, in regard to preliminary or superseded information, EPA include an express disclaimer informing the requester of the preliminary or superseded nature of the information.	**Response:** EPA agrees that an express disclaimer would be an appropriate way to convey to information requesters the preliminary or superseded nature of the information requested. Though not a requirement of this final rule, EPA intends to provide disclaimers as appropriate. Additionally, EPA does not intend to publish preliminary or superseded information on its own initiative but would only provide the information in response to specific requests and in accordance with any applicable exemptions to the definitions of emissions data in 40 CFR part 2.

Comment ID(s): 1325 (Cummins), 1203 (EMA)	**Response:**
Some commenters opposed EPA's proposed emission data determinations on the basis that some of the information at issue constitutes "trade secrets." These commenters highlight that the CAA protects trade secrets "in accordance with the purposes of section 1905 of title 18[]" of the U.S. Code. The commenters explain that title 18 refers to the Uniform Trade Secrets Act ("UTSA"), and that the provisions of section 1905 prohibit the unauthorized disclosure of information that "concerns or relates to the trade secrets, processes, operations, style of work, or apparatus, or to the confidential statistical data … of any person, firm, partnership corporation, or association." The commenters seek to ensure that the disclosure of a manufacturer's emission data does not allow others, including direct competitors, to reverse-engineer that manufacturer's emission-control strategies, designs, methods, techniques, processes, programs or codes. They assert that EPA must interpret the CAA to give meaning to the restrictions of the UTSA, meaning that EPA cannot disclose emission data in a manner that nullifies manufacturers' statutory rights to the protection of their "trade secrets." The commenters specifically state the following information constitutes "trade secrets": (1) one Hertz (Hz) in-use emissions data, or any other similar second-by-second off cycle data, other than emission values and engine speed; (2) engine fuel maps, including any associated NOx data; (3) one Hz data from SEA reports or similar compliance-assessment reports, other than emission values and engine speed; (4) data regarding the manner in which manufacturers electronically protect passwords and/or encrypt data to restrict the adjustment of electronically adjustable parameters and to prevent unauthorized reflashes (see section 1068.50); and (5) any other emissions data deemed capable of facilitating reverse-	As an initial matter, the Uniform Trade Secrets Act restricts the "unauthorized disclosure" of information that qualifies as a "trade secret." In this instance, the CAA authorizes, if not mandates, the disclosure of information that qualifies as "emission data." In section 208(c), the CAA expressly provides that only information "other than emissions data" is capable of treatment as trade secrets. Otherwise, section 208(c) expressly provides that "[a]ny records, reports or information obtained under this part or part C of this subchapter shall be available to the public." As described at length in the proposed and final rule preambles, the specific categories of information addressed by EPA's determination in this action is either emission data or otherwise not entitled to confidential treatment, or information that remains subject to the confidentiality determination process of 40 CFR part 2. EPA notes that the commenters have not disputed EPA's determination the information specified in the categories of §1068.11(c) are emission data, under EPA's longstanding regulatory definition of that term. Indeed, one commenter appears to have conceded as much, referring to the information at issue as "emission data" in its comments. (See EPA-HQ-OAR-2019-0055-1203-A1 at p. 168, EMA supplement at 2). Given the nature of the information as emission data, the CAA unambiguously prohibits treating emission data as confidential, and therefore authorizes EPA to release this information to the public, regardless of how submitters may characterize the sensitivity of the information.

engineering of a manufacturer's trade secrets. The one Hz data that would be subject to public disclosure under this rule are trade secrets in that they would allow parties to reverse-engineer each other's emissions-related designs and strategies, including warm-up controls, fuel-map configurations, and more—all of which are developed at a cost by trained staff and carefully guarded by manufacturers. Similarly, manufacturers' engine fuel maps, including associated NOx data, are also trade secrets, and their disclosure would allow parties to reverse-engineer manufacturers' thermal controls, fuel system and injection controls, and strategies for controlling engine emissions to ensure they comply with the broad range of emissions tests (FTP, RMC, LLC, NTE) and GHG limits that are required. Disclosing this information would destroy the manufacturers' capital investments and violate their rights to the protection of confidential trade secrets.	

Comment ID(s): 1222 (DoD)	**Response:**
The Department of Defense requested that EPA include provisions allowing engine manufacturers to claim as confidential any engine performance data (e.g., emissions rate) that is considered "national security information." The Department of Defense suggested that any such language be structured so EPA would approve only those manufacturers' designation requests for "national security information" where that request has been endorsed by an agency of the Federal Government responsible for national defense or homeland security, similar to the existing EPA requirement at 40 CFR 1068.225(d). The Department of Defense requested that EPA accommodate their national security concerns about broad availability of non-emissions technical performance data for engines used in national defense and homeland security applications. The Department of Navy was concerned that the availability of critical data, such as fuel flow rates for engines used in military aircraft, ground vehicles, and marine applications, as well as certain key stationary engines, could provide a strategic advantage to foreign adversaries.	Most of the information of concern for national security is never submitted to EPA. FAA excludes military aircraft from airworthiness certification requirements, which in turn excludes those aircraft from EPA emission standards. We therefore never receive information related to military aircraft. As specified in 40 CFR 1068.225, engines installed in land-based or marine vehicles or equipment that are used in combat applications are similarly automatically exempted from EPA standards and we therefore never receive information related to those engines. A qualified exemption applies for land-based and marine applications that do not qualify for an automatic exemption. Manufacturers are generally required to submit information as needed to demonstrate the need for their engines to be exempt from emission standards. After consideration of comments, we are revising the final rule at 40 CFR 1068.11(c)(14) to clarify that information submitted in support of such a request for an exemption from emission standards and certification requirements will be subject to the 40 CFR part 2 process. These provisions apply equally for exemptions identified in 40 CFR part 1068, subpart C or D, or in the standard-setting part.

Comment ID(s): 1203 (EMA)	**Response:**
The Truck and Engine Manufacturers Association (EMA) stated that EPA's reasoning behind the emission data determinations appears to be merely administrative convenience and easing its own workload relating to FOIA requests. EMA stated this is not a sufficient basis for removing the presumptive protections for manufacturers' claiming their information as confidential. EMA further stated that the determinations in §1068.11 will only incentivize additional FOIA requests to which EPA must respond, as competitors will be spurred on to discover all that they can about other manufacturers' products and processes.	EPA did not undertake this rulemaking for "merely administrative convenience" or to "ease its own workload." EPA has determined that due to the nature of the information at issue in this rulemaking that it is appropriate to make advance determinations as to the status of the information. The determinations in this final rule are the same as those that EPA would otherwise make through case-by-case assessment under the 40 CFR part 2 process. As a result, the rulemaking serves to streamline the process for making information available. While the final rule will increase administrative efficiency, it also promotes greater transparency and provides certainty to both submitters and requestors of information. The final rule also provides certainty to manufacturers regarding the release of specific categories of information that EPA collects and ensures consistent treatment of such information across manufacturers. With this advance notice, each submitter will have certainty regarding how EPA will treat the information specified in section 1068.11.

Comment ID(s): 1324 (Volvo)	**Response:**
Volvo expressed a concern that the definition of “emission data” is so ambiguous that all the information manufacturers are required to submit for certification could be construed as not being entitled to confidential treatment even if that information is not identified as such. Accordingly, Volvo requested that EPA either revise the definition of “emission data” in 40 CFR 2.301(a)(2) for clarity or provide additional examples of what is and is not considered emission data by adding discussion in the preamble to the final rule and to 40 CFR 1068.11. Volvo further requested that EPA classify AECD descriptions covering shift strategies for an automated transmission, raw test data and results, and similar items as confidential under the “reasonably obtainable” provisions of 40 CFR 2.208 as allowed in 40 CFR 2.301(e). Volvo stated as an example that an AECD describing shift strategies could be critical in determining the compliance-related characteristics identified in 40 CFR 2.301(a)(2)(i)(A), and further stated that it could be argued that the same information could be considered emission data under 2.301(a)(2)(i)(C).	EPA did not propose, nor are we finalizing, any changes to the regulatory definition of “emission data” in 40 CFR 2.301(a). EPA did not reopen that regulatory definition in this rulemaking and any comments regarding changes to the existing definition of “emission data” are beyond the scope of this rulemaking. EPA promulgated that general regulatory definition in 1976. In this rulemaking, EPA is making determinations that merely apply the existing definition of emissions data to specific categories of information EPA collects. In the proposal notice, EPA described in great detail, with even further detail in the referenced and docketed CBI spreadsheet, about which types of certification and compliance information qualify as emission data under 40 CFR 2.301(a)(2)(i)(A), (B), or (C) (or multiple subsections, independently). In this final action, EPA is retaining the preamble description of the types of information that constitute emission data. EPA notes that through this process, EPA has in effect provided specific examples of information that are or are not emissions data that the commenter requested. Volvo appears to concede that the suggested data elements identified as indeterminate (i.e., not determined in this rule to be excluded from treatment as confidential) are in fact emission data that is not entitled to confidential treatment. However, EPA is not making an emission data determination in this rule regarding the AECD descriptions identified and instead will evaluate whether such information is emissions data, and thus not entitled to confidential treatment under the 40 CFR part 2 process, on a case-by-case basis.

Comment ID(s): 1324 (Volvo)	**Response:**
One commenter requested clarity as to whether the test information and results category includes raw test data and results, including raw coast down data, actual vehicle drag coefficient and $F_{altaero}$ calculations and values, or if the category only includes the GEM inputs necessary to determine the FEL. Additionally, the commenter requested clarity as to whether the GEM inputs covered by this determination apply only to the required ten vehicle configurations for each vehicle family certification application or to all possible configurations. This commenter opposed the emission data determination in this rule on the basis that the information may be misconstrued or provide a misleading impression of the emission benefit for a specific engine or vehicle application. Specifically, the commenter describes the many different heavy-duty engine and vehicle types and duty cycles that are not represented by the GEM calculations that could be misconstrued or appear misleading.	EPA understands the commenter's concerns about clarity and wishes to be very clear about these specific points. First, under the current regulations, EPA does not collect raw coast down data, actual vehicle drag coefficients, or the $F_{altaero}$ calculations and values. Accordingly, that information is beyond the scope of the emission data determinations made in this rule. Second, the test information and results category does include any GEM inputs submitted for certification application, as those model scenarios are used by EPA to determine compliance of the vehicles that are manufactured. EPA understands that the ten GEM configurations submitted for certification might potentially be misleading in isolation, because the configurations are hypothetical and demonstrate the highest and lowest emitting configurations, the manufacturer's highest projected sales configuration, and seven other likely or possible configurations. However, EPA believes that providing the end-of-year production information will resolve questions about a manufacturer's emission profile that may arise out of the GEM scenarios used at the time of certification. Additionally, the model scenarios are emission data as they are used to demonstrate that the manufacturer's products will likely meet the standards, though it is possible that the manufacturer might not produce the exact configurations represented in the GEM scenarios submitted during certification. The certificate of conformity that EPA issues based on the GEM configurations is used, as all certificates are, to ensure that the products produced comply with the requirements of the standard setting parts through conforming to the certificate issued.

Comment IDs: 1203 (EMA),	**Response:**
Some commenters suggested that, instead of collecting and disclosing certain emission data included in this determination, that EPA require manufacturers to keep those records for inspection at EPA's request. Commenters suggested that this would allow EPA access to the necessary information without the Agency obtaining it, which would subject the information to public disclosure as "emission data." Some specific examples included the one Hertz data, fuel maps, and GPS data for in-use testing.	EPA has carefully considered the information it collects and determined that the information currently collected is necessary for determining the compliance of parties with the requirements of the standard setting parts. EPA notes that one reason the CAA requires that emissions data be available to the public is to promote transparency and meaningful public participation. In particular, this transparency encourages source compliance. The commenters' preferred approach to information that is clearly emissions data needed to determine compliance would defeat that purpose. With respect to the specific types of information that the commenters identified, EPA uses the one Hertz data information to assess compliance with 40 CFR part 86, subpart T, Heavy Duty In-Use Testing provisions, while using the fuel maps are used to determine compliance with part 1036 testing requirements. Moreover, EPA has a long-standing practice of regularly releasing the one Hertz data in the heavy-duty in-use testing program under part 86, subpart T, and this regulation makes emission data determinations by rule that are consistent with the Agency's prior treatment of this information through regular web postings since 2017. Additionally, the one Hertz and fuel map information is emission data for the reasons described in the preamble and, therefore, should be made available to the public. The commenters have not disputed EPA's determination that this information is emission data. Lastly, EPA is not in this rulemaking making a determination whether GPS data from in-use testing programs is or is not emission data. Instead, the existing 40 CFR part 2 process will be used to determine on a case-by-case basis whether in-use testing GPS data is or is not entitled to confidential treatment.

30.2 Adjustable parameters

<u>Comments by Organizations</u>

Organization: *Alliance for Automotive Innovation (Auto Innovators)*

<u>40 C.F.R. 1068.50 Adjustable parameters.</u>

Auto Innovators requests clarification on the additional requirements to include driver selectable modes in this brand-new additional section. This section seems to require inclusion of information on each selectable mode as an adjustable parameter. In some vehicles, this could reach hundreds of possible drive modes and user-selectable features to be described in the certification application, creating unnecessary burden to timely review. We recommend that EPA update this section to exclude driver selectable modes from this description. [EPA-HQ-OAR-2019-0055-1303-A1, p.8]

Organization: *American Honda Motor Co., Inc. (Honda)*

1068.50 - General

For SSIE product, it is necessary to clarify more detailed definitions or exemption requirements for the adjustable parameter. [EPA-HQ-OAR-2019-0055-1348-A2, p. 1]

1068.50 - Exemption

It should be clarified that governor adjustment mechanisms (such as "Turtle" to "Rabbit" levers or governor springs) are exempt from the adjustable parameter. [EPA-HQ-OAR-2019-0055-1348-A2, p. 1]

It should be clarified that idle speed adjustment mechanisms (e.g., throttle stop screw) are exempt from the adjustable parameter, because they are necessary to achieve proper idle speed. [EPA-HQ-OAR-2019-0055-1348-A2, p. 1]

It should be clarified that main jets, pilot jets of carburetor are exempt from the adjustable parameter.

The main jets or pilot jets are commercially available in different sizes and can be installed with common tools. Because the jets should be easily removable for maintenance which is necessary to prevent engine failure or emission increase. In addition, the necessity of jets for high altitude are described in the Clean Air Act (42 U.S.C. §7549) or regulations (40 CFR) and has been approved by EPA. [EPA-HQ-OAR-2019-0055-1348-A2, p. 1]

According to proposed text, the service part is considered "practically adjustable" if it costs less than $30. However the cost of the SSIE carburetor would be less than $30. It should be clarified that such cases are exempt from adjustable parameters (i.e. Replacement of the carburetor is not considered as adjustable parameter). [EPA-HQ-OAR-2019-0055-1348-A2, p. 1]

It should be clarified that a manual lever choke mechanism only used for starting engine is not considered an adjustable parameter. [EPA-HQ-OAR-2019-0055-1348-A2, p. 1]

1068.50 - Tamper resistance

It should be clarified that any approval of tamper resistant received in the past is still valid.

As tamper resistant mechanism, for example, adjustable range of the pilot screw limited by limiter cap, even though the limiter cap could be destroyed by the "ordinary tools" which includes very wide range of tools according to the proposed text, we believe that this should not be treated as "practically adjustable". [EPA-HQ-OAR-2019-0055-1348-A2, p. 1]

1068.50 - Definition

Definition of "significantly degrading engine performance" should be defined. [EPA-HQ-OAR-2019-0055-1348-A2, p. 1]

Guideline of the determination of "Operating parameter" for SSIE is necessary in order to create application document. [EPA-HQ-OAR-2019-0055-1348-A2, p. 1]

Definition of "mechanically controlled adjustable parameters" should be defined to clarify the criteria. [EPA-HQ-OAR-2019-0055-1348-A2, p. 1]

Definition of "practically adjustable" should be made more clear, or should set clear requirement for exemption. Current description of 1065.50(d)(1) is too vague and not practical. [EPA-HQ-OAR-2019-0055-1348-A2, p. 1]

Organization: *California Air Resources Board (CARB)*

With regards to the proposed changes to adjustable-parameter criteria in 1054.115, CARB staff notes that the Proposed Amendments to the California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines; Engine-Testing Procedures ([California]Part 1054), which the board heard and approved in December, revise Section 1054.115(b) to read as follows:

- '(b) Adjustable parameters.
    - Engines that have adjustable parameters must meet all the requirements of this part for any adjustment in the physically adjustable range. An operating parameter is not considered adjustable if you permanently seal it. Operating parameters that can be adjusted using tools are considered adjustable. We may require that you set adjustable parameters to any specification within the adjustable ranges during any

> testing including certification testing, production-line testing, in-use testing, or new engine compliance testing.' [EPA-HQ-OAR-2019-0055-1186-A2, p.133]

CARB staff determined that this was necessary and appropriate given the availability of even ‘specialized’ tools (e.g., on Amazon.com and other online retailers) to the modern consumer. [EPA-HQ-OAR-2019-0055-1186-A2, p.133]

The proposed textual changes to 1054.115(b) reference 1068.50. CARB staff has reviewed 1068.50 as well. It is not clear from this review whether U.S. EPA will consider screws adjustable if they require specialized screwdrivers. On the one hand, it's clear those screwdrivers are ‘available’ as described in 1068.50(d)(1). On the other, they are not made available to operators by the manufacturers or their dealers, as described in 1068.50(g)(1). Would U.S. EPA consider screws that require specialized screwdrivers to be ‘adjustable’ based on the new language in 1068.50? If not, we note that as described above such specialized screwdrivers can be readily obtained by consumers, and that this should be accounted for in the proposed regulation. [EPA-HQ-OAR-2019-0055-1186-A2, p.133]

Organization: *Cummins Inc. (Cummins)*

EPA proposes to migrate, consolidate, and revise adjustable parameter provisions with a new proposed section §1068.50 which would apply broadly to on- and off-highway engine categories starting MY 2024. Among the updates are proposed provisions regarding the adjustability of electronically controlled parameters, which manufacturers must limit through ECM password or encryption protection. If EPA learns that the new provisions drive significant ECM changes such as hardware upgrades, EPA should provide additional lead time to implement the changes at least for some applications. For example, it may not be possible to upgrade ECMs for certain SI alternative fuel and off-highway families until MY 2027. EPA should allow additional lead time, especially for lower volume and/or non-SCR engines such as in these categories. That would facilitate prioritizing higher volume SCR-equipped engines in the 2024-2025 timeframe. [EPA-HQ-OAR-2019-0055-1325-A1, p. 15]

Regarding mechanically controlled parameters for engines at or above 560 kW discussed in §1068.50(d)(1), EPA proposes no limitation on the time or parts cost for those parameters to be considered “practically adjustable”. Cummins suggests determining a limit consistent with the higher cost of these engines to provide clarity for manufacturers. [EPA-HQ-OAR-2019-0055-1325-A1, p. 15]

Organization: *Maine Department of Environmental Protection (Department)*

The Department is fully supportive of provisions to ensure that there are measures in place to prevent engine control module (ECM) tampering. Motor vehicle tampering is a pervasive problem not only in Maine, but throughout the country, and EPA’s proposal that manufacturers include a document at time of certification which outlines and describes the process and/or industry technical standards that were used to prevent unauthorized access to the ECM on the vehicle is an important step in addressing this issue. Manufacturers should be required to take definitive actions to prevent unauthorized access to the ECM, ensure that calibration values, software, or diagnostic features cannot be overwritten or otherwise disabled; and respond to repeated, unauthorized attempts to reprogram the ECM, if they become aware of such attempts. [EPA-HQ-OAR-2019-0055-1288-A1,p.8]

Organization: *Midwest Ozone Group (MOG)*

The proposed rule to regulate emissions from Heavy Duty Trucks is very relevant to MOG as it continues to assess ozone improvement initiatives and state implementation plan development. MOG recommends EPA include directed regulatory provisions concerning inspections and enforcement to address circumstances like the defeat devices issues. Such provisions will significantly drive reliable emissions reductions. [EPA-HQ-OAR-2019-0055-1272-A1, p.2]

Organization: *Motorcycle Industry Council (MIC)*

Manufacturers benefit greatly from clear regulatory information that enables more efficient, correct, and complete preparation and execution of certification and compliance processes. EPA's proposal on adjustable parameters in 40 CFR 1068.50(f)(2) may result in unnecessary confusion and potential certification delays if it affects diagnostic tools as discussed below. These diagnostic tools are not used to create performance or functional adjustability in the ECU's control of emissions, but instead are to push through updates related to customer service campaigns and recalls. [EPA-HQ-OAR-2019-0055-1212-A1, p.1]

EPA proposes in 40 CFR 1068.50(f)(2) that software and other products sold or offered for sale by manufacturers having the capability to reflash or modify the electronic control unit (ECU) be included in consideration of the practically adjustable range. EPA's proposal may be reasonable for some consumer products but does not make sense for diagnostic tools normally sold or made available to dealers or professional service technicians. Manufacturers may not always be able to limit or control sales of those diagnostic tools. [EPA-HQ-OAR-2019-0055-1212-A1, p.1]

Adjustments requiring reflash of the ECU using professional grade diagnostic tools and software are typically related to recalls and customer service campaigns and are not intended to create performance or functional adjustability in the ECU's control of emissions. Adjustments made using this equipment are vehicle manufacturer approved and supplied to dealers and professional service technicians to maintain compliance with regulatory requirements. These diagnostic tools do not open ECUs so dealers or technicians can independently adjust or create ranges of engine and emission control operating parameters or calibrations, they overwrite and update entire ECU calibrations. Including these professional diagnostic tools would create manufacturer confusion about how to determine related adjustable operation ranges and parameters for their consideration, potentially resulting in certification delays. [EPA-HQ-OAR-2019-0055-1212-A1, p.1]

MIC recommends EPA not include diagnostic tools normally sold or made available to dealers and used by professional service technicians in the proposed consideration of the practicably adjustable range in 40 CFR 1068.50(f)(2). [EPA-HQ-OAR-2019-0055-1212-A1, p.2]

Diagnostic tools normally sold or made accessible to dealers and professional service technicians are intended to ensure ECUs and vehicles remain in safe and compliant operation. They are not intended to create independent adjustability in manufacturer supplied calibrations. Including these diagnostic tools in the scope of this regulatory activity will work against EPA's target of clarifying requirements so MIC, SVIA and ROHVA request EPA exclude these diagnostic tools from the regulation. [EPA-HQ-OAR-2019-0055-1212-A1, p.2]

Organization: *National Association of Clean Air Agencies (NACAA)*

Effective provisions to detect and enforce against tampering with vehicle emission controls are key to ensuring long-term in-use emissions performance. Recognizing the complexity of engine control modules (ECM) and the sophistication of tampering methods, EPA's proposal to prevent ECM tampering is designed to provide manufacturers with flexibility to quickly respond to new or emerging threats and vulnerabilities. Under the proposal, manufacturers would be required to include in their certification application a description of all adjustable parameters, including electronically controlled parameters, as well as the approach or industry technical standards used to prevent unauthorized access to a vehicle's ECM; ensure that calibration values, software and diagnostic features cannot be modified or disabled; and respond to repeated unauthorized attempts to reprogram or tamper. Manufacturers would also be required to attest that they are using sufficient measures to secure the ECM, thereby limiting adjustment or alteration beyond those used in the certified configuration. EPA would retain the right to evaluate a manufacturer's decisions regarding the measures used to prevent access to and tampering with the ECM. [EPA-HQ-OAR-2019-0055-1232-A1, p. 16]

EPA should finalize these proposed anti-tampering provisions. [EPA-HQ-OAR-2019-0055-1232-A1, p. 16]

Organization: *Northeast States for Coordinated Air Use Management (NESCAUM)*

Should EPA instead promulgate Option 1, we urge the Agency to make the following changes to the proposed standards: The NESCAUM states are prioritizing detection and enforcement against tampered vehicles because tampered vehicles substantially increase vehicle NOx emissions. Given the importance of identifying tampered vehicles and enforcing against emission control system tampering, NESCAUM supports EPA's proposed provision to ensure that there are measures in place to prevent engine control module (ECM) tampering. EPA proposes that manufacturers include a document at the time of certification that outlines and describes the process and/or industry technical standards that were used to prevent unauthorized access to the ECM on the vehicle. This document shall describe the measures that a manufacturer has used to: prevent unauthorized access to the ECM; ensure that calibration values, software, or diagnostic features cannot be overwritten or otherwise disabled; and respond to repeated, unauthorized attempts to reprogram the ECM, if they become aware of such attempts. [EPA-HQ-OAR-2019-0055-1249-A1, p. 16]

Organization: *North Central Texas Council of Governments (NCTCOG)*

NCTCOG supports the EPA's current anti-tampering efforts outlined in the 2020 National Compliance Initiatives and encourages significantly more attention to minimize excessive vehicle emissions. [EPA-HQ-OAR-2019-0055-1254-A2, p.4]

Organization: *Outdoor Power Equipment Institute (OPEI)*

However, several aspects the proposed amendments to Part 1068.50, Adjustable Parameters have raised concern for small spark-ignited engine stakeholders. As a result, OPEI has included several comments, questions and proposed revisions to this section for EPA's consideration. [EPA-HQ-OAR-2019-0055-1205-A1, pp.1-2]

1054.801 – Adjustable Parameter means any device, system, or element of design that someone can adjust (including those which are difficult to access) and that, if adjusted, may affect emissions or engine performance during emission testing or normal in-use operation. This includes, but is not limited to, parameters related to injection timing and fueling rate. You may ask us to exclude a parameter that is difficult to access if it cannot be adjusted to affect emissions without significantly degrading engine performance, or if you otherwise show us that it will not be adjusted in a way that affects emissions during in-use operation. [EPA-HQ-OAR-2019-0055-1205-A1, p.2]

Section 1054.115(b) – Adjustable Parameters With the removal of language in 1054.115(b), it appears permanent sealing off an operating parameter may no longer exclude a parameter from being adjustable. However, 1068.50(c)(2)(ii) allows use of recessed fasteners sealed with a durable plug, cap or cover plate that adequately limits access to the faster, consistent with paragraph (d)(1) of this section to determine a parameter is not adjustable.

- **i. OPEI recommends the current language in 1054.115 is retained for clarity as permanent seals have long been effective, have long been accepted by EPA, and are applied to many small spark-ignited engines.**
- **ii. Regarding permanent seals, OPEI is seeking clarification where 'extraordinary measures' to access a 'parameter' change from goodfaith tamper-resistance to end-user tampering? It is OPEI's interpretation that if a 'parameter' (setting) is sealed with, for example, a durable interference-fit plug, not intended to be accessed or serviced, and if an end-user uses a hammer, chisel, screwdriver or drill to destroy the plug and access the parameter, this is tampering, and does not otherwise constitute a parameter as 'adjustable'.** [EPA-HQ-OAR-2019-0055-1205-A1, p.2]

For example, it is OPEI's understanding that if an owner used a hand drill to drill out (destroy) a press fit cap, or used pliers to disassemble a glued or plastic welded electronic component consisting of a circuit board (but unpotted), these actions are extraordinary measures beyond the manufacturers control and tampering. In outdoor power equipment applications, while the effects of destroying such seals may not be immediately realized (may not immediately negatively impact performance), destruction of such seals may indeed have long-term performance impacts on equipment due to dirt and debris that may be ingested through uncovered circuits (both mechanical and electrical). [EPA-HQ-OAR-2019-0055-1205-A1, p.3]

Additionally, OPEI believes altering computer codes would similarly be considered extraordinary measures and tampering if done so without ‘reasonably available ordinary tools’ provided by the manufacturer. [EPA-HQ-OAR-2019-0055-1205-A1, p.3]

Section 1054.115(b) – Adjustable Parameters OPEI is seeking clarification that engine throttle controls, commonly known as idle speed control / adjustment / setting, or rabbit / turtle control / adjustment / setting, and governor settings are not considered ‘adjustable parameters’ per Parts 1054 or 1068. [EPA-HQ-OAR-2019-0055-1205-A1, p.3]

When working with different regulators in the U.S., OPEI members have received inconsistent responses regarding whether the engine idle speed controls and governor settings are considered adjustable parameters. While speed settings are ‘adjustable’ from high-idle to low-idle, they are fixed in range for the end-user. In this sense, the emissions are fixed along that range. In this regard, adjustment of engine speed does not ‘affect emissions or engine performance during emission testing or normal in-use operation’ [EPA-HQ-OAR-2019-0055-1205-A1, p.3]

Additionally, the ability of the user to operate the engine at low and high speeds is necessary for the start ability, performance and safety of many small spark-ignited engine equipment. However, equipment function and performance are generally optimized for the engine to be loaded from ‘high idle’ and this speed reflects normal operating condition. For example, a lawn mower blade tip speed or governor frequency are optimized from the engine high idle speed and as a result generally reflect the normal engine speed / operating conditions. [EPA-HQ-OAR-2019-0055-1205-A1, pp.3-4]

For these reasons OPEI does not interpret engine idle speed controls or governor settings to be adjustable parameters. OPEI is seeking clarification that these specific parameters are not considered adjustable parameters for consistent application of the requirement across regulators. [EPA-HQ-OAR-2019-0055-1205-A1, p.4]

Section 1068.50 – Adjustable Parameters Today’s small-engine manufacturers follow industry-developed guidance to develop tamper resistance methods which are effective (see Appendix A). The requirements in this guidance have (to-date) been accepted by EPA. However, the potential all-inclusive nature of tools in the Proposed Rule and the ability to use tools to destroy seals, caps and covers would result in a significant increase in stringency, with undetermined costs and benefits. [EPA-HQ-OAR-2019-0055-1205-A1, p.5]

Furthermore, almost any small spark-ignited engine adjustment / parameter can be accessible in 15-minutes for a person with small engine knowledge and a desire to tamper – However that does not mean it happens with a frequency that impacts overall fleet emissions and that the cost of potential new requirements is justified. For these reasons OPEI does not believe the additional provisions of Part 1068.50 are necessary for small spark-ignited engines. SSIE should be exempted from these provisions. [EPA-HQ-OAR-2019-0055-1205-A1, p.5]

OPEI is concerned that technology differences in SSIE and the wide range of applications covered by the sector require unique consideration and that requirements for adjustable parameters are most appropriate in the rulemaking section (part 1054). [EPA-HQ-OAR-2019-0055-1205-A1, p.5]

Section 1068.50 – Adjustable Parameters: OPEI is concerned with the applicability and requirements of the Proposed Rule. Practically speaking, many small spark-ignited engines may be partially or completely disassembled in 15 minutes with ‘hand tools’. [EPA-HQ-OAR-2019-0055-1205-A1, p.5]

Arguably, the engine compression could be considered an adjustable parameter because it is an ‘element of design’ that could be ‘adjusted’ by changing bore, stroke or piston(s) and ‘affect emissions or engine performance during emission testing or normal in-use operation’. For example, the original equipment manufacturer piston in a chain saw, which is designed to be serviced/replaced, could be replaced with an aftermarket (non-OEM), higher compression piston in 15 minutes, ‘affecting emissions or engine performance during emission testing or normal in-use operation’. However, practically speaking the piston cannot be tamper resistant because its access is necessary for maintenance, service and replacement purposes. Other (less complicated) examples include fuel lines, or intake flow restrictor plates, both of which if changed could impact the air fuel ratio element of design / operating parameter, but need to be accessible for normal maintenance and service. This creates complexity for interpretation and enforcement of the regulation not realized for other sectors (specifically applications >30kW in which the engines take significant time to access, adjust, tamper and/or repair, likely much greater than 30 minutes). [EPA-HQ-OAR-2019-0055-1205-A1, pp.5-6]

One solution may be to update the Proposed Rule to clarify that the responsibility of identifying adjustable parameters shall be limited to original equipment manufacturer components offered each specific family. In the above example, if the OEM did not provide service parts that change the compression (for example different pistons or conrods), the compression would not be considered an adjustable parameter (assuming the components can be replaced in less than 15 minutes), regardless of the state of OEM non-endorsed aftermarket components. [EPA-HQ-OAR-2019-0055-1205-A1, p.6]

Section 1068.50(a) – Adjustable Parameters A model year 2024 implementation date does not provide the lead time necessary to comply with a Final Rule. OPEI requests the provisions or Part 1068.50 be rescheduled until at least model year 2025 to allow manufacturers time to assess products, implement necessary design changes (if/as needed, including exhausting existing inventory), certify products and work though supply chain challenges. Other parts of the amendments appear to have longer lead times. [EPA-HQ-OAR-2019-0055-1205-A1, p.6]

Today’s rule is ‘proposed’. OPEI and other stakeholders have included several comments EPA will consider before promulgating the Final Rule. In the spirit of this rulemaking process, manufacturers cannot be expected to invest in adjustable parameter analysis and redesign before a rule is ‘final’ (certain). [EPA-HQ-OAR-2019-0055-1205-A1, p.6]

Based on OPEI rulemaking experience, a Final Rule may not be published until late 2022. Manufacturers will start preparing for model year 2024 certification in the first months of 2023. The Proposed Rule includes several new requirements for which manufacturers will need to analyze and potentially redesign adjustable parameters. An appropriate lead time is needed to complete analysis and redesign (if/as needed), and work through supply chain challenges, including supplier production and inventory and engine manufacturer inventory, to assure compliance with new requirements for a given model year. This will need to be completed by early 2023 for the MY 2024 certification season. Furthermore, section (k) outlines significant compliance risk for which appropriate time is needed to minimize. For these reasons OPEI requests the provisions of section 1068.50 be rescheduled until at least model year 2025. [EPA-HQ-OAR-2019-0055-1205-A1, pp.6-7]

Section 1068.50(b)(1) – Adjustable Parameters OPEI is seeking clarification regarding the decision process related to adjustable parameters. It is unclear if EPA will require and/or provide 'approval' (upon request) for adjustable parameters based on the criteria of (b)(1) and other relevant parts of 1054.60. [EPA-HQ-OAR-2019-0055-1205-A1, p.7]

1. If approval is required, or if a manufacturer seeks a preliminary approval, what is EPA's expectation for who will apply for adjustable parameter approval? The SSIE sector is non-integrated for many components and equipment types. Equipment manufacturers rely largely on sourced components, including 'approved' components with adjustable parameters, for assembly into end products. This complicate certification and implementation of component design changes for the sector and needs consideration for rule implementation. [EPA-HQ-OAR-2019-0055-1205-A1, p.7]
2. Regarding EPA 'establishing the adequacy of the limits, stops, seals, or other means used to limit adjustment', OPEI requests additional detail of how this process and analysis will work; more specifically:
    - a. Is approval component level, engine level, and/or equipment level based? OPEI requests EPA consider providing a flexible 'approval' path with the consideration of component manufacturers and lead times needed to rollout design changes +industry wide;
    - b. Will EPA require a sample component, engine, and/or piece of equipment for determination of whether a parameter is 'not practically adjustable' (1068.50(d))?
        - i. In some cases, the California Air Resources has 'approved' methods to protect adjustable parameters.
            - 1. What will EPA require and what analysis will EPA conduct if a CARB approval is provided?
            - 2. CARB is promulgating new rules which will ban small engine-powered equipment. Moving forward manufacturers will not likely be receiving 'approval' (new or on-going) from CARB for tamper resistant methods. Will EPA recognize CARB approvals, and for how long?
    - c. Will EPA provide a template for evaluation and/or certification purposes?
    - d. Based on experience with another agency for similar approvals, OPEI is concerned this test and determination can be subjective and varies from test

personnel to test personnel. For this reason, OPEI is interested in further understanding:

    - i. Where will testing be conducted and by whom (for both certification and compliance purposes)?
    - ii. What steps/process will be in-place to assure consistency across testing personnel?
    - iii. How will EPA determine an adjustment ‘does not affect emissions’?
    - iv. How will EPA determine ‘significant engine performance degradation’ and ‘the effect of adjustments on engine performance’ (see (g)(1))?
    - v. What does a report or approval look like?
  - e. What is the expected evaluation and approval time?
  - f. How long is an EPA approval valid for (what are the terms of an approval or compliance inspection)? [EPA-HQ-OAR-2019-0055-1205-A1, pp.7-8]

Section 1068.50(c)(2)(i) – Adjustable Parameters OPEI is seeking clarification regarding what is ‘adjustable’ on circuit boards and onboard computers? It is OPEI’s opinion that rebuilding circuit boards is an extraordinary event and tampering. OPEI is not aware of users tampering with circuit boards or onboard computers for small spark-ignited engine equipment in such a way. Requiring ‘potted’ circuit boards for small spark-ignited engine electronic components is an unnecessary cost and may not be technologically practical for all equipment. [EPA-HQ-OAR-2019-0055-1205-A1, pp.8-9]

Section 1068.50(c)(2)(ii) – Adjustable Parameters OPEI is seeking clarification that a recessed plugged, capped or covered parameter is not considered practically adjustable. OPEI is seeking clarification of the term ‘simple’ tools’. OPEI is seeking clarification that the intent is that ‘simple tools’ are used for their generally intended purposes. [EPA-HQ-OAR-2019-0055-1205-A1, p.9]

OPEI members have reported that another agency has determined that a durably plugged, capped or covered parameter is indeed accessible and ‘adjustable’ after destroying caps and covers with combinations of punches, hammers, pliers and similarly ‘ordinary tools’. OPEI understands 1068.50(c)(2)(ii) to say that recessed capped, plugged or covered parameters are not considered adjustable, however industry experiences raise concerns. [EPA-HQ-OAR-2019-0055-1205-A1, p.9]

Furthermore, based on the experiences noted above, OPEI is concerned ‘durable’ (plug) is subjective. OPEI is seeking clarification of what EPA considers durable, including things like interference fit (pressed) and adhesive bonding ‘durable’ (but not indestructible), and how durability will specifically evaluated. A test procedure must be developed with consideration of how tools may be used and by whom. If plugs, caps and covers are going to be subject human testing, additional guidance is needed to identify repeatable evaluation requirements. [EPA-HQ-OAR-2019-0055-1205-A1, p.9]

This section introduces the term ‘simple tools’. OPEI is seeking clarification of the definition of ‘simple tools’ vs ‘ordinary tools’ vs ‘hand tools’ (a subcategory of ‘ordinary tools’), specifically as the definition relates to an adjustment of a sheared fastener or recessed and plugged/capped/covered parameter. [EPA-HQ-OAR-2019-0055-1205-A1, p.9]

Finally, OPEI is also seeking clarification that it is the intent that 'simple' and 'ordinary' tools are used for their generally intended purpose, and not in destructive ways. For example, using a hand drill to penetrate and remove a press-fit plug is not the generally intended use of that tool. [EPA-HQ-OAR-2019-0055-1205-A1, pp.9-10]

Section 1068.50(c)(2)(iii) – Adjustable Parameters OPEI is seeking clarification that bimetal springs that a contained within a housing with a crimped cover are also considered not practically adjustable. It is OPEI's opinion that crimping offers the same level of adjustment protection as welding, rivets, or sealed threaded fasteners. Installing bimetal springs into a housing incorporated into the exhaust system with a crimped cover is a common approach for today's small spark-ignited engines when these springs are used. OPEI is not aware of users tampering with bimetal springs in these applications where crimped housing covers are used. [EPA-HQ-OAR-2019-0055-1205-A1, p.10]

Section 1068.50(d)(1) – Adjustable Parameters OPEI is seeking clarification that 'adjustment' times and 'service part' costs are in terms of the normal consumer/operator, not a servicing dealer or otherwise 'experienced mechanic' with regards to engines and equipment powered by engines at or below 30 kW. [EPA-HQ-OAR-2019-0055-1205-A1, p.10]

Section 1068.50(d)(1) – Adjustable Parameters OPEI is seeking clarification that 'specialized tools' intended exclusively for servicing dealers, including software and hardware for analysis of electronics, and not intended for retail to the consumer/operator are not considered 'ordinary tools' if not otherwise 'reasonably available' as described in section (d)(1) with regards to engines and equipment powered by engines at or below 30 kW. [EPA-HQ-OAR-2019-0055-1205-A1, p.10]

Section (g)(1) of the proposal states 'if your published maintenance instructions describe routine procedures for adjusting engines or if you or your dealers make specialized tools available to operators….' OPEI understands this to mean that specialized tools intended for dealer-only use are not considered 'reasonably available ordinary tools' and would not automatically result in a determination that a parameter is 'practically adjustable'. [EPA-HQ-OAR-2019-0055-1205-A1, p.10]

Section 1068.50(d)(1) – Adjustable Parameters OPEI is seeking clarification that 'hand tools' included in the scope of 'ordinary tools' are limited to screwdrivers, pliers, hammers, awls, wrenches, electric screwdrivers, electric drills and any tools supplied by the manufacturer with the product, and that 'hand tools' not included in this list are not considered 'ordinary tools'. OPEI recommends 'simple tools', 'specialized tools', 'ordinary tools' and 'hand tools' are defined in 1068.30. [EPA-HQ-OAR-2019-0055-1205-A1, p.11]

Section (d)(1) specifically identifies 'hand tools' as screwdrivers, pliers, hammers, awls, wrenches, electric screwdrivers, electric drills and any tools supplied by the manufacturer with the product. OPEI appreciates the inclusion of this list of 'hand tools' and is seeking clarification that this list is all-inclusive of 'ordinary hand tools'. OPEI does not consider 'hand tools' not included in this list to be 'ordinary tools' or 'other supplies that are reasonably available to the operator' ('other supplies' is not a 'catch all' for *any* tool that could be purchased). [EPA-HQ-OAR-2019-0055-1205-A1, p.11]

Nonetheless, OPEI is concerned that this section may imply or be interpreted to state that any tool that may be purchased on the internet or at a retail store is an 'available' tool and the cost of any such tools shall not be included in the ($30) threshold for determining if a parameter is 'practically adjustable'. A manufacturer cannot practically confirm the availability of all existing tools in the world, considering the number of internet options and retailers, and speculate how an end user may use *any* tool to tamper with a product (whether it is the tools 'normal' or 'intended' use or not). It is also unclear how a manufacturer would demonstrate compliance if questioned by EPA certification staff or enforcement. [EPA-HQ-OAR-2019-0055-1205-A1, p.11]

Finally, OPEI is unclear why a product unique or 'specialty' tool sold for the purpose of a specific repair or adjustment, for specific equipment, should be excluded from the cost of repair. 'Specialty' tools, such as diagnostic tools and software specific to a product, likely have significant cost in comparison to the outdoor power equipment product cost, which industry believes minimizes the risk of such tools being purchased for tampering. As a result, such 'specialty' tools should be included in the tampering cost threshold, and/or excluded from 'ordinary' and 'simple' tools, even if provided by the manufacturer. [EPA-HQ-OAR-2019-0055-1205-A1, pp.11-12]

Section 1068.50(f)(2) & (g)(1) – Adjustable Parameters OPEI recommends clarification that these sections ('sell or offer for sale software or other products that could be used to modify the ECU', 'if you or your dealers make specialized tools available to operators') clarify the intent of these sections is to make resources available to 'equipment owners / operators', 'end users', and/or 'final purchasers'. [EPA-HQ-OAR-2019-0055-1205-A1, p.12]

Section 1068.50 – Adjustable Parameters OPEI is concerned that Right to Repair regulations may conflict with draft requirements. [EPA-HQ-OAR-2019-0055-1205-A1, p.12]

OPEI is engaged with Congress, States, and the Federal Trade Commission ('FTC') regarding ongoing 'right to repair' legislation and regulations. OPEI continues to express concerns that right to repair regulations may impact consumer safety specific to outdoor power equipment and will directly conflict with U.S. EPA adjustable parameter and tamperproof requirements, both currently in place and outlined in the proposed amendments. OPEI requests that EPA investigate:

- (1) How the FTC's new policy statement (adopted unanimously on July 21, 2021), outlining its enforcement strategy on corporate practices deemed anticompetitive and unfair to consumers with regards to product repair, impacts current and proposed adjustable parameters and tamper resistance regulations;
- (2) How the Fair Repair Act (HR 4006), requiring equipment OEMs to more broadly provide repair tools and information without proper regard for the risks of modification

and tampering with equipment safety and emissions controls, would impact current and proposed adjustable parameters and tamper resistance regulations; and

- (3) How proposed state legislation would impact current and proposed adjustable parameters and tamper resistance regulations. [EPA-HQ-OAR-2019-0055-1205-A1, p.12]

Section 1068.50 – Adjustable Parameters OPEI is seeking feedback regarding the impact of the draft adjustable parameter requirements on the existing OPEI guidance regarding tamper resistance guidelines for small spark ignition engine and carburetor manufacturers. [EPA-HQ-OAR-2019-0055-1205-A1, p.13]

In 2011 OPEI published the Tamper Resistance Guidance for Small Spark Ignition Engine and Carburetor Manufacturers document. See Appendix A. Industry manufacturers have been proactive and relied on this guidance document to streamline certification activities and reduce compliance risk for a decade. The guidelines and examples provided there-in have been successful in identifying adjustable parameters and tamper resistance methods consistent with the written and 'in-spirit' requirements of current regulations. OPEI is seeking EPA feedback regarding how the proposed regulations would impact the specific guidance outlined in this document. [EPA-HQ-OAR-2019-0055-1205-A1, p.13] [Appendix A is located at EPA-HQ-OAR-2019-0055-1205-A1, pp.14-27]

Organization: *Ozone Transport Commission (OTC) and Mid-Atlantic/Northeast Visibility Union (MANE-VU)*

Tampering-related provisions: The OTC members are prioritizing detection and enforcement against tampered vehicles because tampered vehicles substantially increase vehicle NOx emissions. Given the importance of identifying tampered vehicles and enforcing against emission control system tampering, OTC supports EPA proposed provision to ensure that there are measures in place to prevent engine control module (ECM) tampering. EPA proposes that manufacturers include a document at time of certification that outlines and describes the process and/or industry technical standards that were used to prevent unauthorized access to the ECM on the vehicle. This document shall describe the measures that a manufacturer has used to: prevent unauthorized access to the ECM; ensure that calibration values, software, or diagnostic features cannot be overwritten or otherwise disabled; and respond to repeated, unauthorized attempts to reprogram the ECM, if they become aware of such attempts. [EPA-HQ-OAR-2019-0055-1250-A1, p.17]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EPA has proposed to transition the "adjustable parameters" provisions to §1068.50, including numerous amendments. EMA supports the consolidation of these requirements, and finds most of the proposed requirements to be reasonable and practical. EMA recommends several modifications, however, to address various concerns. [EPA-HQ-OAR-2019-0055-1203-A1, p. 129]

EPA's proposal to migrate, consolidate, and revise adjustable parameter provisions in a new proposed section 1068.50, would apply broadly to on- and off-highway engine categories starting in MY 2024. Among the updates are proposed provisions regarding the adjustability of electronically controlled parameters, which manufacturers must limit through ECM password or encryption protection. In that regard, if EPA learns that the new provisions drive significant ECM changes such as hardware upgrades, EPA should provide additional lead time to implement the changes at least for some applications. For example, it may not be possible to upgrade ECMs for certain spark-ignited alternative fuel and off-highway families until MY 2027. EPA should allow additional lead time, especially for lower volume and/or non-SCR engines such as in these categories. [EPA-HQ-OAR-2019-0055-1203-A1, pp. 129 - 130]

More generally, the proposed adjustable parameters provisions should be streamlined for improved understanding and greater consistency. There are three main ways in which this could be accomplished. First, the provisions could be restructured to define basic concepts, then to break down how they apply to physically adjustable parameters, programmable adjustable parameters, and replenishable parameters. Second, it is not necessary to define "operating parameters" to achieve EPA's goals in these provisions. Finally, it is recommended to apply greater consistency in terminology. We will discuss these points in detail, and make other recommendations as well. [EPA-HQ-OAR-2019-0055-1203-A1, p. 130]

EMA recommends restructuring the proposed §1068.50 to improve clarity and consistency in the application of the fundamental principles of EPA's adjustable parameter controls. The provisions should start with the most fundamental principle that emissions compliance is required, consistent with the standard setting part, over the range of adjustments to which the user has access. "Adjustable parameter" should then be defined, including the specific requirements regarding the "practical" range of adjustment with respect to the three types of adjustable parameters of relevance: physically adjustable parameters, programmable parameters and user-replenishable consumables. For each of those three types of adjustable parameters, EPA should set forth the requirements and limitations that EPA considers appropriate for the practical range of adjustment. [EPA-HQ-OAR-2019-0055-1203-A1, p. 130]

Consistent with the recommendation of the previous paragraph, §1068.50(a) should be modified. The provision as proposed, which states: The standard-setting part generally requires that production engines, preproduction engines, and in-use engines with adjustable parameters meet all the requirements of this part for any adjustment in the physically adjustable range. should be modified to read: The standard-setting part generally requires that, as a condition of certification, engines with adjustable parameters meet all the requirements of the standard-setting part for any adjustment in the practically adjustable range. [EPA-HQ-OAR-2019-0055-1203-A1, p. 130]

Related to the improved structure recommended above, the new provisions could be simplified by eliminating the definition of "operating parameter." It is adequate, clearer and more efficient to simply define an "adjustable parameter," including the special condition of the practical range of adjustment, and the consequence of emissions increases. EPA should not finalize requirements that could be interpreted as requiring manufacturers to disclose all "operating parameters," because on most modern engines there are thousands of programmable parameters coded into the ECUs. For example, §§§1036.205(r) and §1039.205(s) require that manufacturers "Describe all adjustable operating parameters (see §1036.115(f)), including production tolerances. For any operating parameters that do not qualify as adjustable parameters, include a description supporting your conclusion." The manufacturer's responsibility should be to disclose all parameters to which users have practical access for adjustment. Descriptions of how manufacturers will limit access to ECU code through passwords and encryption can be managed without the complexity EPA included in the proposed definition of "operating parameter." [EPA-HQ-OAR-2019-0055-1203-A1, pp. 130 - 131]

EPA includes the following in §1068.50(c)(1): "An operating parameter is not an adjustable parameter if…we determine that engine operation over the full range of adjustment does not affect emissions without also degrading engine performance to the extent that operators will be aware of the problem." However, §86.094-22(e)(ii) provides that, "The Administrator may, in addition, determine to be subject to adjustment any other parameters on any vehicle or engine which is physically capable of being adjusted and which may significantly affect emissions." (Emphasis added.) The requirement that emissions impacts from adjustable parameters should be significant as a condition for adjustment limitation requirements is an important consideration, as adjustments should not be encumbered with regulated adjustment limitations and related obligations when the emissions impacts are minor. The final provisions should not exclude the "significant" qualifier when addressing emissions impacts related to adjustable parameters. [EPA-HQ-OAR-2019-0055-1203-A1, p. 131]

Regarding terminology, the term "physically adjustable parameter" should be used in lieu of "mechanically controlled parameter," and "programmable parameter" in lieu of "electronically controlled parameter" and "electronically controlled setting." In addition, §1068.50(c)(2)(ii) and (iii) should not be limited to "mechanically controlled engines." [EPA-HQ-OAR-2019-0055-1203-A1, p. 131]

The proposed regulations require further consolidation related to adjustable parameters to eliminate confusion as to definitions and applicability. For example, the definition of "Adjustable Parameter" in §1039.801 should be replaced with a reference to the proposed §1068.50. Additionally, §1036.250(r) and §1039.205(s) include further descriptive elements related to adjustable parameters, including requirements to provide in the application for certification "nominal or recommended setting, the intended physically adjustable range, and the limits or stops used to establish adjustable ranges. Also include information showing why the limits, stops, or other means of inhibiting adjustment are effective in preventing adjustment of parameters on in use engines to settings outside your intended physically adjustable range." (Emphasis added.) While perhaps reasonably descriptive, the various terms used may cause confusion when referencing §1068.50. EMA stands ready to work with the Agency on improving the consistency and clarity of the various CFR provisions related to adjustable parameters. While we have made reference in these comments to the adjustable parameter provisions in Parts 1036 and 1037, our comments should be applied more generally to other sections where adjustable parameters are included, such as Part 1042. Additionally, §86.094-22 may require modification to terminate its applicability at the appropriate model year. [EPA-HQ-OAR-2019-0055-1203-A1, p. 131]

Many states are adopting "right to repair" legislation or regulations that compel manufacturers to make service tools and instructions available to third-party independent repair facilities. Those regulations usually require that manufacturers allow the independent repair centers to gain access to programmability normally protected from anyone outside the OEM's dealer network, including granting the ability to reflash ECUs with different ratings. EMA opposes those right-to-repair laws and regulations because, among other concerns, they could lead to problems where engines and vehicles are not in their certified configuration, or, even, worse, they open the door for nefarious actions violative of EPA's tampering prohibitions. Notwithstanding EMA's opposition, right-to-repair regulations are becoming more and more prevalent each year. Engine manufacturers cannot be held liable for the actions of the independent repair facilities. It is important for EPA to acknowledge this by providing appropriate protections in the adjustable parameter provisions. To that end, EMA recommends that EPA add the italicized text to §1068.50(d)(2):

> Conversely, such parameters are not practically adjustable if you limit access to the electronic control units with password or encryption protection. You must have adequate protections in place to prevent distribution and use of passwords or encryption keys, *except where required by law to make them available*. We may exclude… [EPA-HQ-OAR-2019-0055-1203-A1, p. 131 - 132]

In addition to EMA's concerns related to right-to-repair laws, there are also concerns about the adjustable parameter provisions as they relate to enterprises unlawfully marketing emissions "delete" kits that employ various techniques, through programming or hardware changes or both, to tamper with emissions control systems. While engine manufacturers take significant steps to try to prevent those actors from "hacking" into the ECU to reprogram controls or to override tampering detection capabilities, it is impossible to completely protect engine systems from such actions. We therefore recommend that §1068.50(f)(3) be modified as follows:

> If your engines/equipment have other electronic [*programmable*] settings that can be *legally* modified or accessed as described in paragraph (d)(2) of this section, consider all those settings to be within the practically adjustable range. [EPA-HQ-OAR-2019-0055-1203-A1, p. 132]

Similarly, §1068.50(d)(1) should be modified to say:

> …Any such items that are *legally* sold at hardware stores, automotive parts supply stores or on the Internet are considered available. [EPA-HQ-OAR-2019-0055-1203-A1, p. 132]

As well, (d)(2) should be modified to say:

> Electronically controlled parameters are considered "practically adjustable" if they can be adjusted using any *legally* available tools (including devices that are used to alter computer code). [EPA-HQ-OAR-2019-0055-1203-A1, p. 132]

These recommended amendments to the proposal are important to avoid undue manufacturer liability as it relates to certain tampering actions. [EPA-HQ-OAR-2019-0055-1203-A1, p. 132]

EMA also recommends a specific change to the adjustable parameters provisions applicable to small SI engines ("SSIE"). In proposed §1054.115(b), after the reference to §1068.50, the following language should be added: However, engine speed control (insert rabbit turtle symbol) and governor (insert paperclip symbol) levers on engines regulated under Part 1054 are not considered to be adjustable parameters as defined in §1068.50. [EPA-HQ-OAR-2019-0055-1203-A1, p. 132]

Due to the inherent design of SSIEs, it is inappropriate to include the engine speed control and governor levers as adjustable parameters. EMA provided extensive background information to the EPA Gasoline Engine Compliance Center, Compliance Division on August 24, 2020, in a follow up discussion after the issuance of the May 11, 2020, Test Cycle Guidance Document. The presentation appended as Exhibit "F" to these comments was used to demonstrate the operation and function of speed controls and governor levers, and explained why it is inappropriate for them to be considered adjustable parameters. We believe EPA staff understood and agreed with EMA's position based on subsequent discussions. [EPA-HQ-OAR-2019-0055-1203-A1, p. 133]

From a broader viewpoint, EPA is proposing that the consolidated and modernized adjustable parameter provisions of §1068.50, applying to on- and off-highway engine categories, would be effective starting MY 2024. Among the updates proposed are provisions regarding the adjustability of electronically controlled parameters, which manufacturers must limit through ECM password or encryption protection. As noted, if the new provisions compel significant ECM changes, such as hardware upgrades, EPA should provide additional lead time to implement the changes, at least for some applications. For example, it may not be possible to upgrade ECMs for certain spark-ignited alternative fuel or off-highway families until MY 2027. EPA should allow additional lead time for such engines, especially for lower volume and/or non-SCR applications. [EPA-HQ-OAR-2019-0055-1203-A1, p. 133]

Finally, EPA should review all guidance documents related to adjustable parameters and update them as appropriate to be consistent with the revised adjustable parameter provisions. EMA stands ready to support the Agency in this effort. [EPA-HQ-OAR-2019-0055-1203-A1, p. 133]

Organization: *Volkswagen Group of America, Inc., (Volkswagen) (VWGoA)*

<u>40 CFR 1068.50 Adjustable parameters</u>

We request clarification on the additional requirements to include driver-selectable modes in this brand new additional section. This section seems to require the inclusion of information on each selectable mode as an adjustable parameter. In some vehicles, this could reach hundreds of possible drive modes and user-selectable features to be described in the certification application, creating an unnecessary burden to timely review. Please update this section to exclude driver-selectable modes such as 'sport' or 'trailer tow' from this description. [EPA-HQ-OAR-2019-0055-1296-A1, p.3]

EPA Summary and Response

Comment Summary	EPA Response
OPEI requested that EPA delay the new requirements by at least one year to allow manufacturers time to assess products, implement necessary design changes, certify products, and work though supply chain challenges; manufacturers would also need to prepare for the compliance responsibilities identified in the proposed §1068.50(k). OPEI stated that these tasks would need to be completed by early 2023 for certifying all their engine families for model year 2024, including consideration of the effect of other amendments in this rule. OPEI pointed out that they cannot be expected to invest in adjustable parameter analysis and redesign before EPA completes the final rule. Cummins commented that EPA should provide additional lead time to implement the changes, especially to account for reducing the priority of lower-volume families in favor of meeting requirements for high-volume families in the 2024-2025 time frame. EMA recommended that EPA provide additional lead time as needed to account for manufacturers' redesign efforts to improve protections to prevent tampering with electronic control modules. EMA suggested that manufacturers may need until model year 2027 to comply with the new requirements for lower-volume and/or non-SCR engines.	Preamble Section XI.A.2 responds to these comments.

OPEI: Almost any small spark-ignited engine parameter can be accessible in 15-minutes for a person with small engine knowledge and a desire to tamper. However, that does not mean it happens with a frequency that impacts overall fleet emissions or that the cost of potential new requirements would be justified. OPEI therefore does not believe the additional provisions of 1068.50 are necessary for small spark-ignited engines.	We have made several changes for the final rule to more carefully align with the existing guidance for Small SI engines. Where the final rule includes provisions that go beyond the existing guidance, we believe those provisions are justified for establishing how manufacturers need to improve tamper-resistance with current or future engine designs. The responses to more detailed comments in this section elaborate on these broad conclusions.
Honda suggested the need for defining terms: Guideline of the determination of "Operating parameter" for SSIE is necessary in order to create application document. Definition of "mechanically controlled adjustable parameters" should be defined to clarify the criteria. [EPA-HQ-OAR-2019-0055-1348-A2, p. 1] Definition of "practically adjustable" should be made more clear, or should set clear requirement for exemption. Current description of 1065.50(d)(1) is too vague and not practical.	The final rule includes several changes to the proposed 40 CFR 1068.50 to reorganize and clarify the content of 40 CFR 1068.50 including updates to 40 CFR 1068.50(d) where we clarified the definition of practically adjustable as compared to the proposal. We believe this addresses the concerns for clarity for identifying operating parameters, adjustable parameters, and the practically adjustable range. Note that we are changing terminology to reference “physically adjustable parameters” instead of “mechanically controlled adjustable parameters.”
Honda: EPA should define "significantly degrading engine performance".	The proposed regulation does not include the expression "significantly degrading engine performance". The proposed regulation instead referred to “degrading engine performance to the extent that operators will be aware of the problem.” We believe this description, finalized as proposed, establishes the degree of degradation necessary to understand and apply the provision.

CARB: Consumers can readily obtain specialized screwdrivers and other tools from Amazon.com and other online retailers. This should be accounted for in the proposed regulation for Small SI engines. CARB staff has already determined that this was necessary and appropriate and revised their regulation accordingly.	EPA's proposed rule specified that specialty hardware from stores and online retailers should be considered ordinary tools for purposes of evaluating tamper-proof designs for certification. We are including this provision in the final rule. However, we expect consumers operating Small SI engines will not be likely to pursue specialty tools for the purpose of tampering with their engines as these engines are relatively inexpensive, are generally in wide use, and there are many repair shops for small engines. We believe this applies equally for engines less than 30 kW that are used in recreational vehicles or marine applications. We are therefore identifying the list of "ordinary tools" for engines less than 30 kW without naming such specialty tools.
Honda: It should be clarified that any approval of tamper resistance received in the past is still valid.	The provisions we are adopting in 40 CFR 1068.50 are consistent with the existing guidance for Small SI engines. We therefore expect that Small SI engine manufacturers will not need to make changes to comply with the new requirements. However, if we find that engine designs do not comply, we will require them to upgrade the engine designs. We note too that we intend to be aware of ongoing developments and monitor in-use experiences so that we can require manufacturers to upgrade their engine designs to reflect best practices that are in place for each sector.

Honda – extraordinary measures. 1. According to proposed text, the service part is considered "practically adjustable" if it costs less than $30. However, the cost of the SSIE carburetor would be less than $30. It should be clarified that such cases are exempt from adjustable parameters (i.e. Replacement of the carburetor is not considered as adjustable parameter). 2. The main jets or pilot jets are commercially available in different sizes and can be installed with common tools. Because the jets should be easily removable for maintenance which is necessary to prevent engine failure or emission increase. In addition, the necessity of jets for high altitude are described in the Clean Air Act (42 U.S.C. §7549) or regulations (40 CFR) and has been approved by EPA. [EPA-HQ-OAR-2019-0055-1348-A2, p. 1] 3. It should be clarified that main jets, pilot jets of carburetor are exempt from the adjustable parameter. 4. As tamper resistant mechanism, for example, adjustable range of the pilot screw limited by limiter cap, even though the limiter cap could be destroyed by the "ordinary tools" which includes very wide range of tools according to the proposed text, we believe that this should not be treated as "practically adjustable".	We have revised the proposal in the final rule to acknowledge that manufacturers do not need to include tamper-resistance measures to protect against extraordinary measures. The list of extraordinary measures includes fully or partially removing carburetors and drilling or grinding through caps or plugs. This change to the proposal is consistent with existing guidance for Small SI engines.

OPEI recognized that speed settings are 'adjustable' from high-idle to low-idle, but stated that they are fixed in range for the end-user, which fixes emissions in that range. In this regard, adjustment of engine speed does not 'affect emissions or engine performance during emission testing or normal in-use operation.' OPEI further argued that the user's ability to operate the engine at low and high speeds may be necessary for the startability, performance, and safety, but noted that equipment function and performance are generally optimized for the engine to be loaded from the normal operating condition of 'high idle.' OPEI gave as an example that lawn mower blade tip speed or governor frequency are optimized from the engine high idle speed and as a result generally reflect normal operating conditions. OPEI therefore believes idle speed controls should not qualify as adjustable parameters. Honda requested that idle speed controls not be considered adjustable parameters because they are necessary to achieve proper idle speed. EMA also requested that idle speed controls not be considered adjustable parameters.	Idle speed screws and similar adjustment mechanisms are designed to allow operators to make adjustments to the engine's speed at idle. Those controls are therefore adjustable parameters and manufacturers are responsible for any setting in the adjustable range. If it is important for engines to operate at a high-idle speed as a normal operating condition before applying a load, manufacturers should design their engines to ensure that idle speed increases without depending on the operator to change the idle speed setting. As long as the design depends on the operator to establish the idle speed setting, it is an adjustable parameter. Manufacturers do not need to account for adjustments between user-selectable operating modes if the controls are designed to prevent operators from selecting those operating points. Even assuming OPEI is correct that idle speed does not affect emissions, there should be no problem with manufacturers accepting the responsibility to control emissions across the engine's physically adjustable range.
Honda requested clarification that a manual lever choke mechanism only used for starting engine is not considered an adjustable parameter.	Misapplied choke setting degrades engine performance after engine warm-up to the extent that the operator will be aware of the problem. The regulation therefore allows for considering this operating parameter to not be adjustable (see 40 CFR 1068.50(d)(2).

EMA and Honda suggested that governor adjustment mechanisms (such as "Turtle" to "Rabbit" levers or governor springs) should not be considered adjustable parameters.	User-selectable features, such as the rabbit-turtle option for Small SI engines, and the functions controlled by those features should properly be considered adjustable parameters under the proposed and final regulation. These features are specifically designed to invite operators to adjust an engine's control settings to achieve the desired performance. These are excellent examples of what manufacturers should consider for demonstrating that engines meet standards for all settings within the physically adjustable range. We have held this position consistently from the earliest implementation of standards for Small SI engines.
VW and Auto Innovators: Request clarification on the proposed requirement to identify driver-selectable modes. Section 1068.50 seems to require manufacturers to include information on each selectable mode as an adjustable parameter. In some vehicles, this could reach hundreds of possible drive modes and user-selectable features to be described in the certification application, creating unnecessary burden to timely review. We recommend that EPA update this section to exclude driver selectable modes such as "sport" or "trailer tow" from this description.	We note that we did not propose to apply the provisions of 40 CFR 1068.50 to vehicles subject to standards under 40 CFR part 86, subpart S. However, those vehicles are subject to similar requirements under 40 CFR 86.1833-01. As with the Honda comment on rabbit-turtle controls, user-selectable features and the functions controlled by those features are properly considered adjustable parameters under both 40 CFR 86.1833-01 and 1068.50. These features are specifically designed to invite operators to adjust control settings to achieve the desired performance. It is therefore important for manufacturers to comply with standards for all those settings that fall within the physically adjustable range.

Cummins suggests that EPA provide clarity for manufacturers by adopting a limit on the time and parts cost to be considered “practically adjustable” for mechanically controlled parameters on engines with rated power at or above 560 kW. The limits should be consistent with the higher cost of these engines.	We recognize that manufacturers can’t reasonably be expected to design an engine to be tamper-proof if a mechanic would have unlimited time to modify an engine. We are therefore adopting in the final rule the same 60-minute limit that applies for 30-560 kW engines, as a change from the proposal. An additional change from proposal in the final rule to address this concern is the provision naming cylinder head removal to be an extraordinary measure that manufacturers need not consider for tamper-proofing. We consider any modifications to the engine’s internal parts to be inherently resistant to tampering due to the degree of difficulty to access and specialty knowledge required to modify these components. At the same time, we understand that cost considerations for buying, servicing, and operating these very large engines lead us to believe that we should not exclude any potential modifications based only on the price of service parts. Therefore, we will not be including a price exclusion for engines with rated power at or above 560 kW.

NACAA: EPA should finalize the proposed anti-tampering provisions. Maine's Department of Environmental Protection is fully supportive of provisions to ensure that there are measures in place to prevent engine control module (ECM) tampering. Manufacturers should be required to take definitive actions to prevent unauthorized access to the ECM, ensure that calibration values, software, or diagnostic features cannot be overwritten or otherwise disabled; and respond to repeated, unauthorized attempts to reprogram the ECM, if they become aware of such attempts. NESCAUM OTC and MANE-VU support EPA's proposed provision to ensure that there are measures in place to prevent engine control module (ECM) tampering. NESCAUM also supports the procedural requirements to describe measures to: • prevent unauthorized access to the ECM • ensure that calibration values, software, or diagnostic features cannot be overwritten or otherwise disabled • respond to repeated, unauthorized attempts to reprogram the ECM, if they become aware of such attempts NCTCOG supports EPA's current anti-tampering efforts outlined in the 2020 National Compliance Initiatives and encourages significantly more attention to minimize excessive vehicle emissions.	We acknowledge the affirmation that the proposed rule appropriately addresses these issues. We note that the proposed and finalized provisions do not aim to establish a definitive approach for preventing unauthorized access and modification to ECMs, or to ensure that ECM software will not be overwritten or disabled. Rather, we intend to evaluate manufacturer statements in their application for certification to monitor developments in ECM security so we can ensure that manufacturers are taking appropriate steps to reasonably prevent unauthorized access to the ECM as risks, vulnerabilities, and technology solutions evolve over time. We also note that the proposed and finalized provisions do not include specific requirements to respond to attempted tampering with ECMs. Rather, if we determine that ECM tampering exists with a manufacturer's engines, we would expect to engage in discussions with that manufacturer to identify methods of upgrading ECM security for the affected engines.

MIC recommends that EPA not consider diagnostic tools normally sold or made available to dealers and used by professional service technicians for determining the practicably adjustable range. Vehicle manufacturers approve adjustments using this equipment and they supply the tools to dealers and professional service technicians to push through updates related to customer service campaigns and recalls, which helps to maintain compliance with regulatory requirements and keep vehicles safe and compliant. These diagnostic tools do not open ECUs so dealers or technicians can independently adjust or create ranges of engine and emission control operating parameters or calibrations for making performance or functional adjustability. Rather, they overwrite and update entire ECU calibrations. Including these professional diagnostic tools would create manufacturer confusion about how to determine related adjustable operation ranges and parameters for their consideration, potentially resulting in certification delays.	We state in final 40 CFR 1068.50(e)(2) that programmable adjustable parameters are not considered practically adjustable if access to the electronic control modules is limited by password or encryption protection with appropriate protections in place to prevent distribution and use of passwords or encryption keys. These access limitations are intended to allow the manufacturer and agents acting on the manufacturer's behalf to perform any necessary diagnosis and testing. If diagnostic tools allow independent dealers and professional service technicians to modify an engine to be outside of its certified configuration, those modifications would be included in the engine's adjustable range.
OPEI recommends retaining the current language in §1054.115 to recognize that permanent seals can be used to demonstrate that operating parameters are not physically adjustable. OPEI is also seeking clarification regarding 'extraordinary measures' that are outside the scope of EPA's anti-tampering assessment. It is OPEI's interpretation that if a 'parameter' (setting) is sealed with, for example, a durable interference-fit plug, not intended to be accessed or serviced, and if an end-user uses a hammer, chisel, screwdriver or drill to destroy the plug and access the parameter, this is tampering, and does not otherwise constitute a parameter as 'adjustable'.	We agree with the comment but are not adopting the suggested modification to the proposal. We have instead modified from proposal the final 40 CFR 1068.50(e)(1)(vii)(C) to explicitly call out "drilling or grinding through caps or plugs" as an extraordinary measure that we will not consider in assessing an engine's tamper-resistance. We agree that the actions suggested in the comment to destroy permanent seals would qualify as tampering and the associated engine modification would not qualify as representing part of the engine's practically adjustable range.

OPEI believes altering computer codes would be considered extraordinary measures and tampering if done so without ‘reasonably available ordinary tools’ provided by the manufacturer. EMA expressed a concern that enterprises may unlawfully market emission “delete” kits that employ various techniques, through programming or hardware changes or both, to tamper with emission control systems.	The proposal acknowledged that we would not automatically hold a manufacturer responsible if a third party independently created a tool for reflashing an ECM. On the other hand, as described in the proposed rule, we intend to review a manufacturer’s plans for limiting access to ECM software to prevent unauthorized changes. Rather than defining unauthorized ECM modifications as an extraordinary measure, we would implement these requirements by evaluating whether the manufacturer should do more to prevent unauthorized access to their ECM. We would then expect to engage with the manufacturer to consider whether or how to upgrade future designs for better protection (see Section XI.A.2.ii of the preamble). If someone alters an engine from its certified configuration, they will be liable for violating the tampering prohibitions of §1068.101(b)(1) or the defeat device prohibition in §1068.101(b)(2).

OPEI: Arguably, the engine compression could be considered an adjustable parameter because it is an ‘element of design’ that could be ‘adjusted’ by changing bore, stroke or piston(s) and ‘affect emissions or engine performance during emission testing or normal in-use operation’. Other (less complicated) examples include fuel lines, or intake flow restrictor plates, both of which if changed could impact the air fuel ratio element of design / operating parameter, but need to be accessible for normal maintenance and service. This creates complexity for interpretation and enforcement of the regulation not realized for other sectors (specifically applications >30kW in which the engines take significant time to access, adjust, tamper and/or repair, likely much greater than 30 minutes). One solution may be to update the Proposed Rule to limit the responsibility of identifying adjustable parameters to the components the manufacturer offers. In the above example, if the OEM did not provide service parts that change the compression (for example different pistons or conrods), the compression would not be considered an adjustable parameter (assuming the components can be replaced in less than 15 minutes), regardless of the availability of aftermarket components not endorsed by the manufacturer	We agree that manufacturers’ tamper-resistance designs should not need to account for replacing pistons and other actions requiring engine disassembly. This applies equally for engines above and below 30 kW. We have therefore made a change from proposal for the final regulations to specify removing a cylinder head as an extraordinary measure.

OPEI: If approval is required, or if a manufacturer seeks a preliminary approval, what is EPA's expectation for who will apply for adjustable parameter approval?	Yearly approval is required by the manufacturer as a condition of certification, and all engines with adjustable parameters need to meet all the requirements of the standard-setting part. The standard setting part for small SI engines includes the provisions in 40 CFR 1068.50 so all adjustable parameter approvals will be included in the application for certification. We expect that any request for approval or preliminary approval for strategies that limit adjustable parameters will be submitted by the manufacturer during the yearly process of applying for certification.
OPEI: Is approval component level, engine level, and/or equipment level based?	We will review adjustable parameter approval in the context of reviewing an application for certification for a specific engine family or vehicle family. We would expect to reach consistent conclusions for technologies or strategies that a manufacturer uses across engine families and across model years unless changes are made in tamper-resistant methods of the engine or equipment, or we determine that existing methods are no longer enough to address concerns for tampering with in-use engines. Manufacturers seeking preliminary approval before submitting their application for certification would be able to request approval in a way that would apply more broadly than for a single engine family or vehicle family. We will consider all aspects of any engine or equipment to ensure that any adjustable parameters are limited to their in-use range or appropriate steps have been taken to limit access to operating parameters.
OPEI: Will EPA require a sample component, engine, and/or piece of equipment for determination of whether a parameter is 'not practically adjustable'?	We have codified, as proposed, the ability to perform inspection in §1068.50(j). We may request the manufacturer to supply an engine or equipment at any time for inspection.

OPEI: What will EPA require and what analysis will EPA conduct if a CARB approval is provided?	We expect that any CARB approval will be provided for review during the engine or equipment certification process. We would expect to review the documentation related to CARB's approval. We may also perform additional review to ensure that engines meet requirements.
OPEI: CARB is promulgating new rules that will ban small engine-powered equipment. Moving forward manufacturers will not likely be receiving 'approval' (new or on-going) from CARB for tamper resistant methods. Will EPA recognize CARB approvals, and for how long?	As is currently the case, we will consider any available information from CARB's review and approval of tamper-proofing designs. To the extent further review is warranted, we would expect to review available information to determine whether engines meet the requirements of 40 CFR 1068.50. We expect that a new request for approval will be submitted every year with the application for certification process. We expect that this application will be carried over from year to year unless changes are made in tamper-resistant methods of the engine or equipment, or we determine that existing methods are no longer enough to address concerns for tampering with in-use engines.
OPEI: Will EPA provide a template for evaluation and/or certification purposes?	At this time, EPA does not intend to create a template. We plan to continue using the same methods that apply today by reviewing the application for certification.
OPEI: Where will testing be conducted and by whom (for both certification and compliance purposes)?	If we choose to perform testing on emission-data engines as part of certification, or with in-use engines after certification is approved, we may perform that testing ourselves, or we may choose any commercially available organization to do that testing for us. Manufacturers generally perform testing in a selective enforcement audit, but we may include testing instructions to adjust engine controls to any setting within the physically adjustable range.

OPEI: What steps/process will be in-place to assure consistency across testing personnel?	As with all implementation questions for certification, EPA reviewers make every effort to maintain a consistent approach for ensuring that manufacturers comply with regulatory requirements as adopted. Where there is a need to apply judgment for testing engines or establishing consistent performance criteria, we would expect to EPA staff to adopt a coordinated approach for all manufacturers within a given industry sector, and, as appropriate, for all industry sectors.
OPEI: How will EPA determine an adjustment 'does not affect emissions'? How will EPA determine 'significant engine performance degradation' and 'the effect of adjustments on engine performance' (see (g)(1))?	As proposed, we have retained language from 40 CFR 1054.801 as a criterion for excluding an operating parameter from being an adjustable parameter. As proposed, it is further defined in final 40 CFR 1068.50(d)(2) as "degrading engine performance to the extent that operators will be aware of the problem". If a manufacturer claims that an operating parameter is not an adjustable parameter because it does not increase emissions without also degrading engine performance, we would start by reviewing any available information and analysis from the manufacturer to support that conclusion. We might also operate engines as needed to determine emission impacts and any associated degradation of engine performance. For example, manual choke levers are exempt in the final requirements from being considered adjustable parameters because warmed-up engines have unacceptable performance when operating with the choke engaged.

OPEI: What does a report or approval look like?	The final regulation describes what manufacturers should include in the application for certification. Manufacturers may request preliminary approval before submitting the application. EPA will review available information and follow up as needed for additional information. We may also request that the manufacturer supply engines or engine components for testing. The approval will be included with the standard certification approval, there will be no separate approval process for adjustable parameters. If preliminary approval is received for adjustable parameters, this information will need to be included in the final submittal of the application for certification and we can re-review as part of the final certification approval. As preliminary approval has already been received, we expect there would be no issue receiving final approval for adjustable parameters unless changes are made in tamper-resistant methods of the engine or equipment, or we determine that existing methods are no longer enough to address concerns for tampering with in-use engines.
OPEI: What is the expected evaluation and approval time?	Manufacturers should request preliminary approval if the application for certification will be time-sensitive with respect to a manufacturer’s plans for producing and selling engines or equipment. We expect that the evaluation and approval time will not significantly extend the application for certification process, but some additional time may be needed if a manufacturer’s description is incomplete or if the designs do not clearly meet the requirements of 40 CFR 1068.50.

OPEI: How long is an EPA approval valid for (what are the terms of an approval or compliance inspection)?	EPA certification is always valid for one model year. Information regarding adjustable parameters will be required to be submitted with each application for certification. EPA's review for engines certified with carryover emission data consistent with the prior model year, will typically be rather cursory, but manufacturers should not expect that EPA will re-approve tamper-proof designs just because they were approved for the preceding year. New information could lead us to determine those existing methods are no longer enough to address concerns for tampering with in-use engines
OPEI is seeking clarification regarding what is 'adjustable' on circuit boards and onboard computers? Requiring 'potted' circuit boards for small spark-ignited engine electronic components is an unnecessary cost and may not be technologically practical for all equipment.	As an example, EPA understands that sensor inputs on an ECU can be modified to read differently than their actual value and cause the engine or equipment to run outside of their intended in-use range. Implementation of adjustable-parameter provisions for programmable operating parameters focuses on reflashing with different calibrations or other settings. We are removing the requirement of potting or encapsulating circuit boards to prevent tampering from the proposed rule. Manufacturers may still choose to do this for durability concerns, but we don't anticipate that owners or service personnel would modify programmable operating parameters by modifying circuit boards since third-party programming tools have become more widely available and user friendly.

OPEI is seeking clarification of the term 'simple' tools'. OPEI is seeking clarification that the intent is that 'simple tools' are used for their generally intended purposes.	We have updated from proposal our final terminology for the tools specified in 40 CFR 1068.50(e)(1) to "ordinary tools" for engines at or below 560 kW and stayed consistent with this terminology throughout the final 40 CFR 1068.50. We have also modified the list of ordinary tools from the proposal to a specific list of tools for engines less than 30 kW. This list is expanded for engines between 30 and 560 kW. The list of "ordinary tools" for engines below 30 kW is a complete list of tools. The final regulation specifies that these tools need to be used for their intended purpose for applying the provisions of 40 CFR 1068.50. For 30 – 560 kW engines, the set of ordinary tools expands to include reasonably available solvents or supplies, and any hand tools that are available from retail or online merchants. For engines above 560 kW, all tools are considered available.
OPEI is seeking clarification that bimetal springs contained within a housing with a crimped cover are also considered not practically adjustable.	We have updated from proposal our final regulation text to address both crimped fasteners and bimetal springs. 40 CFR 1068.50(f)(1) and (2) define the characteristics of a physical limit or stop that are adequate for limiting the practically adjustable range. These characteristics include crimped threads and bimetal springs recessed within a larger permanently sealed body if they meet the time and cost thresholds in 40 CFR 1068.50(e)(1).
OPEI is seeking clarification that 'specialized tools' intended exclusively for servicing dealers, including software and hardware for analysis of electronics, and not intended for retail to the consumer/operator are not considered 'ordinary tools' if not otherwise 'reasonably available' as described in section (d)(1) with regards to engines and equipment powered by engines at or below 30 kW.	If manufacturer-specific service tools, especially tools with the ability to reflash, are not made directly available to the operators, they will not be considered ordinary tools. An inclusive list of ordinary tools for engines below 30 kW is defined in 40 CFR 1068.50(e)(1)(vi)(A).

OPEI is unclear why a product unique or 'specialty' tool sold for the purpose of a specific repair or adjustment, for specific equipment, should be excluded from the cost of repair. 'Specialty' tools, such as diagnostic tools and software specific to a product, likely have significant cost in comparison to the outdoor power equipment product cost, which industry believes minimizes the risk of such tools being purchased for tampering. As a result, such 'specialty' tools should be included in the tampering cost threshold, and/or excluded from 'ordinary' and 'simple' tools, even if provided by the manufacturer.	Such specialty tools would alone almost always exceed the cost threshold without considering the cost of service parts. Including consideration of the cost of such specialty tools would therefore automatically prevent us from determining that modifications with those tools is tampering. Moreover, we would expect anyone purchasing a specialized tool to be ready to use that tool for modifying multiple engines to justify the significant cost of purchasing the tool. However, we are modifying the final rule to align with existing guidance for engines below 30 kW. Specifically, we name the list of tools that manufacturers must consider for evaluating tamper-resistance for engines below 30 kW. That list includes unique or specialty tools only to the extent that those tools are supplied by the manufacturer. We would not expect a typical user of engines below 30 kW to seek out third-party or aftermarket specialty tools to modify engines. If the manufacturer designs, produces, and supplies such specialty tools, we would consider those tools to be available to typical users.

O**PEI** is concerned that right to repair regulations may impact consumer safety specific to outdoor power equipment and will directly conflict with U.S. EPA adjustable parameter and tamperproof requirements, both currently in place and outlined in the proposed amendments. OPEI requests that EPA investigate how the FTC's new policy statement (adopted unanimously on July 21, 2021), the Fair Repair Act (HR 4006), and proposed state legislation would impact current and proposed adjustable-parameter and tamper-resistance regulations. EMA noted that many states are adopting "right to repair" legislation or regulations that compel manufacturers to make service tools and instructions available to third-party independent repair facilities. Those regulations usually require that manufacturers allow the independent repair centers to gain access to programmability normally protected from anyone outside the OEM's dealer network, including granting the ability to reflash ECUs with different ratings. Engine manufacturers cannot be held liable for the actions of the independent repair facilities. It is important for EPA to acknowledge this by providing appropriate protections in the adjustable parameter provisions. To that end, EMA recommends that EPA adds "*except where required by law to make them available*" when referring to the need for manufacturers to prevent distribution and use of passwords.	We are finalizing the adjustable-parameter provisions without the exception recommended by EMA ("except where required by law to make them available"). This exception, coupled with a hypothetical state law that requires disclosure of adjustable parameters information beyond the configurable range, would give owners and mechanics the information they need to easily modify the engine to be outside of its certified configuration. Such modifications could allow engines to operate with emissions substantially exceeding emission standards, with consequent negative environmental impacts. This would frustrate the purpose of the adjustable parameter regulations, as well as the tampering and defeat-device provisions of the CAA and EPA's regulations. EPA therefore acts well within its authority in adopting the adjustable parameters regulations without the suggested exception. The commenters did not identify with reasonable specificity any existing state law that conflicts with EPA's regulation or specify how any existing federal law conflicts with EPA's regulation. Any regulation or guidance from FTC or other federal agencies will not supersede the tampering and defeat-device provisions of the CAA and EPA's regulations. EPA will not speculate on pending state or federal legislative processes. However, we note that any state laws that conflict with EPA's regulations are preempted. We also note that the latest draft of HR 4006 includes language to create a specific exception for motor vehicles. EPA intends to monitor the development of state laws in this area and may issue clarifying guidance as appropriate.

OPEI is seeking EPA feedback regarding how the proposed regulations would impact the specific guidance outlined in EPA's 2011 guidance document on adjustable parameters.	We intended for the proposed rule to be consistent with the 2011 guidance document for engines less than 30 kW. The comments from OPEI and others have led us to make several adjustments to the final regulation as compared to the proposal to more carefully align with the guidance document. Where the new final regulation differs from the guidance document, or where manufacturers didn't take the guidance as normative, there will need to be modest changes to the manufacturers current approach to adjustable parameters. Adding specifications for electronic controls is the most significant new content compared to the 2011 guidance document in the final 40 CFR 1068.50; however, we note that most engines below 30 kW do not have electronic controls.
EMA supports the consolidation of adjustable-parameter requirements, and finds most of the proposed requirements to be reasonable and practical. EMA recommends streamlining provisions for improved understanding and greater consistency. The provisions could be restructured to define basic concepts, then to break down how they apply to physically adjustable parameters, programmable adjustable parameters, and replenishable parameters. EMA also recommends apply greater consistency in terminology.	We acknowledge the affirmation that the proposed rule appropriately addresses these issues. We recognized that improvements to the proposal were appropriate and the final preamble and regulation text reflect more organized and easier-to-read requirements which in part use suggestions from the commentor, to the extent EPA agreed such suggestions aligned with the intent and purposes of the new adjustable parameter regulation.

EMA: Related to the improved structure recommended above, the new provisions could be simplified by eliminating the definition of "operating parameter." It is adequate, clearer and more efficient to simply define an "adjustable parameter," including the special condition of the practical range of adjustment, and the consequence of emissions increases. EPA should not finalize requirements that could be interpreted as requiring manufacturers to disclose all "operating parameters," because on most modern engines there are thousands of programmable parameters coded into the ECUs. The manufacturer's responsibility should be to disclose all parameters to which users have practical access for adjustment. Descriptions of how manufacturers will limit access to ECU code through passwords and encryption can be managed without the complexity EPA included in the proposed definition of "operating parameter."	We are keeping the definition of "operating parameter" because the application for certification needs to identify any operating parameters that the manufacturer does not consider to be adjustable parameters. We agree that manufacturers do not need to name every programmable parameter coded into the ECU to support EPA's need to evaluate tamper-resistance. Rather, we have modified the final regulation from proposal to state that manufacturers should consider all programmable parameters not involving user-selectable controls to be a single, collective operating parameter. This would effectively treat the ECU with its access restrictions as the operating parameter of interest for purposes of 40 CFR 1068.50.
EMA recommends that the condition in proposed §1068.50(c)(1) include a reference to "significant" emission impacts. This would preserve what already applies under 40 CFR 86.094-22(e)(1)(ii). The adjustable-parameter provisions should not apply for things that have only a minor impact on emissions.	40 CFR 86.094-22 and proposed 40 CFR 1068.50 set up the logic to allow EPA to approve a decision to exclude operating parameters from being considered adjustable parameters if the effect on emissions causes a corresponding performance degradation. The important part of this assessment relates to the performance degradation. If the operator is aware of a performance problem, they can be expected to operate the engine in a way that avoids the degradation. Adding a further restriction to allow EPA to exclude operating parameters only if the emission effect is significant would be both unwarranted and adverse to manufacturers' interest. We are therefore not revising final 40 CFR 1068.50(d)(2) to add the word "significantly" to qualify the extent of emission impact that is considered for excluding operating parameters.

EMA: Regarding terminology, the term “physically adjustable parameter” should be used in lieu of “mechanically controlled parameter,” and “programmable parameter” in lieu of “electronically controlled parameter” and “electronically controlled setting.”	We have adopted this suggested terminology in the final 40 CFR 1068.50 to present more consistent, organized, and easier-to-read requirements.
EMA: Proposed §1068.50(c)(2)(ii) and (iii) should not be limited to “mechanically controlled engines.”	We have revised final 40 CFR 1068.50(f)(1) and (2) for threaded fasteners and bimetal springs to remove the limitation to mechanically controlled engines since threaded fasteners and bimetal springs are not limited in application to mechanically controlled engines.
EMA: There are also concerns about the adjustable parameter provisions as they relate to enterprises unlawfully marketing emission “delete” kits that employ various techniques, through programming or hardware changes or both, to tamper with emissions control systems.	If someone alters an engine or equipment from the certified configuration, they will be liable for violating the tampering prohibition of 40 CFR 1068.101(b)(1) or the defeat-device prohibition in 40 CFR 1068.101(b)(2). The manufacturer will be responsible in each certification application for ensuring that all aspects of the manufacturer’s statements regarding adjustable parameters are still appropriate. We may also engage with the manufacturer to see if there is a need or opportunity to upgrade future designs for better protection as stated in final 40 CFR 1068.50(i)(2). For example, it may be appropriate to design electronic controls to recognize that certain programming or hardware changes take the engine out if its certified configuration and to include some appropriate design algorithm to prevent the engine from operating in the tampered condition.

EMA suggested that modifying the proposed §1068.50(d)(2) to reference "legally available tools", rather than allowing for use of any available tools.	As described in the preamble, we would generally not hold manufacturers liable for tools developed by third parties to tamper with an engine's electronic controls. This presumes that the manufacturer is not cooperating with third parties to develop or make available such tools. However, if we find that such tools are available to operators, we may engage with the manufacturer to see if there is a need or opportunity to upgrade future designs for better limitations and protection. This measured approach establishes a process for considering tools that do not qualify as "legally available." As such, it would not be appropriate to modify the regulation to exclude consideration of such tools.
EMA suggested replacing the definition of "adjustable parameter" in §1039.801 and other standard-setting parts with a reference to §1068.50 to avoid confusion. EMA also suggested that the description for the applications for certification was perhaps reasonably descriptive, but suggested that there was a risk of confusion when comparing to the provisions in §1068.50.	In the proposed rule we inadvertently left the existing definitions of "Adjustable parameter" in the standard-setting parts. The new provisions in §1068.50 clearly replace those existing definitions, so we are revising the final rule to change all the definitions to instead reference §1068.50. We have modified the instructions for the application for certification to more carefully align with the terminology in §1068.50.

30.3 ULSD-related exemption for Guam

Comments by Organizations

Organization: *Truck and Engine Manufacturers Association (EMA)*

EPA proposes to remove the exemption for aftertreatment-equipped engines sold in~~to~~ Guam because USLDF is now widely available in that territory (§1036.655). EMA supports the proposal, but manufacturers will need more time to plan for this change and to modify emissions labels accordingly. To simplify planning of product supply and delivery, EMA recommends that EPA implement this change to be effective at the start of a new calendar year. Given the anticipated timing of the CTP rulemaking, EMA recommends that the exemption become effective on January 1, 2023. [EPA-HQ-OAR-2019-0055-1203-A1, p. 134]

Also related to the ULSDF exemption, EPA has proposed to limit the exclusion for nonroad engines in the territories of American Samoa and the Commonwealth of the Northern Mariana

Islands to engines “at or above 56kW” (§1039.655). Many manufacturers’ products below 56kW use DPFs to control PM emissions. Those engines require ULSDF to ensure long-term emissions control. EPA should not limit the exemption to engines at or above 56kW. [EPA-HQ-OAR-2019-0055-1203-A1, p. 134]

EPA Summary and Response

Comment Summary	EPA Response
EMA supports the proposed removal of the exemption for aftertreatment-equipped engines sold into Guam because USLDF is now widely available in that territory (§1036.655), but manufacturers will need more time to plan for this change and to modify emissions labels accordingly. EMA recommends that EPA implement this change to be effective at the start of a new calendar year. Given the anticipated timing of the CTP rulemaking, EMA recommends that the exemption continue to be available until January 1, 2023.	We recognize that manufacturers need some established time frame to work out commercial considerations related to discontinuing the exemption for engines shipped to Guam. This may be for managing orders and inventory in addition to updating emission labels. With the uncertain timing for publication in the Federal Register, we believe it is appropriate to identify January 1, 2024 as the fixed date for discontinuing the Guam exemption. This applies equally for highway and nonroad engines.
EMA also objected to the change in the analogous proposal for nonroad diesel engines in §1039.655, which applied the exemption only for engines at or above 56 kW. Many manufacturers’ products below 56kW use DPFs to control PM emissions. Those engines require ULSDF to ensure long-term emissions control and they therefore also need the exemption.	The proposed limitation for engines at or above 56 kW was based on a consideration of the need for engines to have ULSD for SCR. We recognize that similar concerns apply for engines below 56 kW that may use DPF technology to meet Tier 4 PM standards. We are therefore retracting this amendment for the final rule.

30.4 Deterioration factors for certifying nonroad engines

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

On page 17628 of the NPRM, U.S. EPA requests comments regarding the proposed alternative for establishing and verifying DF for the identified nonroad engines. [EPA-HQ-OAR-2019-0055-1186-A2, p.134]

CARB staff has concerns regarding applying the on-highway durability procedures to nonroad applications and believes it would be premature and inappropriate for U.S. EPA to finalize regulations allowing that at this time. The nonroad sector is very diverse in terms of operations and the types of emission control systems used. CARB is currently funding a nonroad demonstration contract to support the development of Tier 5 off-road standards. CARB staff suggests that U.S. EPA and CARB staff work together to consider any changes to off-road durability protocols. [EPA-HQ-OAR-2019-0055-1186-A2, p.134]

Organization: *Deere & Company*

Section XI.A.8 of the NPRM proposes the addition of a new provision 40 CFR 1039.245(e) for nonroad engines giving the engine manufacturer the option to determine Deterioration Factors (‘DF’) based on bench-aging aftertreatment per 40 CFR 1036.245 and 1036.246. It is not clear which provisions of 40CFR 1036.245 and 1036.246 are applicable to nonroad engines. For example, 40 CFR 1036.246(d)(2) requires the testing of at least five engines using the procedure specified in 40 CFR 1036.520, which references the moving average windows calculations described in 40 CFR 1036.515. These calculations are not directly applicable to nonroad engines. Another example is the case of a nonroad engine family with low annual usage, never reaching the minimum age requirement defined in Table 1 of 40 CFR1036.246(c): it is not clear whether the provisions of 40 CFR 1036.246(c)(5) are applicable to nonroad engines or not. [EPA-HQ-OAR-2019-0055-2743, p.1]

Organization: *Cummins Inc. (Cummins)*

Cummins supports inclusion of the aftertreatment bench aging option as a more efficient and accurate method for determining DFs for off-highway engine DF determination, as EPA has proposed in §1033.245, §1039.245, §1042.245, and §1048.240. [EPA-HQ-OAR-2019-0055-1325-A1, p. 11]

Cummins appreciates that EPA proposes to allow aftertreatment bench aging as an option for DF testing in lieu of traditional engine dynamometer-based aging for other regulatory categories beyond on highway, including nonroad, marine, locomotive, and large spark-ignited (LSI) engines. However, there are significant and unique differences in those regulations, customers, and markets which warrant differences in DF verification requirements compared to on-highway. While EPA seems to have taken some of this into account in its proposal, additional considerations and flexibilities need to be incorporated. [EPA-HQ-OAR-2019-0055-1325-A1, p. 12]

For marine engines in §1042.245, a manufacturer should be allowed to propose an alternate verification method, similar to the alternative option (f) EPA included in their guidance document CD-2022-02 for marine DF validation. For example, for any marine engine family that is a direct carry-across from a previously certified nonroad engine family, the manufacturer may submit durability-demonstration test data from that nonroad engine family, which will constitute sufficient validation for the DF of the carry across marine engine family. [EPA-HQ-OAR-2019-0055-1325-A1, p. 12]

For locomotive engines in §1033.245, EPA should leverage the existing in-use program in Subpart E that already covers 50-75% of useful life and only additionally require a single-step DF verification at >85% useful life. [EPA-HQ-OAR-2019-0055-1325-A1, p. 12]

Finally, regarding LSI engines in §1048.240, it is unclear whether the experiences from studies by EPA, the Truck & Engine Manufacturers Association (EMA), and SwRI, which resulted in the DF validation guidance documents issued by EPA for SCR-based diesel CI engines, necessitate an additional verification program for LSI. Since LSI has an existing in-use program in Subpart E, EPA should provide data to demonstrate that DF verification is additionally needed for this category. [EPA-HQ-OAR-2019-0055-1325-A1, p. 12]

Organization: *Truck and Engine Manufacturers Association (EMA)*

EPA has proposed to allow bench-aging of aftertreatment systems as an alternative to traditional dyno-based aging processes. EMA fully supports this approach for HDOH engines, as well as locomotive engines in §1033.245, non-road engines as described in §1039.245, marine engines in §1042.245, and LSI engines in §1048.240. [EPA-HQ-OAR-2019-0055-1203-A1, p. 111]

EPA proposes that non-road engine manufacturers may "alternatively determine and verify deterioration factors based on bench-aged aftertreatment." (§1039.245(e)). The existing provisions of (§1039.245), however, apply at the family level. EMA recommends that §1039.245(e) applies only for each DF demonstration, not for all engine families to which DF's were applied through carry-over or carry-across provisions. [EPA-HQ-OAR-2019-0055-1203-A1, p. 113]

For marine engines in §1042.245, a manufacturer should be allowed to propose an alternate verification method, similar to the alternative option (f) EPA included in their guidance document CD-2022-02 for marine DF validation. For example, for any marine engine family that is a direct carry-across from a previously certified nonroad engine family, the manufacturer should be allowed to submit durability-demonstration test data from that nonroad engine family, which will constitute sufficient validation for the DF of the carry-across marine engine family. For locomotive engines in §1033.245, EPA should leverage the existing in-use program in Subpart E that already covers 50-75% of useful life, and only additionally require a single-step DF verification at >85% useful life. [EPA-HQ-OAR-2019-0055-1203-A1, p. 113]

Finally, regarding LSI engines in §1048.240, it is unclear whether the experiences from studies by EPA, EMA, and SwRI, which resulted in the DF validation guidance documents issued by EPA for SCR-based diesel compression-ignition engines, necessitate an additional verification program for LSI. Since LSI has an existing in-use program in Subpart E, EPA should provide data to demonstrate that DF verification is additionally needed for this category. [EPA-HQ-OAR-2019-0055-1203-A1, p. 113]

EPA Summary and Response

Comment Summary	EPA Response
CARB staff believes it would be premature and inappropriate for U.S. EPA to finalize regulations allowing the highway durability procedures for nonroad applications. The nonroad sector is very diverse in operations and the types of emission control systems used. CARB is currently funding a nonroad demonstration contract to support the development Tier 5 off-road standards. CARB staff suggests that U.S. EPA and CARB staff work together to consider any changes to off-road durability protocols.	Current regulations allow us to approve alternative DF demonstration programs for individual manufacturers. The proposal simply expanded on that broad authority to clarify specific provisions that capture the principles and general measurement procedures for highway engines. We are prepared to revisit all provisions related to DF procedures in the context of future rulemakings for the various types of nonroad engines. In the meantime, we are confident that the methodology we finalize for heavy-duty highway engines will serve as a reasonable starting point to establish acceptable alternative DF demonstration procedures for nonroad engines.

Deere: It is not clear which provisions of 40 CFR 1036.245 and 1036.246 apply to nonroad engines. For example, 40 CFR 1036.246(d)(2) requires testing with the procedure specified in 40 CFR 1036.520, which references the moving average windows calculations described in 40 CFR 1036.515. These calculations are not directly applicable to nonroad engines. It is also not clear how to apply the minimum age requirement in 40 CFR 1036.246(c)(5) for a nonroad engine family with low annual usage.	Deere raises these specific concerns: 1. The proposal included the instruction to “use good engineering judgment to perform verification testing using the procedures of § 1039.515 rather than 40 CFR 1036.520.” We used this approach specifically to avoid relying on moving average windows from §1036.515. 2. The proposal instructs manufacturers to test engines after accumulating operating hours as a percentage of the useful life. We would expect manufacturers to preferentially select equipment with a consistently high usage rate, both to meet the testing requirements and to compete testing as quickly as possible. Deere also raises the broader point that the regulation is unclear for performing DF verification for nonroad engines. We recognize that there is a need to apply judgment in adapting the principles embodied in the highway program for performing DF verification with nonroad engines. We might pursue further clarity in a future rulemaking by adopting provisions that are specific to nonroad engines. In the meantime, we are confident that this provision can provide a good option for manufacturers wanting to accelerate the certification process and instead rely on in-use testing to verify deterioration factors.
EMA and Cummins support inclusion of the aftertreatment bench-aging option as a more efficient and accurate method for determining DFs for off-highway engine DF determination, as EPA has proposed in §1033.245, §1039.245, §1042.245, and §1048.240.	We acknowledge the affirmation of the proposed provisions for the subject nonroad engines.

EMA and Cummins elaborated that the different types of nonroad engines have significantly different regulations, customers, and markets that should lead to different approaches for implementing DF verification requirements compared to highway engines. They requested that additional considerations and flexibilities be incorporated beyond what was included in the proposed rule. Marine CI (§1042.245): A manufacturer should be allowed to propose an alternate verification method, similar to the alternative option (f) in guidance document CD-2022-02. For example, for any marine engine family that is a direct carry-across from a previously certified nonroad engine family, the manufacturer may submit durability data from the nonroad engine family, which serves to validate the DF of the related marine engine family. Locomotive (§1033.245): EPA should leverage the existing in-use program in Subpart E that already covers 50-75% of useful life and only additionally require a single-step DF verification at >85% useful life. Large SI (§1048.240): Since Large SI engines already have an in-use testing program, EPA should provide data to demonstrate that it is necessary to add DF verification for this category. It is not clear that the proposed DF verification procedures designed abound SCR-equipped diesel engines justify applying the additional verification program.	1. We intend that the regulation for each sector properly reflect the unique circumstances that apply. To the extent there is a provision that doesn't translate well from 40 CFR part 1036, we would expect to work with the manufacturer to exercise good engineering judgment in making any appropriate adjustments. 2. The new provision allowing manufacturers to rely on the DF verification approach from 40 CFR part 1036 applies in addition to the existing guidance. Manufacturers may continue to certify within the guidelines of CD-2022-02. We may in a future rule broaden or narrow the range of options for determining deterioration factors in ways that account for all the learning that will occur in the years ahead. 3. It may be appropriate to apply good engineering judgment to accomplish DF verification with some incremental effort relative to current in-use testing. This might involve new testing at intermediate test points in addition to the need for a final emission measurement beyond 85 percent of useful life. We would be ready to work with any manufacturer wanting to pursue this option. 4. There is no additional burden to justify because the final rule simply adds an option for manufacturers to pursue a different approach for establishing deterioration factors. Even though the test parameters were designed based on SCR-equipped diesel engines, we are confident that the testing will give results that are at least as effective as the laboratory-based procedures that manufacturers use today. We may in a future rule revise these new procedures and perhaps broaden or narrow the range of options for determining deterioration factors in way that accounts for all the learning that will occur in the years ahead.

EMA—Nonroad CI (§1039.245): Existing provisions for deterioration factors apply at the family level. EMA recommends that the new DF verification procedures in §1039.245(e) apply only for each DF demonstration, not for all engine families to which DF's were applied through carry-over or carry-across provisions.	The DF verification procedure will continue to apply to all engine families to which the DFs applied as there is no reason to limit the family if there is an issue with the DFs. The procedure to verify DFs will remain in 40 CFR part 1036.246 but will be optional only upon EPA's request. See section IV.F.2 of the preamble.

31 Provisions related to refueling light-duty and heavy-duty vehicles

31.1 Gasoline dispensing rates for facilities serving heavy-duty vehicles

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

The NPRM states: 'We are proposing a requirement for all gasoline-fueled HD highway vehicle manufacturers to comply with refueling standards, it is no longer appropriate to preserve the exemption from the dispensing rate limit for dispensing pumps dedicated exclusively to HD vehicles.' [EPA-HQ-OAR-2019-0055-1186-A2, p.123]

CARB staff agrees with this assessment. Unlike retail diesel dispensing facilities (i.e., truck stops), gasoline dispensing pumps 'dedicated exclusively to heavy-duty vehicles' do not exist in California because the gasoline flow rate at the nozzle is limited to a maximum of 10 gallons per minute. For reference, the 10 gallons per minute flow rate limitation is contained in CARB certification Executive Orders for Phase II (Stage II) systems.187 In other words, in California, heavy-duty gasoline powered vehicles use the same dispensing pumps that serve passenger cars and light-duty trucks. As such, CARB staff agrees that there is no need to maintain an exemption for heavy-duty vehicles. [EPA-HQ-OAR-2019-0055-1186-A2, p.123]

187 Reference https://ww2.arb.ca.gov/our-work/programs/vapor-recovery/vapor-recovery-equipment-defects-list and Vapor Recovery Phase II EVR Executive Orders | California Air Resources Board

CARB staff also agrees with the assessment in the NPRM stating: 'Retail stations and fleets rarely have dispensing pumps that are dedicated to HD vehicles. Since there are no concerns of feasibility or other issues related to meeting the 10 gallon per minute dispensing limit, we are proposing to remove the exemption upon the effective date of the final rule.' [EPA-HQ-OAR-2019-0055-1186-A2, p.123]

The NPRM also requests comments regarding: 'We request comment on allowing additional lead time for any legacy installations that continue to have higher dispensing rates for gasoline-fueled HD vehicles. We expect few such cases. This may occur, for example, with a remaining fleet of gasoline-fueled school buses or with farms that have refueling capabilities for delivery trucks along with nonroad implements.' CARB staff does not believe additional lead time is necessary in California, since there are no legacy installations in California. [EPA-HQ-OAR-2019-0055-1186-A2, p.123]

EPA Summary and Response

Comment Summary	EPA Response
CARB staff agrees that there is no need to keep the exemption from the 10 gallon-per-minute dispensing limit for stations dedicated to heavy-duty vehicles. CARB staff does not believe additional lead time is necessary in California.	We acknowledge the affirmation to adopt the proposed provision applying the 10 gallon-per-minute limitation to any stations that may be dedicated to servicing heavy-duty vehicles.

31.2 Refueling interface for gasoline-fueled motor vehicles

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

Section 109 of the federal CAA authorizes and directs U.S. EPA to establish national ambient air quality standards (NAAQS) for air pollutants, and U.S. EPA has promulgated NAAQS for a number of air pollutants, including ozone. [EPA-HQ-OAR-2019-0055-1186-A2, p.124]

States that have not attained a NAAQS for a specified pollutant are required by section 110(a)(1) of the CAA to adopt SIP that describe how they will attain the NAAQS in those regions by certain deadlines. California has, and continues to experience some of the worst air quality in the nation, and the South Coast and San Joaquin Valley Air Basins, in particular, are in extreme non-attainment with the national ambient air quality standard for ozone. [EPA-HQ-OAR-2019-0055-1186-A2, p.124]

CARB has developed regulations that require gasoline dispensing facilities to incorporate Stage II vapor recovery systems. Such systems help to control the evaporative emissions that are displaced from the fuel systems of motor vehicles as they are fueled. Several air districts within California, including the South Coast Air Quality Management District and the San Joaquin Valley Air Pollution Control District, have incorporated CARB's Stage II vapor recovery systems within their local regulations and have included those regulations within their SIPs, and U.S. EPA has approved such submissions.188 [EPA-HQ-OAR-2019-0055-1186-A2, p.124]

188 See, e.g., 78 Fed Reg. 21543 (Apr. 11, 2013) (approving SCAQMD Rule 461; available at Regulations.gov), 80 Fed. Reg. 7345 (Feb. 10, 2015) (San Joaquin Air Quality Management District Regulation 4622; available at Regulations.gov)); 78 Fed. Reg. 897 (Jan. 7, 2013) (approving Sacramento Metropolitan Air Quality Management District Rule 449; available at RULE449 CLEAN.doc (airquality.org))

NPRM states that: 'The filler-neck restriction is no longer needed to prevent misfuelling with leaded fuel. There is also no need for new vehicles to be designed to accommodate Stage II refueling controls now that they are subject to vehicle-based refueling standards. As a result, the only remaining need for restricting the filler-neck diameter is for those vehicles that depend on such a design to meet spitback and refueling standards.'
As discussed below, CARB staff disagrees with U.S. EPA’s statement that 'there is no need for new vehicles to accommodate Stage II controls now that they are subject to vehicle-based refueling standards':

- a) Unlike other states that have decommissioned Stage II vapor control at gasoline dispensing facilities, California has retained Phase II (similar to U.S. EPA Stage II) vapor recovery requirements on a statewide basis. California’s Phase II systems are dependent on nozzles and vehicle fill pipes having uniform dimensions in order to achieve a good seal, which is assisted by the fill pipe restriction, during the refueling process. Specifically, a good seal enables the Phase II nozzle to detect if the vehicle is equipped with on-board refueling vapor recovery (ORVR) or non-ORVR. CARB field studies189 have concluded, without uniform dimensions (standardization) for the nozzle and vehicle fill pipe interface, a poor seal will occur, resulting in excess air ingestion, storage tank headspace overpressure, and excess breathing loss emissions. [EPA-HQ-OAR-2019-0055-1186-A2, pp.124-125]

189 Reference: CARB field studies VR-OP-A3 and VR-OP-A4 available at: https://ww2.arb.ca.gov/resources/documents/overpressure-studies-and-technical-support-documents

As of 2022, approximately 90 percent of California’s gasoline powered vehicle population is equipped with a vehicle based ORVR emission control system. Despite this high percentage of ORVR equipped vehicles, Phase II vapor recovery controls are still needed to capture the displaced gasoline vapors that are generated by the remaining 10 percent of California’s vehicle population, not equipped with ORVR system. In a state where some regions have the worst air quality in the nation, retaining Phase II control is needed to help achieve NAAQS attainment goals. [EPA-HQ-OAR-2019-0055-1186-A2, p.125]

CARB staff estimates that even when about 98 percent of gasoline in California will be dispensed to vehicles with ORVR (predicted to be about 2030 or later), Phase II controls will provide volatile organic compound (VOC) emission reductions of about nine tons per day.190 Making up nine tons per day VOC emissions in the 2030 timeframe may be extremely difficult since most of the cost-effective VOC control measures have already been implemented. [EPA-HQ-OAR-2019-0055-1186-A2, p.125]

190 Reference: https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/gdfnozzles2018/fsor.pdf

- b) Gasoline vapors that are displaced during the storage and transfer of gasoline contain benzene, a known carcinogen. CARB's Benzene Air Toxic Control Measure191 requires Phase II vapor recovery at retail gasoline dispensing facilities regardless of ozone attainment status, in order to reduce public exposure to benzene. Reducing benzene exposure requires a good seal between the fill pipe and the nozzle. [EPA-HQ-OAR-2019-0055-1186-A2, p.125]

191 Reference: https://ww2.arb.ca.gov/resources/documents/benzene-retail-service-stations#:~:text=The%20California%20Air%20Resources%20Board,Benzene%20from%20Retail%20Service%20Stations.

- c) In California, certain non-retail gasoline dispensing facilities are exempt from Phase II controls if they serve a captive fleet of predominately ORVR equipped vehicles. In 2015,192 CARB adopted standards for Enhanced Conventional (ECO) nozzles that do not include vapor recovery, but are required to control liquid releases including spillage, post-fueling drips, spitting, and liquid retention. ECO nozzles are subject to a spillage standard of 0.12 pounds per 1,000 gallons dispensed, which represents an approximately 80 percent reduction over spillage rates from conventional nozzles. [EPA-HQ-OAR-2019-0055-1186-A2, p.125]

192 Reference: https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2015/vapor2015/vapor15eo.pdf

Additionally, CARB staff found the currently certified ECO nozzles can comply with a more stringent spillage standard of 0.05 pounds per 1,000 gallons, a 90 percent reduction.193 [EPA-HQ-OAR-2019-0055-1186-A2, p.126]

193 Reference: ISOR_EVR_2020 (ca.gov)

In order to meet these liquid release standards, ECO nozzles are equipped with similar features found on Phase II nozzles including spout design, insertion interlock (minimizes spillage), face plate, and bellows. With ECO nozzles, adequate contact between vehicle fill pipe and nozzle face plate is required for the insertion interlock feature to work properly. ECO nozzles are also subject to almost identical dimensional standards as required for Phase II nozzles. [EPA-HQ-OAR-2019-0055-1186-A2, p.126]

According to the 2015 staff report, at least 17 states (other than California) will consider the use of ECO nozzles. Those 17 states have a combined population and annual gasoline throughput, that is approximately three times greater than California. If those states moved forward with

ECO nozzle requirements, the national emission reductions associated with the reduced spillage of gasoline would be significant. [EPA-HQ-OAR-2019-0055-1186-A2, p.126]

As explained above in the CARB comments in subsections (a) through (c) above, the proposal to delete the preexisting requirement for vehicles to incorporate a fuel filler restriction does not consider the extent to which the proposal may adversely affect the effectiveness of Phase II vapor recovery systems to capture displaced gasoline vapors generated by motor vehicles, or the corresponding projected increases of VOCs, ozone emissions, or benzene emissions. These considerations constitute an important aspect of states' abilities to attain or maintain compliance with NAAQS and to maintain the effectiveness of state adopted measures to protect the health of their citizens, and NPRM therefore improperly failed to address those considerations. State Farm, 463 U.S. at 43. It is also clear that U.S. EPA's rationale that its proposal will not result in increased emissions is directly inconsistent with the evidence presented in CARB staff's comments, State Farm, 463 U.S. at 473. Moreover, these considerations arguably preclude U.S. EPA from demonstrating there are good reasons for the proposal, including a justification for 'disregarding facts and circumstances that underlay or were engendered by the prior policy.' FCC v Fox Television Stations, 556 U.S. at 515-516. [EPA-HQ-OAR-2019-0055-1186-A2, p.126]

The CAA requires that federal agencies ensure that their actions do not interfere with a state's ability to implement its SIP and to attain applicable NAAQS. CAA section 176(c)(1)-(2). As previously discussed, U.S. EPA's proposal will result in the increase of VOC emissions that could affect ozone formation e, but U.S. EPA has not evaluated or considered the extent to which its proposal will likely result in increased VOC emissions in states that have approved SIPs containing Stage II vapor recovery systems that are dependent upon fuel filler pipe restrictions in motor vehicles. It is accordingly clear that U.S. EPA must, at a minimum, reevaluate the foreseeable increased emissions attributable to the proposal to ensure its proposal does not violate its conformity obligations. [EPA-HQ-OAR-2019-0055-1186-A2, pp.126-127]

The NPRM states: 'Since there is no longer an external emission-related design constraint for filler necks, vehicle manufacturers will no longer be constrained to design their vehicles to meet spitback and refueling standards with a limiting orifice. If vehicle manufacturers need to have a narrow-diameter filler neck to achieve a mechanical seal for onboard refueling vapor recovery or to prevent spitback, then they will need to include those design specifications. If they can use a different orifice or no orifice at all and still meet spitback and refueling standards, that would also represent a compliant configuration. We therefore propose to remove the filler-neck restrictions from 40 CFR 80.24 without migrating those requirements to the CFR parts for light-duty or HD vehicles.' [EPA-HQ-OAR-2019-0055-1186-A2, p.127]

CARB staff disagrees with the concept of eliminating fill pipe dimensional standards especially removal of the filler-neck restrictions, which would result in excess emissions due incompatibility between the vehicle fill pipes and Phase II/ECO nozzles. Doing so would also be inconsistent with CARB regulations adopted in 2019 that are based upon findings and recommendations of the SAE Fuel System Task Force (Task Force). [EPA-HQ-OAR-2019-0055-1186-A2, p.127]

The goal of the Task Force was to identify design parameters to improve compatibility of nozzles and vehicle fill pipes by establishing a set of dimensions to effectively standardize the interface. In other words, the dimensional standards provide a ‘design envelope’ for both nozzle and vehicle fill pipe manufacturers to follow. The dimensions are found in SAE J285 (April 2019) for Phase II194 and ECO nozzles195 and CARB Specification for Fill Pipes196 and Openings of 2015 and Subsequent Model Motor Vehicle Fuel Tanks (May 31, 2019). [EPA-HQ-OAR-2019-0055-1186-A2, p.127]

194 https://www.arb.ca.gov/testmeth/vol2/cp201.pdf?_ga=2.178947043.654532313.1648057694-1201589631.1627687357

195 https://www.arb.ca.gov/testmeth/vol2/cp207.pdf?_ga=2.189967724.654532313.1648057694-1201589631.1627687357

196 https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/fillpipe2018/finalspecs.pdf?_ga=2.189967724.654532313.1648057694-1201589631.1627687357

In addition to forming a good seal between the Phase II and ECO nozzles and vehicle fill pipes, the Task Force considered other factors when determining appropriate dimensions, including pre-mature shutoff, loose latch, customer effort (insertion force), and likelihood of the nozzle becoming caught within the fill pipe pocket. [EPA-HQ-OAR-2019-0055-1186-A2, p.127]

The NPRM also states: 'We acknowledge that there are commercial reasons to have standardized specifications for filler necks. This is reflected by the referenced voluntary consensus standards adopted to accomplish that purpose.' [EPA-HQ-OAR-2019-0055-1186-A2, p.128]

CARB staff agrees with this assessment and recommends that the U.S. EPA reference SAE J285 (April 2019) for Phase II and ECO nozzles and CARB Specification for Fill Pipes and Openings of 2015 and Subsequent Model Motor Vehicle Fuel Tanks (May 31, 2019) for the vehicle fill pipe. [EPA-HQ-OAR-2019-0055-1186-A2, p.128]

As mentioned in the comment above, these documents retain the fill pipe restriction needed to support Phase II and ECO nozzles and were developed after extensive deliberations by CARB, nozzle, vehicle, and fill pipe manufacturers who participated in the SAE Task Force. In 2019, CARB adopted the dimensional specifications listed in these documents. [EPA-HQ-OAR-2019-0055-1186-A2, p.128]

Standardization of Phase II and ECO nozzle and vehicle fill pipe dimensions provides a defined ‘design envelope’ needed by the nozzle, vehicle, and fill pipe manufacturers to effectively produce a compatible interface. These dimensional specifications provide flexibility to manufacturers because they include a range of values, rather than a single value. As mentioned in a prior comment, in developing these dimensional specifications, the Task Force considered other factors such as pre-mature shutoff, loose latch, customer effort (insertion force), and likelihood of the nozzle becoming caught within the fill pipe pocket. [EPA-HQ-OAR-2019-0055-1186-A2, p.128]

Additionally, the NPRM states: ‘U.S. EPA's existing specifications are compatible with those published standards but allow for a much wider range of dimensions. The comment from the earlier rulemaking requested that we update our specifications to match those in the voluntary consensus standards.’ [EPA-HQ-OAR-2019-0055-1186-A2, p.128]

CARB staff recommends that U.S. EPA consider updating the nozzle and vehicle fill pipe requirements by referencing applicable portions of SAE J285 and CARB Specifications for Fill Pipes and Openings of 2015 and subsequent Model Motor Vehicles (May 31, 2019). [EPA-HQ-OAR-2019-0055-1186-A2, p.128]

The NPRM also states: ‘We request comment on the appropriateness of either keeping the existing specifications or adopting the specifications from voluntary consensus standards into the U.S. EPA regulations. We specifically request comment on the benefit of adopting such standards and on the authority for adopting such standards under CAA considering that we intend to remove the now obsolete requirements in 40 CFR 80.24.’ [EPA-HQ-OAR-2019-0055-1186-A2, p.128]

CARB staff refers to previous comments concerning the need for U.S. EPA to update existing specifications to include the new dimensional specifications recommended by the SAE Task Force. Providing a standardized ‘design envelope’ will ensure Phase II and ECO nozzles are compatible with vehicle fill pipes and will minimize emissions during refueling. [EPA-HQ-OAR-2019-0055-1186-A2, p.128]

Organization: *Ingevity Corporation (Ingevity)*

EPA’s assessment that the fill neck restriction was put in place in 1973 to prevent misfuelling with leaded fuel is correct, and since leaded fuel is no longer in use, it is appropriate to suggest that this requirement be eliminated. However, its purposes are not necessarily obsolete. Since the implementation of this requirement, fuel system designers have considered its role in helping to retain the nozzle in the fill pipe during refueling, its effects on air ingestion into the fill pipe during refueling, and the dynamics of nozzle shut off at the end of a refueling event. In fact, the presence of the fill neck restrictor is accounted for in the anchor spring requirements of SAE J285 for gasoline fuel dispensing nozzles. Eliminating the regulatory requirement will not necessarily lead the manufacturers to remove the fill neck restrictor from vehicle designs since its presence is now considered in other functions which occur during the refueling event. [EPA-HQ-OAR-2019-0055-1213-A1, p. 7]

Furthermore, there is one other very important consideration of the role of the fill neck restrictor which EPA did not mention in the NPRM. Note that within SAE J285 the nozzle spout outer diameter specification for an unleaded fuel nozzle is 20.5/21.34 mm, and that for a diesel fuel nozzle spout the specification is 23.6/25.5 mm for a low flow nozzle, and 28.5/38.5 mm for a high flow nozzle. The provisions of 40 CFR §80.24 specify a not to exceed diameter of 23.63 mm for the inlet restriction for a gasoline-fueled vehicle. This regulatory specification effectively eliminates the potential for diesel misfuelling, which is a special point of interest for HDGVs. [EPA-HQ-OAR-2019-0055-1213-A1, p. 7]

EPA also sought comment on removing the provisions of 40 CFR §80.22 and replacing them with those of SAE J285 through incorporation by reference. We support incorporating by reference the appropriate portions of SAE J285 as a means of updating these provisions. [EPA-HQ-OAR-2019-0055-1213-A1, p. 7]

<u>EPA Summary and Response</u>

Comment Summary	EPA Response
CARB staff disagrees with eliminating the filler-neck restrictions. CARB staff disagrees with U.S. EPA's statement that 'there is no need for new vehicles to accommodate Stage II controls now that they are subject to vehicle-based refueling standards. CARB has developed regulations that require gasoline dispensing facilities to incorporate Phase II vapor recovery systems. California's Phase II systems are dependent on nozzles and vehicle fill pipes having uniform dimensions in order to achieve a good seal, which is assisted by the fill pipe restriction, during the refueling process. As of 2022, Phase II vapor recovery controls are still needed to capture the displaced gasoline vapors that are generated by the 10 percent of California's vehicle population not equipped with ORVR system. In 2015, CARB adopted standards for Enhanced Conventional (ECO) nozzles that do not include vapor recovery, but are required to control liquid releases including spillage, post-fueling drips, spitting, and liquid retention. With ECO nozzles, adequate contact between vehicle fill pipe and nozzle face plate is required for proper operation. CARB staff estimate that at least 17 states will consider adopting California's requirement to use ECO nozzles.	We recognize that state refueling-related requirements depend on a consistent filler-neck restriction to ensure a proper interface for controlling emissions. We are therefore preserving the longstanding requirement for vehicle manufacturers to include the existing filler-neck restriction for all vehicles up to 14,000 pounds GVWR. We are codifying this provision in 40 CFR 86.1810-17 instead of 40 CFR 80.24. We are including no lead time for this requirement because it is consistent with the requirement from 40 CFR 80.24.

Ingevity: Fuel system designers consider the filler-neck restriction to retain the nozzle in the fill pipe during refueling and to account for its effects on air ingestion into the fill pipe during refueling and the dynamics of nozzle shut off at the end of a refueling event. Eliminating the regulatory requirement will not necessarily lead the manufacturers to remove the fill neck restrictor from vehicle designs. The filler-neck restriction also effectively eliminates the potential for diesel misfuelling, which is a special point of interest for gasoline-fueled heavy-duty vehicles.	We recognize that the existing filler-neck restriction has the additional benefit of preventing operators from inadvertently dispensing diesel fuel into fuel tanks for gasoline-fueled vehicles. As described for the previous comment, we are migrating the existing filler-neck restriction from 40 CFR 80.24 to 40 CFR 86.1810-17.
Standardization of Phase II and ECO nozzle and vehicle fill pipe dimensions provides a defined 'design envelope' needed by the nozzle, vehicle, and fill pipe manufacturers to effectively produce a compatible interface. CARB staff recommends that EPA update the nozzle and vehicle fill pipe requirements by referencing applicable portions of SAE J285 and CARB Specifications for Fill Pipes and Openings of 2015 and subsequent Model Motor Vehicles (May 31, 2019).	
Ingevity supports incorporating by reference the appropriate portions of SAE J285 as a means of provisions to specify geometry for gasoline refueling nozzles.	

32 Sector-specific amendments to EPA's emission control programs

32.1 Test procedures for electric vehicles

<u>**Comments by Organizations**</u>

Organization: *Alliance for Automotive Innovation (Auto Innovators)*

<u>40 C.F.R. 600.011 Incorporation by reference.</u>

Auto Innovators generally supports the incorporation of the 2021 version of SAE J1634 by reference at 40 C.F.R. 600.011(c)(2). Incorporating the 2021 revision of SAE J1634 would harmonize BEV test procedures with the California Air Resource Board (CARB) proposed Advanced Clean Cars II test procedures. [EPA-HQ-OAR-2019-0055-1303-A1, p.3]

We also request the option to allow use of the Short Multi-Cycle Test (sMCT) and the Short Multi-Cycle Test Plus Steady State (sMCT+) procedures. Allowing these procedures would also harmonize with the CARB proposed test procedures and significantly reduce laboratory test burden associated with BEV testing while providing equivalent test results. [EPA-HQ-OAR-2019-0055-1303-A1, p.3]

EPA's current proposal prohibits manufacturers from using thermal conditioning during cold soak periods. Unlike vehicles with internal combustion engines, managing battery temperature in BEV vehicles is critical to battery durability, vehicle performance, and energy efficiency. Thermal conditioning of the BEV propulsion battery can provide real-world benefits in these areas. We would like to request for EPA to remove requirements explicitly prohibiting thermal conditioning in order to not restrict emerging technologies that could improve real-world performance and efficiency, for example under extreme cold start conditions during short trip city driving. [EPA-HQ-OAR-2019-0055-1303-A1, p.3]

We would also request for the use of thermal conditioning to be considered as part of the 5-cycle test procedure approval process. Keeping in mind that the industry is still learning about customer behavior related to BEV thermal conditioning, and any allowance of thermal conditioning should be customer representative, either by default operation, manufacturer instruction, or demonstrated real-word usage, we urge the EPA to allow manufacturers to incorporate new technologies such as this one, when sufficient justification is provided. [EPA-HQ-OAR-2019-0055-1303-A1, p.3]

<u>40 C.F.R. 600.116-12 Special procedures related to electric vehicles and hybrid electric vehicles.</u>

(2)(i) We request that EPA omit the 15 second idle energy from the highway cycle energy consumption. Including the idle in the highway phase data does not align with the highway test for ICE vehicles. The idle energy should be included in the overall Usable Battery Energy (UBE).

(a)(4) We request that EPA remove the requirement to use Method 1 or Method 2 described in SAE J1634 Appendix A to estimate the mid-test constant speed cycle distance (dM). OEMs are developing methods to calculate dM which ensure the CSCe distance is less than 20% of the overall distance with margin to reduce the risk of invalid tests. Requiring the use of the SAE J1634 methods will require process changes and may result in less accurate determination of dM.

(a)(5) —"At the conclusion of each mid-test constant speed phase a minimum 5-minute key-off soak will be performed."
We would like further clarification of this requirement. Specifically, we'd like to inquire whether this means a key-off would be necessary before the dynamic UDDS3 segment?

(a)(8) We request that all energy measured during the entire test be included in the usable battery energy (UBE). The UDDS and HFET cycles are used to calculate energy efficiency over these

cycles. The remaining test is used to determine total DC discharge energy. Including all energy measured during the test, including key-off soaks and idles, represents the UBE stored in the battery.

(a)(11)(i)—"The 20 °F charge-depleting UDDS must be performed with a minimum 10-minute key-off soak period between each UDDS cycle. Key-off soak periods of up to 30 minutes are allowed."
With the final rule expected to be released shortly before MY 2025 vehicles are launched, there is very limited lead-time to implement change for MY 2024, or even MY 2025 vehicles. Therefore, we request to make this procedure optional prior to MY26 to allow labs to make any necessary upgrades or training.

(a)(11)(iii)— "Beginning with the 2024 model year the 20 °F UDDS charge-depleting UDDS test will be replaced with a 20 °F UDDS test consisting of 2 UDDS cycles performed with a 10-minute key-off soak between the two UDDS cycles."
It is of our opinion that MY24 is too soon for this type of testing requirement. We propose the following changes: "Beginning with the **2026 model year, optional prior to MY26,** the 20 °F UDDS charge-depleting UDDS test will be replaced with a 20 °F UDDS test consisting of 2 UDDS cycles performed with a 10-minute key-off soak between the two UDDS cycles." This additional lead time will give OEMs enough time to address any potential issues that may arise.

(a)(11)(iv)(D)—"Beginning in model year 2024 the *RunningFC* equation used to calculate the City Fuel Economy found on Page 30 in Appendix C of J1634 should be replaced with the following equation when calculating City Fuel Economy."
We would like to align this requirement with our request for (11)(iii) and extend the timeframe to begin in MY26. We propose the following language: ""**When 2 UDDS cycles are used, as described in (a)(11)(iii)**, the *RunningFC* equation used to calculate the City Fuel Economy found on Page 30 in Appendix C of J1634 should be replaced with the following equation when calculating City Fuel Economy."

Organization: *Rivian Automotive, LLC (Rivian)*

Additional Considerations Regarding Proposed Amendments to LDV GHG and Fuel Economy Testing. EPA used the NPRM to introduce a variety of amendments to LDV GHG and fuel economy testing procedures. Beginning with MY2024, EPA is proposing that manufacturers be allowed to perform only two UDDS cycles when running the CTTP, with a 10-minute key-off soak between the UDDS cycles to generate a BEV 5- cycle adjustment factor. Rivian recommends a different approach to these amendments and offers additional related comments. [EPA-HQ-OAR-2019-0055-1229-A1, p.6]

- **Timeline**. EPA should provide sufficient lead time for manufacturers to implement changes. Testing for MY2023 is already underway and MY2024 work will begin before the conclusion of this rulemaking. The agency should provide additional time to manufacturers before requiring any changes in test procedure.
- **Flexibility**. Rather than mandate a new approach to testing, the agency should provide manufacturers with optionality. Specifically, EPA should allow up to 6 UDDS cycles when running the CTTP at the manufacturer's recommended state of charge. [EPA-HQ-OAR-2019-0055-1229-A1, p.6]

Organization: *Volkswagen Group of America, Inc., (Volkswagen) (VWGoA)*

<u>40 CFR 600.011 Fuel economy and greenhouse gas exhaust emission of motor vehicles</u>

EPA proposes to incorporate the 2017 version of SAE J1634 Battery Electric Vehicle Energy Consumption and Range Test Procedure. We appreciate EPA's acceptance of this important, consensus-based standard, however, there is an even more recent version. J1634 was successfully updated in 2021 and VWGoA requests that this version be codified in this section for use in its entirety throughout the testing process. [EPA-HQ-OAR-2019-0055-1296-A1, p.2]

We support allowing the option to use thermal conditioning during the cold temperature test as defined in the 2021 version of SAE J1634. Unlike vehicles with internal combustion engines, managing battery temperature in BEV vehicles is critical to battery durability, vehicle performance, and energy efficiency. Thermal conditioning of the BEV propulsion battery provides real-world benefits in these areas. By allowing the option to use thermal conditioning prior to the cold test BEV vehicles will more accurately demonstrate real-world performance and efficiency under extreme cold start conditions during short trip city driving. Significant innovation continues in the area of battery thermal management. Prohibiting thermal conditioning during the cold test may result in constraining innovation and limit real-world benefits. [EPA-HQ-OAR-2019-0055-1296-A1, p.2]

<u>40 C.F.R. 600.116-12 (a)(11) Special procedures related to electric vehicles and hybrid electric vehicles.</u>

It is our opinion that removing the option to perform a full charge depletion 20 °F cold test no longer allows manufacturers to demonstrate the efficiency improvements of technologies more prevalent in the full charge depletion test procedure. We see this as a barrier to investment in advanced technologies. To preserve the 5-cycle test procedure pathway as a driver of efficient technologies, we ask that the EPA reconsider the impact of the proposed change and preserve the option of performing a full charge depletion 20 °F cold test beyond MY 2024. [EPA-HQ-OAR-2019-0055-1296-A1, p.2]

Organization: *General Motors LLC (GM)*

General Motors supports comments provided by the Alliance for Automotive Innovation related to BEV test procedures. Allowing usage of the Short Multi-Cycle Test (sMCT) and the Short Multi-Cycle Test Plus Steady State (sMCT+) procedures harmonizes with the California Air Resource Board (CARB) proposed Advanced Clean Cars II test procedures and significantly reduces laboratory test burden. [EPA-HQ-OAR-2019-0055-1246-A1, pp.6-7]

General Motors supports usage of battery thermal conditioning as outlined in the 2021 revision of SAE J1634. By applying a small amount of wall energy to keeping the battery at efficient operating conditions, battery thermal conditioning leverages existing customer behavior of leaving EVs plugged in when not in use and optimizes vehicle performance throughout a wide range of ambient temperatures. It also improves system efficiency, fast charging performance, and battery durability. The inclusion of battery thermal conditioning on test procedures would advance the administration's goals for EV adoption by encouraging the introduction of vehicles with this technology's improved real-world performance by making it visible to customers on the label. Prohibiting thermal conditioning during testing could limit such innovation. [EPA-HQ-OAR-2019-0055-1246-A1, p.7]

For example, GM agrees with the EPA's statement in the NPRM that "the intent of the CTTP (Cold Temperature Test Procedure) is to capture the performance of vehicles under extreme cold start conditions during short trip city driving". BEVs utilizing thermal conditioning will demonstrate improved real-world performance on short trip city driving under these conditions. Reflection of this benefit on the label allows customers a more accurate comparison between vehicles. [EPA-HQ-OAR-2019-0055-1246-A1, p.7]

Moreover, allowing these technologies on test procedures would incentivize manufacturers to further encourage customers to adopt the desirable behavior of leaving EVs plugged in when not in use. This practice will become increasingly important not just to benefit from vehicle innovations such as thermal conditioning, but also to enable future transformative network improvements such as smart grids. [EPA-HQ-OAR-2019-0055-1246-A1, p.7]

Organization: *Tesla, Inc. (Tesla)*

EPA also proposes several changes to the existing light-duty BEV test procedures.156 As per below, Tesla provides response to a number of these specific proposals. In support of these comments, Tesla has provided confidential business information to the agency containing this relevant data.157 [EPA-HQ-OAR-2019-0055-1219-A1, p.20]

156 87 Fed. Reg. at 17631-17635.

157 See, Appendix 2. Submitted separately as confidential business information.

A. EPA Proposal: *For model year 2023, manufacturers may continue to perform full charge depletion testing on BEVs when running the CTTP to determine the 5-cycle adjustment factor. However, EPA is proposing that in model year 2023 manufacturers would be required to perform a 10-minute key-off soak between each UDDS cycle performed as part of the charge depleting CTTP. We are not proposing to change the existing requirement to submit a written request for EPA approval to perform 5-cycle testing prior to beginning 5-cycle adjustment procedure testing. EPA is proposing that manufacturers will be required to attest that the vehicle was not preconditioned or connected to an external power source during the 20°F cold soak period.*158 [EPA-HQ-OAR-2019-0055-1219-A1, p.20]

158 87 Fed. Reg. at 17632/1.

Tesla disagrees with this proposal. Enforcing a 10-minute key-off soak during the CTTP will increase the test length of the CTTP by approximately 45%. Based on our physics-based modeling, the change from 0 to a 10- minute soak is expected to impact the cold running consumption by 4.5% and overall consumption by 0.5%. This rule change would significantly increase test burden with little impact to the overall sticker range/MPGe. Additionally, Tesla proposes that EPA only require retesting on new vehicle lines or existing vehicle lines with product changes significantly affecting fuel economy. For vehicle lines that are substantially similar to the previously certified Model Year, EPA should allow carry-over of data from previous Model Year. This would significantly help reduce the additional testing burden induced by this proposed change. [EPA-HQ-OAR-2019-0055-1219-A1, p.20]

B. EPA Proposal: *Beginning with model year 2024, EPA is proposing that manufacturers would be allowed to perform only two UDDS cycles when running the CTTP, with a 10-minute key-off soak between the UDDS cycles to generate their BEV 5- cycle adjustment factor. The running fuel consumption for the City fuel economy equation would be modified from the equation provided in Appendix C of the 2017 version of SAE J1634. The charge depletion value would be replaced with the results from Bag 2 of the first and second UDDS and Bag 1 from the second UDDS. The Agency would allow manufacturers to use their existing CTTP test results to make these calculations, or they could perform new tests with the option to have the vehicle's state-of-charge set to a value specified by the manufacturer such that the vehicle can capture regeneration energy during the first UDDS cycle.*159 [EPA-HQ-OAR-2019-0055-1219-A1, pp.20-21]

159 Id.

Tesla understands and appreciates the EPA's proposal and desire to reduce testing burden on manufacturers. However, Tesla is concerned that the proposed change is not in the spirit of the significance of the Cold Temperature Running Fuel Use as originally proposed in the EPA's 5-cycle support document to capture the 'Fuel use once the engine is warmed up at colder temperatures.'160 The 5-cycle support document states explicitly that the assumption is that the vehicle is fully warmed up by the end of Bag 1 of the FTP.161 Per the document, the impact was studied on conventional internal combustion engine (ICE) vehicles and Hybrid Electric Vehicle (HEV) and the assumption was found to have a larger negative impact on HEVs (1.2%) than ICE vehicles (0.3%) mainly because the powertrain had not adequately reached steady state operating temperatures.162 With BEVs, the impact is generally much larger for the same reason – it takes longer for the HV battery and other powertrain components to heat up relative to other fuel types. If we take inspiration from the previously accepted threshold of 1.2% impact on MPG for HEVs, then this change being almost 3x that threshold is unacceptable and would put BEVs at a disadvantage due to inaccurate representation relative to other fuel types. Appendix 2, Error! Reference source not found. provided in Tesla's confidential business information (CBI) submission summarizes the impact that the proposed rule change would have on all currently approved Tesla vehicles, showing an average impact of 3.4%, far above the previously acceptable 1.2% threshold established for HEVs and 0.3% for ICE vehicles. Tesla urges the EPA reconsider the proposal and not put BEVs at a disadvantage relative to other fuel types. [EPA-HQ-OAR-2019-0055-1219-A1, p.21]

160 EPA, Final Technical Support Document Fuel Economy Labeling of Motor Vehicles: Revisions to Improve Calculation of Fuel Economy Estimates EPA-420-R-06-017 (Dec. 2006) at 4, 36.

161 Id. at 78.

162 Id. at 136.

EPA outlines its justification of the methodology a difference in calculation between BEVs and other fuel types to include an additional datapoint (UDDS2 Bag2) in the calculation procedure to account for the expectation that 'BEVs will require more than two UDDS cycles with a 10-minute key-off soak between them for the vehicle to reach a fully warmed up and stabilized operating point.' 163Tesla believes that the 2 cycles (even with the inclusion of the addition bag) are insufficient to capture the cold steady-state consumption. Tesla has studied the impact on this change and found it to decrease consumption by an average of 0.5% compared to the methodology used for other fuel types as shown in Appendix 2, of Tesla's CBI submission. [EPA-HQ-OAR-2019-0055-1219-A1, p.21]

163 EPA, Final Technical Support Document Fuel Economy Labeling of Motor Vehicles: Revisions to Improve Calculation of Fuel Economy Estimates (Dec. 2006) at 220.

Tesla appreciates the acknowledgement of the differences in warm-up times and the desire to reduce test burden, but Tesla believes the agency is heading in the wrong direction with these proposed changes. EPA's goal should be to encourage automakers to produce more efficient vehicles. Since most BEVs will not achieve steady state operating condition during the first 2 cycles, if EPA's proposed change is adopted, it will disincentivize manufacturers to improve their steady-state consumption in the cold. In fact, it could do the opposite and encourage them to make the consumption worse in hopes of reducing the cold start fuel penalty. Tesla believes the actual stabilized cold consumption is an important aspect to capture in the five-cycle methodology. [EPA-HQ-OAR-2019-0055-1219-A1, p.21]

If EPA is hoping to reduce test burden while also capturing the steady-state consumption during cold city driving conditions without conducting a full cold depletion, Tesla highly recommends that EPA consider an asymptotic convergence criterion for stopping the CTTP. Our simple proposal is to stop the CTTP when the consumption has stabilized and take the average consumption over the last few cycles as the cold running consumption. If we consider the proposal of stopping when the latest cycle consumption is within 3% of the running consumption of the last three cycles (as shown in Tesla's CBI submission Appendix 2, on the 2022 Tesla Model 3 Long Range AWD) we could reduce the number of cycles driven in the CTTP from 41 to 5 (88%) with only a 2.1% increase in Cold Running Consumption, which translates to a 0.4% change in range/MPGe. With this proposal, we would be in the same accuracy region as ICE vehicles in the original proposal. Tesla believes a procedure such as the one proposed could accomplish the EPA's goals of reducing test burden while more accurately capturing the true steady-state cold energy consumption. [EPA-HQ-OAR-2019-0055-1219-A1, pp.21-22]
Applying the Tesla proposed convergence criterion methodology for all other currently Tesla vehicles, we get an average impact of -0.1% with an average reduction of CTTP test cycles by 85% as shown in Appendix 2, in the Tesla CBI submission. [EPA-HQ-OAR-2019-0055-1219-A1, p.22]

The proposed asymptotic convergence criterion by Tesla accomplishes the EPA's goal of capturing the warmed up consumption in the cold while significantly reducing the testing burden with only 0.1% impact to the overall MPGe on average. The method proposed here is also much more robust to different vehicle architectures with larger battery packs and cabins than specifying an arbitrary number of cycles to conduct the testing. Tesla urges the EPA to consider further study this proposal as an efficient way to reduce testing burden while accurately capture the warmed-up cold consumption. [EPA-HQ-OAR-2019-0055-1219-A1, p.22]

Tesla would also like to urge the EPA to consider revamping the 5-cycle testing methodology to capture important effects that are not yet captured in the current regulations specifically related to BEVs. Tesla is open to working with the EPA together to support a new testing standard that captures all the important considerations for BEV customers instead of making minor revisions to existing standards that were not originally developed with BEVs in mind. [EPA-HQ-OAR-2019-0055-1219-A1, p.22]

Namely, Tesla firmly believes that the range and MPGe should be decoupled from each other. The two values represent different types of driving concerns that should not be linked. Customers generally care about range on long trips where their behavior more closely mimics highway driving, while MPGe should more accurately capture the lower speed stop and start nature of day-to-day driving. Tesla also believes that the label should be broken out based on temperature to give customers a more accurate representation of the consumption they should expect under cold conditions, given that it is a large deterrent for customers from colder climates. Other governments around the world have taken the lead in showing cold consumption estimates on their label (Tesla will refrain from commenting on their methodology here). If customers in the U.S. had information for how BEVs performed in the cold relative to ambient conditions that were backed by a governing body, it could give customers more confidence in their buying choice and help meet the federal government's goal of increasing the share of electric vehicle sales on the road. [EPA-HQ-OAR-2019-0055-1219-A1, p.22]

C. EPA Proposal: E*PA is proposing to update the SAE J1634 standard referenced in 40 CFR part 600 from the 2012 version to the 2017 version. This update will require manufacturers to use 65 mph for the constant speed cycles of the MCT. In addition, this update will allow manufacturers to use the BEV 5-cycle adjustment factor methodology outlined in Appendices B and C of the 2017 version of SAE J1634 with the revisions described below.*164 [EPA-HQ-OAR-2019-0055-1219-A1, p.22]

Tesla supports the regulations update to reference the 2017 version of SAE J1634 that requires the constant speed cycles to be conducted at 65 mph, but Tesla urges the EPA to instead adopt the latest published version of SAE J1634 from April 2021. The April 2021 revision represents the industry's best understanding of the real world use of BEVs and how to test them. [EPA-HQ-OAR-2019-0055-1219-A1, p.22]

164 87 Fed. Reg. at 17631/3

D. EPA Proposal: *The Agency is also proposing additional changes to the procedures outlined in the 2017 version of SAE J1634 including: Specifying a maximum constant speed phase time of 1 hour with a minimum 5-minute soak following each one-hour constant speed phase; specifying the use of the methods in Appendix A of the 2017 version of SAE J1634 to determine the constant speed cycle's total time for the mid-test constant speed cycle; and, specifying that energy* *depleted from the propulsion battery during key-off engine soak periods is not included in the useable battery energy (UBE) measurement.*165 [EPA-HQ-OAR-2019-0055-1219-A1, p.23]

165 87 Fed. Reg. 17632/1-2

Tesla does not support these changes to the regulations. First, Tesla does not agree that mandating breaks during the CSCM is necessary or represents the real-world driving behavior. If a manufacturer or an independent test lab can perform the complete CSCM without taking a break, they should not be required to take a break. Mandating a 5-minute break every hour will introduce another source of error by increasing the number of instances where a test operator needs to act and potentially result in an invalid test. [EPA-HQ-OAR-2019-0055-1219-A1, p.23]

E. EPA Proposal: *Manufacturers predetermine estimates of the mid-test constant speed cycle distance (dM) using the methods in SAE J1634, Appendix A.*166 [EPA-HQ-OAR-2019-0055-1219-A1, p.23]

166 87 Fed. Reg. 17632/1

Tesla believes that each manufacturer should be given the flexibility to determine the length of the CSCM using their own methodology. Specifying the exact calculation procedure is unnecessary and will stifle innovation in this domain. Better methods (than those detailed in Appendix A of SAE J1634 2017) exist and manufacturers should be able to use them if they are capable. For example, the calculation in Appendix A of SAE J1634 2017 uses a target speed of 65 mph to calculate the time necessary to complete the target distance. What is not accounted for is if the vehicle is not driven exactly at 65 mph but instead driven at speeds closer to 67 mph, the CSCM will experience both a higher consumption and a larger distance travelled than intended, potentially creating an invalid test if we were to run out of energy during the second dynamic section. Tesla can monitor its cars remotely and can switch from the CSCM to the dynamic section when necessary by measuring the appropriate signals. This helps ensure repeatability on our end and significantly reduces the likelihood of us running out of energy during the second dynamic section, creating an invalid test. [EPA-HQ-OAR-2019-0055-1219-A1, p.23]

F. EPA Proposal: *Discharge energy that occurs during the key-off soak periods is not included in the useable battery energy.*167 [EPA-HQ-OAR-2019-0055-1219-A1, p.23]

167 Id.

Tesla disagrees that the energy during the key-off soak periods should be excluded from the UBE measurement. This proposal seems to be in direct contrast to the true intent of measuring UBE, which is to determine the totality of the energy available in the HV battery available to the vehicle for driving. If the energy during breaks is excluded, it would result in an artificial and arbitrary limit to the total range and give a false impression to the user about the true capability of the vehicle. Moreover, by including the energy during the CSCM break in the UBE, we can realize the EPA's goal of reducing testing variability by ensuring that no matter how the CSCM is conducted, each laboratory should be able to recreate the same energy number. [EPA-HQ-OAR-2019-0055-1219-A1, p.23]

EPA Summary and Response

Auto Innovators, Volkswagen, and Tesla recommended revising the proposed rule to reference the 2021 version of SAE J1634 to harmonize BEV test procedures with the California Air Resource Board and capture the current best understanding of real-world effects for BEVs. Auto Innovators also requested the option to allow use of the Short Multi-Cycle Test (sMCT) and the Short Multi-Cycle Test Plus Steady State (sMCT+) procedures to harmonize with CARB and significantly reduce laboratory test burden associated with BEV testing, while providing equivalent test results.

> It is EPA's understanding California will allow manufacturers to utilize the SMCT, SMCT+, MCT, or SCT procedure to determine in-use BEV range values as part of California's proposed BEV durability requirements beginning in the 2026 MY. California retains the right to perform any of the test procedures. While California allows manufacturers to submit data utilizing the SMCT and SMCT+ test procedures, California may not utilize those procedures when performing their battery durability testing on the same vehicles.
>
> Currently EPA BEV testing regulations are used to determine BEV range and MPGe for fuel economy labeling, the Agency currently does not have BEV durability requirements similar to the requirements proposed by California. California's proposal is for in-use vehicles to be tested to determine whether the vehicle meets the California battery durability requirement. Manufacturer generated data submitted to EPA is used to determine fuel economy label values and EPA routinely performs confirmatory testing on BEVs.
>
> The Agency is currently evaluating the updated test procedures in the 2021 version of J1634. The Agency needs to understand if the different procedures produce different test results. The Agency needs to understand prior to adopting the updated standard if any differences in vehicle performance and UBE are observed between the SMCT, SMCT+, MCT, and SCT test procedures. Prior to adopting the 2021 updates to SAE J1634 EPA believes it is important to understand these differences and the potential impact on range and MPGe label values.
>
> EPA notes the Auto Innovators did not provide data supporting the conclusion that the SMCT and the SMCT+ test results were equivalent with each other and with the 2017 J1634 version MCT test procedure. The Agency is aware that there is very little publicly available test data that could be used to conclude the procedures produce equivalent test results.
>
> EPA understands managing propulsion battery temperature is important for battery durability, vehicle performance, and energy efficiency. Current EPA regulations and the proposed update to the 2017 version of J1634 do not allow for the use of thermal conditioning during the cold soak portion of the Cold Temperature Test Procedure (CTTP or 20°F charge depleting UDDS).

The Agency does not agree with the Auto Alliance's assertion that the current regulations and policy "restrict emerging technologies that could improve real-world performance and efficiency." The Agency understands that many BEVs available today have remote start and battery and cabin preheating features. These features have been introduced by the manufacturers without the benefit of these features being captured during the CTTP and used to determine the 5-cycle adjustment factor. In addition, significant investments are being made by industry to develop higher efficiency HVAC systems for BEVs including adopting heat pumps. The improvements due to the higher efficiency HVAC systems are captured when performing 5-cycle adjustment factor testing.

The fuel economy label essentially serves two purposes: (1) to provide consumers with a basis on which to compare the fuel economy of different vehicles, and (2) to provide consumers with a reasonable estimate of the fuel economy they can expect to achieve (71 FR 77873). EPA extended fuel economy labeling requirements to BEVs beginning in the 2013 MY with the adoption of the NHTSA/EPA Revisions and Additions to Motor Vehicle Fuel Economy Label Final Rule in July 2011 (76 FR 39478). The 2011 rule further extended the capability to compare fuel economy not only from vehicles using the same fuel, but to vehicles using different fuels including BEVs with the adoption of the equivalent MPG (MPGe) value for vehicles using non-liquid fuels. For the fuel economy comparisons to be relevant it's important that the estimates are determined as EPA has noted in prior rulemakings 'using a "common yardstick" – that is the same test run under the exact same set of conditions, making the fuel economy estimates a fair comparison from vehicle-to-vehicle' (71 FR 77874).

At this time the Agency is not prepared to adopt the 2021 version of SAE J1634. The Agency is evaluating the new test procedures (SMCT and SMCT+) to ensure they produce results equivalent to those generated using the existing SCT and MCT test procedures. In addition, the Agency is assessing the use of pre-conditioning the battery and cabin of BEVs prior to performing tests. The Agency is not prepared to adopt preconditioning for BEVs during the soak period prior to starting the drive cycle for the CTTP. The intent of the 12- to 36-hour cold soak period prior to the start of the drive cycle for the CTTP is to stabilize the vehicle and its components at 20°F prior to starting the driving portion of the test. While BEVs have technology and operating modes designed to precondition the battery and cabin while the vehicle is soaking, for this technology to function the vehicle must have access to a dedicated EVSE and the operator must enable this operation. The Agency does not expect that a predominance of BEVs will have access to a dedicated EVSE while the vehicle is 'cold soaking' prior to many cold starts and the operator will also have enabled the preconditioning mode. Therefore, the Agency is not prepared to adopt the 2021 version of SAE J1634.

Auto Innovators, General Motors, and Volkswagen requested that EPA remove proposed requirements explicitly prohibiting thermal conditioning to avoid restricting emerging technologies that could improve real-world performance and efficiency (for example, under extreme cold start conditions during short trip city driving). Manufacturers further requested that EPA consider allowing them to incorporate new thermal-conditioning technologies as part of the 5-cycle test procedure approval process, based on the manufacturer's demonstration that the technology represents real-world operation (such as through default settings, instructions from the manufacturer, or demonstrated in-use behavior). General Motors further suggested that modifying the regulation to account for thermal-conditioning technologies would incentivize manufacturers to motivate customers to adopt better charging practices, which could also become important to enable future transformative network improvements such as smart grids.

> EPA recognizes the Agency allows test procedures to be modified based on determinations that the test procedure modification is something that will occur in customer operation based on default operation or demonstrated real-world usage. One current example relates to the use of premium grade fuel when performing testing to demonstrate compliance with EPA's criteria pollutant standards. With the adoption of the Tier3 regulation EPA revised the test fuel specifications for demonstrating compliance with criteria emissions. EPA revised the fuel specification so that it more closely matched commercial fuel. Compared to the Tier 2 test fuel, the Tier 3 test fuel has a lower octane rating and includes 10% ethanol. The Agency, however, does allow manufacturers to perform certification testing using a premium fuel when the manufacturer conditions the warranty on use of premium gasoline. Based on broad market availability of premium fuel and the manufacturer informing their customer that the powertrain warranty requires use of the premium fuel, the Agency allows manufacturers to use premium fuel for certification testing.
>
> While EPA believes a manufacturer could instruct a BEV owner to 'precondition their vehicle' by plugging it into an EVSE while the vehicle is parked and the ambient temperature is below a specified cold temperature, the Agency believes this will not occur for many of the cold temperature parking conditions BEVs will encounter. It is the Agency's understanding that this type of conditioning occurs only while the vehicle is connected to the EVSE and consuming power from the electric utility which will require the owner to locate and connect to an EVSE during extended parking periods. BEV owners who commute to a workplace will experience an extended soak at home and at their workplace. The Agency would expect BEV owners, who also live in a single-family home would have the ability to ensure their BEV is plugged in and the vehicle is programmed to precondition the battery during the overnight cold soak. BEV owners that live in communities without a specified parking spot most likely do not have 24-hour access to an EVSE. These BEV owners therefore would most likely not be able to ensure the vehicle is connected to the EVSE and programmed to maintain the battery temperature during the overnight soak. In addition, at the workplace the vehicle will most likely not have access to a dedicated charger. Therefore, the daily cold soak at the workplace will most likely not include battery preconditioning.
>
> The Agency is not prepared to adopt preconditioning for BEVs during the soak period prior to starting the drive cycle for the CTTP. The intent of the 12- to 36-hour cold soak period prior to the start of the drive cycle for the CTTP is to stabilize the vehicle and its components at 20°F prior to starting the driving portion of the test. While BEVs have technology and operating modes designed to precondition the battery and cabin while the vehicle is soaking, for this technology to function the vehicle must have access to a dedicated EVSE and the operator must enable this operation. The Agency does not expect that a predominance of BEVs will have access to a dedicated EVSE while the vehicle is

‘cold soaking’ prior to many cold starts and the operator will also have enabled the preconditioning mode. Therefore, the Agency is not prepared to adopt the 2021 version of SAE J1634.

The possibility exists a manufacturer may decide to consume stored battery energy to precondition the battery depending on the ambient temperature, the battery temperature when the vehicle is parked, and other factors. Using stored battery energy for preconditioning the battery temperature also has not been addressed in either EPA regulations or SAE J1634. If a manufacturer were to implement such a strategy, the Agency would expect the energy consumed during the extended cold soak prior to the CTTP would need to be measured and captured as DC discharge energy. The current BEV CTTP procedure does not require measuring BEV DC discharge energy during the extended cold soak prior to performing the CTTP since it is assumed the BEV goes into sleep mode during the extended cold soak and consumes minimal to no electrical energy during this time. If a vehicle does not go into a minimal to no energy consumption condition during an extended cold soak while not connected to an EVSE and this energy is used for conditioning any vehicle components, including the battery or the cabin, the Agency would want to work with the manufacturer to determine a means to capture this energy consumption and include it in the measured DC energy as part of the test procedure.

The Agency is not aware of any vehicles which when not plugged into an EVSE will consume stored energy to maintain the temperature of the battery during extended cold soaks.

<u>Auto Innovators had the following comments on the changes proposed in 40 CFR 600.116-12:</u>

§600.116-12(a)(2)(i) Auto Innovators request that EPA omit the 15 second idle energy from the highway cycle energy consumption. Including the idle in the highway phase data does not align with the highway test for ICE vehicles. The idle energy should be included in the overall Usable Battery Energy (UBE).

We agree that the BEV measurement procedure should align with testing for engine-equipped vehicles, for which emission sampling starts at the beginning of the HFET cycle. We have amended the regulation accordingly. With respect to UBE, the 2017 version of SAE J1634 specifies UBE as the summation of the measured DC discharge energy for the MCT drive cycles. As the commentor noted, the measured portion of the HFET does not include the idle period before starting the HFET. In addition, the measured portion of the UDDS does not include the idle period following the UDDS; this 15 second idle is therefore not included in either the UDDS or HFET energy consumption and therefore is also not included in the UBE.

§600.116-12(a)(4) Auto Innovators request that EPA remove the requirement to use Method 1 or Method 2 described in SAE J1634 Appendix A to estimate the mid-test constant speed cycle distance (dM). Manufacturers are developing methods to calculate dM to ensure that the CSCe distance is less than 20% of the overall distance, with margin to reduce the risk of invalid tests. Requiring the methods from SAE J1634 will require process changes and may result in less accurate determination of dM.

EPA is adding an additional option allowing manufacturers to determine mid-test constant speed distance using a method based on good engineering judgment, or using the methods outlined in Appendix A. *§600.116-12(a)(5)* Auto Innovators request that EPA clarify the requirement to perform a minimum 5-minute key-off soak at the conclusion of each mid-test constant speed phase; specifically regarding the need for key-off before the dynamic UDDS3 segment.

As noted in Section 6.6 of the 2017 version of SAE J1634 the phase breaks during the constant speed cycle require a 5- to 30-minute key-off soak period. The Agency is setting the other soak periods (key-on and key-off) equivalent to those outlined in the 2017 version of SAE J1634. Therefore, at the conclusion of the mid-test constant speed cycle, the vehicle does not need to have a key-off pause before starting UDDS3.

§600.116-12(a)(8) Auto Innovators requested that all energy measured during the entire test be included for determining usable battery energy (UBE). Auto Innovators stated that the UDDS and HFET cycles are used to calculate energy efficiency over these cycles, and that the remaining test is used to determine total DC discharge energy. Auto Innovators also stated that including all energy measured during the test, including key-off soaks and idles, represents the UBE stored in the battery.

This request is inconsistent with SAE J1634. UBE is the summation of the battery energy captured during the measured phases of the MCT. DC discharge energy is not measured during the key-off soak periods.

As noted in §1066.425(e), sampling for a drive cycle concludes when the vehicle is shut down at the conclusion of the drive cycle and the sampling response time elapses. SAE J1634 does not specify a response time for the DC discharge energy measurement; the standard does specify a maximum integration time of 0.05 seconds. Therefore, the measurement of each cycle concludes once the vehicle speed reaches 0 mph at the conclusion of the drive cycle. SAE J1634 defines UBE as the total DC discharge energy (Edc_{total}) measured for a full discharge test. SAE J1634 also defines Edc_{total} as the sum of all discharge energies for all phases of a test. The key-off soak periods occur before or after a measured phase or cycle. As the key-off soak periods are not measured periods of drive cycles, we are writing the final rule to exclude the key-off battery discharge from the UBE measurement.

§600.116-12(a)(11)(i), (iii), and (iv)(D) Auto Innovators requested that EPA modify the proposed regulation by delaying the requirements to perform the 20 °F charge-depleting UDDS with a 10-30 minute key-off soak period between each UDDS cycle, and the requirement to perform the 20 °F test using two UDDS cycles. Auto Innovators stated that the change to the regulation should be optional through model year 2025 to allow manufacturers enough lead time to address any potential issues, make any necessary upgrades, and to train testing personnel. Auto Innovators further requested that, to the extent EPA delays implementation of the requirement to perform cold temperature testing with two UDDS cycles, EPA should also delay the requirement to use the modified equation for “RunningFC” to calculate city fuel economy.

Rivian recommended allowing additional lead time beyond model year 2024 for manufacturers to implement the proposed requirement to perform only two UDDS cycles when running the CTTP to generate a BEV 5- cycle adjustment factor.

We agree that the timing of the final rule does not allow adequate lead time for manufacturers to comply with the updated requirements for model year 2024. We are changing the final rule to require manufacturers to meet the new requirements starting in model year 2025.

Rivian recommends changing the proposed requirement to perform only two UDDS cycles when running the CTTP to generate a BEV 5- cycle adjustment factor to instead provide manufacturers with options for a different amount of driving as part of the BEV procedure. Rivian specifically recommends allowing up to six UDDS cycles when running the CTTP.

Volkswagen objected to the proposed change to §600.116-12(a)(11) and requested that EPA instead preserve the option of performing a full charge-depletion 20 °F cold test beyond model year 2024. Volkswagen stated that removing the option to perform a full charge-depletion 20 °F cold test would no longer allow manufacturers to demonstrate the efficiency improvements of technologies more prevalent in the full charge-depletion test procedure, which would create a barrier to investment in advanced technologies.

> As noted in the preamble to the notice of proposed rulemaking (87 FR 17632), allowing BEVs to perform a full charge-depletion Cold Temperature Test Procedure (CTTP) creates test procedure differences between BEVs and non-BEVs. The intent of the CTTP is to capture the performance of vehicles under extreme cold-start conditions for the shorter trips associated with city driving. The NPRM proposed two options for BEV CTTP tests: (1) testing vehicles on two UDDS cycles with a 10-minute key-off soak between the cycles, or (2) follow the existing CTTP test procedure by running one UDDS cycle followed by a 10-minute soak and then running one Bag 1 phase from the second UDDS cycle. Performing more than two UDDS cycles during the CTTP does not represent extreme cold-start short-trip urban driving, which is the activity the CTTP captures for fuel economy labeling.

Tesla disagrees with the requirement to perform a 10-minjute key-off soak between each UDDS cycle. Tesla stated that enforcing a 10-minute key-off soak during the CTTP will increase the test length of the CTTP by approximately 45% and impact the cold running consumption by 4.5% and overall consumption by 0.5%, along with an increase in test burden with little impact to the overall sticker range/MPGe. Additionally, Tesla proposes that EPA only require retesting on new vehicle lines or existing vehicle lines with product changes significantly affecting fuel economy. Tesla stated that, for vehicle lines substantially similar to the previously certified Model Year, EPA should allow carry-over of data from previous Model Year to reduce testing burden.

> The Agency has identified two testing procedural issues with the Charge Depleting Cold Temperature Test Procedure (CD CTTP) for BEVs as outlined in the 2017 version of J1634. The primary procedural issue is using a full charge depletion test to determine the average UDDS energy consumption for the running fuel consumption calculation. The second procedural issue when allowing a full charge depletion is to not require the 10-minute soak between UDDS cycles following the second UDDS cycle. The CTTP is designed to capture short trip urban driving, which typically consists of multiple short trips with variable soak times between each trip. To not include the soak period after each UDDS cycle except between the first and second UDDS cycles is not representative of the driving experience the CTTP test is designed to capture. As noted by Tesla's analysis, not including the 10-minute soak period improves BEV efficiency as the vehicle does not lose heat.
>
> It was not the intent of the Agency to force all BEVs to perform new CD CTTP testing for model year 2023. The Agency intended for any new CD CTTP testing to be

performed with the 10-minute soak occurring between each UDDS cycle. As proposed this change in the CD CTTP test procedure would create a discrepancy between vehicles tested using the 5-cycle procedure prior to model year 2023 and vehicles tested in model year 2023. The Agency also agrees with Tesla that this change to the CD CTTP would add additional test burden due to the length of the CD CTTP for long range BEVs.

The Agency has concluded not to move forward with this proposal for a single model year for the reasons described above. If the Agency were to move forward with this proposal, the 5-cycle test procedures would be different between vehicles tested for model year 2023 and vehicles using carry-over fuel economy label data from model years prior to 2023. This is not consistent with the Agency's objective of maintaining test procedure consistency for fuel economy labeling.

Tesla is concerned that the proposed testing changes in §600.116 are not in the spirit of the significance of the Cold Temperature Running Fuel Use as originally proposed in the EPA's 5-cycle support document. Tesla observed that EPA's 5-cycle support document explicitly assumes that the vehicle is fully warmed up by the end of Bag 1 of the FTP. Tesla urges that EPA reconsider the proposal and not put BEVs at a disadvantage relative to other fuel types. Tesla believes that the two UDDS cycles are insufficient to capture the cold steady-state consumption. Tesla stated EPA's proposed change would disincentivize manufacturers to improve their steady-state consumption in the cold. Tesla believes the actual stabilized cold consumption is an important aspect to capture in the five-cycle methodology.

Tesla highly recommends that EPA consider an asymptotic convergence criterion for stopping the CTTP. Our simple proposal is to stop the CTTP when the consumption has stabilized and take the average consumption over the last few cycles as the cold running consumption.

Tesla would also like to urge EPA to consider revamping the 5-cycle testing methodology to capture important effects that are not yet captured in the current regulations specifically related to BEVs. Namely, Tesla firmly believes that the range and MPGe should be decoupled from each other. Tesla stated that the two values represent different types of driving concerns that should not be linked and that, if customers in the U.S. had information for how BEVs performed in the cold relative to ambient conditions that were backed by a governing body, customers would have more confidence in their buying choice.

As noted in the Final Technical Support Document (Final Technical Support Document: Fuel Economy Labeling of Motor Vehicle Revisions to Improve Calculation of Fuel Economy Estimates, December 2006, EPA-420-R-06-017), the Agency understood that vehicles using spark-ignition internal combustion engines did not reach fully warmed up operating temperatures during Bag 2 and Bag 3 of the 20°F FTP, or Cold Temperature Test Procedure (CTTP). The following language is from the Final TSD:

"As discussed in detail in the Draft Technical Support Document to the NPRM, it is not clear that vehicles are fully warmed up during Bags 2 and 3 at 20°F. However, as described above, the average city driving trip is only 4.1 miles, well below that of the FTP (7.5 miles). Thus, Bags 2 and 3 of the cold FTP provide a reasonable estimate of warmed up driving during city-like driving (i.e., the vehicle is warmed up to the extent that it typically reaches during short trips). The effect of cold temperature on [running] fuel use during city driving can be estimated from the difference in fuel use over Bags 2 and 3 of the FTP at 20°F and that at 75°F." (EPA-420-R-06-017, December 2006, pg. 78)

The intent of the CTTP and its use in the 5-cycle equation was to capture the running fuel consumption observed during average city driving. As the average city trip was determined at the time of the 5-cycle fuel economy label rulemaking to be 4.1 miles, bags 2 and 3 of the CTTP are representative of 'running' as opposed to 'cold start' vehicle operation (Bag 1) during an average city trip. The intent for these data in the fuel economy label calculation is to capture the running fuel consumption of the vehicle, during a city trip and not to determine the fully warmed up energy consumption at the colder ambient temperature. This criterion applies to all vehicles, independent of the power source.

To reduce the CTTP test burden Tesla proposes to stop the CTTP once the BEV's energy consumption has stabilized and take the consumption over the last few UDDS cycles for the running fuel consumption calculation. Tesla indicates this would require approximately 5 to 7 UDDS cycles. The Tesla proposal would use the energy consumption measured after the vehicle has driven anywhere from 3 to 5 UDDS cycles to represent the energy consumption occurring during the first two UDDS cycles.

The Tesla proposal would have the running fuel consumption used to represent city driving be measured after the vehicle has driven a minimum of 22.5 miles. As this value is intended to represent the running fuel consumption on a city trip which is typically much shorter than 22.5 miles, this procedure would not generate representative fuel consumption data for an average city trip during cold ambient conditions following a cold soak.

Tesla is also requesting the Agency revise the 5-cycle regulations specifically for BEVs. The Agency is not currently considering any further revisions to the 5-cycle regulations, beyond the changes adopted in this rulemaking.

Tesla does not support changing the regulation to (1) specify a maximum one-hour constant-speed phase time with a minimum 5-minute soak after each phase, (2) specify methods to determine the total time for the mid-test constant speed cycle, and (3), specify that energy depleted from the propulsion battery during key-off engine soak periods is not included in the useable battery energy (UBE) measurement. First, Tesla does not agree that mandating breaks during the CSCM is necessary or represents the real-world driving behavior. Tesla stated that, if a manufacturer or an independent test lab can perform the complete CSCM without taking a break, they should not be required to take a break, instead of introducing another source of error.

EPA believes it is appropriate to require breaks during the constant-speed portion of the MCT. SAE J1634 allows for breaking the constant speed cycles into phases and the Agency has concluded that it is appropriate to have a consistent approach to the operation of the vehicle during the constant-speed portion. The Agency believes allowing drivers to take a break after an hour of constant-speed driving is appropriate and will not add significant time to the MCT procedure and will reduce driver/operator fatigue.

Tesla believes manufacturers should be allowed to determine the length of the CSCM for their own testing, and that specifying the exact calculation procedure is unnecessary and will stifle innovation in this domain. Tesla stated that better methods exist and manufacturers should be able to use them if they are capable. Tesla suggested as an example that SAE J1634 2017 uses a speed value of 65 mph to calculate the time necessary to complete the target distance, but it does not account for the fact that the CSCM will experience both a higher consumption and a larger distance travelled than intended if vehicle speed is closer to 67 mph than 65 mph, potentially creating an invalid test. Tesla can switch from the CSCM to the dynamic section when necessary, which helps ensure repeatability and significantly reduces the risk an invalid test resulting from running out of energy during the second dynamic section.

EPA agrees with this comment and will include an additional option for determining the length of the CSCM. The additional option is for the manufacturer to determine the appropriate length using good engineering judgment. This will allow manufacturers to innovate and utilize their extensive knowledge and understanding of their products to determine the appropriate length of the CSCM.

Tesla believes energy during the key-off soak periods should be included in the UBE measurement to reflect the true intent of measuring UBE, which is to determine the totality of the energy available in the HV battery available to the vehicle for driving. Tesla stated that, excluding energy during breaks would result in an artificial and arbitrary limit to the total range and give a false impression to the user about the true capability of the vehicle. Tesla also stated that they can reduce test variability by including the energy during the CSCM break in the UBE.

UBE is defined in the 2017 version of SAE J1634. UBE is defined as the total DC discharge energy (Edc_{total}), measured in DC watt-hours for a full discharge test. The UBE represents the total deliverable energy the battery can provide while a vehicle follows test cycles on a chassis dynamometer. As noted in the definition, UBE is measured while the vehicle is following test cycles. The measured portion of each phase does not include the key-off portion of test cycle. This is the case for all vehicles, independent of whether they use electricity or another fuel.

32.2 Miscellaneous amendments for light-duty vehicles

Comments by Organizations

Organization: *Alliance for Automotive Innovation (Auto Innovators)*

40 C.F.R. 86.117-96 Evaporative emission enclosure calibrations.

We request a correction to the proposed methanol mass equation in 86.117-96(d) by replacing the following NPRM proposed equation: [See equations at docket number EPA-HQ-OAR-2019-0055-1303-A1, p. 2]

$$M_{CH3OH} = V_n \times \left[\frac{\left(TE_f \times (C_{MS1f} \times AV_{1f}) + (C_{MS2f} \times AV_{2f})\right)}{V_{Ef} \times T_{SHEDf}}\right] - \left[\frac{\left(TE_i \times (C_{MS1i} \times AV_{1i}) + (C_{MS2i} \times AV_{2i})\right)}{V_{Ei} \times T_{SHEDi}}\right] + \left(M_{CH3OH,out} - M_{CH3OH,in}\right)$$

With the following corrected equation:

$$M_{CH3OH} = V_n \text{ x } \left[\frac{TE_f \text{ x } \left((C_{MS1f} \text{ x } AV_{1f}) + (C_{MS2f} \text{ x } AV_{2f})\right)}{V_{Ef} \text{ x } T_{SHEDf}}\right] - \left[\frac{TE_i \text{ x } \left((C_{MS1i} \text{ x } AV_{1i}) + (C_{MS2i} \text{ x } AV_{2i})\right)}{V_{Ei} \text{ x } T_{SHEDi}}\right] + \left(M_{CH3OH,out} - M_{CH3OH,in}\right)$$

We also request that an update be made for the Methanol Mass Equation in 86.143-96(b)(1)(i) to align with the corrected equation 86.117-96(d). [EPA-HQ-OAR-2019-0055-1303-A1, p.2]

Additionally, we request a correction for the THC density reference error in 86.143-96(c). The THC density referenced in 1066.1005(f) is based on a hydrogen to carbon ratio of 1.85. As defined in 86.143-96(b)(ii), for evaporative emissions the THC mass assumes a hydrogen to carbon ratio of 2.3. We recommend a THC density with an H/C ratio of 2.3 (576.816 g/m3) be added to 1066.1005(f) and that EPA update the reference in 86.143-96(c) accordingly. [EPA-HQ-OAR-2019-0055-1303-A1, p.2]

<u>40 C.F.R. 86.1823-08 Durability demonstration procedures for exhaust emissions.</u>

Auto Innovators requests the provisions in (m) be optional until 26MY.

Additionally, we request that the following edit be made in (iii):

> (iii) For plug-in hybrid electric vehicles and any other vehicle model the manufacturer determines will experience increased CO2 emissions over the vehicle's useful life, consistent with good engineering judgment, manufacturers must either install aged **<u>batteries and/or other relevant</u> c**omponents on test vehicles as provided in paragraph (f)(2) of this section, determine a deterioration factor based on testing, or provide an engineering analysis that the vehicle is designed such that CO_2 emissions will not increase over the vehicle's useful life. Manufacturers may test using the whole-vehicle mileage accumulation procedures in 86.1823-08(c) or (d)(1), or manufacturers may request prior EPA approval for an alternative durability procedure **<u>or an engineering analysis</u>** based on good engineering judgment. [EPA-HQ-OAR-2019-0055-1303-A1, p.2]

40 C.F.R 600.311-12 Determination of values for fuel economy labels

In this section the phrase 'actual in-use driving conditions' is used. We would like further clarification on the definition of this term or reference to previous section, and clarification on the method or equation used to make the required adjustments. [EPA-HQ-OAR-2019-0055-1303-A1, p.4]

40 C.F.R. 600.512-12 Model year report.

Auto Innovators requested similar revisions in 2020 and supports these proposed changes. [EPA-HQ-OAR-2019-0055-1303-A1, p.4]

Labeling for Battery Electric Vehicles.

Auto Innovators would like to request EPA review testing, labeling and associated processes of vehicles with advanced technology propulsion systems to ensure that drivers of these vehicles are given a clear, concise picture of the capabilities of these vehicles. Testing should be efficient and the labels should be understandable and reflective of understood processes. If items in the testing and labeling process should be updated, EPA should begin to work with stakeholders prior to the Multipollutant Rule to identify what items are outdated and require revision. [EPA-HQ-OAR-2019-0055-1303-A1, p.4]

40 C.F.R 1066.420 Test Preparation.

We agree with EPA's revision to help minimize NMHC contamination in the sampling system for LD diesel vehicles. The language in this section for LD vehicles (below 14,000 lbs GVWR) refers to the HD requirement in 40 C.F.R. 1065.520 (f). 40 C.F.R 1065.520(f)(8) notes that if the initial hang-up in the sampling system exceeds the greatest of the three values shown below, then the source of contamination must be identified and corrective action, such as purging the system, must be performed. [EPA-HQ-OAR-2019-0055-1303-A1, p.5]

(i) 2 % of the flow-weighted mean concentration expected at the HC (THC or NMHC) standard.

(ii) 2 % of the flow-weighted mean concentration of HC (THC or NMHC) measured during testing.

(iii) 2 µmol/mol. [EPA-HQ-OAR-2019-0055-1303-A1, p.6]

The greatest of the three values for light duty will always be the 2 PPM (2 µmol/mol.). For LD, a HC hang-up value on the order of 0.5 PPM is considered high and causes negative drift during testing. The 2 PPM limit is not appropriate for LD testing. [EPA-HQ-OAR-2019-0055-1303-A1, p.6]

Auto Innovators proposes the following change to 40 C.F.R. 1066.420(b)(1)(ii) Perform the contamination verification in paragraph (b)(2) of this section, except use 0.5 µmol/mol in 40 CFR 1065.520(f)(8)(iii) [EPA-HQ-OAR-2019-0055-1303-A1, p.6]

40 C.F.R. 1066.710 Cold temperature testing procedures for measuring CO and NMHC emissions and determining fuel economy.

We support the agency proposal to move the test sequence figure to 40 C.F.R. 1066.710(f). [EPA-HQ-OAR-2019-0055-1303-A1, p.6]

However, it isn't clear what the maximum temperature excursion allowance is during the emissions test. Using the language that is already included in the precondition step, Auto Innovators proposes to improve the clarity of maximum temperature excursion allowed during the emissions test by adding the following to 40 C.F.R. 1066.710(b)(1) At no time may the ambient temperatures be below −12.0 °C or above −1.0 °C. [EPA-HQ-OAR-2019-0055-1303-A1, p.6]

Further, we find it confusing that the high and low limit temperature values aren't equidistant from the nominal value. We suggest simplifying 40 C.F.R. 1066.710 by setting the temperature limits to -7 ± 5 °C for maximum instantaneous excursions and -7 ± 3 °C for three-minute excursions in the text and in the figure for consistency, ease of use, software and hardware implementation. [EPA-HQ-OAR-2019-0055-1303-A1, p.6]

40 C.F.R. 1066.835 Exhaust emission test procedure for SC03 emissions.

Auto Innovators supports the proposed changes in this section as we believe they improve the clarity of the requirements overall. [EPA-HQ-OAR-2019-0055-1303-A1, p.6]

40 C.F.R.1066.1010 Incorporation by reference.

While we support the decision to update to SAE J2263 MAY 2020, we request that the implementation be optional until MY26 to allow time for track and environmental condition updates to be completed. The most recent version contains several updates and tighter tolerances for completion of coast-down testing. These may require construction and testing of new surfaces and hardware. [EPA-HQ-OAR-2019-0055-1303-A1, p.6]

Auto Innovators generally supports the incorporation of the 2021 version of SAE J1634 by reference at 40 C.F.R.1066.1010(b)(2). Incorporating the 2021 revision of SAE J1634 would harmonize BEV test procedures with the California Air Resource Board (CARB) proposed Advanced Clean Cars II test procedures. [EPA-HQ-OAR-2019-0055-1303-A1, p.6]

Organization: *Volkswagen Group of America, Inc., (Volkswagen) (VWGoA)*

40 CFR 86.1823(m) Durability demonstration procedures for exhaust emissions

EPA proposes to add the requirement to generate deterioration factors for CO2 and updates language pertaining to PHEV test procedures.

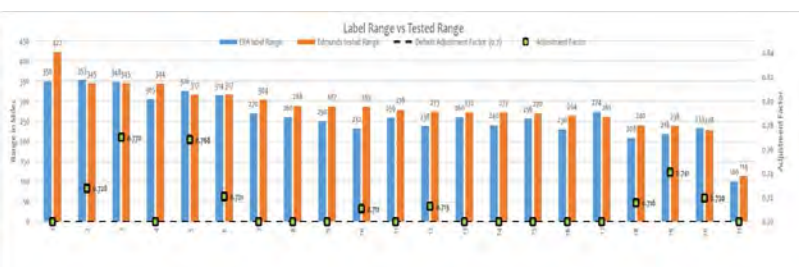
VWGoA requests that EPA allow optional implementation of this until 26MY as this rule will be finalized too close to the start of production for 25MY, and 24MY will already be underway by the time this Final Rule becomes effective.

In subsection (m)(iii) we request the following addition to allow alternative engineering analysis as an alternative durability procedure:

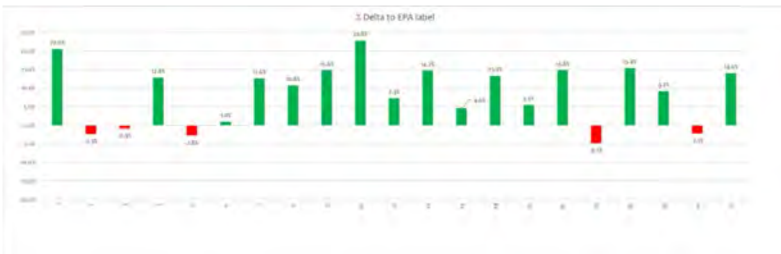
'[…] determines will experience increased CO2 emissions over the vehicle's useful life, consistent with good engineering judgment, manufacturers must either install aged components on test vehicles as provided in paragraph (f)(2) of this section, determine a deterioration factor based on testing, or provide an engineering analysis that the vehicle is designed such that CO2 emissions will not increase over the vehicle's useful life. ~~Alternatively, manufacturers may use~~ Manufacturers may test using the whole-vehicle mileage accumulation procedures in 86.182308 (c) or (d)(1) ~~to determine CO2 deterioration factors~~, or manufacturers may request prior EPA approval for an alternative durability procedure <u>**or an engineering analysis**</u> based on good engineering judgment. [EPA-HQ-OAR-2019-0055-1296-A1, p.1]

<u>40 CFR 600.210-12 (d)(3)(ii)-(iii) Calculation of fuel economy and CO2 emission values for labeling</u>

This section relates to the approval of an adjustment factor for deriving 5-cycle fuel economy results from 2-cycle test data that is based on operating data from their in-use vehicles. As you stated in guidance CD 15-15, the 0.7 factor was no longer to be used for conventional vehicles because it was based on outdated data (then). It remained available for BEVs because there was not enough data to generate a new factor. It has been 7 years since that guidance and BEV models have increased. It is time for EPA to increase this factor. Current research shows that using current model years and real-world driving patterns, this factor could be as high as 0.74. [EPA-HQ-OAR-2019-0055-1296-A1, p.2]



Furthermore, when you look at these 2021MY and 2022MY in terms of differences in the certification range, you see a stark difference to an arguably more real-world test cycle. OEMs should not be penalizing these vehicles right at the time when they are needed most. If this data is not sufficient, EPA should work with OEMs to generate data to update this factor in a meaningful way. [EPA-HQ-OAR-2019-0055-1296-A1, p.2]



Organization: *Rivian Automotive, LLC (Rivian)*

Labeling and Test Groups. EPA should approach the below in both an immediate and longer-term approach including any changes that can be made in this rule, new guidance, or rules ahead of the 2027 LD GHG program.

- Reexamine the label. Consider an approach that focuses on real-world highway driving for range
- Allow for a broader definition of test group including the addition of 2WD and 4WD in the same test group, irrespective of number of motors, with EPA approval.
- Additional test group flexibilities should be examined in light of upcoming battery durability and testing requirements being considered by the California Air Resources Board ("CARB") and POSSIBLE common test group definitions across CARB and EPA.
- Provide an analytically derived range and consumption method specific to EVs.
- Reconsider the default 0.7 adjustment factor to reduce unnecessary test burden and be more reflective of the original 5-Cycle adjustment. This is especially important given the experience gained in implementing EV technology in both hot and cold conditions. [EPA-HQ-OAR-2019-0055-1229-A1, p.6]

Organization: *Edwin J. Ward*

Keeping Section 86.1823-08 as is, with the ultimate goal of ending the light-duty truck loophole

The next source of potential emissions reductions I will address is the enduring light-duty truck emissions loophole. Although this proposed rule is primarily targeted at heavy-duty vehicle emissions, there is nevertheless a section dedicated to light-duty vehicle standards in Section X(E). The light-duty truck loophole allows vehicles not considered heavy-duty, but still larger and heavier than smaller vehicles and sedans, to escape the more stringent emissions requirements of smaller vehicles.10 This loophole dates back to 1975, when few individual drivers were purchasing large trucks for everyday use, and those vehicles were limited to commercial operations.[11] The loophole means that light-duty trucks have to comply with emissions standards that are 34-36% less stringent than the ones that apply to smaller cars like sedans.[11] Unfortunately, a huge proportion of vehicles now sold in the US fall under the light- duty truck loophole. SUVs, pickup trucks, and even some crossovers like the Toyota RAV4 and Honda CR-V are considered light-duty trucks.[11] Last year, twenty of the top twenty-five bestselling vehicles in America were pickups, SUVs, and crossovers, presumably falling into the light-duty truck loophole.[12] [EPA-HQ-OAR-2019-0055-1050]

EPA's proposed rule for light-duty trucks would eliminate the requirement for manufacturers to perform emissions tests with vehicles fully loaded. The proposed revision is quoted in its entirety below:

“Section 86.1823-08: Revising to specify a simulated test weight based on Loaded Vehicle Weight for light light-duty trucks (LDT1 and LDT2). The regulation inadvertently applies adjusted loaded vehicle weight, which is substantially greater and inappropriate for light light-duty trucks because they are most often used like lightly loaded passenger vehicles rather than cargo-carrying commercial trucks. In practice, we have been allowing manufacturers to implement test requirements for these vehicles based on Loaded Vehicle Weight. This proposed revision is responsive to manufacturers' request to clarify test weights for the affected vehicles.” [EPA-HQ-OAR-2019-0055-1050]

This proposed revision is disheartening for two reasons. First, by allowing manufacturers to test light-duty trucks without a full load, EPA is in effect weakening emission standards even further for light-duty trucks, which will widen the already large gap between standards for light- duty trucks and smaller cars like sedans. Manufacturers have fully taken advantage of this loophole over the preceding decades to transform their fleet offerings by heavily investing in large trucks and SUVs, while discontinuing smaller car models. EPA has accounted for this disturbing trend by labeling it simply as “market shift,”[13] despite the fact that modelers have specifically attributed part of the auto industry’s shift to heavier, less efficient vehicles on the loophole.[14] For instance, Ford Motor Company decided in 2020 to axe every single sedan from its lineup[15], leaving exclusively larger, more polluting, and more dangerous[16] trucks and crossovers for its customers.

The second dismaying part of the proposed light duty truck revision is that EPA acknowledges that light-duty trucks are “most often used like lightly loaded passenger vehicles rather than cargo-carrying commercial trucks.” By declaring that trucks should be tested as if they are passenger vehicles, EPA is effectively conceding that the light-duty truck loophole doesn’t make any practical sense. The loophole allows manufacturers to exploit a broken system and undermine potential emissions reductions by simply not making any vehicles subject to the more stringent standards (like Ford did). [EPA-HQ-OAR-2019-0055-1050]

Rejecting the proposed revision to Section 86.1823-08 will not close the light-duty truck loophole. Rejecting it will, however, prevent any further erosion of emissions standards for light-duty trucks until EPA has a chance to propose new light-duty vehicle emission standards that finally, after nearly a half-century, close the loophole. Consequently, I urge EPA to reject the proposed revision to Section 86.1823-08 of the light-duty truck Loaded Vehicle Weight testing standards. [EPA-HQ-OAR-2019-0055-1050]

[Conclusion] In the medium term, EPA should finally close the light-duty truck loophole so manufacturers aren’t incentivized to sell larger, more polluting vehicles. EPA should also evaluate potential idling technologies like start-stop to further reduce emissions. [EPA-HQ-OAR-2019-0055-1050]

10 Andrew Hawkins, US unveils stricter tailpipe emissions standards for new vehicles, THE VERGE (Apr. 1, 2022),

https://www.theverge.com/2022/4/1/23006139/us-new-tailpipe-emissions-standards-fuel-economy-cafe-mpg- buttigieg.

11 Aaron Gordon, Biden's New Fuel Economy Standards Still Allow Cars to Pollute More If They're Not Called Cars, VICE (Dec. 20, 2021), https://www.vice.com/en/article/3abk7b/bidens-new-fuel-economy-standards-still-allow-cars-to-pollute-more-if-theyre-not-called-cars.

12 Joey Capparella, Top 25 Bestselling Cars, Trucks, and SUVs of 2021, CAR AND DRIVER (Jan. 5, 2022), https://www.caranddriver.com/news/g36005989/best-selling-cars-2021/.

13 EPA, HIGHLIGHTS OF THE AUTOMOTIVE TRENDS REPORT, https://www.epa.gov/automotive-trends/highlights- automotive-trends-report (last visited Apr. 30, 2022).

14 Brad Plumer, CAFE loophole could lead to bigger cars, WASH. POST (Dec. 14, 2011), https://www.washingtonpost.com/blogs/ezra-klein/post/cafe-loophole-could-lead-to-bigger- cars/2011/12/14/gIQA3bGLuO_blog.html.

15 Brett Foote, Executive Explains Decision To Discontinue Ford Sedans In North America, FORD AUTH. (Oct. 10, 2020), https://fordauthority.com/2020/10/executive-explains-decision-to-discontinue-ford-sedans-in-north-america/. 16 Eric Jaffe, Op-Ed: The Troubling Tie Between Big Cars and Pedestrian Deaths, STREETSBLOG USA (Oct, 20, 2021), https://usa.streetsblog.org/2021/10/20/op-ed-the-troubling-tie-between-big-cars-and-pedestrian-deaths/.

EPA Summary and Response

Auto Innovators and EMA requested that EPA correct equations in part 86, subpart B: (1) Correcting the proposed adjustment to the methanol mass equation in §86.117-96(d) by applying the TE_f and TE_i factors to the sum of the subsequent terms, and (2) Update the methanol mass equation in §86.143-96(b)(1)(i) to match the updated equation in §86.117(d).

We agree with the comment and have revised the regulation accordingly.

Auto Innovators and EMA requested a correction for the THC density reference error in §86.143-96(c). Commenters stated that the THC density referenced in §1066.1005(f) is based on a hydrogen-to-carbon ratio of 1.85. Commenters stated that, as defined in §86.143-96(b)(ii), the THC mass for evaporative emissions assumes a hydrogen-to-carbon ratio of 2.3. Commenters recommended adding a THC density with a hydrogen-to-carbon ratio of 2.3 (576.816 g/m^3) to §1066.1005(f) and updating the reference in §86.143-96(c) accordingly.

The proposed rule did not include any changes to density reference errors. Auto Innovators did not provide any data or rationale supporting their recommendation. If there is a need to reconsider hydrogen-to-carbon ratios, we will consider that in a future rulemaking.

Auto Innovators and Volkswagen requested that we amend the proposed regulation at §86.1823-12(m) to make the new provisions optional through model year 2025 to allow manufacturers enough lead time.

> The revisions to §86.1823-12(m)clarify how certification and testing procedures apply in areas that are not entirely specified in current regulations. The amendments in this final rule reflect the procedures EPA and manufacturers have worked out in the absence of the detailed regulatory provisions. We do not see any need to allow additional lead time for these established procedures.

Auto Innovators suggested adding a reference in §86.1823-12(m) to “installing aged batteries and/or other relevant components” instead of referring only to “aged components” for PHEV durability testing.

> We agree that it is appropriate to call out batteries as the specific component of interest, along with other relevant components. There is no need to consider the other relevant components separate from the battery, so we have omitted the “or” from the suggested insert.

Auto Innovators and Volkswagen suggested adding a reference in §86.1823-12(m) to “or an engineering analysis” in the description of the option for manufacturers to request an alternative PHEV durability procedure.

> The proposed regulation set up the sentence in question to describe how the manufacturers have the option to either follow the specified whole-vehicle testing procedures, or do something different based on good engineering judgment. There is no specified limit to what the alternative demonstration might include, other than the need to stay within the bounds of good engineering judgment. Manufacturers might properly apply engineering analysis in conjunction with something other than the specified whole-vehicle testing procedures. We therefore find it unnecessary to insert the extra words in the description of option to pursue an alternative durability procedure. We also don’t see any possibility that an alternative durability demonstration would involve engineering analysis completely separate from testing.

Auto Innovators requested that we clarify the meaning of “Adjust the values to reflect actual in-use driving conditions…” in the proposed §600.311-12, and also clarify how to make the required adjustments.

> We have revised the regulation to instead say “Adjust these values to represent derived 5-cycle values…”. We have also made further editorial changes to more clearly describe the process for adjusting values to give a proper result.

Auto Innovators stated that they supported the proposed changes to §600.512-12 and noted that they had requested that we make changes similar to the proposed changes in 2020.

> We acknowledge this comment supporting the proposed provisions.

Volkswagen suggested that we work with manufacturers to review or generate data as needed to be able to update the 0.7 factor used in §600.210(d) to determine fuel economy and CO_2 values for electric vehicles. Volkswagen suggested that current research would suggest that data may support a factor as high as 0.74. Volkswagen stated that the artificially low value leads manufacturers to penalize electric vehicles a time that they are needed most.

We will consider whether to pursue the suggested amendment in a future rulemaking.

Auto Innovators would like to request EPA review testing, labeling and associated processes of vehicles with advanced technology propulsion systems to ensure that drivers of these vehicles are given a clear, concise picture of the capabilities of these vehicles. Testing should be efficient and the labels should be understandable and reflective of understood processes. If items in the testing and labeling process should be updated, EPA should begin to work with stakeholders prior to the Multipollutant Rule to identify what items are outdated and require revision.

We will consider whether to pursue the suggested amendment in a future rulemaking.

Auto Innovators suggested three separate amendments: (1) Auto Innovators suggested amending 40 CFR 1066.420 to reduce the HC hang-up limit value for LD tests to 0.5 ppm, as the current value of 2 ppm causes negative drift during testing because it is too high for LD testing. (2) Auto Innovators suggested amending 40 CFR 1066.710(b)(1) with the following text to improve the clarity of the specified maximum allowable temperature excursion: “At no time may the ambient temperatures be below −12.0 °C or above −1.0 °C.” (3) Auto Innovators stated that they support updating the regulation to reference the 2020 version of SAE J2263 for coastdown testing procedures, but requested that the implementation be optional until model year 2026 to allow time for completing updates for track and environmental condition updates.

EPA agrees with the reasoning and conclusions in the comments and has amended the final rule accordingly.

Auto Innovators found it confusing that the values for high and low temperatures in 40 CFR 1066.710 are not expressed as a range around a fixed nominal value. They recommended making the change for consistency, for ease of use, and for implementing software and hardware. The specifically suggest setting the temperature limits to -7 ± 5 °C (from the current -12.0 °C to -1.0 °C) for maximum instantaneous excursions and -7 ± 3 °C (from the current -9.0 °C to -4.0 °C) for three-minute excursions.

EPA does not agree with the suggested change. The convention for specifying ranges in the testing regulations, established at 40 CFR 1065.20(f), states that manufacturers must target the nominal value if the range is expressed as a nominal value with a specified range. Alternatively, expressing a range simply as a pair of minimum and maximum values allows manufacturers to complete a successful test by targeting any temperature as long as they stay within the temperature range over the course of the test. The current approach is to specify the range based on the pair of minimum and maximum values. Changing the format of the specified range may require manufacturers to change their current test methods to more carefully control temperatures. We believe this change is neither necessary nor appropriate for testing under 40 CFR 1066.710. Auto Innovators provided no data or other numerical assessment in support of their suggested amendment.

Auto Innovators stated that they support the changes to 40 CFR 1066.835 for measuring exhaust emissions for the SC03 testing.

EPA acknowledges the comment supporting the proposed changes.

Rivian recommends that EPA consider the following near-term and long-term amendments to the regulation: (1) Revise labeling requirements to reflect real-world driving for range, (2) Allow for a broader definition of test group, including the addition of 2WD and 4WD in the same test group, irrespective of number of motors, with EPA approval, (3) Consider additional test group flexibilities in light of upcoming battery durability and testing requirements being considered by the California Air Resources Board ("CARB") and possible common test group definitions across CARB and EPA, (4) Provide an analytically derived range and consumption method specific to EVs, and (5) Reconsider the default 0.7 adjustment factor to reduce unnecessary test burden and be more reflective of the original 5-Cycle adjustment to account for the experience gained in implementing EV technology in both hot and cold conditions.

We will consider whether to pursue these suggested amendments in a future rulemaking.

VW and Auto Innovators request clarification on the proposed requirement to identify driver-selectable modes. Section 1068.50 seems to require manufacturers to include information on each selectable mode as an adjustable parameter. In some vehicles, this could reach hundreds of possible drive modes and user-selectable features to be described in the certification application, creating unnecessary burden to timely review. We recommend that EPA update this section to exclude driver selectable modes such as "sport" or "trailer tow" from this description.

> We note that we did not propose to apply the provisions of 40 CFR 1068.50 to vehicles subject to standards under 40 CFR part 86, subpart S. However, those vehicles are subject to similar requirements under 40 CFR 86.1833-01. As with the Honda comment on rabbit-turtle controls, user-selectable features and the functions controlled by those features are properly considered adjustable parameters under both 40 CFR 86.1333-01 and 1068.50. These features are specifically designed to invite operators to adjust control settings to achieve the desired performance. It is therefore important for manufacturers to comply with standards for all those settings that fall within the physically adjustable range.

Edwin J. Ward commented that EPA should close the "light-duty truck emissions loophole," which has since 1975 allowed passenger vehicles classified as light-duty trucks to meet less stringent emission standards even though their usage is very similar to that for passenger cars. Mr. Ward also objected to the proposed change to decrease the test weight for light light-duty trucks (LDT1 and LDT2), since that further reduces stringency for these vehicles.

> EPA adopted criteria exhaust emission standards for cars and light trucks in the early 1970s, and updated those standards several times since then. The Tier 3 standards that apply today apply equally to all sizes of light-duty vehicles and light-duty trucks. Different measurement procedures and standards apply for heavy-duty vehicles (with gross vehicle weight rating above 8500 pounds). For criteria exhaust emission standards, there is therefore no longer any "light-duty truck emissions loophole.
>
> EPA more recently adopted GHG emission standards that apply separately to cars and light trucks. Those standards were based on a feasibility assessment for the different types of vehicles. We are aware of the significant impact those standards have had on marketing plans for several manufacturers. We are in the process of evaluating new

standards for model year 2027 and later vehicles that will revisit the question of relative stringency for cars and light trucks.

The commenter may also have in mind evaporative and refueling emission standards. The refueling emission standard is expressed in grams of emitted hydrocarbon per gallon of dispensed fuel; the standard of 0.2 g/gal applies equally to all sizes of light-duty and heavy-duty vehicles. The evaporative emission standards continue to allow for higher emissions for the increasing size of light-duty trucks and heavy-duty vehicles. This difference has decreased over the years as the emission standard became more stringent. The remaining difference is generally based on the expected size of fuel tanks and operating characteristics relative to the vehicles' ability to purge evaporative canisters.

Also, to be complete, OBD standards and requirements apply equally for all sizes of light-duty vehicles and light-duty trucks.

Emission standards are most effective for controlling emissions if the measurement procedure most closely represents in-use operation. As described in the proposed rule, we are decreasing the test weight for LDT1 and LDT2 because they are operated more like passenger cars than heavy-duty vehicles. The emission standards adopted for these vehicles were assessed based on the lighter test weights. The proposed change simply corrects an error in the test procedure to more appropriately measure emissions from these vehicles.

32.3 Engine test speed - Small SI Engines

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

U.S. EPA proposed several amendments to Part 1054 regarding testing and certification of Small SI engines at or below 19 kW. [EPA-HQ-OAR-2019-0055-1186-A2, p.132]

With regards to engine test speed, CARB staff suggests that it would make more sense to run the test at the engine's rated speed, and if this speed is not either 3060 or 3600 rpm, to use the special provisions. [EPA-HQ-OAR-2019-0055-1186-A2, p.132]

EPA Summary and Response

Comment Summary	EPA Response
CARB staff suggests that it would make more sense to test at the engine's rated speed, and if this speed is not either 3060 or 3600 rpm, to use the special provisions.	EPA certification depends on testing individual engines to represent families that include a range of engine calibrations, applications, and models. The proposed approach directs manufacturers to test engines within an engine family by grouping them into sets of engines that can be properly represented by testing at 3060 or 3600 rpm. Different test speeds apply for engines with rated speed below 2700 rpm or above 4000 rpm. We believe this approach allows manufacturers to properly and consistently perform testing that best represents engines across their product line.

32.4 Steady-state duty cycles - Small SI Engines

Comments by Organizations

Organization: *American Honda Motor Co., Inc. (Honda)*

1054.505(b)(2)

It should be clarified that 5mode is an option and that additional 5mode testing will not be required for the engines approved in 6mode before (As no definition of Idle, necessity of 5mode testing should be based on manufacturer's GEJ).

If the GEJ is not allowed, 5mode results should be allowed to be calculated from the 6mode results in order to avoid retesting burden. [EPA-HQ-OAR-2019-0055-1348-A2, p. 1]

1054.505(d)

In determining the worst case of emission when the test mode (5mode or 6mode) and/or test speed (3060rpm or 3600rpm) are different, it should be clarified that it is not necessary to prepare durability engines for all cases, and also the durability conditions during accumulation cycle and EM testing for DF should be allowed to use one representative durability condition determined by manufacturer. [EPA-HQ-OAR-2019-0055-1348-A2, p. 1]

It should be clarified that no certification tests other than worst case are required. Worst case determinations should be based on GEJ or in-house tests. [EPA-HQ-OAR-2019-0055-1348-A2, p. 1]

With regards to changes in requirements for engine test speed and duty cycle, it should be clarified that retesting is not required for previously approved specifications, and the carryover is allowed as long as the specifications don't change. [EPA-HQ-OAR-2019-0055-1348-A2, p. 1]

Organization: *California Air Resources Board (CARB)*

With regards to steady state duty cycles:

1. CARB staff sees no issue with the multi-mode duty cycle proposed.
2. It is not clear whether there is an advantage to removing the existing ramped-modal test from the regulations, as it may have utility for other kinds of testing, however CARB staff agrees that not adding an additional ramped-modal duty cycle for the new five-mode test is reasonable. [EPA-HQ-OAR-2019-0055-1186-A2, pp.132-133]

EPA Summary and Response

Comment Summary	EPA Response
Honda: 1054.505(b)(2). Clarify that 5mode is an option and that additional 5mode testing will not be required for the engines approved in 6mode before (As no definition of Idle, necessity of 5mode testing should be based on manufacturer's GEJ). If the GEJ is not allowed, 5mode results should be allowed to be calculated from the 6mode results to avoid retesting burden.	The proposed regulation requires five-mode testing for engines that are not designed to idle. If the manufacturer designs all their engines to idle, there is no need to determine emission results over the five-mode cycle. If the manufacturers make some engines designed to idle and some engines not designed to idle, they can measure emissions using the six-mode duty cycle and then simply recalculate a weighted emission result for the five-mode testing using the same testing to generate a six-mode test result. We agree that manufacturers can and will use good engineering judgment to determine whether they have designed an engine to idle.

Honda: 1054.505(d). In determining the worst case of emission when the test mode (5mode or 6mode) and/or test speed (3060rpm or 3600rpm) are different, it should be clarified that it is not necessary to prepare durability engines for all cases, and also the durability conditions during accumulation cycle and EM testing for DF should be allowed to use one representative durability condition determined by manufacturer.	The regulation at 40 CFR 1054.235(a) instruct manufacturers to select a configuration from the engine family that is most likely to exceed the HC+NOx standard, using good engineering judgment. Further, 40 CFR 1054.240(a) establishes that an emission family complies with standards if tested engines representing the family have test results showing deteriorated emission levels at or below these standards. We agree that a manufacturer meet requirements by performing durability testing with a single configuration to represent worst-case full-life emissions. We are revising the regulation to state that the manufacturer's reporting obligation for certification is limited to the worst-case condition between five-mode testing and six-mode testing.
Honda: 1054.505(d). It should be clarified that no certification tests other than worst case are required. Worst case determinations should be based on GEJ or in-house tests.	Manufacturers can select configurations using engineering analysis and good engineering judgment. That analysis may be informed by additional testing. To the extent that manufacturers perform valid certification tests for such additional testing, they would need to report those emissions results in the application for certification.

Honda: 1054.505(d). With regards to changes in requirements for engine test speed and duty cycle, it should be clarified that retesting is not required for previously approved specifications, and the carryover is allowed as long as the specifications don't change.	As always, the amended regulation does not invalidate certificates issued under the regulations that applied at the time. We will approve an application for certification based on carryover test data if the earlier testing complies with current requirements. This means that manufacturers may need to perform testing at different speed settings. They would also need to submit new test results using the five-mode or six-mode duty cycle if that is needed to properly represent a worst-case test configuration for the engine family. The amended regulation is based on provisions that have applied through guidance for many years, so we don’t expect manufacturers to need additional time to meet these requirements. This expectation is reinforced by the fact that engine manufacturers, through their associations, requested that EPA codify the proposed amendments.
With regards to steady-state duty cycles, CARB staff sees no issue with the proposed multi-mode duty cycle. It is not clear whether there is an advantage to removing the existing ramped-modal test from the regulations, as it may have utility for other kinds of testing, however CARB staff agrees that not adding an additional ramped-modal duty cycle for the new five-mode test is reasonable.	We acknowledge the affirmation that the new five-mode duty cycle is appropriate for Small SI engines. We have gained clarity that engine manufacturers will have an enduring lack of interest in testing with ramped-modal duty cycles. We also see no value in preserving the ramped-modal duty cycle for EPA testing separate from what manufacturers do. We are therefore removing the ramped-modal from the regulation, as proposed.

32.5 Engine family criteria - Small SI Engines

Comments by Organizations

Organization: *California Air Resources Board (CARB)*

With regards to engine family criteria, CARB staff sees no issues with the proposed rule. [EPA-HQ-OAR-2019-0055-1186-A2, p.133]

Organization: *Outdoor Power Equipment Institute (OPEI)*

Section 1054.230(b)(8) – How Do I Select Emission Families? OPEI is seeking clarification (additional examples) of what methods of controls for engines may be grouped into an emission family. [EPA-HQ-OAR-2019-0055-1205-A1, p.4]

The example provided in 1054.230(b)(8) may be confusing. It is OPEI's understanding that different fuel injection technologies, such as open and closed-loop fuel injection systems, may be included in the same emission family. OPEI recognizes an exhaustive list of examples is not practical, however, some additional examples or guidance may be helpful to clarify common emission family technology groupings. [EPA-HQ-OAR-2019-0055-1205-A1, p.4]

Organization: *Truck and Engine Manufacturers Association (EMA)*

In addition, in proposed §1054.230(b)(8) an example is included to provide additional guidance to manufacturers. While this example is helpful, EMA recommends that the provision clearly state that in cases where an engine manufacturer sources a component from multiple suppliers, those components being made to the same specifications, the engines produced from those components may be included in the same engine family. [EPA-HQ-OAR-2019-0055-1203-A1, p .133]

EPA Summary and Response

Comment Summary	EPA Response
With regards to engine family criteria, CARB staff sees no issues with the proposed rule.	We acknowledge the lack of objection to our proposed provisions to establish clearer criteria for defining engine families.

OPEI: The example provided in 1054.230(b)(8) may be confusing. It is OPEI's understanding that different fuel injection technologies, such as open and closed-loop fuel injection systems, may be included in the same emission family. OPEI recognizes an exhaustive list of examples is not practical, however, some additional examples or guidance may be helpful to clarify common emission family technology groupings.	The regulation currently specifies that engines should be grouped into a family only if they have the same method of controlling engine operation. We proposed to include an example to establish that port fuel injection with multi-cylinder engines is a fundamentally different control method than carburetion or throttle-body injection, but that these latter two methods are not fundamentally different from each other. We don't see anything confusing about the way we described that principle. We are not ready to identify additional control methods that we should identify as being categorically alike or different. For example, we may consider open-loop and closed-loop systems to be alike or different, depending on whether engines will operate differently when adding the specific designs for a feedback loop with closed-loop fueling.
EMA acknowledges that the example proposed in §1054.230(b)(8) for defining engine family criteria is helpful. EMA recommends that the provision clearly state that in cases where an engine manufacturer sources a component from multiple suppliers, those components being made to the same specifications, the engines produced from those components may be included in the same engine family.	We have always implemented certification requirements across all sectors without requiring manufacturers to create separate families based on sourcing components from different suppliers. We will continue to implement certification this way, and do not believe it is necessary to describe this in the regulation. The regulation instead identifies how manufacturers must group engines that are the same in regard to several defining characteristics.

32.6 Miscellaneous amendments for marine compression-ignition engines

__Comments by Organization__

Organization: *Truck and Engine Manufacturers Association (EMA)*

The proposed modifications to §1042.660(b) require clarification. EPA should define "non-compliant operation" and "appropriate reductant." The provision should also be clarified as being applicable to “all engines on covered vessels even if the engines are certified to U.S. EPA Appendix VI…”

EPA Summary and Response

Comment Summary	EPA Response
EMA requested that we define or clarify the terms “appropriate reductant” and “noncompliant operation” where we amended the reporting requirements in 40 CFR 1042.660(b) related to operation of SCR-equipped engines without urea or other reductant.	The reporting requirement in §1042.660(b) is tied to SCR systems requiring the use of urea or other reductants. The reductant specifications are in turn driven by the manufacturers’ designs and the corresponding operating instructions for users. The regulation properly references “any operation of such vessels without the appropriate reductant.” This means the operator needs to take steps (1) to purchase reductant meeting the engine manufacturer’s specifications, (2) to handle the reductant in a way that prevents it from being diluted, degraded from extended storage or exposure to high temperatures, and (3) to operate the vessel with the appropriate reductant. Similarly, “noncompliant operation” is any operation where the operator fails to take the steps described above.
EMA also requested that §1042.660(b) should be clarified as being applicable to “all engines on covered vessels even if the engines are certified to U.S. EPA Appendix VI…”	The proposed rule already clarified that this reporting requirement applies for all engines on covered vessels even if the engines are certified to Annex VI standards instead of or in addition to EPA standards under part 1042. It is not clear how we can further clarify how the reporting requirement applies for engines subject to different emission standards.

33 Comments outside the scope of the proposed rule

Comments by Organization

Organization: *Alliance for Vehicle Efficiency (AVE)*

The EPA should, however, consider a filter-enforcing particulate standard for Medium Duty gasoline vehicles. This will help the U.S. implement best available technology as done today in

China and Europe, where the PM/PN standards require OEMs to add filters. [EPA-HQ-OAR-2019-0055-1280-A1, p .3]

Organization: *Advanced Engine Systems Institute (AESI)*

EPA should also close the apparent loophole in the Phase II mandate that Diesel Particulate Filters (DPF) be installed on all new vehicles with Auxiliary Power Units (APU) starting in MY 2024, as set forth in 40 CFR 1039.699. APU manufacturers are avoiding the clear intent of the Phase II rule to control PM emissions with significant public health consequences, particularly for frontline communities. The final rule should contain a remedy for this issue. [EPA-HQ-OAR-2019-0055-1281-A1, p. 2]

Organization: *American Honda Motor Co., Inc. (Honda)*

1051.501(C)(2)

In order to be consistent with the specification in 40 CFR 1060.515, Honda proposes to amend as follows:

> *"Prior to permeation testing of fuel line, precondition the fuel line by filling it with the fuel specified in paragraph (d)(3) of this section, sealing the openings, and soaking it for 4 weeks at (23 ± 5) °C. To measure fuel-line permeation emissions, use the equipment and procedures specified in SAE J30 as described in 40 CFR 1060.810. Use the fuel specified in paragraph (d)(3) of this section. Perform daily measurements for 14 days, except that you may omit up to two daily measurements in any seven-day period. Determine your final emission result based on the average of measured values over the 14-day sampling period. Maintain an ambient temperature of (23 ± 2) °C throughout the sampling period, except for intervals up to 30 minutes for weight measurements."* [EPA-HQ-OAR-2019-0055-1348-A2, p. 1]

Organization: *American Lung Association et al.*

US EPA must move quickly to ensure the transition to zero-emission trucking under the Phase 3 Greenhouse Gas Emission Standards that follow this current proposed rulemaking. The shift to zero-emission trucks will yield major clean air and climate benefits and provide much-needed relief to communities most directly affected by trucking pollution today. The American Lung Association recently issued a report finding that the United States could experience over $1 trillion in public health benefits between 2020 and 2050 through widespread shifts to zero-emission transportation and electricity generation, with the potential for over 110,000 lives saved.5 US EPA must move quickly to establish a clear and direct pathway to the full transition to zero-emission trucks in the near term. [EPA-HQ-OAR-2019-0055-1271-A1, p.3]

5 American Lung Association. Zeroing in on Healthy Air. March 2022. www.lung.org/ev

Organization: *Amy Lane*

The proposed rule regarding heavy duty engine standards beginning in 2027 is insufficient for mitigating nitrous oxides (NOx) and other greenhouse gas (GHG) emissions as intended.

Experts believe that our planet may hit “peak oil” in 13 years or less, triggering societal and economic collapse if society has not drastically lessened its reliance on petroleum products. (Withgott and Laposata 2018, 520) The most sustainable, logical, and efficient course of action for addressing the emissions produced by heavy duty engines is a timely transition to renewable fuel sources. With only 20% of our nation’s electricity generated by renewables, electric vehicles are not sufficient in reducing GHG emissions or our reliance on fossil fuels. (U.S. Energy Administration n.d.) [EPA-HQ-OAR-2019-0055-1217]

On December 7, 2021, the EPA proposed a rule that would strengthen the Renewable Fuels Standards Program (RFSP), with the claim by EPA Administrator Michael S. Regan that, “This package of actions will enable us to get the RFS program back in growth mode by setting ambitious levels for 2022, and by reinforcing the foundation of the program so that it’s rooted in science and the law.” (EPA.gov 2021) The RFSP is required to set the volumes of biofuels used by the transportation industry under the Clean Air Act (CAA). However, the EPA is proposing a rule for heavy duty engines that relies on technology which excludes renewable fuel sources. Also in December, the U.S. Department of Agriculture (USDA) announced its plan to invest $800 million in supporting biofuel producers and infrastructure, with an additional $100 million available to expand the biofuel sales and use of biofuels derived from U.S. agricultural products. (U.S. Environmental Protection Agency 2021) The U.S. Department of Energy (DOE) even provides financial assistance for new infrastructure and upgrades to existing infrastructure for qualified biodiesel retailers under the Renewable Fuels Infrastructure Program (RFIP). (U.S. Department of Energy n.d.) A lack of cohesion between statutes, agencies, and rules, along with an unwillingness to act with the authority it has been granted has plagued the EPA for too long. This is an opportunity for the EPA to apply best practices in a comprehensive, efficient, and effective manner. [EPA-HQ-OAR-2019-0055-1217]

A collaborative effort between the RFSP, RFIP, and a heavy duty engine standards rule would create a high demand for renewables, which could also alleviate the burden felt by small refineries to achieve compliance with the RFSP, thus lessening the amount of resources used for exemption proceedings. By ignoring this obvious collaborative solution, the EPA is essentially denying the refineries that are bound by the RFSP rule a market which gives them the opportunity to both be in compliance with the RFSP and propel their business into the future sustainably. Mr. Regan claims to want the RFSP back in growth mode, with a scientific foundation. What better way to inspire growth in the production of renewables than to create high demand through regulation which relies on sound science and best practices? [EPA-HQ-OAR-2019-0055-1217]

The proposed Heavy Duty Engine Standards rule is counterproductive to mitigating anthropogenic climate change, the RFSP and refineries that are required to comply with it, U.S. farmers growing biodiesel feedstocks, the RFIP, and the industries that will suffer due to their reliance on fossil fuels. The time to transition to renewables was yesterday, and the agency that is entrusted with the protection of environmental health needs to make every effort to ensure that transition is being made- across all rules, statutes, agencies, and industries. I strongly urge the EPA to reconsider EPA-HQ-OAR-2019-0055 and instead create a rule proposal that is in alignment with the vision of the RSFP, the USDA, and the RFIP. [EPA-HQ-OAR-2019-0055-1217]

Organization: *B & H Tractor & Truck*

Also the way the government addressed truck drivers shortage by making them pay $4000.00 and go to school is ridiculous. [EPA-HQ-OAR-2019-0055-1751, p.1]

Organization: Brian Lopez

As addressed by the proposed rule document, early adoption incentives can be a useful tool to encourage policy change. For this we can look towards incentives that have encouraged policy change for renewable energy. Financial incentives have been used to encourage the use of renewable sources of energy through the monetary advantages offered to encourage the accessibility of renewable energy resources by reducing the burden of purchasing for manufacturers and consumers. The use of financial incentives has encouraged the eradication of barriers encountered when supporting the growth of the renewable energy sector. Policies providing financial incentives have been used to reduce the risks characterizing the investment in this sector, especially on long-term projects with extended break-even periods. Varying levels of government have played key roles in supporting the advancement of company investment into renewable energy in order to enhance the development of diversified sources of reusable energy. Such a move has been considered as a strategy to encourage sustainability in line with the current and future demands and capacity needs in the country. Since 2016, over 46 countries have instituted financial incentives to offer support to investors seeking to venture into renewable energy. [EPA-HQ-OAR-2019-1040]

Moreover, many consumers incorrectly believe that an increase in a vehicle’s fuel efficiency is correlated to an increase in fuel savings. Due to the curvilinear relationship between fuel efficiency and fuel consumption, the combined fuel-efficiency value would always be lower than the simple average, resulting in consistent overestimations of the actual fuel efficiency. Therefore, it is possible that consumers can be making suboptimal choices between vehicles, while at the same time believing that they are making rational and environmentally positive choices. [EPA-HQ-OAR-2019-1040]

Organization: *California Air Resources Board (CARB)*

CARB staff proposes to add ‘State the regulatory subcategory that determines the applicable emission standards for the vehicle family (see definition in 1037.801)’ as 1037.135 (c)(4). [EPA-HQ-OAR-2019-0055-1186-A2, p.85]

CARB staff recommends U.S. EPA to adopt a zero-emission standard for off-road powertrains in Part 1039. The standard could be an optional zero-emission standard with no other programmatic tie-ins (i.e., no compliance credit), like the zero-emission standard established by California’s ZEP certification regulation. [EPA-HQ-OAR-2019-0055-1186-A2, p.134]

This change is needed because:

- One of the greatest opportunities to transition into zero-emission in the off-road sector can be found in construction and farm equipment.
- CAA section 209(e) preempts California from establishing emission standards for 'new engines which are used in construction equipment or vehicles or used in farm equipment or vehicles and which are smaller than 175 horsepower.'
- California is exploring various strategies to increase zero-emission technology deployment in construction and farm equipment, including fleet rules that would require fleets to purchase zero-emission equipment.
- By establishing a federal zero-emission standard for off-road powertrains, U.S. EPA would clear the path for CARB to establish zero-emission fleet rules for construction and farm equipment that may arguably fall within the section 209(e) preemption category. [EPA-HQ-OAR-2019-0055-1186-A2, pp.134-135]

CARB staff believes that U.S. EPA’s defect reporting and corrective action program would be improved if U.S. EPA aligned with CARB’s requirements for the reasons summarized below:

<u>Defect Reporting</u> - U.S. EPA’s defect reporting requirements are not as robust as CARB’s. The defect reports currently required by U.S. EPA do not require as much information about the defect as CARB’s program. Also, U.S. EPA’s defect reports are not required to be submitted continuously throughout the warranty reporting period, while CARB’s requirements have manufacturers provide warranty repair information updates on a quarterly basis once the reporting threshold has been exceeded. [EPA-HQ-OAR-2019-0055-1186-A2, p.129]

<u>Corrective Action Requirements</u> - U.S. EPA’s corrective action threshold appears to be more subjective than CARB’s. The corrective action threshold is based on a 'substantial number' of failures, while CARB’s program is based on a percentage of defects exceeding a specific threshold. CARB’s recall requirements also have the added benefit of the Department of Motor Vehicles (DMV) registration tie-in program. The DMV registration tie-in program helps ensure a high capture rate for recalls by preventing owners from renewing their vehicle registrations until after they have the recall repair work completed. U.S. EPA should consider requiring manufacturers meet a high capture for all recalls like 90 percent like what is obtained by California’s DMV registration tie-in program. This can be done by International Registration Plan holds, required multiple mailings or requiring that manufacturer provide owners incentives to get timely repairs done. Lastly, the Omnibus rulemaking established automatic recalls based on specified warranty defects rates. This change was critical, as it will allow CARB staff to require manufacturers to take corrective action once the corrective action threshold has been exceeded, without having to conduct costly and resource-intensive testing to prove an exceedance of emission standards. [EPA-HQ-OAR-2019-0055-1186-A2, p.129]

Organization: *Clay Miller*

I think that before the trucking industry is loaded down with more regulations the RXR industry should be looked at because these old locomotives are still being used and emit more smoke than any truck I have seen on the roads. Are they required to refit with exhaust the burn emissions or DEF injection like trucks, tractors, pretty much every machine that runs on diesel [comment ends here; EPA-HQ-OAR-2019-0055-1539]

Organization: *Clean Energy (CE)*

In addition to this rulemaking, U.S. EPA should support near-zero trucks and buses in all other programs and future regulations pertaining to clean transportation and especially those which seek to tackle air quality issues in environmental justice communities. [EPA-HQ-OAR-2019-0055-1350-A1, p.4]

Organization: *Clean Fuels Alliance America (Clean Fuels)*

Additionally, as part of their PLANET 2050 environmental sustainability strategy, Cummins is committed to powering a healthier environment, stronger communities, and robust and inclusive economies. In the environmental part of their ESG plan Cummins has committed to Destination Zero, whereby their mission is to power a more prosperous world by helping customers succeed through innovative and dependable products that are good for their customers and the environment.6 Cummins is focused on improving GHG emissions that come from the internal combustion engines that dominate most industrial applications today. Cummins recognizes that these reductions are projected to provide more cumulative carbon reductions than an alternate scenario of waiting until the grid is green and deploying technology that relies on electric charging. [EPA-HQ-OAR-2019-0055-1248-A1, p.3]

6 https://www.cummins.com/company/esg/environment/destination-zero

Organization: *Clean Harbors Environmental Services*

However, ZEV technology still is in its infancy. While the industry is investing heavily in a zero-emissions future, the high costs of zero-emission trucks and the lack of the essential national recharging/refueling infrastructure needed to operate those vehicles virtually guarantees that trucking fleets cannot yet make the switch to zero. We must invest in a comprehensive strategy to build the nationwide infrastructure that is essential to support widespread ZEV adoption while also providing fleet owners – 97% of which are small businesses – with the incentives necessary to offset the higher costs of ZEVs.[EPA-HQ-OAR-2019-0055-1063-A2, p.2]

Organization: *ClearFlame Engine Technologies (ClearFlame), Remora, and SixWheel*

In addition, we ask EPA to add "ethanol" to the general categories of fuels that are included in the agency's definition of "Fuel Type."12 Currently, the Proposal lists gasoline blended with 10 percent ethanol as merely one example of a fuel grade with the gasoline fuel type, just as premium and regular gasoline are listed. Instead, we request that EPA adds an Ethanol fuel type to list of general categories of fuels, alongside diesel fuel, gasoline, and natural gas. Within this fuel type, we request that EPA include both E85 and E98 as fuel grades that can be used for certification and other purposes. 13 [EPA-HQ-OAR-2019-0055-1261-A1, p. 9]

12 See Proposal, at 17724.

13 See Table 1 to Paragraph (b)(4) of Section 1036.530 – Reference Fuel Properties and related discussion. This table and discussion does list high-blend ethanol, but does not specify whether E98 can be used. This should be corrected in the final rule. See Proposal, pp. 17703-17704.

Organization: *David Pedersen*

I also believe that the Agency should retroactively change standards for existing engines such that DPFs and SCR are no longer required; in fact, I believe a separate rulemaking process to propose banning the use of DPFs as public-health hazards would be beneficial as well. While the difference in emissions may seem significant, the Administrator *must* take into account the study referenced herein that *shows* that DPFs (and, to a lesser degree, SCR) are themselves contributors to the very pollution that the Agency is mandated to address. Allowing the removal of DPFs would improve safety, have a minimal effect on air quality relative to the status quo, and decrease safety and cost concerns for owners and operators. [EPA-HQ-OAR-2019-0055-1059]

Organization: *David Wong*

The "Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards" is a proposed rule seemingly primarily concerned with "highway" heavy-duty vehicles and engines, based on the emphasis in the first sentence of the rule summary. I have a few main concerns with this rule. First, preexisting engines are not addressed, and little to no incentive is provided to encourage the replacement of older engines. Second, the plan does not directly emphasize, encourage, or support a focus toward improving public transit and public transit hotspots for human activity and thus breathing conditions in those areas especially. [EPA-HQ-OAR-2019-0055-1097]

Scalable increasing improvements should be pushed hard with financial and other penalties that can go toward helping offset damage done by emissions. I recommend that locomotive companies be incentivized to augment preexisting emission control systems and replace diesel engines with electric entirely as soon as possible. I recommend the same thing for public buses and bus stations since more people congregate there with the congregated bus diesel emissions than practically anywhere except for possibly the most metropolitan intersections. I also recommend that the EPA jointly propose another rule for preexisting heavy-duty engines that fairly holds extremely emission-heavy older engines to the highest possible standards by the 2035 time- marker that this rule frequently mentions. One possible idea is to tax the use/mileage of emission-heavy older motors based on estimated or measured emission differences from recent standards, and apply the tax to air filtration and emission control projects. [EPA-HQ-OAR-2019-0055-1097]

The Clean Air Act is 52 years old now, and the Urban bus standards (section 219) have not been significantly amended since 1990. Nitrogen Oxides (NOx), Carbon Monoxide (CO), and particulates in general (PM, aka PM10 coarse dust or PM2.5 fine dust) have been generally accepted as carcinogenic and harmful to human breathing. Hydrocarbons (THC) and Volatile Organic Compounds are also generally seen as very dangerous, but their specific contents and effects vary a bit more. Still, any amount of these is not meant for human consumption. We can keep minimizing over and over, but if we don't put a final goal date on the complete elimination of emissions, it's hard to see how the environment can heal fast enough. So the final big question is: do we really want a completely zero-emission society ever, and if so, when? What is the maximum amount of NOx, CO, and THC that 7 billion people could be personally responsible for emitting each day and the environment still be sustainable? That's the emission max allotment figures we should be working toward today, but I think the public transit systems and reailways should take the lead in going above and beyond by moving to zero emissions soonest. [EPA-HQ-OAR-2019-0055-1097]

Locomotives may burn a much dirtier diesel fuel than trucks, containing up to 500 parts per million sulfur, whereas trucks since 2006 have been limited to fuel with 15 parts per million sulfur (Lyderson, 2010). [EPA-HQ-OAR-2019-0055-1097]

A 2006 report called "Smokestacks on Rails" by the Environmental Defense Fund, a New York- based nonprofit, estimated the economic impact of adverse health effects totaled 23.2 billion dollars due to factors such as premature deaths, non-fatal heart attacks, breathing issues in children, and approximately 290,000 lost work days (Scott & Sinnamon, 2006). [EPA-HQ-OAR-2019-0055-1097]

Adverse health effects associated with 2006 locomotive pollution

Premature deaths	3,400
Non-fatal heart attacks	4,400
Acute bronchitis and asthma exacerbations in children	61,000
Lost work days	290,000
Total economic impact of adverse health effects	$23.2 billion

Compare these figures to the EPA estimates by 2045 for their "most ambitious option" outlined in this proposed rule, that would result in the following annual benefits:

"

- Up to 2,100 fewer premature deaths
- 6,700 fewer hospital admissions and emergency department visits
- 18,000 fewer cases of asthma onset in children
- 3.1 million fewer cases of asthma symptoms and allergic rhinitis symptoms
- 78,000 fewer lost days of work
- 1.1 million fewer lost school days for children

" (from https://www.epa.gov/newsreleases/epa-proposes-stronger-standards-heavy-duty- vehicles-promote-clean-air-protect) [EPA-HQ-OAR-2019-0055-1097]

Weighing the Environmental Defense Fund negative impact estimates for 2006 for locomotives against the EPA estimated positive impacts of this proposed rule nicknamed the EPA's "Clean Trucks Plan", it appears that a mild to moderate reduction of the locomotive emission adverse effects would be approximately as impactful/beneficial as this rule. Because the scope could be narrowed down to just locomotive engines and practically nothing else, I assume the implementation cost for locomotive improvements would be immensely more cost-effective. An electric locomotive is about $4-6.5 million, compared to approximately $1-2 million for a diesel locomotive (Nally, 2022). With more than 28,000 locomotives in the United States, the hardware cost to replace every single diesel locomotive with an electric one might be about $168 billion (28,000 * 6,000,000), plus operational transition costs. If the total economic impact of adverse health effects is actually over $20 billion per year, we can assume that a radical change to electric locomotives would pay itself off in health costs in about 8 years assuming implementation was instant. Furthermore, if public transport moved to zero-emissions, it could finally be seen as the "greenest" option in practically every way and encourage more people to take public transport and be even more environmentally economical than probably all other (motor) transport options. [EPA-HQ-OAR-2019-0055-1097]

A Mayo Clinic study of 3,933 people found "children who lived in census tracts facing the intersections with major highways or railroads had about 40% to 70% increased risks of developing childhood asthma compared with those who lived in census tracts not facing such intersections". (Juhn et al., 2010). I feel that diesel soot from train engines is particularly dense and noticeably smelly to my backyard, which is directly adjacent and only a few feet away from Orlando's train tracks. The hindered plant growth is clearly visible and more brown along the closer fenceline than the plant life farther away and on the other side of the house. In addition to the toxic consequences to human health, there must be devastating effects to wildlife that are much less measured. [EPA-HQ-OAR-2019-0055-1097]

The last guidelines for the Control of Emissions of Air Pollution From Locomotive Engines and Marine Compression-Ignition Engines Less Than 30 Liters per Cylinder were republished in June 2008. The standards only began to take effect in 2015. That program was projected to reduce annual emissions of particulate matter and nitrogen oxides by thousands of tons- but not eliminate them. I am proposing that efforts be made immediately to move to *ELIMINATE* and not just reduce emissions by 2035 by switching to electric locomotive engines as soon as possible. Perhaps older exhaust systems could be augmented to fully or 99% capture/filter particulate matter and nitrous oxides. Notice the emission standards for the year 2023 in Table 1 below from Subpart B - Emission Standards and Related Requirements § 1033.101 Exhaust emission standards. [EPA-HQ-OAR-2019-0055-1097]

Table 1 to § 1033.101 - Line-Haul Locomotive Emission Standards

Year of original manufacture	Tier of standards	Standards (g/bhp-hr)			
		NO_X	PM	HC	CO
1973-1992[a]	Tier 0[b]	8.0	0.22	1.00	5.0
1993[a]-2004	Tier 1[b]	7.4	0.22	0.55	2.2
2005-2011	Tier 2[b]	5.5	[e] 0.10	0.30	1.5
2012-2014	Tier 3[c]	5.5	0.10	0.30	1.5
2015 or later	Tier 4[d]	1.3	0.03	0.14	1.5

The standards for locomotive engines before 2014 are roughly 4-6x less than those for (line-haul) engines manufactured in 2015 or later. Switch-style locomotives are slightly different, but still similarly comparable. I don't see policy that attempts to compensate or correct the older engine emission levels by roughly 4-6 times the particulate matter and nitrogen oxides. [EPA-HQ-OAR-2019-0055-1097]

Busses may be seen similarly. The table 1 below from the EPA Office of Transportation and Air Quality "Average In-Use Emissions from Urban Buses and School Buses - Emission Facts" published in 2008 shows typical bus emissions in grams per mile (note it is not the same unit described for locomotive emissions). [EPA-HQ-OAR-2019-0055-1097]

Table 1 presents average in-use emission rates for urban buses and school buses while being driven.

Table 1: Average Emission Rates for Urban Buses and School Buses*
(in grams per mile)

Pollutant	Urban Diesel Buses	School Diesel Buses	School Gasoline Buses
VOC	0.349	0.642	7.580
THC	0.353	0.653	7.791
CO	3.376	2.312	89.600
NOx	14.793	10.536	7.477
$PM_{2.5}$	.0274	0.556	0.104
PM_{10}	0.297	0.604	0.145

Approximately 65,000 public city buses were operational in December of 2017 (Carlier, 2021). A new electric bus costs about $1,000,000 or more but is actually cheaper upfront than most diesel busses and definitely cheaper and easier to maintain over time. Replacing all of this quickly is probably much, much easier than replacing train locomotives, and it is good to see that the United States seems well on it's way to making all busses electric. However, I recommend that new gas/diesel buses for public city transport be forbidden by 2025, and only new electric be allowed. Perhaps exceptions can be made for remanufactured gas/diesel engines up until 2030 or 2035. [EPA-HQ-OAR-2019-0055-1097]

Organization: *Diesel Technology Forum*

Reducing Emissions should be more than just Setting New Engine Standards, but also Implementing More Immediate Term Solutions Like Use Of Renewable Fuels And Accelerating The Turnover Of The Legacy Fleet

- The most substantial opportunities to reduce emissions in our communities in the relative near term are ones that this proposed rule does not address, the use of renewable fuels and the existing population of older commercial trucks — the legacy fleet. [EPA-HQ-OAR-2019-0055-1004 and Public Hearing Day 1 Testimony, EPA-HQ-OAR-2019-0055-2867]

- Consider if more commercial trucks were operating on blends of 100 percent renewable low- carbon biodiesel fuels. According to EPA's own detailed analysis, the current pool of biodiesel is of very high quality and blends of biodiesel may function seamlessly with next-generation aftertreatment devices developed to meet this low standard. The fuel is available now. The infrastructure to deliver it is available now. The vehicles qualified to use it are available now. Putting it in operation now, can begin reducing emissions now, and, like compound interest, we will be banking emissions reductions every mile, starting now. It is a competitive strategy that is more affordable and available than mandating ZEVs or very stringent future NOx standards. [EPA-HQ-OAR-2019-0055-1004 and Public Hearing Day 1 Testimony, EPA-HQ-OAR-2019-0055-2867]

- As for the legacy fleet, it is large. According to our most recent analysis of vehicles in operation (VIO) data from IHSMarkit as of the end of 2021, 53 percent are 2011 and newer model year vehicles and 47 percent are an older generation. These are pre-2011 model year vehicles with relatively higher emissions. Those made before 2007 do not have particulate traps and/or selective catalytic reduction technology to help combat emissions. They are second, or third, owner trucks operated by independent truckers and smaller fleet operators. [EPA-HQ-OAR-2019-0055-1004 and Public Hearing Day 1 Testimony, EPA-HQ-OAR-2019-0055-2867]

- The potential for rapid mitigation of both NOX and PM emissions by accelerating the turnover of this older fleet to advanced diesel technology, is tremendous. The Diesel Emissions Reduction Act has played an important role in addressing turnover in this legacy fleet and has delivered immediate improvements in local emissions. The new set of options and standards proposed will continue to improve the health of all impacted by the transportation network. While the proposals continue to clean the air, with as much as a 90 percent NOx reduction across the vehicle fleet, we are setting the stage to gain the benefits of these new proposals over the next 25 years. [EPA-HQ-OAR-2019-0055-1004 and Public Hearing Day 1 Testimony, EPA-HQ-OAR-2019-0055-2867]

Organization: *Evergreen Action*

While we appreciate that the EPA is moving forward with a new NOx rule, we urge the agency to ensure that the regulations are as strong as possible which includes limiting loopholes and ensuring maximum compliance with pollution reduction controls. Currently 'glider' trucks which use old engines in new trucks are still on the road even as the Phase 2 Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium and Heavy Duty Engines and vehicles went into effect last year. These incredibly high polluting vehicles ignore the need to rapidly reduce emissions and they continue to put the public at risk of excessive pollution. The EPA must use this rulemaking as an opportunity to close the glider truck loophole for good. [EPA-HQ-OAR-2019-0055-1289-A1, pp.1-2]

Organization: *Ford Motor Company (Ford)*

We would like to work with EPA in the future to develop an alternative compliance pathway for 2024 model year and later engine certification. Our recommended alternative compliance approach would provide significant GHG and criteria emission reductions through greater penetration of ZEVs in the Heavy-Duty fleet. In addition to providing emissions benefits, the proposed alternative compliance pathway would simplify the criteria emissions and engine-based CO2 compliance requirements. The key elements of the recommended alternative compliance pathway are:

• 50-state ZEV targets (using the same ZEV definitions and credit trading rules as the California Heavy-Duty ZEV regulations)
• HD ZEVs would not earn NOx credits.
• No changes to GEM-based vehicle GHG standards
• Non-ZEVs would be allowed to trade criteria emission and engine-based CO2 credits across primary intended service classes (e.g., between compression-ignition Light Heavy-Duty and compression-ignition Medium Heavy-Duty classes). This change would have no negative impact on fleet NOx or CO2 emissions and would enable manufacturers to more efficiently invest in the powertrains of the future. [EPA-HQ-OAR-2019-0055-1300-A1, p. 6]

Organization: *Fuel Cell and Hydrogen Energy Association (FCHEA)*

Finally, another significant non-financial incentive that would encourage fleets to purchase zero-emission trucks is an activity that the EPA could conduct in coordination with the Department of Transportation (DOT) Federal Highway Administration (FHWA). Currently, both battery electric and natural gas-powered heavy-duty trucks benefit from the existing 82,000-pound exemption due to their higher vehicle weights. EPA could work with FHWA to support providing parity in this exemption to hydrogen fuel cell electric trucks. [EPA-HQ-OAR-2019-0055-1187-A2, p. 2]

Organization: *International Union, United Automobile, Aerospace and Agricultural Implement Workers of America (UAW)*

UAW members are ready and willing to build the advanced technology trucks of the future. In fact, UAW members are already building a variety of zero-emission medium and heavy-duty vehicles, along with a wide range of continuously improving ICE (Internal Combustion Engine) vehicles. These zero-emission vehicles built by UAW workers include:

- Thomas Built Bus Saf-T-Liner C2 Jouley EV school bus in High Point, NC
- IC Bus Electric CE school bus in Tulsa, OK
- Ford E-Transit EV commercial van in Kansas City, MO
- Mack LR EV refuse truck in Macungie, PA
- Volvo Truck VNR Electric class 8 truck in Dublin, VA
- Components for these vehicles at supplier plants located throughout our country [EPA-HQ-OAR-2019-0055-1138-A1, p.2]

Organization: *Kenny Sites*

Furthermore has anyone considered that all of the airplanes in the air every day swirling the atmosphere is causing an accelerated effect of climate change not just elevated levels of carbon dioxide. We were told in science class that the different layers of gases in the atmosphere helped shield the earth from the affects of the sun. Thousands of flights a day swirling all theses layers up to 50000 ft. looks to me may be part of the problem. [EPA-HQ-OAR-2019-0055-1495]

Organization: *Labor Network for Sustainability (LNS)*

LNS writes to express our concern about the Rule's impact on workers in the trucking industry and how EPA could address those impacts. [EPA-HQ-OAR-2019-0055-1257-A1, p.1]

Our comments are limited to the potential harmful impacts of the Proposed Rule on workers in the medium and heavy duty trucking industry. The Proposed Rule fails to take into account the industry's current independent contractor (owner-operator) model and the accompanying problem of widespread worker misclassification. Failure to address this problem potentially delays and even reduces the beneficial impact the Rule aims to achieve. [EPA-HQ-OAR-2019-0055-1257-A1, p.2]

As we show more fully below, the deregulation of the trucking industry and corresponding decline of unionized trucking labor gave way to an independent contractor model of employment for trucking and delivery occupations, which has accelerated worker misclassification and caused the deterioration of wages and working conditions. [EPA-HQ-OAR-2019-0055-1257-A1, p.2]

As we will show, EPA has the authority to take further action including models for interagency consultation that could help mitigate harmful impacts of the Proposed Rule to already severely burdened truck drivers. Since EPA's Proposed Rule is being issued consistent with its authority under the Clean Air Act and with Executive Order 14037 (E.O. 14037), Strengthening American Leadership in Clean Cars and Trucks, signed by President Biden on August 5, 2021,3 it has the authority and the imperative for further action to protect workers, public health, and the environment. Specifically:

- EPA must not leave emission reductions and requirements to future rule and should transition to zero-emission trucks and buses by setting stringent emission standards and zero-emission-vehicle sales mandates now.
- EPA should require that all new trucks have zero emissions beginning in 2035 and retire all combustion trucks before 2045.
- EPA should take all available further action within its authority to help mitigate the economic impacts of its Proposed Rule on misclassified and independent contractor truck drivers and ensure that the companies hiring drivers bear the costs for leasing, operating, and maintaining vehicles.
- EPA should enter into purposeful interagency consultation and collaboration with other federal agencies, like DOL-DOT's Driving Good Jobs Initiative, and help develop a system of information and data sharing that leads to enforcement of labor and employment laws, which could protect misclassified and independent contractor truck drivers from further cost burdens associated with the Proposed Rule and later regulation. [EPA-HQ-OAR-2019-0055-1257-A1, p.3]

3 Strengthening American Leadership in Clean Cars and Trucks, 86 Fed. Reg. 43,583 - 43,585 (Aug. 10, 2021)

More than 3.5 million people in the U.S. work as truck drivers4 transporting goods from the ports where they arrive and factories where they are manufactured, across the Interstate Highway

System, and, increasingly, all the way to our front doorsteps. [EPA-HQ-OAR-2019-0055-1257-A1, p.4]

4 Jennifer C. Day & Andrew W. Hait, America Keeps on Truckin', Number of Truckers at All-Time High, U.S. Census Bureau, June 2019, https://www.census.gov/library/stories/2019/06/america-keeps-on-trucking.html

For years, analysts have been warning about a 'shortage' of truck drivers to fill the needs of the industry. The American Trucking Association estimates that by 2028, the country will be 'short' 160,000 truckers.5 This shortage has its roots in the deregulation of the industry and accompanying devaluation of trucking jobs which began with the 1980 Motor Carrier Act. This legislation, and similar laws, deregulated the trucking and logistics industries thereby enabling carriers to reduce rates.6 But a core mechanism by which these rate reductions were made possible was by imposing mass driver dislocation and insecurity. [EPA-HQ-OAR-2019-0055-1257-A1, p.4]

5 Bob Costello & Alan Karikhoff, Truck Driver Shortage Analysis 2019, American Trucking Associations, July 2019, https://www.trucking.org/sites/default/files/2020-01/ATAs%20Driver%20Shortage%20Report%202019%20with%20cover.pdf

6 Jerry Ellig, Trucking & Rail Regulatory Reforms Provide a Model for Bipartisan Cooperation, Regulatory Studies Center, The George Washington University, October 7, 2020, https://regulatorystudies.columbian.gwu.edu/sites/g/files/zaxdzs3306/f/downloads/Commentaries/GW%20Reg%20Studies%20-%20Motor%20Carrier%20and%20Staggers%20Act%20Turn%2040%20-%20JEllig.pdf

Decline in unionization was one of the effects of deregulation. Union density in the regulated sector of the trucking industry dropped from 60% to about 25% in 1990.7 Today, only 2% of long-haul trucking jobs are estimated to be union jobs.8 [EPA-HQ-OAR-2019-0055-1257-A1, p.4]

7 Barry T. Hirsch, Trucking Deregulation and Labor Earnings: Is the Union Premium a Compensating Differential?, 11 J. Lab. Econ., 279 (1993), unionstats.gsu.edu/bhirsch/TruckingDeregulation.pdf

8 John D. Schulz, Union-free carriers trying hard to stay that way, Logistics Mgmt. (Dec. 18, 2013), https://www.logisticsmgmt.com/article/union_free_carriers_trying_hard_to_stay_that_way

Deregulation and the accompanying de-unionization of the industry have caused the deterioration of drivers' wages, benefits and working conditions. Even after adjusting for inflation, median wages for truck drivers fell from $110,00 in 1980 to $47,130 in 2020.9 This deterioration has also resulted in an average 100% industry turnover rate.10 Further, it has given way to an independent contracting model for truck driver employment.11 and paved the way for rampant misclassification of drivers who are employees in all but name and remain dependent on the companies who hire them. [EPA-HQ-OAR-2019-0055-1257-A1, p.4]

9 Michael Sainato, ‘This used to be a great job’: US truckers driven down by long hours and low pay, The Guardian (Dec. 27, 2021), https://www.theguardian.com/business/2021/dec/27/us-truck-drivers-economy-pay-conditions

10 America's Truck Driver Crisis Is Complicated, Nat’l Pub. Radio, (Mar. 7, 2022), https://www.npr.org/2022/03/07/1084923395/americas-truck-driver-crisis-is-complicated

11 Ibid.

The misclassification problem is especially acute for long-haul truck drivers who have been identified as a segment having high concentrations of misclassified truck drivers.12 [EPA-HQ-OAR-2019-0055-1257-A1, p.5]

12 Appel, Sam and Carol Zabin. Truck Driver Misclassification: Climate, Labor, and Environmental Justice Impacts. Center for Labor Research and Education, University of California, Berkeley. August 2019. http://laborcenter.berkeley.edu/truck-driver-misclassification/

According to a 2010 national study conducted by the National Institute on Occupational Safety and Health (NIOSH) ‘approximately 28% of long-haul drivers are leased contractors without their own operating authority.’ These are drivers who ‘would likely be considered misclassified under a number of legal tests . . . .’13 [EPA-HQ-OAR-2019-0055-1257-A1, p.5]

13 Id. at 9.

For drayage drivers, the misclassification problem is even greater. It has been estimated that ‘between 75% and 85%’ of port truck drivers were likely misclassified. The plight of drayage drivers has been well documented.14 15 16 [EPA-HQ-OAR-2019-0055-1257-A1, p.5]

14 Gracey Kay, Truckers at backlogged ports say they've waited in miles-long lines for up to 8 hours without pay, Bus. Insider, (Nov. 4, 2021), https://www.businessinsider.com/truckers-wait-outside-backlogged-ports-8-hourswithout-pay-2021-11

15 Ari Ashe, Port truckers battle over ‘detention’ pay, J. Com. Online, (Apr. 4, 2019), https://www.joc.com/truckinglogistics/drayage/port-truckers-battle-over-%E2%80%98detention%E2%80%99-pay_20190404.html

16 American Shipper Staff, LA drayage truckers file $1m driver misclassification suit against employer, Am. Shipper, (Oct. 23, 2017), https://www.freightwaves.com/news/la-drayage-truckers-file-1m-driver-misclassificationsuit-against-employer

Finally, when goods ordered over the internet make the last-mile journey to our doorsteps, they are often delivered by drivers who are misclassified as independent contractors and bear the burden of the high costs and maintenance associated with operating their vehicles. According to UC Berkeley: ‘In the package delivery segment of short-haul trucking, firms such as FedEx Ground, Amazon, and XPO Logistics all use contract truck drivers, and studies and lawsuits have documented evidence of widespread misclassification at these companies.’17 [EPA-HQ-OAR-2019-0055-1257-A1, p.5]

17 Appel & Zabin, supra note 12 at 8.

Similarly, the Netherlands-based Centre for Research on Multinational Corporations (SOMO) which recently analyzed the last-mile policies of six large parcel-delivery companies, including Amazon, FedEx, UPS, and Walmart, with respect to global warming and found that ‘[s]ubcontracting practices in the last-mile delivery sector have been associated with poor working conditions and labour rights violations in many countries.’18 [EPA-HQ-OAR-2019-0055-1257-A1, p.5]

18 Ilona Hartlief & David Ollivier de Leth, Parcel delivery on a warming planet: The efforts and ambitions of six companies, (December 2021), https://www.somo.nl/wp-content/uploads/2021/12/Parcel-Delivery-on-a-Warming-Planet_Final.pdf

Amazon’s practices, in particular, illustrate the pervasiveness of sub-contracting in the last-mile delivery sector. Over the past few years, the company has brought the majority of its last-mile delivery operations quasi-in house, with two models that have come to predominate. First, there are Amazon Flex drivers ‘who like their Uber or Instacart counterparts are classified as independent contractors exempt from U.S. employment laws,’19; second are employees of its subcontracted Delivery Service Partners (DSP), whose fleets deliver Amazon packages almost exclusively.20 [EPA-HQ-OAR-2019-0055-1257-A1, pp.5-6]

19 Josh Eidelson & Matt Day, Drivers don't work for Amazon but company has lots of rules for them, Detroit News, (May 5, 2021), https://www.detroitnews.com/story/business/2021/05/05/drivers-dont-work-amazon-butcompany-has-lots-rules-them/4955413001/

20 https://www.businessinsider.com/amazon-controls-delivery-drivers-without-paying-wages-2018-9

DSP-type companies face ‘strong pressure . . . to reduce delivery costs and shorten delivery times’ and these ‘[s]ubcontractors themselves often outsource activities to other subcontractors or independent workers.’21 [EPA-HQ-OAR-2019-0055-1257-A1, p.6]

21 Hartlief & Ollivier de Leth, supra note 18 at 18.

UC Berkeley, Labor Center describes the problem of misclassification as follows:

‘While . . . even very large companies misclassify their workers, small firms that misclassify proliferate in the highly fragmented trucking market and regulatory landscape, particularly in local [e.g., last-mile] and port trucking sub-segments. **Ultimately, misclassification is less an episodic problem of misbehavior by large or small companies, and instead a failure of public policy** to create labor market conditions that incentivize fair competition towards high road, environmentally accountable economic development.’22 (emphasis added) [EPA-HQ-OAR-2019-0055-1257-A1, p.6]

22 Appel & Zabin, supra note 12 at 13.

The problem with misclassification is greater than simply an evasion of the law. The model promotes the deterioration of wages, hours, and working conditions of owner-operators/drivers. [EPA-HQ-OAR-2019-0055-1257-A1, p.6]

According to a 2018 study of misclassified port truckers and the California Clean Truck program, written by Claire Sears, drivers ‘provide their own rigs, maintenance, fuel, insurance and other incidental costs like phone service and retirement.’23 Sears further explains that ‘after expenses and deductions, independent driver’s net income floats around minimum wage rates.’24 Similarly, the National Employment Law Project (NELP) found that drayage drivers classified as independent contractors make an average of $28,780 annually on an average 59-hour work week.25 [EPA-HQ-OAR-2019-0055-1257-A1, p.6]

23 Claire Sears, Driver Misclassification and Clean Truck Programs: An In-depth Analysis of Two Southern California Ports, Occidental College, (May 4, 2018), https://www.oxy.edu/sites/default/files/assets/UEP/Comps/Claire%20Sears_Driver%20Miscalssification%20and%20Clean%20Truck%20Program.pdf

24 Ibid. at 5.

25 Rebecca Smith, et al., The Big Rig Overhaul: Restoring Middle-Class Jobs at America’s Port Through Labor Law Enforcement, Nat’l. Emp. L. Project, (Feb. 2014), https://www.nelp.org/wp-content/uploads/2015/03/Big-Rig-Overhaul-Misclassification-Port-Truck-Drivers-Labor-Law-Enforcement.pdf

Additionally, ‘long-haul truckers are typically paid on a per-mile basis with paid time averaging between 7 to 8 hours per day. However, these same drivers are typically working upwards of 14 hours per day, with roughly half of those hours being unpaid time spent refueling or waiting for cargo.26 [EPA-HQ-OAR-2019-0055-1257-A1, pp. 6-7]

26 Naomi J. Dun, et. al, Driver Detention Times in Commercial Motor Vehicle Operations, Dep’t of Transp., (Dec. 1, 2014), https://rosap.ntl.bts.gov/view/dot/193

In the last-mile sphere, Amazon’s increasingly dominant model similarly overburdens drivers. Amazon Flex drivers ‘must provide their own vehicles (or rented delivery van).’27 Similarly, a DSP is ‘responsible for procuring delivery vehicles for its operations’ and can also ‘lease Amazon-branded vans designed specifically for this program . . . .’28 DSPs fleet sizes are capped by Amazon at a maximum of 40 vans ‘mak[ing] it difficult for these small firms to gain leveraging power against Amazon, while giving Amazon flexibility.’ 29 [EPA-HQ-OAR-2019-0055-1257-A1, p.7]

27 Jake Alimahomed-Wilson, The Cost of Free Shipping: Amazon in the Global Economy 74 (Jake Alimahomed-Wilson & Ellen Reese eds., 2020)

28 Frequently Asked Questions, Amazon, https://logistics.amazon.com/marketing/faq#Here_L (last visited May 16, 2022)

29 Alimahomed-Wilson, supra note 27.

UC Berkeley's Labor Center analysis describes the unequal distribution of costs between firms and drivers concisely: 'Contracting out truck driving shifts the costs of truck ownership and operation from trucking companies to individual truck drivers. Contract truck drivers, particularly misclassified contractors, earn low incomes and face high capital costs. While regulatory compliance costs for large trucking firms represent a small percent of total revenue, contract truck drivers face compliance expenses far in excess of their yearly income. Under the contractor business model, truck drivers least equipped financially to buy and maintain clean vehicles bear the financial burden of attaining the state's climate goals in this sector.'30 [EPA-HQ-OAR-2019-0055-1257-A1, p.7]

30 Appel & Zabin, supra note 12 at 1.

As a result of EPA omitting considerations of driver misclassification and the independent contractor model, not only does the Proposed Rule ignore the risk of increased harm to truck drivers, it consequently ignores the risk to its own objectives of getting cleaner heavy-duty vehicles on the road. [EPA-HQ-OAR-2019-0055-1257-A1, p.9]

The analysis by UC Berkeley, looking at compliance with the California Air Resources Board (CARB) regulations of heavy-duty truck emissions, concludes that there is 'clear evidence that non-compliance is concentrated in the contractor segment of the commercial trucking industry.'38 The report finds that the low wages paid to contract drivers 'are the primary reason contract drivers lack capital for clean vehicle investments' and goes on to cite a surprising finding from a 2010 report by the Los Angeles Alliance for a New Economy (LAANE) that cleaner diesel trucks 'cost approximately 70% more to maintain than conventional trucks.'39 [EPA-HQ-OAR-2019-0055-1257-A1, p.9]

38 Appel & Zabin, supra note 12.

39 Ibid.

Sears similarly finds, for those owner-operators who must finance their own vehicles, 'misclassification prevents environmental improvements by requiring drivers to purchase and maintain their own trucks' and that poor wages mean 'they often purchase older trucks which typically are cheaper and emit larger amounts of diesel pollution.'40 [EPA-HQ-OAR-2019-0055-1257-A1, p.9]

40 Sears, supra note 23 at 7

The matrix whereby large firms use either independent contractor drivers, or increasingly, smaller company subcontractors (who often in turn use independent contractor drivers) means that the largest firms who control the nationwide flow of freight shipping can further shield themselves from the responsibility of limiting their operations' harmful impacts to environmental and public health. This Russian nesting doll model of subcontracting diffuses the operations of the wealthiest actors, and obfuscates who shoulders the industry's labor and environmental responsibilities, as distinct from who ultimately benefits and therefore should actually shoulder these responsibilities. [EPA-HQ-OAR-2019-0055-1257-A1, p.9]

Analyzing compliance with CARB regulations, UC Berkeley finds that 'fleets with 1 to 3 trucks, where contract truck drivers are found, boast the largest share of non-compliant trucks, with 44% of all non-compliant trucks.'41 They deduce that 'non-compliant trucks operated by misclassified drivers are prevalent in the short-haul segment' where 'federal operating authority may not be required and yet many drivers are still misclassified.'42 Likewise, in SOMO's analysis of six major last-mile package delivery firms, they make it clear that the diluting of responsibility from layers of subcontracting will not be righted by the companies themselves: 'None of the six companies in this research state explicitly whether their emission reduction targets and fleet electrification measures also apply to outsourced activities.'43 SOMO further observes that 'the strong pressure to reduce costs and the complexity of subcontracting relations in the last-mile delivery sector reduce subcontractor companies' abilities to mitigate environmental impacts.'44 [EPA-HQ-OAR-2019-0055-1257-A1, pp.9-10]

41 Appel & Zabin, supra note 12 at 10.

42 Id. at 12.

43 Hartlief & Ollivier de Leth, supra note 18 at 18.

44 Id.

Still, UC Berkeley's analysis makes clear that 'even very large companies misclassify their workers. CARB compliance data show examples of non-compliant trucks driven by likely misclassified contract truck drivers for major corporations.'45 The port trucking sector provides a clear example of the environmental consequences of even large firms' failure to properly employ and compensate their drivers. One of the early attempts at addressing both heavy-duty vehicle pollution and driver exploitation yielded a 2008 Concession Agreement between the Port of Los Angeles and large carriers. The agreement was 'designed to encourage . . . Licensed Motor Carriers (LMCs) [to] enter into drayage concession agreements with the Port and [be] responsible for owning and maintaining the trucks used to perform drayage services at the Port.'46 Sears shows a finding attached to the 2008 agreement explicating a primary reason for mandating a reclassification to full employment status of port drivers:

'Many drayage truck drivers have testified at the Board of Harbor Commissioners meetings of both Ports of Los Angeles and Long Beach, stating that they are unable to afford and maintain the cleaner trucks needed to achieve air quality standards, even with the subsidies proposed to be offered by the Ports.'47 [EPA-HQ-OAR-2019-0055-1257-A1, p.10]

45 Appel & Zabin, supra note 12.

46 The Port of Los Angeles, Port of Los Angeles' Clean Truck Program Concession Agreement and Application are Now Available for Licensed Motor Carriers, (July 18, 2008), https://www.portoflosangeles.org/references/news_071808ctp

47 Sears, supra note 23 at 36.

The Warehouse Workers for Justice (WWJ) published a complete sector analysis of the warehousing and trucking hub in Will County, Illinois. WWJ's report shows how poor wages and working conditions for drivers and warehouse workers are inseparable from environmental pollution plaguing the surrounding, largely black and brown, communities and the feedback loop that develops between the two. The community members rendered sick by the industry's pollution are often the same workers who are hyper-exploited by the industry's dominant corporations. In a detailed interview with an area truck driver, WWJ shows that poor compensation models for drivers (e.g., 'per load') lead 'some drivers [to] cut through residential areas to make the most money as they pick up and drop off a load as quickly as possible.'48 They show throughout their study that the 'same systems exploiting truckers at work also forces truckers to contribute to pollution in residential neighborhoods.'49 If EPA is serious about its objectives with the Proposed Rule, it must account for the ways in which misclassified and destabilized trucking labor is undermining otherwise environmentally beneficial regulation. [EPA-HQ-OAR-2019-0055-1257-A1, pp.10-11]

48 Madison Lisle & Yana Kalmyka, For Good Jobs & Clean Air: How a Just Transition to Zero Emission Vehicles Can Transform Warehousing 17 (2022), https://www.ww4j.org/uploads/7/0/0/6/70064813/wwj_report_good_jobs_clean_air.pdf

49 Ibid.

Once again, UC Berkeley's analysis encapsulates with particular concision the confluence of the problems outlined throughout this comment:

'This report documents the significant problem of non-compliance with clean vehicle policies in the commercial trucking industry. It presents evidence of the concentration of non-compliance in the contract trucking sector . . . . The report also links contract trucking, where compliance is lowest, to evidence of high prevalence of misclassification of truck drivers as contractors instead of employees. It concludes that the low incomes of contract drivers, including misclassified truck drivers, are a key obstacle to full compliance with clean truck standards.'50 [EPA-HQ-OAR-2019-0055-1257-A1, p.11]

50 Appel & Zabin, supra note 12 at 13.

EPA's Proposed Rule is being issued pursuant to its authority under the Clean Air Act and with Executive Order 14037 (E.O. 14037), Strengthening American Leadership in Clean Cars and Trucks, signed by President Biden on August 5, 2021.51 E.O. 14037, section 6(b) orders that 'the Administrator of the EPA shall consult with the Secretaries of Commerce, Labor, and

Energy on ways to achieve the goals laid out in section 1 of this order,' such goals including 'to grow jobs that provide good pay and benefits.'52 The White House Fact Sheet announcing E.O. 14037 states that to achieve its goal, it will 'leverage once-in-generation investments and a whole-of-government effort to lift up the American autoworker and strengthen American leadership in clean cars and trucks.'53 [EPA-HQ-OAR-2019-0055-1257-A1, p.11]

51 Strengthening American Leadership in Clean Cars and Trucks, supra note 3.

52 Ibid.

53 Fact Sheet: President Biden Announces Steps to Drive American Leadership Forward on Clean Cars and Trucks, The White House, n.d., https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheetpresident-biden-announces-steps-to-drive-american-leadership-forward-on-clean-cars-and-trucks/

As such, EPA should be doing all that is within its authority to take these impacts into account and assist in addressing misclassification, ensuring that the companies hiring drivers bear the costs for leasing, operating, and maintaining vehicles. EPA can be a significant part of the solution to these issues by participating in ongoing interagency collaborative frameworks (and by developing new ones), which are being implemented to identify and address these kinds of problems. [EPA-HQ-OAR-2019-0055-1257-A1, pp.11-12]

A prime and ready example would be for EPA to immediately formalize a framework of consultation and data exchange regarding the Proposed Rule's impacts on misclassified drivers in partnership with the Departments of Labor and Transportation's Driving Good Jobs Initiative. [EPA-HQ-OAR-2019-0055-1257-A1, p.12]

As a part of President Biden's Trucking Action Plan, launched in December 2021, the joint DOL-DOT Driving Good Jobs initiative is aimed at 'supporting drivers and ensuring that trucking jobs are good jobs . . . for a strong, safe, and stable trucking workforce.'54 Objectives include 'identifying longer term actions, such as potential administrative or regulatory actions that support drivers and driver retention by improving the quality of trucking jobs.'55 An April 4th White House update states that as part of the initiative DOL and DOT are 'conducting joint outreach and education to employers and drivers about these rights and responsibilities under federal wage and hour law' and are 'committed to addressing core challenges, such as worker misclassification . . . .'56 [EPA-HQ-OAR-2019-0055-1257-A1, p.12]

54 Fact Sheet: The Biden-â Harris Administration Trucking Action Plan to Strengthen America's Trucking Workforce, The White House, n.d., https://www.whitehouse.gov/briefing-room/statements-releases/2021/12/16/fact-sheet-thebiden-%E2%81%A0harris-administration-trucking-action-plan-to-strengthen-americas-trucking-workforce/

55 Ibid.

56 Fact Sheet: The Biden Administration's Unprecedented Actions to Expand and Improve Trucking Jobs, The White House, n.d., https://www.whitehouse.gov/briefing-room/statements-releases/2022/04/04/fact-sheet-the-bidenadministrations-unprecedented-actions-to-expand-and-improve-trucking-jobs/

Manufacturing companies must obtain certificates of conformity from EPA under Clean Air Act section 206 in order to sell each heavy-duty engine or vehicle they produce (i.e., each mobile emissions 'source.')57 Pursuant to an application for certification, EPA collects crucial testing and demonstration data and other information from manufacturers in order to approve their applications and issue certificates of conformity. A ready example, EPA requires Production Volume data from manufacturers as a part of certifying compliance with its Proposed Rule. Production Volume data is defined as 'the number of engines, subject to [the Proposed Rule] produced by a manufacturer for which the manufacturer has a reasonable assurance that sale was or will be made to ultimate purchasers in the United States.'58 [EPA-HQ-OAR-2019-0055-1257-A1, p.12]

57 42 U.S.C. 7521 (2018)

58 EPA, Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, 87 Fed. Reg. 17,726 (Mar. 28, 2022), https://www.govinfo.gov/content/pkg/FR-2022-03-28/pdf/2022-04934.pdf

The Bureau of Transportation Statistics (BTS) and the Federal Motor Carrier Safety Administration (FMCSA) within DOT, along with the Bureau of Labor Statistics (BLS) and the Wage and Hour Division (WHD) within DOL, would be ideal agencies with which to establish a formal Data Exchange Committee whereby relevant data can be compiled, analyzed, and identified for enforcement authorities. BTS collects data and reports on registered motor carriers, including their truck assets, employment, and more. FMCSA maintains critical registration information on motor carriers, the details of their operations, and enforces issues pursuant to safe vehicles and safe driving. BLS likewise collects data and issues detailed reports on employment and industry within the U.S. while WHD enforces cases of worker misclassification, compensation, and other worker benefits and standards. EPA stands out as a missing link that could enable the tracking of its Proposed Rule's impacts on misclassified drivers by helping to monitor where newly compliant engines are purchased, by what classification of driver they are eventually used, and to support enforcement to correct the misclassified employment status of drivers - activities that will benefit both workers and the environment. [EPA-HQ-OAR-2019-0055-1257-A1, pp.12-13]

There is ample precedent for such collaboration and interagency exchange from which to think about and even model creative consultation frameworks. EPA and DOL's Occupational Health and Safety Administration (OSHA) established a robust MOU in 1991 to better protect workers and the environment, which included an 'Enforcement and Compliance Monitoring Data Exchange Program.'59 This program established a Data Exchange Committee to 'facilitate understanding of each agency's data and data systems by exchanging data and system descriptions and by providing presentations about data and data systems' for purposes including 'determining compliance histories or background information on specific facilities, industrial segments or categories or related reasons.'60 A similar pathway can easily be imagined for the purposes of EPA assisting in the enforcement of fair labor standards for truck drivers while further ensuring environmental protection. [EPA-HQ-OAR-2019-0055-1257-A1, p.13]

59 EPA & OSHA, Memorandum of Understanding between The U.S. Department of Labor Occupational Safety and Health Administration and The U.S. Environmental Protection Agency Office of Enforcement (Feb. 13, 1991), https://www.osha.gov/laws-regs/mou/1991-02-13

60 Ibid.

Perhaps just as crucially, EPA's assistance in tracking the proliferation of newly compliant heavy-duty trucks would help identify to which carriers compliant products are not going. This will be critical information in identifying smaller carriers, sub-contractors, and similar operations that might be more likely to have drivers misclassified yet still controlled by the largest, most wealthy companies. Smaller operations are also of course where UC Berkeley identifies the largest gap in CARB's regulatory compliance correlated with high rates of independently contracted drivers. [EPA-HQ-OAR-2019-0055-1257-A1, p.13]

Indeed, action by EPA in these and similar ways would also add some muscle to President Biden's oft-stated commitment to being the most pro-union President in modern history. There was established on December 8, 2021, an MOU between WHD and the National Labor Relations Board with the purpose of improving 'law enforcement and greater coordination between the agencies through information sharing, joint investigations and enforcement activity, training, education, and outreach.'61 One of the goals set out in the MOU is 'the identification and investigation of complex or fissured employment structures, including single or joint employer, alter ego, and business models designed to evade legal accountability, such as the misclassification of employees.'62 EPA entering into interagency consultation that establishes robust frameworks for data sharing and analysis, consistent with its granted authority, could lead to a virtuous feedback loop of interagency collaboration that benefits truck drivers, labor in general, the public, and the environment. [EPA-HQ-OAR-2019-0055-1257-A1, pp.13-14]

61 DOL/WHD & NLRB, Memorandum of Understanding Between The U.S. Department of Labor, Wage and Hour Division and the National Labor Relations Board (Dec. 8, 2021), https://www.dol.gov/agencies/whd/flsa/national-labor-relations-board-mou

62 Ibid.

Additionally, EPA could also vocally be taking advantage of the ample opportunity for ongoing interagency consultation to boost the government-wide imperative to further environmental justice. For instance, EPA's Environmental Justice Screening and Mapping Tool would be of great service in prioritizing, for example, in what communities the burgeoning 90-Day Trucking Apprenticeship challenge should be supported and scaled. This initiative, led by the collaborative efforts of DOL and DOT within the Trucking Action Plan referenced above, would greatly benefit from EPA's input and would be consistent with providing direction in related efforts such as prioritizing 40% of the benefits of federal support for communities historically burdened by environmental injustices (i.e., Justice40). An assertive EPA could be directing the efforts to establish good jobs in trucking in such manners consistent with its authority and with the President's explicit commitments to justice. [EPA-HQ-OAR-2019-0055-1257-A1, p.14]

In sum, EPA must consider and acknowledge the impacts of its Proposed Rule on misclassified and independent contractor truck drivers and then act to remedy the resultant harms. EPA must make full use of and act creatively with its authority to work collaboratively with other federal agencies consistent with E.O. 14037 and the President's ubiquitously stated 'whole-of-government approach.'63 64 65 It should enter thoughtfully planned and lasting interagency collaborative frameworks that truly further the purposes of this administration's lofty goals in building clean infrastructure, establishing resilient domestic supply chains, ensuring family-supporting jobs with the free and fair chance to join a union, and finally ending toxic pollution. [EPA-HQ-OAR-2019-0055-1257-A1, p.14]

> 63 Abigail J. Hess, Biden promises to be 'the most pro-union president'—and union members in Congress are optimistic, CNBC, (Dec. 20, 2020), https://www.cnbc.com/2020/12/01/biden-promises-to-be-the-most-pro-unionpresident-and-rep.html
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> 64 Steven Greenhouse, Biden stakes claim to being America's most pro-union president ever, The Guardian, (May 2, 2021), https://www.theguardian.com/us-news/2021/may/02/joe-biden-unions
>
> 65 Ahiza García-Hodges, Biden's vow to be 'most pro-union president' tested in first year, (Jan. 20, 2022), https://www.nbcnews.com/business/economy/bidens-vow-union-president-tested-first-year-rcna12791

LNS recommends that EPA take the actions within its authority outlined above to ensure that the Proposed Rule does not result in further devaluation and harm to truck driver labor and thus can actually achieve what it sets out to achieve. [EPA-HQ-OAR-2019-0055-1257-A1, p.15]

Specifically, LNS recommends the following actions:

- EPA should take all available further action within its authority to help mitigate the economic impacts of its Proposed Rule on misclassified and independent contractor truck drivers and ensure that the companies hiring drivers bear the costs for leasing, operating, and maintaining vehicles.
- EPA should enter into purposeful interagency consultation and collaboration with other federal agencies, like DOL-DOT's Driving Good Jobs Initiative, and help develop a system of information and data sharing that leads to enforcement of labor and employment laws, which could protect misclassified and independent contractor truck drivers from further cost burdens associated with the Proposed Rule and later regulation. [EPA-HQ-OAR-2019-0055-1257-A1, p.15]

Organization: *Manufacturers of Emission Controls Association (MECA)*

Technologies exist to ensure that MD gasoline engines can meet stringent standards like their diesel and natural gas counterparts. We encourage EPA to set tighter MD standards as the agency has indicated in the forthcoming Tier 4 light-duty regulation. [EPA-HQ-OAR-2019-0055-1320-A1, p.31]

Furthermore, we believe that technology available for reducing exhaust emissions from light-duty vehicles and medium-duty chassis certified vehicles has advanced significantly and can be applied to engine certified products. Engine-based technologies that can address cold start emissions include cylinder deactivation, electrical heaters and heated catalysts, hybridization and electronic variable valve timing. To control exhaust temperature under high load, technologies that can be applied to engines include exhaust gas recirculation, Miller cycle, cooled exhaust manifolds, electronic throttle control and advanced transmissions. [EPA-HQ-OAR-2019-0055-1320-A1, p.31]

In addition to the engine technologies described above, several aftertreatment choices can be made to optimize emissions performance. The technology base of advanced three-way catalysts deposited on high cell density, thin-walled substrates has evolved dramatically from light- and medium-duty chassis certified vehicles to comply with Tier 3 and LEV 3 standards. Recent advances have yielded high porosity, low thermal mass substrates with narrow pore size distributions, which enable high emissions reduction efficiency with less precious metal loading [49] [50]. Catalyst manufacturers have developed coating techniques based on layered or zoned architectures to strategically deposit precious metals in ways that optimizes their performance at a minimum of cost. The coated substrates are then packaged using specially designed matting materials and passive thermal management strategies, secondary air injection systems to allow chassis certified medium-duty trucks to meet the stringent Tier 3 emission fleet average limit of 30 mg/mile or approximately 100 mg/bhp-hr. Close-coupled catalyst exhaust architectures have been on light-duty vehicles starting with Tier 2 standards and are an effective strategy for addressing cold-start or low load operation. These same approaches can be readily optimized and applied to allow all medium-duty and heavy-duty gasoline vehicles to achieve the same ultra-low exhaust emission levels being considered for diesel engines by this rule.[EPA-HQ-OAR-2019-0055-1320-A1, pp.31-32]

[49] T. Asako, D. Saito, T. Hirao and E. Popp, ‘Achieving SULEV30 Regulation Requirement with Three-Way Catalyst on High-Porosity Substrate while Reducing Platinum Group Metal Loading (SAE 2022-01-0543),’ in SAE WCX, Detroit, MI, 2022.

[50] J. Warkins, T. Tao, M. Shen and S. Lyu, ‘Application of Low-Mass Corning FLORA Substrates for Cold-Start Emissions Reduction to Meet Upcoming LEV III SULEV30 Regulation Requirement (SAE 2020-01-0652),’ in SAE WCX, Detroit, MI, 2020.

In 2007, MECA applied the above-mentioned strategies to two full-sized 2004 pick-up trucks equipped with a 5.4L and 6.0L engine [51]. The aftertreatment systems were packaged with dual-wall insulated exhaust systems and fully aged to represent 120,000 miles of real-world operation. Even with 15 year old engine technology and limited engine calibration on one of the vehicles, both vehicles achieved FTP NMHC+NOx emissions of 60-70 mg/mile. Although we did not replace the cast-iron exhaust manifolds on these vehicles, an OEM likely would take advantage of such cost effective passive thermal management strategies, including dual-wall insulated exhaust or integrated exhaust manifolds, to further reduce cold-start emissions. [EPA-HQ-OAR-2019-0055-1320-A1, p.32]

[51] J. W. Anthony and J. E. Kubsh, 'The Potential for Achieving Low Hydrocarbon and NOx Exhaust Emissions from Large Light-Duty Gasoline Vehicles,' in SAE Technical Paper 2007-01-1261, 2007.

Engines and aftertreatment systems have evolved significantly over the past 15 years and in fact, in support of the Tier 3 light-duty regulation [52], EPA tested a 2011 LDT4 pick-up truck with a 5.3L V8 engine that included a MECA supplied aftertreatment system. The aftertreatment consisted of advanced catalyst coating on 900 cpsi substrates in the close-coupled location as well as underfloor catalysts and was aged to 150,000 miles. The system was combined with cylinder deactivation and achieved an FTP NMHC+NOx level of 18 mg/mile. We believe that these same technology approaches can be deployed on medium-duty gasoline engines to meet the same stringent emission levels being considered for medium-duty diesel engines. Best in class Class 2b and 3 vehicles are currently reporting levels that are up to 75% below the Tier 3 NMOG+NOx certification standards. [EPA-HQ-OAR-2019-0055-1320-A1, p.32]

[52] U.S. EPA, 'EPA,' March 2013. [Online]. Available: https://www.epa.gov/regulations-emissions-vehicles-and-engines/proposed-rule-and-related-materials-control-air-pollution.

Organization: *Moving Forward Network (MFN)*

The exploitative practice of a freight transportation system that relies on misclassified workers ultimately undermines any regulatory policy that aims to "clean up" the trucking industry by shifting costs of emissions reductions to the most economically vulnerable within the industry. However, with the correct policy levers in place and working with the whole of government approach, while centering frontline and fence line experience and knowledge the EPA could be proposing the necessary successful Rule that would move ZEVS with the goal of just transition and entering environmental justice. Otherwise, we risk leaving zero emission transition up to chance. 158 [EPA-HQ-OAR-2019-0055-1277-A1, p. 40]

158. https://laborcenter.berkeley.edu/pdf/2019/Truck-Driver-Misclassification.pdf

In the workplace, the just transition framework centers the voices of workers whose jobs will radically transform by the promise of clean energy industries. Bearing in mind that the jobs of truckers and some warehouse workers might look quite different in an electrified world, looking to workers to provide leadership on what their needs will look like around training, affordability, and working conditions is a way to ensure a fair progression to EVs.159 [EPA-HQ-OAR-2019-0055-1277-A1, p. 40]

159. https://www.ww4j.org/uploads/7/0/0/6/70064813/wwj_report_good_jobs_clean_air.pdf

Port drivers have become indentured servants to their trucks. “Drivers are on the job five days a week, from ten to twelve hours a day, earning an average income of $28,000 per year.”160 Because they are not considered to be employees they have no benefits -- no health care, pension, paid vacation, etc. As previously stated, drivers have to pay the total cost of their rigs and of being on the road. [EPA-HQ-OAR-2019-0055-1277-A1, p. 40]

160. Bensman, David. (2009). Port trucking down the low road: a sad story of deregulation. Rutgers University. DEMOS pg.5

In the National Employment Law Project Report in 2014, Big Rig: Poverty, Pollution, and the Misclassification of Truck Drivers at America’s Ports, found that over 60% of port truck drivers are misclassified as independent contractors.161 The labor practice of misclassifying workers in the trucking industry undermines climate action by shifting the costs of emission reductions from companies onto the most economically vulnerable in the industry: contract truck drivers. Contract truck drivers often earn a low income and face high capital costs. These drivers “purchase” the truck that will fall under the new emission standard at a higher cost and are responsible for paying the for ownership and operation costs that can be significantly above their earnings. Drivers are often in the position of absorbing the costs of upgrading to new technologies, while trucking companies externalize their costs. [EPA-HQ-OAR-2019-0055-1277-A1, p. 40]

161. https://www.nelp.org/wp-content/uploads/2015/03/Big-Rig-Overhaul-Misclassification-Port-Truck-Drivers-Labor-Law- Enforcement.pdf

To begin to address the issues of exploitation of the workforce especially for port truck drivers the EPA needs to propose a just transition towards zero emission vehicles. This means that there would be supportive policies and programs needed to ensure that workers within the port transportation sector are not further burdened but actually could benefit from the increases in job growth. MFN is committed to a just transition towards zero emissions.162 This means that the voices of workers are critical to the success of policies and programs that will ultimately move towards zero emission solutions across the freight transportation system. [EPA-HQ-OAR-2019-0055-1277-A1, pp. 40 - 41]

162. The Just Transition Alliance defines this concept as “a principle, a process and a practice. The principle of just transition is that a healthy economy and a clean environment can and should co-exist. The process for achieving this vision should be a fair one that should not cost workers or community residents their health, environment, jobs, or economic assets. “What Is Just Transition?” Just Transition Alliance, http://jtalliance.org/what-is-just transition/.

“Just transition advocates within the labor movement often say that while ‘transition is assured, justice is not.’” - Warehouse Workers for Justice, For Good Jobs & Clean Air, How a Just Transition to Zero Emission Vehicles Can Transform Warehousing163 [EPA-HQ-OAR-2019-0055-1277-A1, p. 41]

163. https://www.ww4j.org/uploads/7/0/0/6/70064813/wwj_report_good_jobs_clean_air.pdf

Organization: *North Central Texas Council of Governments (NCTCOG)*

EPA must ensure that legacy HD trucks are still maintaining their emissions components and staying compliant with Clean Air Act requirements with regard to emissions component tampering and deterioration. To continue efforts, EPA must address legacy HD trucks and vehicles by providing funding incentives for replacing diesel engines with newer alternative fuel vehicles. [EPA-HQ-OAR-2019-0055-1254-A2, p.4]

Organization: *Natural Gas Vehicles for America (NGVAmerica)*

NGVAmerica and its members submit the following recommendations for policies and programs that the EPA and other federal agencies can advance to encourage the use of cleaner trucks.

3) Adopt incentives for hybrid electric vehicles that are powered by alternative fuels for a number of years to aid in the commercialization of these technologies, which previously have not been available and have not benefited from regulatory incentives; this includes extending sales multiplier for hybrid electric and plug-in electric vehicles that are powered by alternative fuel; [EPA-HQ-OAR-2019-0055-1330-A1, pp.12-13]

6) Amend the greenhouse gas regulations for all types of medium- and heavy-duty motor vehicles and incorporate the benefits of renewable natural gas as part of the engine and vehicle certification regulations; these credits could be based on the percentage of RNG expected to be used during the timeframe covered, or alternatively EPA could reinstate the 0.15 factor for calculating GHG emissions for NGVs, which is in line with the expected reductions achieved by the fuel mix of RNG and conventional fuel currently in use; [EPA-HQ-OAR-2019-0055-1330-A1, p.13]

7) Provide enhanced SmartWay designations for trucks powered by low-NOx engines and fueled by renewable natural gas; [EPA-HQ-OAR-2019-0055-1330-A1, p.13]

8) Fund pilot programs and infrastructure development that demonstrate the ways in which natural gas can be used to fuel a variety of different transportation sectors by supporting the purchase of vehicles and equipment at multimodal facilities such as ports and rail facilities; [EPA-HQ-OAR-2019-0055-1330-A1, p.13]

10) Work with state authorities to ensure that transportation policies include performance metrics and consider a variety of different technologies as opposed to only promoting specific technologies regardless of their cost; [EPA-HQ-OAR-2019-0055-1330-A1, p.14]

11) Work with state authorities to ensure that they give effect to the recently enacted weight allowance (i.e., 2,000 lb.) for natural gas trucks operating on the federal interstate system and consider extending this provision to state roads to maximize the benefit of this provision; [EPA-HQ-OAR-2019-0055-1330-A1, p.14]

12) Work with Congress to extend the alternative fuel tax credit (AFTC) for natural gas used as a motor vehicle fuel for a minimum of five years to stimulate real demand for cleaner new truck purchases; [EPA-HQ-OAR-2019-0055-1330-A1, p.14]

Organization: *PACCAR, Inc (PACCAR)*

PACCAR is committed to ultimately moving toward a zero emission future to help reduce the carbon footprint associated with U.S. commerce, and we believe that a GHG Phase 3 rule will help achieve this goal. PACCAR supports the GHG Phase 3 rulemaking and other rulemakings that provide regulatory certainty and facilitate product planning. [EPA-HQ-OAR-2019-0055-1346-A1, p.3]

Organization: *Red Fox Resources*

We wish to point out that engine emission controls make use of Platinum Group Metals (PGM) such as platinum and palladium. Due to their scarcity, recycling as part of sustainable circular economy best practices, is critical to control costs and to ensure emission control products and other products (such as hydrogen fuel cells and electrolyzers) remain affordable and cost effective. Today, extractive mining accounts for approximately 70% of the global supply of PGM, while the remaining 30% comes from recycling. [EPA-HQ-OAR-2019-0055-1209-A1, p.1]

The environmental impact of recycling these metals is dramatically less than traditional extractive mining, as recycling precious metals produces about one-twentieth the emissions than mining (a 95% reduction). Also, increasing reclaimed PGM from the domestic use, lessens the threat of supply interruptions from foreign countries. [EPA-HQ-OAR-2019-0055-1209-A1, p.1]

For these reasons, we strongly encourage the EPA to make manufacturers aware of the opportunity for recycling, and to incorporate best practices for end-of-life and sustainability in the design, manufacture, and support of emissions components. Examples of this include OEMs implementing core return programs to ensure the maximum number of components are cost effectively aggregated for recycling, and kept out of the secondary markets, scrap metals bins, or landfills. Without these core return programs, these components often get scrapped and the PGM is lost. Another example is that the components are designed for ease of recycling; in terms of both the types of material used and layout of the parts. [EPA-HQ-OAR-2019-0055-1209-A1, pp. 1-2]

One last consideration is that these catalyzed emissions components be designed with anti-theft measure in mind. Given the increasing value of some parts, theft has become and will continue to an important issue that causes downtime for fleets and adds to an overall cost increase to the industry and their customers. [EPA-HQ-OAR-2019-0055-1209-A1, p.2]

Organization: *Repair Association/Repair.org*

Given that the EPA has the goals; ‘to reduce in-use emissions under a broad range of operating conditions,’ ‘the CTI can be summarized as a holistic approach to implementing our Clean Air

Act obligations,' and 'CTI should support improved vehicle reliability' The EPA has stated that this proposed rule shall apply to 'various types of nonroad engines' I hope that the EPA will also promulgate this rule to equipment used in agriculture. [EPA-HQ-OAR-2019-0055-1036-A1, p.1]

Hours of use verses miles traveled: Agricultural and Construction equipment do not use miles traveled as a measurement of the usage or age of the engine. Industry standard is the hours of operation.
Recommendation: The rule should include both measures and where appropriate, provide a translation between the two measurement systems. [EPA-HQ-OAR-2019-0055-1036-A1, p.2]

Adequate maintenance instructions: Agricultural equipment manufactures do not make available service information of emission control systems as required by rule 74 FR 8310, February 24, 2009.[1] John Deere CTO Jahmy Hindman publicly stated that because of regulation they do not allow for repairs by owners and independent service organizations.[2]
Recommendation: The rule should require all information provided to franchise dealership as intended by the Clean Air Act, Section 202(m)(5)

> Information availability - The Administrator, by regulation, shall require (subject to the provisions of section 7542(c) of this title regarding the protection of methods or processes entitled to protection as trade secrets) manufacturers to provide promptly to any person engaged in the repairing or servicing of motor vehicles or motor vehicle engines, and the Administrator for use by any such persons, with any and all information needed to make use of the emission control diagnostics system prescribed under this subsection and such other information including instructions for making emission related diagnosis and repairs. No such information may be withheld under section 7542(c) of this title if that information is provided (directly or indirectly) by the manufacturer to franchised dealers or other persons engaged in the repair, diagnosing, or servicing of motor vehicles or motor vehicle engines. Such information shall also be available to the Administrator, subject to section 7542(c) of this title, in carrying out the Administrator's responsibilities under this section. [EPA-HQ-OAR-2019-0055-1036-A1, pp.2-3]
>
> [1] 'manufacturers make available to the service and repair industry information necessary to perform repair and maintenance service on OBD systems and other emission related engine components.'
>
> [2] https://www.theverge.com/22533735/john-deere-cto-hindman-decoder-interview-right-to-repair-tractors, June 15, 2021, accessed on 24-April-2022.

Warranty of 5 years or 50,000 miles: Warranties of agricultural equipment are typically one year. Additional warranty coverage may be purchased from the dealer.
Recommendation: I recommend that the rule include explicit warranty requirements analogous to current or proposed regulations in equivalent hours with regards to emissions equipment. [EPA-HQ-OAR-2019-0055-1036-A1, p.3]

Usefulness of currently available emission diagnostic information and equipment: Some agricultural equipment manufactures do NOT make emission diagnostic information available to owners and independent service organizations. Some may provide the information on a limited rental basis only to the equipment owner. In the Case of John Deere, the tool needed for diagnostic information, Dealer Level Service ADVISOR is controlled in real time for exclusive use by current dealer service technicians. Additionally, full completion of an emission repair may require a technician be provided additional resources from exclusively the original manufacture often in an encrypted format. [EPA-HQ-OAR-2019-0055-1036-A1, p.3]

Certain manufactures of agricultural equipment have error codes that are colloquially known as ‘latch codes.’ They are often associated with issues with the emission control system that can disable the equipment’s designed functionality until cleared. These ‘latch codes’ exclusively require an franchise dealership technician to clear the code and restore the equipment to full working order. It is useful to note that a ‘latch code’ does not necessarily involve a repair. But rather can be tripped by an inadvertent action by the equipment operator and corrected by the equipment operator. Nevertheless, the equipment would need to be serviced by a dealer technician using the restricted software tool. [EPA-HQ-OAR-2019-0055-1036-A1, p.3]

Recommendation: I recommend that any information or software tools related to the service, repair, installation or replacement of parts or systems developed by third party (Tier 1) suppliers for OEMs, to the extent they are made available to franchise dealerships be made available to equipment owners and independent repair facilities. [EPA-HQ-OAR-2019-0055-1036-A1, p.3]

The adequacy of emission-related training for diagnosis and repair of these systems: Training of emission related diagnosis and subsequent repair is only provided to franchise dealership technicians.
Recommendation: I recommend that any information or software tools related to the service, repair, installation or replacement of parts, or systems developed by third party (Tier 1) suppliers for OEMs, to the extent they are made available to franchise dealerships be made available to equipment owners and independent repair facilities. [EPA-HQ-OAR-2019-0055-1036-A1, p.4]

The readiness and capabilities of repair facilities in making repairs: The availability of qualified technicians is an decades old problem that is well documented by Diane Benck, General Operations Manager and Owner, West Side Tractor Sales Co., in her testimony before the U.S. House of Representatives Small Business Committee's Innovation, Entrepreneurship and Workforce Development Subcommittee on March 31, 2022 3
Recommendation: I recommend that any information or software tools related to the service, repair, installation or replacement of parts, or systems developed by third party (Tier 1) suppliers for OEMs, to the extent they are made available to franchise dealerships be made available to equipment owners and independent repair facilities.[EPA-HQ-OAR-2019-0055-1036-A1, p.4]

3 https://docs.house.gov/Committee/Calendar/ByEvent.aspx?EventID=114554, Statement: https://docs.house.gov/meetings/SM/SM22/20220331/114554/HHRG-117-SM22-Wstate-BenckD-20220331.pdf, accessed 24-April-2022.

The reasonableness of the cost of purchasing this information and the equipment: Some agricultural equipment manufacturers such as John Deere’s Customer Level Service ADVISOR, make a reduced functionality version of the dealer level software or a ‘lite’ version. These ‘lite’

versions of the software often limit information, diagnostics, and repair capabilities especially with regards to emission issues. The annual license fee of this software tool is very high, hard to order, and not well subscribed.
Recommendation: I recommend that any information or software tools related to the service, repair, installation or replacement of parts, or systems developed by third party (Tier 1) suppliers for OEMs, to the extent they are made available to franchise dealerships be made available to equipment owners and independent repair facilities on fair and reasonable terms. [EPA-HQ-OAR-2019-0055-1036-A1, pp.4-5]

The prevalence of repairing this equipment outside of large repair facilities: Because agricultural equipment manufactures regularly limit the use of the software tools to only franchise dealership both small and large, agricultural equipment dealers of other manufactures, do not have access to the necessary tools.
Recommendation: I recommend that equipment owners and independent repair facilities be allowed to either own or rent any information or software tools related to the service, repair, installation or replacement of parts, or systems developed by third party (Tier 1) suppliers for OEMs, to the extent they are made available to franchise dealerships. [EPA-HQ-OAR-2019-0055-1036-A1, p.5]

If there are any existing barriers to enabling owners to quickly diagnose emission control system problems: Agricultural equipment manufactures suggest existing paper-based manuals as an alternative to software tools. Often those materials exclude information on the maintenance and repair of the emission control system and certainly are not regularly updated. A recent review of a John Deere 8530 Tractor Operation Manual listed 706 error codes of which 627 (89%) referred the user to contact their dealer for the indicated repair. See Appendix A.
Recommendation: I recommend that any information or software tools related to the service, repair, installation or replacement of parts, or systems developed by third party (Tier 1) suppliers for OEMs, to the extent they are made available to franchise dealerships be made available to equipment owners and independent repair facilities. [EPA-HQ-OAR-2019-0055-1036-A1, p.5]

Inadequate maintenance instructions lead to Mal-maintenance: Because the information and the required tools are often not available to owners and independent service organizations on the maintenance of emission control systems owners may defeat, eliminate, or disable, emission control systems out of desperation for meeting tight time limitations of planting, spraying, and harvesting.4
Recommendation: I recommend that any information or software tools related to the service, repair, installation or replacement of parts, or systems developed by third party (Tier 1) suppliers for OEMs, to the extent they are made available to franchise dealerships be made available to equipment owners and independent repair facilities. [EPA-HQ-OAR-2019-0055-1036-A1, pp.5-6]

4 https://www.agequipmentintelligence.com/articles/3728-dealers-alerted-to-consequences-of-illegal-modifications-to-ag-equipment-systems, accessed 24-April-2022.

Broad comment on actions EPA should take, if any, to improve maintenance practices and the repair experience for owners: The EPA should enforce section 2 of rule 74 FR 8310, February 24, 2009, or promulgate similar rules as it pertains to off-road agriculture vehicles over 14,000 GVW. Additionally, the EPA should widely publicize the false and misleading information that agricultural equipment manufactures, and their associations have promulgated that the EPA limits agricultural equipment owners and independent service organization from maintaining or repairing their equipment emission systems, such as 'Farmers and ranchers have the ability to perform the vast majority of repairs on their equipment unless it impacts federally mandated safety or emissions regulations.'5 [EPA-HQ-OAR-2019-0055-1036-A1, p.6]

5 https://r2rsolutions.org/right-to-repair-legislation/, accessed 24-April-2022

Organization: *Saahil Pasha*

The EPA is proposing a legislation to significantly reduce dangerous emissions from such heavy-duty gasoline and diesel engines. As a public health professional, I strongly support the EPA in this legislation. Although there is opposition displayed from the partners in the trucking industry about costs or government overreach, the EPA must prioritize the protection of air, land, and water to ensure public health and welfare. Furthermore, the EPA should bolster this proposed regulation with:

1. Congress sponsored, incentive-based tax credit to encourage industry participation.
2. U.S. Department of Transportation sponsored modified trucking and freight routes to avoid urban areas.
3. Longitudinal study to assess outcomes and impacts of the proposed legislation.

The proposed rule from the EPA to control emissions on heavy duty gasoline and diesel engines is well structured and informed. It is the responsibility of the EPA to work towards protecting the environmental conditions and public health and welfare. This rule definitely takes a step towards improving the surrounding environmental conditions for North Texans. The projected reduction in nitrogen oxide air pollution and the positive monetized health benefits align with achieving the goals of cleaner air in North Texas. Nonetheless, there are some recommendations that must be considered to increase industry participation, reduce risks for disadvantaged communities, and identify emission and health outcomes. [EPA-HQ-OAR-2019-0055-1206]

RECOMMENDATIONS [EPA-HQ-OAR-2019-0055-1206]

1. Work with the United States Congress to create a tax credit: through this strategy the EPA would urge Congress to pass a bill that provides tax credits for industry partners and businesses that choose to purchase heavy duty vehicles that follow the standards set by the EPA's proposed rule. The tax credit could also be extended to include businesses that use vehicles with zero emission engines or renewable energy engines. This strategy would incentivize industry partners to participate in purchasing vehicles with stricter emission standards and assist with the progression of the improved health outcomes (German & Parilla, 2021).

2. Work with Department of Transportation (DOT) to modify trucking routes: through this strategy, the EPA would urge the U.S. DOT to create regulations which

would alter trucking routes and prevent heavy freight traffic from passing through densely populated or urban areas. This strategy would improve equity because trucking routes and population impact minority and low-income populations at a higher rate. The U.S. DOT would work with the Freight Advisory Committee to determine methods for limiting freight trucking through urban areas. This strategy could include requiring large freight trucks to dispatch their loads, outside cities, to smaller trucks with reduced emission that could travel through urban areas.

3. Longitudinal research to study outcomes and impacts: this strategy would provide the EPA with valuable feedback about the impact of the proposed regulation over the years. This study would occur over a 15–30-year period and researchers would analyze, biological indicators such as lung function, blood pressure, health outcomes, pollution levels, etc. Longitudinal studies are important when analyzing policies that project to have long term impacts (Adar et al., 2018).

CONCLUSION. With increasing temperatures and climate changes, the issue of ground level ozone will only continue to get worse. Moreover, the impacts of ground level ozone and air pollution are disproportionately impacting minority and low-income populations. The EPA must focus all efforts toward passing the proposed legislation. The EPA must work with industry partners to increase participation, attempt to change trucking routes in urban areas, and conduct a longitudinal study to assess impacts. Future EPA regulations should work towards eliminating the usage of fossil fuel combustion for energy. These efforts will significantly contribute to improving the lives of millions of people across the United States. [EPA-HQ-OAR-2019-0055-1206]

Organization: *San Joaquin Valley Air Pollution Control District (District)*

We also urge EPA to consider the other major portion of our 2016 petition and begin formal rulemaking to reduce emissions from locomotives, another source category of growing relative importance as the District and CARB work to reduce other sources of emissions. [EPA-HQ-OAR-2019-0055-1291-A1, p.3]

Organization: *Taxpayers Protection Alliance (TPA)*

Additionally, TPA urges the EPA and Biden administration to consider deregulatory alternatives that could decrease emissions while keeping inflation in check. For example, the administration is currently exploring increased rail regulations, including crew size mandates (despite little evidence of safety gains from such a rule).6 Because alternatives such as rail tend to pollute less than heavy-duty vehicles, reducing the regulatory burden on different modes of freight transportation would allow for the supply chain to embrace flexibility and lower emissions. This is a far better strategy for controlling emissions than introducing ever-costlier rules. [EPA-HQ-OAR-2019-0055-1102-A1, p.2]

6 Ike Brannon and Michael Gorman, 'The Biden Administration’s Rail Regulation Efforts Make Little Sense,' The Regulatory Review (May 3, 2022).

Organization: *Victoria D'Amico*

Small businesses should receive aid for the expenses they may incur in making these transitions. I have read some other comments and that seemed to be a common theme among some small business owners. The Political Economy Research Institute (2022) states that 100 companies are responsible for 70% of global emissions. This demonstrates that large corporations and governments are the biggest problem in combating climate change. Large corporations are often given large tax breaks or incentives for programs like these. A program designed to help small businesses continue to thrive during this transition would be extremely important to keeping their businesses afloat and keeping public support with this rule. [EPA-HQ-OAR-2019-1214]

Organization: *WE ACT for Environmental Justice*

In addition to putting in place a national regulatory framework to reduce NOx and GHG emissions by the end of the year, we urge the EPA to advance other policies that support mandatory emissions reductions and remedy environmental injustices from the entire freight transport sector. Complementary to encouraging the transition to all-electric trucks and buses by 2035, the Agency should encourage the rapid retirement of internal combustion trucks on or before 2045. This would close the loop and ensure we truly reap the pollution reductions, public health, and climate gains from the deployment of these zero-emission vehicles,28 especially in overburdened communities. Federal and state coordination is needed to rapidly build out the charging infrastructure to support this level of deployment. It is also critical that transportation electrification be matched with aggressive movement towards renewable electricity generation, displacing fossil fuels to avoid shifting emissions from vehicles to power plants. [EPA-HQ-OAR-2019-0055-1347-A1, p.5]

https://www.mjbradley.com/sites/default/files/EDF MHDVEVFeasibilityReport22jul21.pdf

Organization: *William Limpert*

I would also like to see EPA promote other forms of transportation for environmental , health, and climate benefits. My father worked for the Baltimore and Ohio Railroad, and I am always impressed by the extensive rail systems that are in place in other countries. Moving freight by rail is 3-4 times more efficient in fuel consumption, pollution emissions, and greenhouse gas emissions than moving freight by truck, even under current conditions, and without full electrification. We may be able to attain full electrification of rail systems sooner than we can with trucks. Moving freight by rail would also reduce the public safety issues with large trucks on crowded highways. It would be of great benefit to move more freight by rail, especially for long distance transportation across our country. Trucks could still be used for moving freight from the rail terminal to local businesses and industry. The same may be true for moving freight by boat or barges, and even more so if that freight is being moved downstream, or with the prevailing winds. I don't think air freight transport would be more efficient than truck transport. EPA should consider more efficient and less polluting freight transport, and rail and ship transport should be greatly encouraged. [EPA-HQ-OAR-2019-0055-1190]

- Reward manufacturers, especially American manufacturers who comply by offering incentives for early compliance, and incentives for reducing emissions below the levels set in the rules. Even more so, reward those who develop vehicles that are powered by only electricity as quickly as possible. This could be done by public acknowledgement, including public acknowledgement by President Biden. [EPA-HQ-OAR-2019-0055-1190]

- Punish those who do not comply with the finalized rules with minimal penalties for initial or minor violations, and escalating penalties for ongoing and major violations. The penalties must be cost effective in assuring that the penalty costs more than the savings that would be gained by the violation. For the most egregious violations, incarceration and a fine should be considered. I, and the public, are frustrated and angry when the wealthy and powerful pay a fine for violating the law, when ordinary citizens would be incarcerated for the same violation. Volkswagen's falsification of emission test findings comes to mind in this regard. [EPA-HQ-OAR-2019-0055-1190]

- Consider subsidizing the industry to enable a faster transition to low emission and zero emission technologies. The revenue for subsidizing the industry should predominantly come from wealthier tax payers, most of whom currently do not pay their fair share of taxes. In 2012 my elderly mom earned $17 thousand in income, and Mitt Romney earned $19 million in income. My mom paid a higher percentage of her income in taxes than did Romney. [EPA-HQ-OAR-2019-0055-1190]

EPA Summary and Response

Comments on the proposed rule covered a wide range of topics across most of the industry sectors that are subject to EPA emission standards and we appreciate the thoughtful recommendations and information shared by commenters. Comments in this section are related to topics that are out of scope for this final rule, as noted below.

We did not propose or request comment on the following topics raised by commenters and are not taking final action in this rule related to: more stringent standards specific to the medium-duty vehicle category, standards for sectors other than heavy-duty highway engines and vehicles (e.g., locomotive, airplane, off-road vehicles, light duty vehicles, agricultural, industrial applications), APU requirements in 1039.699, test procedures in 1051.501, requirements for glider vehicles[74], incentives for use of renewable fuels, adding ethanol as a fuel type in 1036.530, additional definition references in 1037.135(c), defect reporting, recalls, and corrective action (i.e., "remedial action" for EPA) requirements, SmartWay designations, pilot programs for natural gas fueled vehicles or infrastructure, coordination with states on alternative fuel programs, and coordinating heavy-duty engine programs with renewable fuels programs from EPA and other federal agencies. We may consider some of these commenter recommendations in a future rule.

[74] We note that, as part of our migration from 40 CFR part 86 to 40 CFR part 1036, we are finalizing a revision to 40 CFR 1037.635(b)(2) that updates the reference to the applicable standards for glider vehicle engines. Any other requested changes regarding glider vehicle regulations are out of scope for this rule.

We did not propose or request comment on the following additional topics and are also not taking final action in this rule related to: maintenance of emission components on legacy trucks, addressing the resilience of the supply chain, recycling platinum and palladium, tax credits for new technologies or usage taxes for older technologies, modification of trucking routes, retroactive changes to emission standards for existing engines, incentives to replace older engines, improvements to and incentives for public transit, truck driver shortages, truck driver unionization, classification, or exploitation, direct financial incentives to encourage biodiesel use, and financial assistance for small business to meet new standards.

We agree with comments recommending we coordinate with other federal agencies when our programs overlap and that longitudinal research studies can provide valuable feedback on the long-term impacts of our rulemakings. While generally not at issue in this rule, we may pursue these recommendations in the future as applicable.

As explained in preamble Sections III and IV and sections 3 and 12 of this document, we are not finalizing the proposed allowance for manufacturers to generate NO_X emissions credits from heavy-duty ZEVs and the final criteria pollutant standards are not based on projected utilization of ZEV technologies, although manufacturers may choose to comply with the standards through using ZEV technologies, or other technology pathways than included in our demonstration program. As noted in section 28 of this document, EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. Therefore, we are not taking final action at this time regarding issues raised in comments relating to CO_2 and other GHG emissions, ZEV infrastructure, manufacturers' and labor's willingness to develop ZEVs, incentives and exemptions for fuel cell technologies, and coordination with other federal agencies' ZEV or fuel cell programs. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards) and may consider the comments in this section of this document in the development of that future rulemaking. In response to comments on alternative compliance pathways that involve ZEV targets for reaching GHG and/or criteria pollutant emissions standards, we refer readers to discussion in section 3.1.1 of this document, as well as the discussion on not finalizing the proposed allowance for manufacturers to generate NO_X emissions credits from heavy-duty ZEVs, which was previously noted as located in section 12 of this document.

34 Late Comments

The Agency has been, is, and will continue to be committed to considering timely comments received on proposed rules. The compressed final rule schedule is necessary to finalize the standards this year to ensure that these important emission reductions occur as soon as possible. However, EPA was able to also consider late comments on this final action up to those submitted on October 4, 2022. In the interest of transparency, we have included comments we received after October 4, 2022 in the docket; however, those comments are not part of the record for judicial review of this rule.

Organization: *California Air Resources Board (CARB): EPA-HQ-OAR-2019-0055-2857*

Since the submission of California Air Resources Board's (CARB) comments on May 13, 2022, and the closing of the comment period for the Clean Trucks Plan (CTP) notice of proposed rulemaking (NPRM) on May 16, 2022, CARB staff has reviewed the comments submitted by other stakeholders on the CTP NPRM. I am writing this supplemental letter to comment on some requests and statements made by other stakeholders in order to provide CARB's feedback and clarity on "matters of central relevance to the rulemaking" before the U.S. Environmental Protection Agency (U.S. EPA).1

1 42 U.S.C. § 7607(d)(4)(B)(i); see also id. §7607(d)(7)(A) (providing that such material forms part of the administrative record for judicial review).

Because this letter bears upon such matters, please add it to the record of this rulemaking and all appropriate dockets. The main points of our supplemental comments are summarized below:

- The Truck and Engine Manufacturer Association (EMA) has asked the U.S. EPA to provide a 0.026 Grams per brake-horsepower hour (g/bhp-hr) margin when setting nitrogen oxides (NOx) standards. The margin requested by EMA is dangerously and unnecessarily large, given the margins with which manufacturers have historically certified. In addition, crankcase ventilation, which was not included in U.S. EPA's NPRM technology package, offers a cheap, widely used way for manufacturers to provide additional margin if needed.
- Regarding EMA's concerns about possible pre-buy and no-buy caused by the proposed regulations, we expect any pre-buy and no-buy effects to be small. History shows sales are driven by economic factors (recession, etc.) much more than any emission standard changes. In addition, supply chain issues today make pre-buy impossible or unlikely. Finally, sensitivity analyses CARB staff performed for the Omnibus regulation show that even with a 20 percent pre-buy/no-buy, the Omnibus regulation was still cost-effective and worth pursuing, and the same would hold true for U.S. EPA's program.
- CARB staff opposes Daimler's ask for regulatory relief for hydrogen-fueled internal combustion engines (HrlCE) because such engines emit tailpipe NOx just like traditional combustion engines. In addition, adding special flexibilities for HrlCE technology would violate applicable public notice requirements because it is outside the scope of U.S. EPA's rulemaking.
- CARB staff opposes EMA's request for U.S. EPA to retain the language defining the parent engine based on existing requirements because doing that would allow manufacturers to avoid testing the engine with highest potential emissions.
- CARB staff objects to EMA's assertion that biodiesel specification regulations are needed as part of the CTP rulemaking.
- CARB staff disagrees with EMA's comments regarding a need for more consideration of on-board diagnostics (OBD) requirements and capabilities before adoption of the proposed standards.
- CARB staff believes there is a need to continue particulate matter (PM) and non-methane hydrocarbons (NMHC) measurements as a part of the heavy-duty in-use testing (HDIUT) program.

- Many private and public agencies are investing in future infrastructure activities to support the heavy-duty (HD) sector's transition to zero-emission. Furthermore, CARB staff believes that rollout of initial heavy-duty zero-emission vehicle (HD ZEV) volumes is not dependent on the infrastructure of pre-existing public charging networks.

CARB staff's supplementary comments are presented in detail below:

Margin Requirement - EPA-HQ-OAR-2019-0055-1203_Attachment_1.pdf (Pages 23-33), EMA

In its comment letter, EMA uses a margin stack-up analysis to request a 0.026 g/bhp-hr margin to be included in establishing future NOx emissions standard in order to ensure that 97.7 percent of the future engine sales would have emission levels below the applicable standards (page 28 of the EMA comment letter).

CARB staff conducted a historical survey of past margin levels used by HD diesel engine manufacturers and submitted the information in its comment letter2 to U.S. EPA. If EMA's margin stack-up analysis was correct, it should also apply to previous engine sales as these engines would also require similar (or greater) margin levels in order to comply with the existing emissions standards. Based on historical certification data, a 0.026 g/bhp-hr NOx margin requirement would mean that 24 percent of the HD diesel engine families sold between 2010 and 2020 model years in California did not have sufficient margin levels to be certified but were nevertheless certified by engine manufacturers. The historical data indeed suggests that engine manufacturers do not feel the need to include any margins when certifying their existing products for sale. It therefore does not make sense to include margin stack-ups for establishing future standards.

2 https://www.regulations.gov/comment/EPA-HQ-OAR-2019-0055-1186 . Pages 41-44.

It should also be noted that engine manufacturers have many options to comply with the proposed Option 1 standards including establishing a margin by deploying new emission control technologies. For instance, today's diesel engines do not typically use closed crankcase ventilation systems, and hence vented blowby or open crankcase ventilation presents an untapped means to further reduce NOx emissions from on-road HD diesel engines. Rather than closing crankcases, most HD diesel manufacturers instead measure and account for emissions from the blowby gases, which are vented directly to the atmosphere. Some rudimentary physical filtration is typically employed to reduce oil mist and a portion of PM emissions from the raw exhaust of the blowby gases. But NOx aftertreatment has not been applied to these directly vented blowby gases.

Blowby vented from the crankcase presents a ready opportunity for significant additional NOx reductions. For 0.20 g/bhp-hr NOx certified engines, the blowby NOx contribution was typically a very small fraction of total engine NOx emissions, which were dominated by the tailpipe contribution. However, as the blowby percentage of total exhaust flow approaches the percentage of NOx surviving the aftertreatment, the blowby becomes a much more important opportunity for reducing an engine's overall NOx emissions impact. For example, if one percent of raw exhaust is escaping via blowby and the aftertreatment reduces the remaining exhaust flow's tailpipe NOx by 99 percent, then both blowby NOx and tailpipe NOx emission rates would be of similar orders of magnitude.

Currently, technological pathways exist for eliminating blowby NOx emissions. Closed crankcase ventilation is an obvious pathway to eliminate the NOx emissions contribution from blowby. Routing the blowby crankcase vapors to eventually go through the existing exhaust aftertreatment would render blowby NOx negligible and could be accomplished in a number of ways.

Introducing the blowby gases into the inlet of the engine has been employed in the light-duty sector for many years as well as in Cummins Optional Low NOx certified medium- and heavy-HD engines certified through diesel test procedures since the 2016 model year.3 Cummins reported a 70 percent reduction in methane emissions just by closing the crankcase of those methane powered engines.4 They apparently valued the emissions reductions sufficiently to merit working through whatever potential durability challenges the blowby gases in the intake tract may have presented to turbo compressor wheels, various intake air sensors and the like.

3 https:/lwww.truckinginfo.com/137270/cummins-starts-production-of-isl-g-natural-gas-engine
4 https://mart.cummins.com/imagelibrary/data/assetfiles/0042998.pdf

Alternatively, one could avoid exposing the turbo compressor to blowby gases by routing blowby gases into the main exhaust prior to the aftertreatment with the associated backpressure on the crankcase. This could also be achieved without the crankcase pressure rise by actively pumping blowby gases to a post turbo compressor (boosted) intake location or an exhaust pre-aftertreatment location using a smaller version of the exhaust gas recirculation pumps available today.5 Actively pumped crankcase ventilation strategies are used extensively across stationary and marine reciprocating engines to control oil mist and reduce operator exposures.

5 https:/lwww.eaton.com/us/en-us/productslengine-solutionslsuperchargers/NS-technology-applications/tvs- diesel-egr-pump.html

The fraction of gases escaping as blowby is also a potential target for engineering improvements. The designs of valve guides and valve stem seals, turbocharger shaft seals, and the piston ring stack and cylinder liners can each affect the amount of blowby experienced by a given engine initially and as it wears. Each approach to eliminating blowby NOx would have different engineering tasks to assure acceptable function and durability, but sufficient physical filtering of these gases in preparation for combustion or catalytic treatment is an application engineering endeavor not an act of technology invention.

Testing shows elimination of blowby NOx emissions would yield significant "compliance margin" beyond current Low NOx Engine demonstrations. The industry typical approach of including vented blowby emissions in the emissions measurement was also employed in the Southwest Research Institute Stage 1 and Stage 3/Stage 3 Rework Low NOx diesel engines and further work is being done on an Off-Road Low NOx engine. The performance reported previously for these engines has not exploited the significant additional NOx reduction opportunity from eliminating blowby emissions that are being directly vented to the environment. Measurements with and without the blowby included were conducted on more than one base engine platform and showed that blowby emissions contribute between 20-60 percent of cycle average NOx depending on engine designs and test cycles. Applying this kind of closed crankcase benefit specifically to the Stage 3 Rework engine is projected to yield an overall 20 percent federal test procedure (FTP) compliance margin at 435,000 miles, 35 percent FTP compliance margin at 600,000 miles, and 18 percent at 800,000 miles (see attached presentation by Southwest Research Institute).

Cost for closed crankcase ventilation is expected to be low compared to other means for additionally achieving equivalent NOx reductions. Closed crankcase ventilation has already been commercially demonstrated on medium- and heavy-HD Optional Low NOx engines for 6 model years and across 3 displacements (6.7-liter, 8.9-liter and 12-liter). It is quite likely that the any additional filtering of the closed crankcase blowby gases needed to maintain durability across longer useful life could be accomplished for very reasonable cost. The cost of implementing such filtering is expected to be very competitive compared to other methods of securing additional margin from engines already well equipped with modern generation catalysts and aftertreatment architectures, model-based controls, and cylinder deactivation and exhaust gas recirculation cooler bypass thermal management hardware. Products for closing turbocharged diesel crankcases already exist ready for evaluation and validation from many suppliers.6 7 8 One might note that Cummins initially chose in model year 2016 to reduce greenhouse gas (GHG) emissions relative to their existing ISL-G engine by capturing the blowby methane via external closed crankcase methods rather than immediately investing in the spark-ignition specific cylinder head and other engine internal design changes subsequently seen in their about-to-be-released lower GHG spark-ignited products. This may be another indication of the closed crankcase approach's practicality and cost effectiveness for reducing blowby emissions relative to other means of improving the engine itself.

6 http://donaldson-filters.com/donaldsonoemfiltration/library/files/documentslpdfs/053490.pdf
7 https:/lwww.cumminsfiltration.com/eme/closedcvfilters
8 https://oem.mann-hummel.com/en/oem-products/crankcase-ventilation-systems.html

Concern regarding possible pre-buy and no-buy caused by the proposed regulations EPA-HO-OAR-2019-0055 1168_Attachment_1.pdf {Exhibit "D"}, EMA

EMA voiced concerns that the proposed regulations would cause economic disruption and have less benefits than projected due to pre-buy or no-buy of vehicles due to the regulation's increased cost of engines. But this scenario simply cannot offset the benefits of more stringent standards. At a fundamental level, companies are not going to rush out and buy so many trucks in a few years (especially under current economic conditions) as to undermine comprehensive national rules, or fail to buy trucks for many years. Even very substantial responses along these lines, should they occur, would not warrant setting weaker standards because remaining reductions are still very large. As mentioned in the final statement of reasons9 (FSOR) for the Low NOx Omnibus Regulation, CARB staff conducted an analysis to see the possible impacts of a pre-buy no-buy scenario. Staff analyzed a scenario where there is a 20 percent decrease in sales and fleets retain their existing vehicles longer throughout the life of the regulation. This would result in fewer Low NOx engine sales in the analyzed time period up to 2050. The retained vehicles would have engines meeting the current 0.2 g/bhp-hr NOx emissions standard. In this analysis, from 2024 to 2050, the pre-buy and no buy effect resulted in approximately 40 percent less NOx benefits compared to the assumed compliance. The cost effectiveness increased to $7.50 per pound NOx. Even if a pre-buy no-buy would occur as a result of the regulation, there would be a significant reduction in NOx in the time period adding up to 206,312 tons of NOx. The benefits would be significant, cost effective and worth pursuing.

9 https:/lww2.arb.ca.gov/sites/default/files/barcu/board/rulemaking/hdomnibuslownox/fsor.pdf

The historical assessment of pre-buy based on HD emissions regulations was investigated in Anticipation and Environmental Regulation by Rittenhouse and Zaragoza-Watikins, as cited by U.S. EPA.10 Their analysis shows minimal impacts on sales projections due to upcoming regulations. Diesel aftertreatments were first introduced in 2007 and the analysis showed an increase in sales slightly outside of regular variation for four months. There was a symmetric decrease in sales lasting for four months. Their study shows the impacts of pre-buy due to regulation changes are minimal and occur for only a short time span. The comments from the Moving Forward Network11 (MFN) also reached this conclusion on page 38. Additionally, the MFN comments also showed the impact on sales of HD vehicles greatly depends on economic factors. Events like the dot com crash, great recession and COVID-19 pandemic have a much greater impact than any emission standard changes, affecting hundreds of thousands of engine sales.

10 Draft Regulator Impact Analysis. Page 407. March 2022, EPA-420-D-22-00

11 https:/lwww.regulations.gov/comment/EPA-HQ-OAR-2019-0055-1277 ; page 38

In the current economic climate and supply chain shortages resulting from COVID-19, there are doubts that pre-buy could even be possible. The supply chain delays have made the supply of any type of vehicle very limited. We are a couple of years into low production/high demand conditions where desired vehicle purchases are stacking up due to aging fleets because dealers cannot secure vehicles from original equipment manufacturers (OEM) who are constrained on accessing parts (e.g., computer chips, castings, and at times certain lubricants)12• The vehicles that were not manufactured are a permanent 'hole' in the age distribution of vehicles moving through the fleet resulting in further demand for vehicles for the foreseeable future that will also drive-up vehicle prices until the production volumes catch up. Because the cost of vehicles is currently inflated due to supply chain problems, pre-buying additional vehicles today would not provide savings. It is also expected that 2023 vehicle production will also suffer computer chip and other supply chain constraints on manufacturer volumes13•14•15•16• Under these supply chain limitations, ramping up production to make more vehicles in a year would not be possible. Vehicle manufacturers will need to get back to their previous production volumes to satisfy replacements, and then produce more to start working through the backlog of pent-up demand

and growth in the transportation sector. If it takes them half as many years to make up the 2020 to 2023 hole in production starting in 2024, that leaves only 2026 to execute a "pre-buy" effort. Because fleets will likely already have been buying vehicles at an accelerated rate just to backfill their delayed replacements, it is unlikely they would have the resources to further accelerate purchasing to execute a pre-buy.

12 https:/lwww.wsj.com/articles/chip-shortage-curtails-heavy-duty-truck-production-11630661401
13 https:/lwww.fleetowner.com/news/article/21242829lchip-availability-continues-to-hamper-oem-production- act-reports
14 https:l/www.busandmotorcoachnews.com/global-shortage-of-microchips-slows-bus-production/
15 https:/lwww.truckinginfo.com/10173589/may-truck-orders-remain-constrained-by-supply-chain
16 https:/lwww.repairerdrivennews.com/2022/04/12/chip-shortages-expected-to-last-into-2023-auto-execs-say/

Request for Regulatory Relief for H2-ICE Hydrogen-Fueled Internal Combustion Engines - EPA-HQ-OAR-2019-0055 168_Attachment_1.pdf (Pages 125-129), Daimler Truck North America LLC (Daimler)

Daimler is requesting the introduction of so-called regulatory relief measures applicable to future model year HrlCEs. According to Daimler, the intent of these measures is to " ... foster innovation and enable immediate penetration of innovative technologies with effectively zero carbon dioxide (CO2) emissions and near-zero NOx emissions such as HrlCE engines".

CARB staff is strongly opposed Daimler's request for two reasons:

- CARB staff does not believe that the H2-ICE technology is equivalent to other zero-emission technologies such as battery- or fuel-cell electric vehicles. As stated by Daimler, HrlCE technology does emit tailpipe NOx emissions, and the engine-out NOx emissions are high enough that a complex selective catalytic reduction (SCR) aftertreatment system would be needed to reduce the tailpipe emissions to a level that complies with the regulations. It is therefore unreasonable to consider H2-ICE technology as an advanced zero-emission technology. CARB staff firmly believes that future H2-ICE products should go through a vigorous certification process to evaluate the durability of the hardware as well as demonstrating compliance with auxiliary emission control device requirements as well as all other regulatory requirements for internal combustion engines.

- As a threshold matter, Daimler's proposal would require U.S. EPA to take final actions in contravention of applicable public notice requirements, 17 because such final actions would impermissibly depart from "the terms or substance of the proposed rule", and "[the] description of the subjects and issues involved"18 in the NPRM.19 U.S. EPA expressly states that it is not proposing to enact policies to advance the introduction of zero-emission vehicles (ZEV) in this rulemaking action, nor is it proposing to establish nationwide requirements that manufacturers must produce a portion of their vehicle fleets as ZEVs, but states it will consider such policies in the context of future rulemaking proposals.20 Moreover, the NPRM does not contain either factual data, the methodology of obtaining and analyzing such data, or the major legal interpretations and policy considerations underlying Daimler's proposal, in contravention of 42 U.S.C. § 7607(d)(3)(A) through (C).

17 5 U.S.C. § 553(6), 42 U.S.C. § 7607(d)(3)
18 5 u.s.c. § 553(6)(3)
19 Envtl. Integrity Project v. EPA, 425 F.3d 992 (D.C. Cir. 2005).
20 NPRM at 17420.

It is accordingly clear that the NPRM notice fails to provide adequate notice and opportunity to comment on a final U.S. EPA action that would finalize Daimler's proposal, given that U.S. EPA expressly stated it would not enact policies or requirements regarding ZEVs in the NPRM.21 Furthermore, the proposed final U.S. EPA action cannot be considered a "logical outgrowth" of the NPRM notice since the logical outgrowth doctrine does not extend to final rules that are not rooted in the agency's proposal or to situations where "interested parties would have had to 'divine [the agency's] unspoken thoughts,'." Envtl. Integrity Project, 425 F.3d at 996. Moreover, the logical outgrowth doctrine only applies if the N PRM itself provides recipients sufficient notice of the final action that U.S. EPA may take- i.e., U.S. EPA cannot assert that requisite notice resulted from comments received. Shell Oil Co. v. EPA, 950 F.2d 741, 760 (D.C. Cir. 1991); Small Refiner Lead Phase-Down Task Force v EPA, 705 F.2d 506, 549-550 (D.C. Cir. 1983). First, this request is beyond the scope of the CTP rulemaking and was not proposed in the NPRM. In order to evaluate the benefits and feasibility of this request, an official proposal would need to be provided by U.S. EPA so that all stakeholders would have the opportunity to evaluate and provide comments to U.S. EPA. Daimler's request completely circumvents the rulemaking process and should not be considered by U.S. EPA.

21 "If the APA's notice requirements mean anything, they require that a reasonable commenter must be able to trust an agency's representations about which particular aspects of its proposal are open for consideration." Envtl. Integrity Project v. EPA, 425 F.3d at 998.

Request Regarding Selection of Test Engines - EPA-HQ-OAR-2019-0055-1203_Attachment_1.pdf (Pages 114-115), EMA

EMA submitted a comment requesting that U.S. EPA retain the language defining the parent engine based on existing requirements in §86.096-24(b)(3)(ii) which allows selecting "the engine that features the highest fuel feed per stroke, primarily at the speed of maximum rated torque and secondarily at rated speed." It should be noted that this language was originally established for combustion engines that did not deploy any aftertreatment systems. In making its proposal, EMA has overlooked the requirement in §86.096-24(b)(3)(iii) which states:

> The Administrator may select a maximum of one additional engine within each engine-system combination based upon features indicating that it may have the highest emission

> levels of the engines of that combination. In selecting this engine, the Administrator will consider such features as the injection system, fuel system, compression ratio, rated speed, rated horsepower, peak torque speed, and peak torque.

CARB's Omnibus regulation modified the applicable regulatory language in §86.096-24(b)(3)(iii) by adding the following statement to the end of subparagraph:

> For 2024 and subsequent model years, the Executive Officer will also consider the aftertreatment conversion efficiency.

CARB staff supports the proposed U.S. EPA language in §1036.235(a)(1) that requires the manufacturer to select an engine configuration for criteria pollutant certification testing that is "most likely to exceed (or have emissions nearer to) an applicable emission standard or FEL...." That approach would be consistent with the requirements in §86.096-24(b)(3)(iii). In terms of the parent engine selection process, the methodology for determining the model with the highest emission levels can be discussed with the certification staff.

Furthermore, given the introduction of GHG subfamilies under recent phase 2 technical amendments in §1036.230(f):

> Engine families may be divided into subfamilies with respect to compliance with CO2 standards.

CARB staff does not believe that the requirement for parent engine selection would interfere with GHG subfamily determination. While the parent engine would determine the certification NOx level, different GHG subfamilies would be declared to represent the corresponding GHG family certification levels for the various subfamilies.

Concerns Regarding Fuel Quality - EPA-HQ-OAR-2019-0055-1203_Attachment_1.pdf (Pages 134-141), EMA

In addition to EMA, other engine manufacturers including Daimler, Navistar, and Paccar have once again raised issues and concerns regarding the quality of biodiesel fuel in the U.S. and how poor fuel quality may adversely impact the emission performance of diesel engines in the field. Volvo's comments,22 while expressing a desire for tighter fuel standards, acknowledge that biodiesel quality problems are not widespread. Navistar and others refer to a CARB study of biodiesel NOx mitigation additive efficacy while ignoring the regulatory countermeasures23 CARB put in place in 2020 as a direct result of this study. The study showed that certain additives to finished biodiesel were not mitigating non-aftertreatment engines' increased NOx emissions while that fuel was being used. The study does not indicate damage to aftertreatment systems but rather describes a compliance issue for fuel suppliers not vehicle or engine manufacturers. CARB and U.S. EPA's vehicle and engine testing procedures already have mechanisms for dealing with in-use vehicles encountered with demonstrably out-of-spec fuel in their tanks. The range of engine-out NOx increases even for the out-of-spec fuels were within the capability of SCR systems to compensate and control at the tailpipe. It is important to differentiate between an engine's instantaneous and reversible NOx response between two different fuel compositions that is the subject of the CARB study of biodiesel NOx mitigation additive efficacy (especially so if a test fuel is not even legal for sale) and separately the potential for actual damage to the aftertreatment from purported fuel contamination as might be the case for high metal content fuels. Some of the commenters appear to conflate the former effect and its limited effect duration during that given tank of fuel with the latter effect that rather integrates toward long-term cumulative effect via a catalyst deactivation mechanism.

22 https:/lwww.regulations.gov/comment/EPA-HO-OAR-2019-0055-1324
23 https:/lww2.arb.ca.gov/rulemaking/2020/adf2020

CARB staff performed an extensive field sampling study of diesel and biodiesel fuel quality in the California market and found no evidence that would substantiate the claims by engine manufacturers of contaminated fuel. The results of this study were provided to U.S. EPA24 during the Advanced NPRM comment period. CARB also analyzed nationally obtained samples provided from a U.S. EPA sampling campaign with consistent results. EMA commented that a Fuels Institute study found SO percent of samples contained detectable metals. Merely possessing the analytical chemistry capability to detect the presence of a given element does not address whether that element is present in sufficient quantities to be a practical concern. Indeed, EMA notes that levels were well below recommended limits. The large field sample count results of the Fuels Institute study and the several years of BO-9000 producer audit data are all consistent with the CARB field sampling study's result that fuel contamination is not a widespread issue.

24 https:/lwww.regulations.gov/comment/EPA-HQ-OAR-2019-0055-0471

In the past, CARB staff has reached out to OEMs and requested information regarding the origin of their poor-quality samples that have been identified. Each time, the OEMs have refused to provide information regarding the source of these samples. Without further information, claims regarding poor-quality fuels cannot be corroborated. Therefore, CARB staff firmly objects to the need for new biodiesel specification regulations as part of the CTP rulemaking.

The most potentially significant issues OEMs raised allege the possibility for occasional deviation outside of fuel specifications or an "off spec batch" that as discussed above has not been found to be a frequent occurrence. This is much different from when the 2007/2010 standards necessitated an entirely new fuel to be able to even conduct the engine demonstration testing in the lab and then the subsequent wide-spread oil refinery upgrades and 2006 rollout of Ultra Low Sulfur Diesel distribution to enable the proposed technology's commercial introduction. Again, the OEM fuel quality control concerns raised here are much different than the earlier situation of a current on-spec fuel (200 parts per million Low Sulfur Diesel) being positively destructive to the proposed technology PM and NOx catalyzed aftertreatment). U.S. EPA is not dependent on improvements in fuel quality to be able to move forward with standards at least as stringent as the NPRM's Option 1.

CARB staff also note that an additional relief from chemical aging compared to today's situation is anticipated on the lubricant composition side via recent American Petroleum Institute actions to define a new generation of "PC-12" category oils. These new oils are expected to become available in time for 2027 coinciding with CARB and anticipated U.S. EPA standards. Among the target improvements is compatibility with longer useful lives and warranty periods and "improved aftertreatment capability."25·26

25 https:/lwww.trucking info.com/1016027Sinew-diesel-emissions-regs-mean-new-engine-oil-category
26 https:/lwww.forconstructionpros.com/equipment/fleet-maintenance/oils-lubricants- greases/news/21940827Iapi-approves-development-of-pc12-diesel-engine-oil-category

CARB in the Omnibus FSOR responses27 to comments noted the likelihood of just such action and its potential additional benefit, though the Omnibus standard stringency was not based on assuming such lubricant improvements. U.S. EPA likewise is not dependent on such future lubricant improvements to move forward with standards at least as stringent as the NPRM’s Option 1.

27
https:/lww2.arb.ca.gov/sites/default/files/barcu/board/rulemaking/hdomnibuslownox/fsor.pdf, pages
378-379.

Concerns Regarding OBD – EPA-HO-OAR-2019-0055- 1203_Attachment_1.pdf (Pages 90-101), EMA

CARB staff respectfully disagrees with EMA's comments on pages 90-92 of their comment letter," Environmental Protection Agency (EPA) Has Not Fully Considered All of the OBD Requirements and Capabilities that Could Frustrate the Implementation of the Low-NOx Regulations." CARB staff would like to note that EMA provided the same comments28 to CARB for its Omnibus rulemaking, and CARB staff provided responses for all these comments as part of the FSOR for the rulemaking.29

28 https:/lwww.arb.ca.gov/lists/com-attach/10-hdomnibus2020-JAxb8FFZFNoOFNbo.zip . Pages 98-101.
29
https:/lww2.arb.ca.gov/sites/default/files/barcu/board/rulemaking/hdomnibuslownox/fsor.pdf

CARB staff also disagrees with EMA's comments on page 93, "OBD threshold requirements," supporting U.S. EPA's proposed OBD thresholds. While CARB staff understand that U.S. EPA's proposed OBD thresholds were intended to harmonize with CARB's Omnibus OBD thresholds, CARB staff now believes the OBD thresholds can be more stringent than the proposed federal OBD thresholds. While CARB staff did not have much data to support more stringent thresholds when developing the Omnibus OBD thresholds, staff has since received information that some diesel and gasoline engines certified to lower emission standards are able to meet more stringent OBD thresholds than EPA's proposed OBD thresholds. As such, CARB staff believes that more stringent OBD thresholds than those being proposed by U.S. EPA are feasible and recommends that U.S. EPA adopt more stringent OBD thresholds based on available data. Should U.S. EPA adopt more stringent OBD thresholds, CARB staff would likely propose harmonizing with U.S. EPA's thresholds in a future rulemaking update.

In-Use Testing for PM and NMHC Should Be Eliminated - EPA-HQ-OAR-2019-0055-1168_Attachment_1.pdf (Pages 41-129), EMA

EMA is requesting to eliminate requirements to test the criteria pollutants PM and NMHC from in-use testing. EMA argues there has only been one incidence in the in-use program where an engine failed due to a cracked diesel particulate filter (DPF) and misfuelling. While this seems compelling, U.S. EPA and CARB staff have discovered manufacturers have been inappropriately screening their HDIUT vehicles. This includes but is not limited to rejecting engines likely to have excess PM based on visual inspections which identify excess PM on the exhaust and replacing DPFs prior to testing. These screening practices were discussed by CARB at the 2021 EMA workshop. These practices produce tests that are unrepresentative of real in-use PM emissions. Since it is unclear how the historical engines were screened for in-use PM testing, CARB staff believes it is prudent to continue PM testing using the appropriate test procedures. EMA argues the costs of testing PM and NMHC are burdensome. CARB staff acknowledges the costs of the portable emissions monitoring systems needed for the HDIUT program for all criteria pollutants, however it is important to ensure all certified criteria pollutants are evaluated in the real world to ensure compliance. Considering these arguments, CARB staff believes there is a need to continue PM and NMHC measurements as a part of the HDIUT program.

Infrastructure for HD ZEV

In addition to these responsive comments, CARB staff noted multiple comments discussing infrastructure issues. CARB staff would like to take the opportunity to emphasize that many public and private organizations are currently working on projects focused on developing charging and fueling infrastructure for HD zero-emission technologies. A partial listing of these projects was provided on pages 6-8 of the CARB comment letter.30

30 https:/lwww.regulations.gov/comment/EPA-HQ-OAR-2019-0055-1186

California is tackling Medium-HD Zero-Emission Vehicle (MHD ZEV) infrastructure from many angles and providing funding for MHD ZEVs and supporting infrastructure to CARB, California Energy Commission (CEC}, Department of Transportation, among other agencies. For a primer, the California ZEV Market Development Strategy31 lays out the overall strategy to meet the State's ZEV goals and addresses vehicles, infrastructure, end users and workforce. The Zero-Emission Plan,32 developed by CEC supports and provides a fuller description of near- and long-term actions to ensure that ZEV infrastructure will meet the needs of the growing ZEV market.

31 https://business.ca.gov/industries/zero-emission-vehicles/zev-strategy/
32 https:l/www.energy.ca.gov/sites/default/files/2022-04/CEC-600-2022-054.pdf

Today, one source of infrastructure funding for HD ZEV fleets is EnergllZE, which provides funding for charging and hydrogen stations for HD vehicles. EnergllZE has 4 funding lanes covering (1) fleets that need fast assistance to accommodate pending electric truck deliveries, (2) small fleets, transit or school bus fleets, or fleets operating in disadvantaged communities; (3) public DC fast charging; and (4) public hydrogen refueling. The program opened with initial allocation of $50 million with the state legislature sending strong signals to provide additional funding to this program on an annual basis. In addition, the Innovative Small e-Fleets program, which is expected to launch this summer will provide funding for creative mechanisms, like truck-as-a-service, and will support both zero-emission trucks and infrastructure solutions to small fleets that otherwise face barriers to electrification.

On the utility side, the larger investor-owned utilities have been authorized by the California Public Utilities Commission to fund transportation electrification programs. With this authorization, utilities can pay for utility upgrades necessary to bring power to the site as well as provide power to the charging infrastructure make-readies.

CARB staff has observed that there is ample opportunity for electrification across many applications without dependence on a pre-existing public HD charging network. While availability of convenient and reliable public charging networks is helpful and being actively worked on, it is not a necessary prerequisite for U.S. EPA to consider significant HD ZEV penetration across the HD sector. This is especially true in the initial introductory period of 2027-2030 which U.S. EPA is considering for Phase 2 GHG updates prior to mature exploitation of these electrification opportunities. Support for this observation of ample electrification opportunity prior to wide-spread public charging networks comes from analysis looking at the usage and operational characteristics of trucks in California conducted as part of the Advanced Clean Trucks33·34 and Advanced Clean Fleets35 regulatory development work. The Advanced Clean Truck's one-time Large Entity Reporting (LER)36 from >50 truck fleets, entities with >$SOM revenue and government agencies was conducted in early calendar year 2022. Of the 386,286 vehicles represented in the LER, 31 percent of day-cab tractors and 78 percent of non-tractor trucks go less than 100 miles/day. The LER also showed daily return to base facility by 91 percent of day-cab tractors and 57 percent of non- tractor trucks. Furthermore, 65 percent of day-cab tractors and 52 percent of non-tractor trucks reported having "predictable usage patterns." Further detailed aggregated breakdowns of the LER data is available on CARB's website. The ubiquity of low daily mileage usage patterns in the LER is consistent with the 2018 California Vehicle Inventory and Use Survey (VIUS)37 data showing most "straight-trucks" travel less than 100 miles/day and 2002 VIUS based on national data indicating almost 90 percent of Class 2b-Class 7 vehicles and 80 percent of Class 8 vehicles also travel less than 100 miles/day. 38 Despite the potential for individual fleet specific needs and constraints, there is broad electrification opportunity for delivery, solid waste collection, short-haul, and a wide range of Class 4-8 vocational applications and especially during the early deployment period when the easiest routes and applications are still available to electrification early adopters.

33 https:/lww2.arb.ca.gov/sites/ default/files/barcu/regact/2019Iact2019/isor.pdf
34 https:/lww2.arb.ca.gov/sites/ default/files/barcu/regact/2019Iact2019/fsor.pdf
35 https:l/ww2.arb.ca.gov/our-work/programs/advanced-clean-fleetsladvanced-clean-fleets-meetings-events

36 Large Entity Fleet Reporting - Statewide Aggregated Data (ca.gov) https://ww2.arb.ca.gov/sites/default/files/2022-02/Large_Entity_Reporting_Aggregated_Data_ADA.pdf
37 https://dot.ca.gov/programs/transportation-planning/division-of-transportation-planning/data-analytics- serviceslstatewide-modeling/california-vehicle-inventory-and-use-survey

[Attachment omitted; proprietary information]

EPA Response

We appreciate the comments from CARB on the proposed rule. Regarding comments on the standards, in-use margin, and how we incorporated the emissions reductions from closed crankcase systems in setting the standards, see our responses in preamble section III, and section 3 of this document. Regarding comments on pre-buy and no-buy, see our responses to comments in section 25 of this document. Regarding the comment on the rule being cost-effective and worth pursuing even with 20% pre-buy/no-buy, as explained in Section X of the preamble and section 25 of this document, EPA maintains our assessment that any possible sales effects of the final rule are likely to be minimal and short lived, see RIA Chapter 10 for more detail and we have not undertaken such a sensitivity analysis at 20%. Regarding comments on supply chain issues, see our responses to comments in sections 3.2 and 25 of this document. Regarding comments on regulatory relief for hydrogen-fueled internal combustion engines, see our responses to comments in section 3.10 of this document. Regarding comments on the definition of parent engine, see our responses to comments in section 29.3 of this document. Regarding comments on OBD, see our responses to comments in section 7 of this document. Regarding comments on heavy-duty in-use testing (HDIUT) program, see our responses to comments in section 11 of this document.

As explained in preamble Sections III and IV and sections 3 and 12 of this document, we are not finalizing the proposed allowance for manufacturers to generate NO_X emissions credits from heavy-duty ZEVs and the final criteria pollutant standards are not based on projected utilization of ZEV technologies, although manufacturers may choose to comply with the standards through using ZEV technologies, or other technology pathways than included in our demonstration program. As noted in section 28 of this document, EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. Therefore, we are not taking final action at this time regarding issues raised in comments relating to ZEV infrastructure. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards) and may consider the comments in this section of this document in the development of that future rulemaking.

Organization: *Catherine Horine, Laura Ubasczewski, Jennifer Ryan: EPA-HQ-OAR-2019-2872, 2873, 2875*

Thank you for your recently announced proposal to reduce air pollution from medium- and heavy-duty trucks. As a person who cares about the impact of pollution on lung health, I am concerned that the proposed rule doesn't do enough to reduce dangerous air pollution or to protect environmental justice communities that are often disproportionally impacted by pollution from overwhelmingly diesel-fueled medium- and heavy-duty trucks.

This is important for all communities, especially those with higher truck traffic. The primary concerns I have are as follows:

- The proposed tighter tailpipe emission requirements don’t kick in until 2027. California and several other states are already requiring trucks sold within their borders to meet tighter pollution standards by 2024. EPA should do what states are already requiring by 2027. EPA should adopt the schedule and pollution limits in the California NOx Omnibus Rule.

- EPA’s rule allows for manufactures to make more dirtier diesel trucks if they offset their impact by making electric zero-emissions trucks. EPA should account for electric truck sales that are already being driven by state requirements in multiple states and provide for adjustments if more states adopt such requirements. Credit should only be given if manufacturers go above and beyond what they already must do.

- EPA needs to set a zero - emissions standard in this rule and a set a date by which it is the default requirement. In short, EPA should require increasing sales of electric trucks over time and require that all new trucks sold are zero - emission versions by 2035.

Additionally, because of the points above, I believe that the proposed rule fails Environmental Justice (EJ) communities. It ignores the disproportionate impact that diesel pollution has on community health, especially in communities already inundated with medium - and heavy - duty vehicle traffic and pollution. The proposed rule punts meaningful action on stricter requirements onto uncertain future decisions, which delays or possibly prevents cleaner air for those communities. Forgoing action now to reduce harmful diesel pollution exposure to the greatest extent possible will reinforce and entrench historic inequities.

The EPA should be proposing solutions aimed at phasing out our dependency on deadly diesel. I do not accept partial solutions that leave the air we all breathe and the climate we all depend on further burdened and damaged by pollution for decades to come, and urge the Agency to fix the rule to address the above faults.

EPA Response

We appreciate the comments from Catherine Horine, Laura Ubasczewski, and Jennifer Ryan on the proposed rule. Regarding the comments on the level of the standards and alignment with CARB, see our responses in section 3.1.2 of this document. Regarding comments on credits for zero-emission vehicles, see section 12 of this document. Regarding comments on setting standards based on zero-emission vehicles, see sections 3.1.1 and 28 of this document.

Regarding comments on communities with Environmental Justice concerns, see section 22 and 23 of this document.

Organization: *ChargeEVC-NJ: EPA-HQ-OAR-2019-0055-1418*

ChargEVC-NJ, a coalition of utilities, OEMs, technology companies, organized labor, developers, power producers, environment, consumer and equity advocates, support the Environmental Protection Agency (EPA) in finalizing a Clean Trucks Plan that accelerates the transition to zero-emission medium and heavy-duty electric vehicles. The Clean Trucks Plan represents a unique opportunity for the US to transition to widespread electrification of trucks and buses, spurring economic development, innovation, the creation of new jobs and skills. Importantly, this transition will result in significantly cleaner air for the generations that follow.

New Jersey is among six states – representing twenty (20) percent (%) of national medium and heavy- duty vehicle registrations – that have adopted the Advanced Clean Trucks (ACT) standard, which sets a minimum level of zero-emission sales in these six states. This policy will drive nearly 20% of Class 4-8 sales in model year 2027, nearly 30% in model year 2028 and nearly 40% in model year 2029.1 There is a notable gap in EPA's assessment proposed updates to the Phase 2 GHG standards, which calls for just 1.5% of Class 4-8 vehicle national sales in model year 2027 versus the ACT's 20% requirement. Federal standards should not lag so far behind the commitments of 20% of the market.

> 1 Based on sales-weighted averages of zero-emission vehicle sales requirements in the Advanced Clean Trucks standard for Class 4-8 straight trucks and Class 7-8 tractors.

We call attention to the varied and multiple policy mechanisms the EPA can use, in coordination with other Federal agencies and policies, to achieve this transition in an accelerated time frame. There needs to be a whole of government approach to accelerate zero-emission vehicle deployments over the next decade, that will set us up for future success.

Parallel to our support of regulatory action is our support of state and federal policies for incentives, investments, and creation of new markets for zero-emission vehicles and infrastructure. While the Infrastructure Investment and Jobs Act is an important step towards providing financial support for the transition to zero-emission vehicles, more is needed, such as the tax incentives for zero-emission vehicles and infrastructure, including storage. Again, a whole of government approach is required on the incentive and market side.

We have done a lot in New Jersey to help move along this transition but additional support from the Federal Government is needed. We stand by ready to work with EPA and the other Federal agencies to enable this market.

EPA Response

We appreciate the comments from Charge EVC-NJ in support of accelerating ZEV adoption and the need for incentives to support the transition to ZEVs. As explained in preamble Sections III and IV and sections 3 and 12 of this document, we are not finalizing the proposed allowance for manufacturers to generate NO_X emissions credits from heavy-duty ZEVs and the final criteria pollutant standards are not based on projected utilization of ZEV technologies, although manufacturers may choose to comply with the standards through using ZEV technologies, or other technology pathways than included in our demonstration program. As noted in section 28 of this document, EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards) and may consider this comment in the development of that future rulemaking.

Organization: *Clean Air for the Long Haul; EPA-HQ-OAR-2019-0055-2889*

We write to urge the Environmental Protection Agency (EPA) to finalize the strongest and most protective heavy-duty trucks nitrogen oxides (NOx) standards by the end of 2022 to safeguard overburdened communities and put us on a path towards a zero-emissions future.

As a coalition of environmental justice organizations from across the country, the Clean Air for the Long Haul Cohort lives in and advocates for communities that are disproportionately and adversely impacted by harmful air pollution from the transportation sector. Medium- and heavy-duty trucks, in particular, are the largest source of harmful smog and soot-forming nitrogen oxides in the U.S.1 Our communities are unjustly exposed to greater concentrations of these health-harming pollutants due to their proximity to “diesel death zones,” composed of high-traffic roadways and trucking routes, bus depots, and goods movement facilities.

Transportation pollution compounds upon similarly concentrated industrial air pollution in our communities, all due to this country’s legacy of discriminatory transportation and land-use planning. Low-income and communities of color that are overburdened by unrelentingly poor air quality face heart attacks, other cardiovascular and respiratory conditions, asthma-related emergency room visits, and premature deaths. Chronic exposure to harmful air pollution is the reason our friends and families are more susceptible to viruses that cause the COVID-19 pandemic.

Option 1 of the Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards (Docket no. EPA-HQ-QAR-2019-0055) could provide necessary relief to overburdened communities.8s This option, if aligned with the stringency and abridged timeline of California’s Heavy-Duty Omnibus rule,9 would require 90% NOx emissions reductions from medium- and heavy-duty vehicles and engines by 2027, avoiding $1.3 trillion in health damages linked to fine particulates and ozone pollution from 2027-2050.10,11 In contrast, Option 2 would require 75% NOx emissions reductions starting in 2027, achieving less reductions than Option 1,12 and would create less stringent useful life and warranty periods. This weaker option prioritizes industrial interests and does little to alleviate the environmental and health burdens of diesel pollution that has plagued our communities for generations.

To further strengthen Option 1, we ask that you eliminate zero-emission vehicle crediting and not allow early action credits. These proposed flexibilities would undermine the emission reduction standards and incentivize continued purchasing of dirty fossil fuel trucks and buses. The 72 million people living within 200 meters of major trucking routes, many of which are low-income and people of color,13 will continue to suffer from unequal health impacts from medium- and heavy-duty vehicle pollution if crediting is advanced.

The agency should set stringent standards that align with California's Heavy-Duty Omnibus requirements, ensuring that stringent NOx emission reductions are achieved across the country, and encouraging a ramp-up of zero-emission electric technology for all classes of trucks and buses. To address the health and environmental burdens placed disproportionately upon environmental justice communities, we urge the EPA to move swiftly in finalizing the Clean Trucks rule with an enhanced Option 1.

Thank you for your leadership on this issue and we welcome any opportunities for further discussion. For inquiries or to schedule a meeting with the Clean Air for the Long Haul Cohort, please reach out Anastasia Gordon via email at anastasia@weact.org.

EPA Response

This comment was submitted to EPA as official correspondence to the Administrator. We appreciate the comments from Clean Air for the Long Haul. on the proposed rule. Regarding the comments on the level of the standards and alignment with CARB, see our responses in section 3.1.2 of this document. As noted in sections 3.1.1 and 28 of this document, EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards) and may consider this comment in the development of that future rulemaking. Regarding comments on credits for zero-emission vehicles, see section 12 of this document. Regarding comments on communities with Environmental Justice concerns, see section 22 and 23 of this document.

Organization: *Clean Air Task Force et al: EPA-HQ-OAR-2019-0055-2878*

Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club ("Commenters") respectfully submit these supplemental comments on the Environmental Protection Agency's ("EPA") Proposed Rule for Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, 87 Fed. Reg. 17,414 (Mar. 28, 2022) (the "Proposal"). Here, we outline important new developments that (1) provide additional factual support for the positions on the criteria pollutant standards laid out in the Commenters' initial comments submitted on May 16, 2022, and (2) provide information that EPA must consider as it develops a supplemental notice of proposed rulemaking ("NPRM") on the GHG standards.[1] Many of the materials cited in these comments are attached as exhibits and are listed in the "List of Attachments."

[1] *See* Comments of Environmental and Public Health Organizations on Proposed Rule Regarding Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, Docket No. EPA-HQ-OAR-2019-0055-1302 (May 16, 2022),

https://wwwregulations.gov/comment/EPA-HQ-OAR-2019-0055-1302 ("Initial Comments").

Introduction

Since the close of the comment period for the Proposal, additional information has become available that further underscores the feasibility of promulgating strong rules to curtail dangerous emissions from heavy-duty vehicles and engines. In particular, the recent passage of the Inflation Reduction Act ("IRA") provides billions of dollars in funding for heavy-duty ("HD") zero-emission vehicles ("ZEVs") and lends further support to a baseline HD ZEV penetration rate much higher than the rate contained in EPA's Proposal, and likely one even higher than the range suggested in Commenters' initial comments. EPA must consider the IRA's impacts on the baseline HD ZEV penetration rate when setting the criteria pollutant standards—which EPA still intends to finalize by December—because the baseline HD ZEV penetration rate also informs the feasibility and appropriate stringency of those standards.

EPA has recognized the IRA's impact on the Agency's rulemaking. The Agency has announced plans to issue a supplemental NPRM in December on the portion of the Proposal concerning updates to the HD greenhouse gas ("GHG") standards in order to consider more stringent standards for model years 2027–2029.[2] For that supplemental NPRM, EPA must consider the IRA's impact on the baseline HD ZEV penetration rate, which is integral to setting standards that fulfill EPA's mandate to protect health and welfare.

[2] David Shepardson, *Exclusive: U.S. EPA to Consider Tougher Emissions Rules for Heavy Trucks*, Reuters (Sept. 21, 2022), https://www reuters.com/business/sustainable-business/exclusive-us-epa-consider-tougher-emissions-rules-heavy-tru cks-2022-09-21/.

The forthcoming supplemental NPRM should reflect the significant support that the IRA adds to the already substantial record regarding the feasibility and cost-effectiveness of zero-emission technologies. Through the IRA, Congress has encouraged the growth of those technologies in all vehicle sectors. EPA must not only consider an updated and accurate baseline HD ZEV market penetration rate but should propose standards that ensure that nationwide levels of HD ZEV deployment go beyond the baseline rates that would occur absent regulation. Only by doing so can EPA meet its statutory mandate to set standards that are adequately protective of public health and welfare.

In addition to providing new information from the IRA in support of a baseline HD ZEV penetration rate higher than that contained in EPA's Proposal, Commenters urge EPA to issue the GHG standards supplemental NPRM and finalize the criteria pollutant standards before the end of this calendar year. EPA should finalize the GHG standards no later than May 2023.

Section I explains how the IRA, through which Congress endorsed and provided substantial funding for greater development and deployment of HD zero-emission technologies and related infrastructure, supports a higher baseline HD ZEV penetration rate than that contained in EPA's Proposal. Section II explains how the IRA supports a greater role for zero-emission technologies in upcoming rulemakings.

I. THE IRA PROVIDES FURTHER SUPPORT FOR A HIGHER BASELINE HD ZEV PENETRATION THAN EPA'S PROPOSAL.

To meet its obligations under section 202 of the Clean Air Act, EPA must set technology-forcing standards that spur improvements in emissions control technologies and prioritize public health and welfare.[3] And to fulfill its duty to engage in reasoned decision making, EPA must consider a realistic HD ZEV baseline penetration rate both in finalizing the criteria pollutant standards and in formulating its supplemental NPRM for the GHG standards. EPA's proposed rate of 1.5% in MY 2027 is unreasonable because it is based on outdated information and flawed methodology, and is "far below even voluntary industry commitments."[4]

3 Commenters' initial comments on the Proposal include a thorough discussion of the legal requirements placed on EPA. *See* Initial Comments at 9–11.

4 Margo Oge, *Inflation Reduction Act Doesn't Meet Biden's Climate Goals: How to Close the Gaps on Transportation,* The Hill (Aug. 31, 2022), https://thehill.com/opinion/energy-environment/3622646-inflation-reduction-act-doesnt-meet-bidens-climate-goals- how-to-close-the-gaps-on-transportation/. For example, Commenters' initial comments described projections from both Navistar and Volvo of 50% ZEV truck sales by 2030 and projections from Navistar of 100% ZEV truck sales by 2040. *See* Initial Comments at 39 & 43. Volvo also projects 100% ZEV truck and bus sales by 2040, and Daimler expects 60% of its truck sales to be ZEVs by 2030. Oge (2022).

The IRA's programs offer significant funding for HD ZEVs, further supporting a baseline penetration rate far greater than EPA's proposed rate of 1.5% in MY 2027, and likely one even higher than the baseline ranges proposed in Commenters' initial comments (at least 8–11% for MY 2027 and 19–27% for MY 2030). In fact, early analyses of the IRA have recognized that the law will support a high baseline HD ZEV number, explaining that "the bill's investments will change the baseline for rulemakings…as it brings down the cost of clean technologies"[5] including HD ZEVs, and that the IRA will "accelerate the adoption of clean vehicles across the sector" and "enable accelerated deployment,"[6] such as can be achieved through standards set by EPA.

In response to the Proposal, some commenters noted that federal and state measures supporting ZEV adoption, manufacturing, and infrastructure would be helpful complements to EPA's standards and would speed the adoption of zero-emission technologies. The IRA, with its "tens of billions of dollars in grants, tax credits, and loan programs to develop manufacturing and supply chains for clean energy components, batteries, electric vehicles, and critical minerals,"[7] does exactly that. In light of these developments, EPA's proposed HD ZEV penetration rate of 1.5% becomes even more unreasonable.

[7] Jesse D. Jenkins et al., *Preliminary Report: The Climate and Energy Impacts of the Inflation Reduction Act of 2022*, Princeton University Zero Lab 16 (Aug. 2022), https://repeatproject.org/docs/REPEAT_IRA_Prelminary_Report_2022-08-12.pdf.

As explained in our initial comments, an accurate baseline HD ZEV market penetration rate is vital to EPA's standards.[8] For the GHG standards, EPA's supplemental NPRM must recognize a much higher baseline penetration rate than the 1.5% rate in the Proposal. Because the GHG standards apply as a fleet average, by vastly underestimating the penetration rate in the Proposal, EPA in turn underestimates the percentage of vehicles that would be able to meet the current Phase 2 GHG standards without installing emission-reduction technologies, undermining the program's goal of requiring all conventional vehicles to install such controls.[9] Moreover, failing to revisit the GHG standards with an approach that would further drive adoption of zero-emission technologies—a regulatory path that is clearly feasible—results in standards that fall far short of meeting the Clean Air Act's mandate. Commenters' initial comments outlined information supporting a baseline HD ZEV penetration of at least 8–11% for MY 2027 and 19–27% for MY 2030—rates far greater than EPA's 1.5% in MY 2027. The IRA provides support for a baseline HD ZEV penetration rate likely even higher than the range in Commenters' initial comments, and EPA must consider this new information in determining the baseline HD ZEV penetration rate used in its upcoming supplemental NPRM for the GHG standards.

[8] See Initial Comments at 20–23 (discussing the impacts of underestimating baseline market penetration of HD ZEVs).

[9] EPA explains in the Proposal that "[t]he intent of the existing HD GHG Phase 2 program was to set the stringency of the standards at a level that all conventional vehicles would need to install some level and combination of emission-reducing technologies or offset another conventional vehicle not installing such technology, since at that time we predicted very little market penetration of EVs." 87 Fed. Reg. at 17,603.

The baseline HD ZEV penetration rate also informs the feasibility and appropriate stringency of the criteria pollutant standards, and considering a more accurate (higher) baseline HD ZEV market penetration "could lead to a more stringent NO_X emission standard," as EPA acknowledges in the Proposal.[10] EPA recognizes that, for the NO_X standards, "information showing higher [battery electric vehicle ("BEV")/fuel cell electric vehicle ("FCEV")] market penetration in the MY 2027 or later timeframe" could require "inclu[ding] [hybrid electric vehicle ("HEV")], BEV and or FCEV technologies in [its] feasibility analysis," and that it may have to "re-evaluate [its] approach" in the final rule.[11]

The information provided regarding baseline HD ZEV penetration rates in Commenters' initial comments, and the IRA's new programs and funding, all support a penetration rate much higher than EPA's 1.5% in MY 2027 and beyond. The Clean Air Act commands EPA to set standards that "reflect the greatest degree of emission reduction achievable through the application of technology" which "will be available for the model year to which the standards apply,"[12] and therefore EPA must consider and include zero-emission technologies within its standard-setting analysis.

[10] 87 Fed. Reg. at 17,561.
[11] 87 Fed. Reg. at 17,458 (requesting comment on revising numeric standards to include HEV, BEV, and FCEV technologies).
[12] 42 U.S.C. § 7521(a)(3)(A)(i).

EPA must also consider an accurate baseline HD ZEV penetration rate, informed by the information contained in Commenters' initial comments and the new funding from the IRA, when considering emissions credits for the criteria pollutant standards. Under EPA's Proposal, HD ZEVs can generate NO_X emissions credits—an especially problematic departure from EPA's prior rules when an accurate baseline HD ZEV penetration rate is taken into account.[13] Underestimating the baseline market penetration of HD ZEVs will lead to the generation of a significant amount of credits that will dramatically undermine the goals of the NO_X standards and fail to protect public health and welfare. The IRA provides even more reason that EPA must consider a revised, more accurate baseline HD ZEV penetration rate and revisit these credits to ensure that the rule reflects the greatest degree of emission reduction achievable, as is EPA's statutory mandate.

[13] See 87 Fed. Reg. at 17,556 ("However, under the current criteria pollutant program, manufacturers do not have a pathway to generate NO_X emission credits for HEVs, BEVs, or FCEVs. For BEVs and FCEVs, current 40 CFR 86.016-1(d)(4) stipulates that these technologies may not generate NO_X emission credits…"); id. at 17,561–62 (proposing to allow ZEVs to generate NO_X emissions credits); 40 CFR 86.016-1(d)(4) ("Electric heavy-duty vehicles may not generate NO_X or PM emission credits.").

A. The IRA's investments in ZEV manufacturing will make many HD ZEVs cheaper to produce, expediting the path to total cost of ownership and purchase price parity with HD internal combustion engine vehicles.

Commenters' initial comments provide an overview of the extensive manufacturer investments in and commitments to HD ZEV technology, even prior to receiving the IRA's extra support.[14] The IRA makes available billions of dollars of investment in clean energy manufacturing, much of which can be used by HD ZEV manufacturers. As manufacturers are able to pass these financial benefits on to HD ZEV purchasers, these manufacturing investments will in turn expedite the path to both purchase price parity and total cost of ownership ("TCO") parity with HD internal combustion engine ("ICE") vehicles. The IRA will support further growth within the already rapidly expanding HD ZEV sector, enabling manufacturers to increase production of HD ZEVs and resulting in a much higher baseline HD ZEV penetration rate than EPA's proposed rate—and one that likely exceeds the range included in Commenters' initial comments—even without considering the effect of future EPA standards. To fulfill its obligations under section 202(a) of the Clean Air Act, then, EPA must consider the impact of the IRA and these more accurate higher baseline penetration rates.

[14] *See* Initial Comments at 39–44.

First, the IRA provides for significant tax credits that will directly reduce manufacturers' costs to produce HD ZEVs. For example, the IRA includes a production tax credit for the domestic production and sale of qualifying components for energy projects, including batteries and critical minerals. Under this Advanced Manufacturing Production Credit, domestically produced battery cells qualify for a credit of $35/kWh of capacity, and battery modules qualify for a credit of $10/kWh of capacity (or $45/kWh for battery modules that do not use battery cells).[15] Battery costs are the largest contributor to the cost difference between ZEVs and conventional vehicles, and these credits could offset a substantial proportion of those costs, bringing down total vehicle costs in turn. Because HD ZEVs use large batteries, manufacturers could qualify for large credits. For example, Volvo has explained that its HD trucks can use batteries with a total energy content of 540kWh or more, contained in six 90kWh modules.[16] For such a battery, a battery manufacturer could receive a credit of approximately $24,300. And for Class 8 long-haul trucks, which could include batteries between 1,173 and 1,800kWh,[17] the credits could decrease the cost of production between $52,785 and $81,000 per vehicle.[18] Furthermore, assuming a Class 8 short-haul truck with a 300-mile range and a battery of 682kWh, the Advanced Manufacturing Production Credit could reduce cost of production by $30,690, and for a Class 4 parcel truck with a battery of 155kWh, by $6,975.[19] This credit will further lower the production costs for manufacturers of HD ZEVs, supporting a higher baseline ZEV penetration rate.

[15] *See* Inflation Reduction Act of 2022, H.R. 5376, 117th Cong. § 13502(b)(1)(K) & § 13502(b)(1)(L) (2022). The tax credit for each component decreases by 25% each year beginning in 2029 and ends in 2032. *Id.* § 13502(b)(3)(B).

[16] Matt O'Leary, *Battery Packs for Heavy-Duty Electric Vehicles*, Volvo Group (May 17, 2022), https://www.volvogroup.com/en/news-and-media/news/2022/may/battery-packs-for-electric-vehicles html (explaining that HD trucks can include around six battery modules with an energy content of around 90kWh each, for a total energy content of 540kWh).

[17] Chad Hunter et al., *Spatial and Temporal Analysis of the Total Cost of Ownership for Class 8 Tractors and Class 4 Parcel Delivery Trucks*, NREL 8 (Sept. 2021), https://www nrel.gov/docs/fy21osti/71796.pdf. Battery size estimates are for 2025 for Class 8 long-haul trucks with 500 and 750 mile range.
[18] Assuming the full value of the credit passed along to HDV production.
[19] *Id.* Battery size estimates are for 2025.

The IRA also revises and expands investment tax credits for projects that equip, expand, or establish manufacturing facilities producing specified clean energy equipment, including HD electric, hybrid, and fuel cell vehicle production and related technologies, components, or materials, along with associated charging or refueling infrastructure.[20] These Advanced Energy Project Credits offer a base credit equal to 6% of the qualified investment, increasing to 30% if the project meets prevailing wage and apprenticeship requirements.[21] The allocation for this program is $10 billion.[22]

[20] IRA § 13501(a) & § 13501(b)(2)(I); *see also* 26 U.S.C. § 48C.
[21] IRA § 13501(a).
[22] *Id.*

In addition to tax credits for HD ZEV manufacturing, the IRA also provides for grants and loans to support ZEV production. The Domestic Manufacturing Conversion Grants program allocates $2 billion for grants to retool existing automobile manufacturing facilities for the production of electric, hybrid, and fuel cell electric vehicles.[23] These grants can cover up to 50% of the costs of a particular project.[24] The IRA also expands the Department of Energy's lending authorities under the Advanced Technology Vehicle Manufacturing ("ATVM") program, adding $3 billion for direct loans for the cost of establishing or expanding U.S. manufacturing facilities that produce advanced technology vehicles or components with low or zero GHG emissions, including qualified HD trucks.[25] The ATVM loan program has a history of successfully supporting progress in zero-emission technologies. For example, an ATVM program loan to Tesla Motors in 2010 supported the company's commercial-scale deployment, helping create more than 1,500 jobs at Tesla's ATVM-supported facilities and securing Tesla as the largest automotive employer in California.[26] Tesla was able to fully repay its loan in 2013, nine years ahead of schedule.[27] The ATVM program will work with the Domestic Manufacturing Conversion Grants program and the manufacturer tax credits to make HD ZEV production increasingly attractive to manufacturers. Taken together, all of these programs are expected to increase the baseline HD ZEV penetration rate even without taking emission standards into account.

[23] IRA § 50143(a).
[24] IRA § 50143(b).
[25] IRA § 50142(a); 42 U.S.C. § 17013(a)(1)(B).

[26] Department of Energy, Loan Programs Office, *Tesla Project Summary*, https://www.energy.gov/lpo/tesla; Andrew J. Hawkins, *U.S. Resurrects Green Energy Loan Program That Helped Put Tesla on the Map*, The Verge (July 25, 2022), https://www.theverge.com/2022/7/25/23277838/doe-atvm-loan-gm-lg-battery-joint-venture.

[27] Tesla, *Tesla Repays Department of Energy Loan Nine Years Early* (May 22, 2013), https://www.tesla.com/blog/tesla-repays-department-energy-loan-nine-years-early.

Moreover, the IRA provides support not only for vehicle manufacturers themselves, but also for related industries such as critical minerals and infrastructure development. For critical minerals, the Advanced Manufacturing Production Credits offer credits in an amount equal to 10% of the costs incurred by the taxpayer with respect to production of critical minerals, including those used in ZEVs such as cobalt, graphite, lithium, and nickel.[28] The Advanced Energy Project credits for critical minerals projects are like those described above for ZEV manufacturers, offering a base credit equal to 6% of the qualified investment and an increase to 30% if the project meets prevailing wage and apprenticeship requirements.[29] The Advanced Energy Project credits are available to projects that re-equip, expand, or establish industrial facilities for the processing, refining, or recycling of critical minerals, including those used in ZEVs.[30] Additionally, the IRA allocates $500 million that can be used for critical minerals processing under the Defense Production Act of 1950.[31]

[28] *See* IRA § 13502(a).

[29] IRA § 13501(a).

[30] IRA § 13501(b).

[31] IRA § 30001; *see also* Steven Mufson & Paulina Villegas, *Biden to Use Defense Production Act for U.S. Critical-Minerals Supply*, Washington Post (Mar. 31, 2022), https://www.washingtonpost.com/climate-environment/2022/03/30/critical-minerals-defense-production-act/ (discussing authorization of Defense Production Act for critical minerals).

The IRA also furthers the development of the infrastructure needed to support HD ZEVs, including through the Advanced Energy Project credits and the Alternative Fuel Refueling Infrastructure tax credits. Support for ZEV charging infrastructure can contribute significantly to lowering total cost of ownership and reducing barriers to HD ZEV uptake. For charging and refueling infrastructure related to HD electric or fuel cell vehicles, the Advanced Energy Project credits are the same as for ZEV manufacturing and critical minerals—credits equal to 6% of the qualified investment with an increase to 30% if the project meets prevailing wage and apprenticeship requirements.[32] The IRA expanded and extended the Alternative Fuel Refueling Infrastructure tax credit for the purchase and installation of charging assets or infrastructure in certain situations. The credit provides 30% of the cost per charger, and the IRA expands the credit to up to $100,000 per site.[33] The IRA also extends the credit through 2032,[34] which "improves the viability of projects with longer lead-times and allows for sequenced development of new fueling station networks."[35]

[32] IRA § 13501(a) & § 13501(b).
[33] IRA § 13404(b)(2)(B).
[34] IRA § 13404(a).
[35] Jonathan Lewis, On the Road: Inflation Reduction Act Jumpstarts U.S. Transportation Sector Decarbonization, Clean Air Task Force (Aug. 19, 2022), https://www.catf.us/2022/08/on-the-road-inflation-reduction-act-jumpstarts-us-transportation-sector-decarbonization/.

Together, all of these programs will reduce costs for manufacturers producing HD vehicles utilizing zero-emission technologies. Manufacturers are already recognizing these IRA benefits. Leaders at Daimler Truck, the nation's largest manufacturer of Class 6–8 commercial vehicles, extended a "special thanks" for the IRA's provisions that apply to zero-emission commercial vehicles.[36] And "[a]s a result [of the IRA], dozens of energy, automobile and clean technology companies have announced plans to move forward with new projects or accelerate the timeline on previous deals," including: Honda and LG Energy Solution opening a new $4.4 billion battery plant with annual production capacity of 40GWh; Hyundai accelerating construction of a $5.54 billion EV and battery plant in Georgia; Panasonic (battery supplier to Tesla) considering a second $4 billion domestic battery plant; Tesla seeking approval to set up a lithium refinery in Texas with construction possible in the fourth quarter of 2022 and commercial production by the end of 2024; Volkswagen and Canada signing an agreement to advance a sustainable battery supply chain and supply lithium, nickel, and cobalt; Sparkz (a battery startup) announcing West Virginia as the site of a future plant that will commercialize a zero-cobalt battery; and Piedmont Lithium Inc. announcing plans to build a $600 million lithium processing plant in Tennessee that will begin production in 2025 with a target of 30,000 metric tons per year.[37]

[36] Daimler Truck North America, *DTNA Applauds Inflation Reduction Act's Support of Zero Emission Trucks* (Aug. 16, 2022), https://northamerica.daimlertruck.com/PressDetail/dtna-applauds-inflation-reduction-act-s-support-2022-08-16 (quoting Sean Waters, VP of product compliance and regulatory affairs at Daimler Truck North America).
[37] Valerie Volcovici, *Factbox: U.S. Climate Package Jump-starts EV, Clean Energy Projects*, Reuters (Sept. 12, 2002), https://www.reuters.com/world/us/us-climate-package-jump-starts-ev-clean-energy-projects-2022-09-12/.

As a historic piece of legislation, the IRA provides "robust support for the development of American manufacturing of…battery and electric vehicle components and assembly as well as critical minerals processing,"[38] all of which will make production of HD ZEVs even more favorable for manufacturers. Commenters' initial comments provided a thorough discussion of TCO projections for HD ZEVs, citing numerous studies that estimate that different categories of HD ZEVs have either already reached TCO parity with their diesel counterparts, and/or will reach TCO parity prior to 2027.[39] Assuming manufacturer cost savings are passed on to HD truck purchasers, these vehicles will reach purchase price parity and TCO parity with HD ICE vehicles even sooner than the already favorable pre-IRA projections. For example, a recent analysis by BloombergNEF found that with the credits available in the IRA, "heavy-duty trucks operating in urban routes—which are already near price parity—may get close to 20% cost advantage by 2023 over similar diesel-engine vehicles," and long-haul electric trucks may reach TCO parity with diesel counterparts by 2030.[40] All of these manufacturer benefits in the IRA support a baseline HD ZEV penetration rate of at least 8–11% for MY 2027 and 19–27% for MY 2030, and very likely higher.

[38] Jesse D. Jenkins et al., *Preliminary Report: The Climate and Energy Impacts of the Inflation Reduction Act of 2022*, Princeton University Zero Lab 20 (Aug. 2022), https://repeatproject.org/docs/REPEAT_IRA_Prelminary_Report_2022-08-12.pdf.

[39] *See* Initial Comments at 44–49.

[40] BloombergNEF, *Commercial Vehicles Decarbonization Monthly: Inflation Reduction Act Eliminates Cost Premium of Electric Trucks* (Aug. 25, 2022) (subscription required) (TCO parity projections assume full battery credit is passed on to the final customer).

B. The IRA's credits for HD ZEV purchasers will expedite TCO and purchase price parity with HD ICE vehicles, supporting a HD ZEV baseline penetration rate well above 1.5%.

The IRA also contains significant funding to support HD ZEV purchasers that will facilitate near-term TCO and purchase price parity with HD ICE trucks. The IRA's primary funding for HD truck purchasers is through the Qualified Commercial Clean Vehicle tax credit, which is expected to "turbocharge adoption of electric medium-duty and heavy-duty trucks."[41] Through this credit, purchasers of HD battery or fuel-cell powered trucks receive a tax credit for either the vehicle's incremental cost over its ICE counterpart, or 30% of the vehicle's purchase price, whichever is less, with a maximum credit cap of $40,000 per vehicle purchase.[42] At a starting purchase price of $150,000, a Tesla Semi, for example, already offers a better cost of operation per mile than its diesel counterpart.[43] This tax credit will make the cost per mile "even more competitive."[44] Numerous state and local incentives, some of which are discussed in Commenters' initial comments,[45] could reduce the purchase price and cost per mile even further.

[41] Ari Kahn et al., *The Inflation Reduction Act Will Help Electrify Heavy-Duty Trucking*, RMI (Aug. 25, 2022), https://rmi.org/inflation-reduction-act-will-help-electrify-heavy-duty-trucking/.
[42] IRA § 13403.
[43] Fred Lambert, *Electric Trucks Like Tesla Semi Will Get Up to $40,000 in Incentives with New Bill*, Electrek (July 29, 2022), https://electrek.co/2022/07/29/electric-trucks-tesla-semi-40000-incentives-new-bill/.
[44] *Id.*
[45] *See* Initial Comments at 33–35, 37–38.

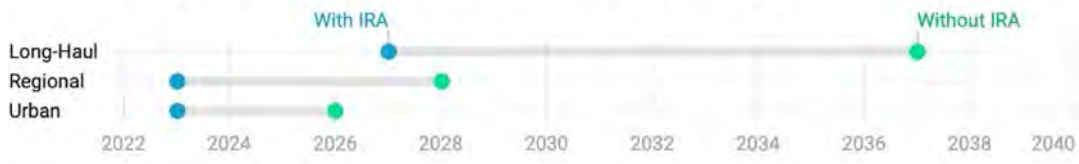
This credit therefore will effectively decrease the initial purchase price of an HD ZEV, with these vehicles likely to achieve TCO and purchase price parity with their ICE counterparts even sooner than previously estimated. Industry leaders have called this credit "a huge boost to support companies" committed to increasing the proportion of their fleet made up of HD ZEVs, and have pointed out that it "can greatly reduce the cost difference" between ZEVs and ICE vehicles, "allow[ing] fleets to make larger commitments to clean vehicle acquisitions and charging infrastructure."[46]

[46] Matt Donath, *Breaking it Down: What Does the IRA Mean for Fleet Electrification*, Edison Energy (Aug. 18, 2022), https://www.edisonenergy.com/blog/breaking-it-down-what-does-the-ira-mean-for-fleet-electrification/ (quoting Simon Horton, Edison Energy's EV Infrastructure Lead).

A recent analysis by RMI found that this credit "makes owning an electric truck cheaper than owning a diesel one in most use cases, with urban and regional electric trucks being cost-superior to diesel ones as soon as 2023. Trucks can travel 100,000 miles per year, and electrification creates significant fuel savings. Even many long-haul trucks that are hardest to electrify could be transformed."[47] Specifically, the RMI analysis found that with the IRA, TCO parity would be achieved five years sooner than without the law, and that this "is true for urban trucks that travel locally in cities an average of 50–100 miles a day; regional trucks that move 100–250 miles per day and return to the same depot; and long-haul trucks that travel 250 or more miles between cities and need to recharge in route."[48] RMI's data is illustrated in the following figure:[49]

[47] Kahn et al. (2022).
[48] *Id.*
[49] This figure is copied from *id.*

Electric truck parity dates with diesel by duty cycle



In light of the IRA, the Environmental Defense Fund ("EDF") worked with ERM to update a previously performed assessment of projected business-as-usual medium- and heavy-duty ZEV sales, and came to similar conclusions.[50] ERM's analysis included Class 4–8 trucks and found that when the IRA's ZEV tax credit is incorporated, "purchase price parity for a wide range of M/HD ZEVs is reached at least 5 years and as much as 12 years earlier than would occur without the credit."[51] It also found that additional funding for ZEV manufacturing and charging "could further reduce the total cost of ownership" of commercial ZEVs.[52]

[50] ERM, *Memo to EDF re Investment Reduction Act Supplemental Assessment: Analysis of Alternative Medium- and Heavy-Duty Zero-Emission Vehicle Business-As-Usual Scenarios* (Aug. 19, 2022), https://www.erm.com/contentassets/154d08e0d0674752925cd82c66b3e2b1/edf-zev-baseline-technical-memo-adden dum.pdf (to be submitted to the docket by EDF).
[51] *Id.* at 1.
[52] *Id.*

In addition, some fleets looking to install charging technology to support their vehicles will qualify for the Alternative Fuel Refueling Infrastructure Tax Credit discussed above, receiving a credit for up 30% of the cost per charger and up to $100,000 per site.[53]

[53] IRA § 13404(b)(2)(B).

The IRA also provides direct support to federal, state, municipal and other public entities looking to increase the share of ZEVs in their HD vehicle fleets. For example, the new Clean Heavy Duty Vehicles rebate program provides $1 billion in rebates for states, municipalities, Indian tribes and school associations to convert fleets to HD ZEVs, along with funding specifically reserved for communities located in nonattainment areas.[54] These rebates can cover up to 100% of incremental costs of replacing non-ZEV HD trucks with ZEVs, and 100% of the costs of charging, refueling, and operation infrastructure; workforce development; and planning and technical activities directed at the adoption and deployment of ZEVs.[55] Other relevant IRA programs include:

- The U.S. Postal Service Clean Fleets program, providing up to $3 billion for the Postal Service to purchase ZEVs and install related infrastructure.[56]

- GHG air pollution implementation grants, earmarking $4.75 billion for the implementation of GHG reduction plans by states, air pollution control agencies, municipalities, or Indian tribes, which includes replacing high-emission ICE trucks with ZEVs.[57]
- $50 million in funding to address air pollution in schools, which could be used to fund zero-emission school buses.
- $3 billion in grants to reduce air pollution at ports, which can be used to purchase or install zero-emission port technology, including for HD trucks.[58]
- $27 billion in direct and indirect financing in the form of grants to states, municipalities, tribal governments and nonprofit organizations for projects implementing zero-emission technologies to reduce GHG emissions, which can include HD ZEV projects.[59]
- $5 million in funding to provide grants to states to adopt and implement GHG and zero-emission standards for mobile sources (including HD trucks) pursuant to section 177 of the Clean Air Act.[60]
- $60 million in grants, rebates, or loans for projects by state, tribal, local, regional, or port authorities and for-profit and nonprofit entities that qualify under the Diesel Emissions Reduction Act, which can include funding the costs of emission reduction technology applicable to HD trucks.[61]

[54] IRA § 60101.
[55] *Id.*
[56] IRA § 70002.
[57] IRA § 60114.
[58] IRA § 60102.
[59] IRA § 60103.
[60] IRA § 60105(g). *See also* 42 U.S.C. § 7507.
[61] IRA § 60104. *See also* 42 U.S.C. § 16132.

C. Early modeling and analyses of the IRA further confirm that EPA’s proposed baseline HD ZEV penetration is far too low.

Early modeling and analyses of the IRA offer significant support for baseline HD ZEV penetration rates far higher than EPA’s 1.5% estimation. For example, modeling conducted by RMI found that with the IRA, over 60% of new truck sales could be electric by 2030.[62] Energy Innovation also modeled sales shares of battery electric vehicles (“BEVs”) under various scenarios and found that, with the IRA, 2030 BEV penetration rates could be as high as 36–38% for light/medium trucks, 20–21% for buses, and 24–27% for heavy trucks.[63] ERM’s updated analysis for EDF found that, for the five scenarios ERM considered, ZEV sales for Class 4–8 trucks average 29% of total sales by 2029.[64] ERM found that post-IRA Class 4–8 ZEV sales were projected to be 46% higher in 2029 than pre-IRA ZEV sales projections, when averaging across the five scenarios.[65] And a pre-IRA analysis considering commercial ZEV tax credits similar to those contained in the IRA found that 50–80% of several truck types could be ZEVs by 2035.[66]

[62] Kahn et al. (2022). RMI's modeling considered vehicles greater than 14,000 pounds Gross Vehicle Weight Rating.
[63] Megan Mahajan et al., *Updated Inflation Reduction Act Modeling Using the Energy Policy Simulator*, Energy Innovation 9 (Aug. 2022), https://energyinnovation.org/wp-content/uploads/2022/08/Updated-Inflation-Reduction-Act-Modeling-Using-the-En ergy-Policy-Simulator.pdf.
[64] ERM, *Memo to EDF re Investment Reduction Act Supplemental Assessment: Analysis of Alternative Medium- and Heavy-Duty Zero-Emission Vehicle Business-As-Usual Scenarios* at 1. ERM's projections include Class 4–8 trucks but exclude long-haul combination trucks. *Id.* at 1 n.1.
[65] *Id.* This projection also excludes long-haul combination trucks.
[66] The credits considered were more ambitious than those in the final version of the IRA, but also excluded all of the bill's other incentives. *See* Joshua Linn & Wesley Look, *An Analysis of U.S. Subsidies for Electric Buses and Freight Trucks*, Resources for the Future Issue Brief 22-1, at 2 (Jan. 2022), https://media.rff.org/documents/IB_22-1.pdf.

Many analysts are still considering the IRA's impacts on baseline ZEV penetration rates. Commenters expect that additional analyses could become available in the coming weeks, and encourage EPA to consider any such information as it becomes available.

II. THE IRA SUPPORTS A GREATER ROLE FOR ZERO-EMISSION TECHNOLOGIES IN UPCOMING RULEMAKINGS.

EPA should also consider the impact of the IRA on "the potential for ZEV technologies to significantly reduce air pollution from the heavy-duty vehicle sector" as the Agency undertakes future light- and heavy-duty rulemakings, including its forthcoming supplemental NPRM for the model year 2027-2029 GHG standards.[67] The IRA strongly supports a greater role for zero-emission technologies, including in the long-haul and fuel cell electric vehicle ("FCEV") applications discussed in our initial comments.

[67] 87 Fed. Reg. at 17,420 (requesting comment on this topic).

Beyond its significant incentives for BEVs, the IRA includes unprecedented investments in hydrogen-based systems like FCEVs and recharging stations, which offer additional promise for long-haul and other heavy-duty market segments that may be slower to electrify. The Qualified Commercial Vehicles tax credit, Alternative Fuel Refueling Infrastructure tax credit, and Clean Heavy Duty Vehicle grants and rebates are all available for hydrogen-based systems and FCEVs, and these investments in FCEVs and related technologies will "giv[e] an unprecedented lift to clean hydrogen."[68] EPA must consider the impacts of these programs on the feasibility of FCEVs and their effect on baseline HD ZEV penetration rates.

[68] Glenn Zorpette, *2022—The Year the Hydrogen Economy Launched?*, IEEE Spectrum (Aug. 17, 2022), https://spectrum.ieee.org/hydrogen-economy-inflation-reduction-act#toggle-gdpr.

By funding a variety of zero-emission technologies, the IRA provides support for an even greater mix of transportation-sector zero-emission options, offering EPA several zero-emission technology pathways to consider as it develops future rules. The programs and funding in the IRA will further reduce the costs companies face in using zero-emission technology of all types to comply with EPA's standards, and will favor both manufacturers and purchasers of HD ZEVs.

Conclusion

For the reasons set forth in Commenters' initial comments and these supplemental comments, EPA must finalize a strong criteria pollutant rule this year to curtail dangerous emissions from heavy-duty vehicles and engines. EPA also must include a higher, more accurate baseline HD ZEV penetration rate in its forthcoming supplemental NPRM for the GHG standards, and should propose standards that ensure HD ZEV deployment beyond the baseline. Adopting Commenters' recommendations would result in feasible and cost-beneficial rules that fulfill EPA's statutory duty to protect public health and welfare.

[Attachments omitted]

EPA Response

We appreciate the comments from Clean Air Task Force et al. with information relating to the Inflation Reduction Act (IRA) and its potential impacts on ZEV technologies adoption. As explained in preamble Sections III and IV and sections 3 and 12 of this document, we are not finalizing the proposed allowance for manufacturers to generate NO_X emissions credits from heavy-duty ZEVs and the final criteria pollutant standards are not based on projected utilization of ZEV technologies, although manufacturers may choose to comply with the standards through using ZEV technologies, or other technology pathways than included in our demonstration program. In section 3.1.1 of this document we respond to comments requesting that the final criteria pollutant standards be based on the projected utilization of ZEV technologies, which in part discusses the timing of the IRA relative to this final rulemaking. As noted in section 28 of this document, EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards) and may consider this comment in the development of that future rulemaking.

Organization: *Jan Hughes: EPA-HQ-OAR-2019-0055-2874*

National Forests, which process carbon dioxide, produce oxygen, filter air pollution, and house many endangered species, could be opened up to oil drilling. Because of the many services forests provide us, destroying forests in order to produce fossil fuels would have far-reaching effects not only on ecosystems but also on people.

The new rule proposed by the Department of the Interior would remove public input, stop the Forest Service from doing environmental review, and remove the requirement for the Forest Service to consent to oil leases. These changes would make it quick and easy for the fossil fuel industry to move in and take over our forests, both destroying nature and increasing the effects of climate change.

Forests are an extremely important part of our nation because of their effects on climate and public health. Trees take in carbon dioxide, which is a greenhouse gas, and in turn release oxygen, which we need to breathe. In this way, trees can help to mitigate the effects of climate change by taking up some of the carbon dioxide produced by burning fossil fuels. Trees also clean the air as they take in carbon dioxide and filter out toxic particles. Besides these benefits for humans, forests host a wide variety of plants and animals, which are already suffering from intense deforestation.

Every year semi-trucks, busses, and other heavy-duty vehicles emit millions of tons of nitrogen oxides (NOx) and other greenhouse gas pollutants driving climate change.

NOx air pollution from heavy-duty vehicles contributes to ozone and fine particulate pollution, which are unsafe to breathe, especially for the young and elderly and anyone exercising outdoors. This pollution is particularly dangerous for communities located close to high truck traffic areas, affecting millions of people that live near highways, warehouses, or ports. In our national parks it harms plants, trees, insects and other animals and it reduces the ability of visitors to see and appreciate the views of our treasured park landscapes.

Heavy-duty vehicles are also one of the nation's top sources of climate pollution. Nearly all of America's national parks are threatened by the symptoms of a warming climate including more frequent heat waves, drought, sea level rise, coastal flooding, and extreme wildfires.

To tackle this threat, the Biden administration must pursue the strongest possible NOx and greenhouse standards for heavy-duty vehicle engines. Any standards adopted should achieve a 90% reduction in NOx pollution from new heavy- duty vehicles by no later than 2027, which has already been implemented in a half-dozen states and counting.

Moreover, the administration should strengthen the rule's greenhouse gas requirements to set us on a path towards 100% zero-emission heavy-duty vehicle sales by 2035.

EPA Response

The Agency's response to general comments with respect to the stringency of the criteria pollutant standards can be found in Section 3.1.1 of this document.

With respect to GHG standards, we appreciate the comment in support of accelerating ZEV technologies adoption. As noted in section 28 of this document, EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards) and may consider this comment in the development of that future rulemaking.

Finally, we acknowledge that forests are an important part of the national ecosystem. Actions taken to directly preserve that ecosystem are led by the Department of the Interior and are out of scope for this rule that sets standards for heavy-duty highway engines and vehicles.

Organization: *Martin L Dutcher: EPA-HQ-OAR-2019-2870*

Myself (Martin Dutcher), along with researchers, health professionals, economists, engineers, and planners, respectfully submit this comment in support of the strongest possible heavy-duty nitrogen oxides (NOx) truck pollution standards. The Environmental Protection Agency (EPA) has made explicit commitments to climate, clean air, and environmental justice under this administration. Environmental justice communities suffer a disproportionate burden of pollution from the goods movement sector writ large. Thus: This NOx rule should be strengthened ASAP to live up to these important stated commitments and to set us on a path to a zero-emission transportation future.

EPA Response

We appreciate the comments from Martin L Dutcher in support of strong NOx standards and EPA's commitment to climate, clean air, and environmental justice. See the Agency's response to general comments with respect to the stringency of the criteria pollutant standards in Section 3.1.1 of this document. See also section 23 of this document for responses to Environmental Justice concerns. As explained in preamble Sections III and IV and sections 3 and 12 of this document, the final criteria pollutant standards are not based on projected utilization of ZEV technologies. As noted in section 28 of this document, EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards) and may consider this comment in the development of that future rulemaking.

Organization: *Mass Comment Campaign sponsoring organization unknown (**96**)*

Thank you for your recently announced proposal to address pollution from medium and heavy-duty trucks. I am worried about the impacts of the climate crisis on the health of our communities, and I'm concerned that the proposal does not go far enough. I'm writing to you today to ask that you please consider strengthening the final standards. The transportation sector is the leading source of climate pollution in the US. The climate crisis is harming our families and our communities today, and heavy-duty vehicles are a major contributor to this pollution. In fact, despite making up only 10% of the total number of vehicles on the road, medium- and heavy-duty trucks contribute a quarter of the total climate pollution from the transportation sector. Trucks are also major sources of other deadly air pollution. Medium and heavy-duty trucks are major contributors to NOx emissions, a potent precursor to ground-level ozone pollution, and they account for more than 60% percent of the deadly particle pollution that comes from vehicles. Particle pollution cuts short tens of thousands of lives in the US every year and contributes to the heavy burden of asthma on our nation's children. Moreover, air pollution impacts are inequitably distributed and disproportionately harm Blacks and Latinos compared to whites. That's why the U.S. should enact standards that put the American truck and bus fleet on a clear roadway to 100% zero-emission sales by 2035. To protect the health of our communities, and to address environmental injustices, EPA must take urgent action to strengthen the proposed standards today to reduce health-harming pollutants, including NOx and PM and greenhouse gasses from medium and heavy-duty combustion vehicles — while continuing to accelerate our transition to zero-emissions vehicles. By taking these steps, the U.S. will be well positioned to protect our family's health, reduce fuel costs for truckers and fleets, strengthen our energy security, and advance environmental justice. [EPA-HQ-OAR-2019-0055-2876]

EPA Response

The Agency's response to general comments can be found in Section 1 of this document. See the Agency's response to general comments with respect to the stringency of the criteria pollutant standards in Section 3.1.1 of this document. See also sections 20 and 21 of this document for responses to air quality impacts and health benefits.

Organization: *Mass Comment Campaign sponsoring organization unknown (**157**)*

Every year semi-trucks, busses, and other heavy-duty vehicles emit millions of tons of nitrogen oxides (NOx) and other greenhouse gas pollutants driving climate change. NOx air pollution from heavy-duty vehicles contributes to ozone and fine particulate pollution, which are unsafe to breathe, especially for the young and elderly and anyone exercising outdoors. This pollution is particularly dangerous for communities located close to high truck traffic areas, affecting millions of people that live near highways, warehouses, or ports. In our national parks it harms plants, trees, insects and other animals and it reduces the ability of visitors to see and appreciate the views of our treasured park landscapes. Heavy-duty vehicles are also one of the nation's top sources of climate pollution. Nearly all of America's national parks are threatened by the symptoms of a warming climate including more frequent heat waves, drought, sea level rise, coastal flooding, and extreme wildfires. To tackle this threat, the Biden administration must pursue the strongest possible NOx and greenhouse standards for heavy-duty vehicle engines. Any standards adopted should achieve a 90% reduction in NOx pollution from new heavy-duty vehicles by no later than 2027, which has already been implemented in a half-dozen states and counting. Moreover, the administration should strengthen the rule's greenhouse gas requirements to set us on a path towards 100% zero-emission heavy-duty vehicle sales by 2035. [EPA-HQ-OAR-2019-0055-2877]

EPA Response

The Agency's response to general comments can be found in Section 1 of this document. See also section 23 of this document for responses to Environmental Justice concerns.

Organization: *Nanette Diaz Barragán et al., Members of Congress and United States Senators; EPA-HQ-OAR-2019-0055-2886*

In our shared effort to protect environmental justice communities and curb air pollution and climate crises, we are writing to urge that the Environmental Protection Agency (EPA) finalize the strongest possible heavy-duty vehicle requirements via the Clean Trucks Plan, now released as a Notice of Proposed Rulemaking (NPRM) Docket ID No. EPA-HQ-OAR-2019-0055. The importance of the heavy-duty rule in accelerating deployment of zero emission vehicles cannot be overstated: it is critical for addressing the climate crisis, safeguarding clean air, and improving public health in our communities. Due to strong state action, the medium- and heavy-duty zero-emission truck market is growing, and EPA has a critical role to play to ensure that zero-emission technologies for all types of trucks and buses are deployed so we can be on the path for all new vehicles to be zero-emissions beginning in 2035. The rule should strengthen EPA's proposed Option 1 by building on the successes of the Advanced Clean Trucks (ACT) rule adopted by seven states: California, New Jersey, Washington, Oregon, New York, Massachusetts, and Connecticut, and set the expectation that at least 50 percent of sales should be zero-emission by 2030, putting the United States on track for all truck sales to be zero-emission by 2035. And as we advance our goals to transition to zero-emission trucks as quickly as possible, it is also important that EPA ensure the remaining new diesel truck purchases operate as cleanly as possible to protect public health, especially in our most overburdened communities.

Diesel trucks play an outsized role in creating and perpetuating environmental injustice and impose a disproportionate burden on Black, Latino, Asian, and Indigenous communities. All diesel- and gasoline- powered trucks produce nitrogen oxides (NOx) and the secondary formation of toxic particulate matter pollution, which causes an increase in cancer rates and mortality. NOx also causes lung irritation and weakens the body's immunity on its own and has worse health consequences when combined with ground level ozone exposure. Updating the outdated NOx standards is a top priority and it is critical that this rule provide pollution reductions that are at least as protective as the reductions that are codified in California's recent Heavy-Duty Omnibus and Advanced Clean Trucks rules. This means, at a minimum, EPA should meet or exceed California's Heavy-Duty Omnibus program by setting a standard that achieves, by 2027, a greater than 90% reduction in NOx emissions from trucks that are sold today relative to 2010 standards. Having a unified national program will provide needed equity of reduced emissions across the country, reduced regulatory complexity, and reduce unnecessary costs of complying with two separate regulatory requirements.

At the same time, this rule must accelerate the adoption of zero-emission trucks by providing a clear signal for manufacturers to chart a path to eliminating tailpipe pollution. At a minimum, the federal government should require that all new trucks must have zero emissions beginning in 2035, with intermediate targets before then. In addition, after completing this Heavy-Duty rule in 2022, EPA should move quickly to advance additional policies to eliminate emissions from the freight sector to accelerate the retirement of all combustion trucks by 2045.

At every regulatory opportunity, EPA must include policies that rapidly advance zero emissions technologies for the entire truck sector. Road freight is the fastest growing source of carbon emissions.[1] Heavy-duty vehicles make up only 10 percent of all vehicles on roads in the U.S., but contribute 45 percent of the transportation sector's nitrogen oxide pollution, 57 percent of its fine particulate matter pollution, and 28 percent of global warming emissions.[2] These impacts fall disproportionately on low-income communities and people of color due to proximity to heavy vehicle traffic and trucking corridors.[3] Recent studies show that diesel traffic is the largest source of nitrogen oxide disparity by race in the United States.[4] Transitioning from combustion to zero-emission trucks is therefore one of our greatest opportunities to tackle both the climate crisis and environmental injustice.

During this transition, remaining sales of combustion trucks should be required to make full use of the identified vehicle technologies that improve overall truck efficiency and reduce fuel consumption and tailpipe emissions. Thus, EPA should strengthen the NOx and Phase 2 greenhouse gas requirements for trucks to account for the aggressive adoption of zero emission heavy-duty trucks. The proposed Clean Trucks Plan underestimates a low penetration of zero-emission trucks in assisting truck engine manufacturer compliance with diesel engine NOx and PM. While we support policies that accelerate the transition to zero emission trucks, we cannot afford dirtier diesel trucks that offset the benefits of successful heavy duty ZEV deployment.

Due to demand from fleets and state action, today there are already over 100 commercially available models of zero-emissions medium- and heavy-duty trucks and buses, with additional models expected to enter production this year.[5] Federal policy is vital to increase zero-emission model availability and speed the transition towards clean transportation. More expansive progress is achievable, given that two-thirds of the current truck fleet is already ripe for electrification, based on their duty cycles and charging needs.[6] Additionally, states are leading the way - six states have already adopted the Advanced Clean Trucks (ACT) rule and more states are expected to follow their lead this year. While the ACT states make up 17 percent of the national truck market, together they will cause only 8 percent of trucks sold to be electric in 2027 and 13 percent in 2030. These percentages fall far short of the President's goals and the urgency that the climate crisis and air pollution demand. However, if EPA were to adopt requirements similar to the ACT, national market share for zero-emission trucks and buses would exceed 30 percent in 2030.

Multiple studies support the consensus that zero-emission trucks produce substantial savings, even more than electric cars; zero-emission trucks have short (and shrinking) payback periods due to reduced fuel and maintenance costs and more predictable maintenance schedules.[7] A recent, in-depth total cost of ownership analysis by California Air Resources Board (CARB) found that starting today, zero-emission trucks save money for their owners in many cases.[8] By 2030, zero-emission trucks have superior cost savings compared to diesel in every category analyzed, including Class 8 long-haul.[9] In addition, a team of GridLab, Energy Innovation, and UC Berkeley's Center for Environmental Public Policy found that electrifying the nation's car and truck sales by 2035 would create a net of 2 million jobs.[10] These benefits do not even account for the far greater health and climate savings, which with targeted implementation would flow to disadvantaged communities who have borne the brunt of truck pollution. New reports by MJ Bradley show the thousands of lives that would be saved in each state if those states were to adopt California's Advanced Clean Truck Rule.[11]

Thank you for your consideration. There is no time to wait; there is a critical need for the EPA to take swift action moving towards a zero-emissions future to protect the health and safety of environmental justice communities. We are confident that you agree on the urgency of this issue.

EPA Response

This comment was submitted to EPA as official correspondence to the Administrator. We appreciate the comments from Nanette Diaz Barragán et al., on the proposed rule. Regarding the comments on the level of the standards and alignment with CARB, see our responses in section 3.1.2 of this document. As noted in sections 3.1.1 and 28 of this document, EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards) and may consider this comment in the development of that future rulemaking. Regarding comments on credits for zero-emission vehicles, see section 12 of this document. Regarding comments on communities with Environmental Justice concerns, see section 22 and 23 of this document.

Organization: *Sherrod Brown et al., United States Senators EPA-HQ-OAR-2019-0055-2859*

We write you today regarding the proposed rule on the "Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicles Standards" (Docket ID No. EPA-HQ-QAR-2019-0055). Achieving significant reductions in nitrogen oxides (NOx) and other pollutants for new heavy duty engines and vehicles is imperative, and we encourage you to take an inclusive, consensus-based approach as you finalize these regulations.

We support setting new, more stringent standards to reduce pollution from heavy-duty vehicles and diesel engines, including emissions of smog- and soot-forming NOx from heavy-duty gasoline and diesel engines. In developing new regulations it is critical that the federal government do so in a manner that is durable and reflects a consensus view among stakeholders.

The proposed rule on the "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicles Standards" includes two options for reducing NOx tailpipe emissions. Option 1 consists of a two-step process to achieve a 90% reduction, from 0.2 to 0.02, in NOx emission reductions by Model Year (MY) 2031. Option 2 consists of a single-step 75% reduction, from 0.2 to 0.05 by (MY) 2027. We have heard from a number of stakeholders, including manufacturers and labor unions, concerned about the feasibility of option 1 and the potential for unintended consequences.

A workable standard should support efforts to transition to zero-emission electric vehicles (EV) -- which will ultimately result in the most significant improvement in air quality. The industry is committed to developing zero-emissions vehicles and has been making considerable investment in research and development. One of the likely unintended consequences of adopting option 1 would be a diversion of investment and resources from developing and scaling up zero-emission EV technology to the development of new heavy-duty engines and vehicles that can comply with option 1 and slowing the EV transition.

EPA has addressed emissions from heavy-duty vehicles since the mid-1980s, and has improved emissions standards several times since, including actions in 2004, 2005, and 2008 to limit emissions of NOx and particulate matter from heavy duty highway vehicles, marine vehicles, locomotives, and aircraft. These improvements are the result of a process that has worked with both advocates and industry. As you move forward with this this rulemaking process, we urge you to take the same approach – working directly with major stakeholders in developing a final rule that achieves significant NOx reductions and supports the transition to cleaner EV options.

Thank you for considering our request and concerns as you move forward with this important initiative.

EPA Response

This comment was submitted to EPA as official correspondence to the Administrator, in addition to being provided to the docket. Regarding comments on the standards, see our responses in preamble section III, and section 3 of this document. As explained in preamble Sections III and IV and sections 3 and 12 of this document, we are not finalizing the proposed allowance for manufacturers to generate NO_X emissions credits from heavy-duty ZEVs and the final criteria pollutant standards are not based on projected utilization of ZEV technologies. As noted in section 28 of this document, EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards) and may consider this comment in the development of that future rulemaking.

Organization: *Tracey Gold: EPA-HQ-OAR-2019-2871*

Thank you for your recently announced proposal to address pollution from medium and heavy-duty trucks. I'm writing to you today to ask that you please consider strengthening the final standards. Trucks are major sources of other deadly air pollution. That's why the U.S. should enact final standards that put the American truck and bus fleet on a clear roadway to 100% zero-emission sales ASAP. Especially the public transportation system!! By taking bold steps, the U.S. will be well positioned to protect our family's health, reduce fuel costs for truckers and fleets, strengthen our energy security, and advance environmental justice.

EPA Response

We appreciate the comments from Tracey Gold in support of strengthening the final standards and accelerating ZEV technologies adoption. See the Agency's response to general comments with respect to the stringency of the criteria pollutant standards in Section 3.1.1 of this document. As noted in section 28 of this document, EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards) and may consider this comment in the development of that future rulemaking. See also section 23 of this document for responses to Environmental Justice concerns.

Organization: *Truck and Engine Manufacturers Association: EPA-HQ-OAR-2019-0055-2858*

This memorandum is a follow-up to our discussions on June 16th, and a supplement to the relevant portion of EMA's detailed written comments on the Agency's NPRM for the CTP. (See EMA's Comments, pp. 162- 167.) As we discussed, EMA is requesting revisions to the Agency's proposal to streamline and narrow the process for protecting manufacturers' confidential business information (CBI). Perhaps the best way to do that will be for the Agency to allow for manufacturers to collect and store certain types of “emission data,” as opposed to submitting those data routinely. EPA would retain the authority to separately request the submission of those certain types of data when necessary to assist in compliance-related matters. As discussed below, this kind of approach is necessitated by the need to preserve and account for both the Agency’s mandate to collect and make public “emissions data,” and manufacturers’ statutory rights to the protection of their confidential “trade secrets.”

The relevant statutory background to this issue is summarized briefly below.

Sections 114 and 208 of the Clean Air Act (CAA) require manufacturers to collect and submit to the Agency testing data and reports to demonstrate that their products are in compliance with the applicable emission standards and related requirements, and with the corollary test procedures. In addition, and in particular, section 208(c) of the CAA provides that,

> Any records, reports or information obtained [by the Agency] under this part or part C of this subchapter shall be available to the public, except that upon a showing satisfactory to the Administrator by any person that records, reports, or information, or a particular portion thereof (*other than emission data*), to which the Administrator has access under this section, if made public, would divulge methods or processes entitled to protection as trade secrets of that person, the Administrator shall consider the record, report, or information or particular portion thereof confidential in accordance with the purposes of section 1905 of title 18. (42 U.S.C. §7542(c).) (Emphasis added.)

Under the foregoing provision of the CAA, “emission data” is carved-out from the types of data for which CBI protection may be sought. In addition, 40 CFR §2.301(a)(2)(i) broadly defines “emission data” to mean,

(A) Information necessary to determine the identity, amount, frequency, concentration or other characteristics (to the extent related to air quality) of any emission which has been emitted by the source (or of any pollutant resulting from any emission by the source), or any combination of the foregoing.
(B) Information necessary to determine the identity, amount, frequency, concentration or other characteristics (to the extent related to air quality) of the emissions which, under an applicable standard or limitation, the source was authorized to emit (including, to the extent necessary for such purposes, a description of the manner or rate or operation of the source), and
(C) A general description of the location and/or nature of the source to the extent necessary to identify the source and to distinguish it from other sources (including, to the extent necessary for such purposes, a description of the device installation, or operation constituting the source).

The net result of the foregoing statutory provisions is that a broad range of “emission data” that the Agency has “obtained” under CAA section 208(c) shall be made available to the public.

At the same time, federal law also provides broad protection for “trade secrets,” including potential criminal liability for the unauthorized disclosure of trade secrets. More specifically, title 18 section 1905, the statutory provision specifically referenced in CAA section 208(c), prohibits the unauthorized disclosure of information that “concerns or relates to the trade secrets, processes, operations, style of work, or apparatus, or to the confidential statistical data . . . of any person, firm, partnership, corporation, or association.” In addition, the more recent enactment of the federal Trade Secrets Act (see 18 U.S.C. §§1832, et seq.) expressly prohibits the unauthorized communication or receipt of “trade secrets,” which are broadly defined to include “all forms and types of business, scientific, technical, economic or engineering information, including patterns, plans, compilations, design, prototypes, methods, techniques, processes, procedures, programs, or codes . . . if the information derives independent economic value, actual or potential, from not being generally known . . . by another person who can obtain economic value from the disclosure or use of the information.”

From these various federal statutes, it seems clear that there are two important policy considerations at issue: (i) ensuring the reasonable public availability of “emission data,” and (ii) ensuring the robust protection of “trade secrets.” Of particular relevance in this instance is ensuring that the public release of a manufacturer’s emission data does not allow others, including direct competitors, to reverse-engineer that manufacturer’s emission-control strategies, designs, methods, techniques, processes, programs or codes. Heretofore, the Agency has understood this, and has treated such emissions data as CBI. Indeed, if that type of protection is not afforded to this sort of emissions-related trade secret data, the independent economic value of manufacturers’ emission- control research, advancements and designs will be subject to forfeit to any competitor that elects to file a FOIA request. The economic consequences throughout the industry, and the disincentives to invest in the research and development of advanced emission-control systems, would be both obvious and very significant.

Importantly, the basic rules of statutory construction prohibit the Agency from causing such detrimental outcomes. More specifically, it is black letter law that overlapping statutes must be construed to give effect to both. Thus, the Agency’s directive to make “emission data” publicly available cannot be implemented in a manner that nullifies manufacturers’ statutory rights to the protection of their “trade secrets.”

One way to ensure that necessary reconciliation is for the Agency to limit in the first instance the types of emission data it will routinely “obtain” from manufacturers, thereby limiting the types of emission data subject to routine public disclosure. In that regard, the Agency has broad discretion regarding the types of “emission data” it deems necessary for submission to verify compliance.

With the foregoing in mind, and in order to guard against the risk of unlawful FOIA-enabled reverse- engineering of manufacturers’ trade secrets, EPA should confirm that the thirteen (13) types of data described in the pending NPRM (along with any comments submitted in the “comments field” of EPA’s compliance reporting software) (see, 87 FR at p. 17619; proposed sections 1068.11(c)(1) through (c)(13)) will remain eligible for CBI treatment and protection. In addition, to enhance the protection for certain subsets of those data, EPA should refrain from routinely obtaining the following types of trade-secret-related CBI:

(i) one Hertz (Hz) in-use emissions data, or any other similar second-by-second off-cycle data, other than emission values and engine speed;
(ii) engine fuel maps, including any associated NOx data;
(iii) one Hz data from SEA reports or similar compliance-assessment reports, other than emission values and engine speed;
(iv) data regarding the manner in which manufacturers electronically protect passwords and/or encrypt data to restrict the adjustment of electronically adjustable parameters and to prevent unauthorized reflashes (see section 1068.50) and
(v) any other emissions data deemed capable of facilitating reverse-engineering of a manufacturer's trade secrets.

It is vital that EPA protect the foregoing types of confidential emissions-related trade secret data from public disclosure. The applicable federal statutes require as much. In that regard, the types of 1 Hz data that could be subject to public disclosure under EPA's proposal are clearly CBI because, using those data, manufacturers can reverse-engineer each other's emissions-related designs and strategies, including warm-up controls, fuel-map configurations, and more—all of which are carefully guarded trade secrets. Further, those types of 1Hz data are not otherwise readily obtainable without resource-intensive configuration and testing of a competitor's product in a test cell utilizing significant amounts of trained staff's time. The high bar necessary to gather such data serves as protection for the independent economic value of those data and of the manufacturer's related capital investments, such that giving away those data through routine FOIA requests would destroy those capital investments and would violate the manufacturer's rights to the protection of confidential trade secrets.

Similarly, manufacturers' engine fuel maps, including associated NOx data, are also CBI because, from those maps and data, one manufacturer can reverse-engineer another's thermal controls, fuel system and injection controls, and strategies for controlling engine emissions to ensure they comply with the broad range of emissions tests (FTP, RMC, LLC, NTE) and GHG limits that are required. As with the 1 Hz data at issue, these fuel maps and associated data are not readily obtainable without resource-intensive analyses of a competitor's product in a test cell using significant commitments of trained staff's time. The high bar necessary to gather such data again serves as protection for the independent economic value of those data and the manufacturer's investments therein, such that giving away those data through routine FOIA requests would unlawfully vitiate those investments and the associated trade secrets.

Given the foregoing, it is clear that the stakes pertaining to this issue are very high. We look forward to additional discussions regarding this critically important matter.

<u>EPA Summary and Response</u>

We appreciate the comments from EMA on the proposed rule. We have responded to this comment, identified as #1203, in section 30.1 of this document.

Organization: *Truck and Engine Manufacturers Association: EPA-HQ-OAR-2019-0055-2869*

The Truck and Engine Manufacturers Association (EMA) hereby submits its response to the supplemental comments that the California Air Resources Board (CARB) sent to EPA on June 20, 2022, regarding the NPRM for the Agency's Clean Trucks Plan. (See 87 FR 17414-17888.) EMA filed its initial comments on the NPRM on May 30, 2022. EMA is filing these supplemental comments to address certain incorrect assertions that CARB has made, and to address "matters of central relevance to the rulemaking" before the Agency.1 Because this supplement involves such centrally relevant matters, please add it (and the attachments) to the record for this rulemaking and all appropriate dockets. [EPA-HQ-OAR-2019-0055-2869]

1 See 42 U.S.C. §7607 (d)(4)(B)(i) (providing that documents that "are of central relevance to the rulemaking shall be placed in the docket as soon as possible after their availability"); see also 42 U.S.C. §7607 (d)(7)A).

The main points of EMA's supplemental comments are summarized below [EPA-HQ-OAR-2019-0055-2869]:

- CARB asserts in its supplemental filing that a NOx compliance margin of 0.026 g/bhp-hr, similar to the compliance margin of 0.030 that EMA has recommended, "is dangerously and unnecessarily high." That is untrue. Compliance margins are not dangerous; they are an important consideration that account for the variety of real-world conditions under which compliance is demanded, and the laws of physics as they relate to the demonstrated technology. Moreover, a compliance margin of 0.026 (or 0.030) is not unnecessarily high. To the contrary, recent data from Southwest Research Institute (SwRI) proves that EMA's recommended margin was far too low. More specifically, SwRI has completed emissions testing of the "Stage 3 RW" prototype under cold ambient conditions (approximately 5°to 7°C) and has found that the "Bin 3" NOx levels increase by approximately 0.04 g/bhp-hr under those conditions over a representative in-use test cycle. That cold-ambient margin (0.04) is much higher (nearly 20-times higher) than the margin component for "cold ambient operation" (0.0023) that EMA used in the margin stackup analysis included in EMA's original comments. Thus, factoring in the actual margin demand attributable to cold ambient operation, EMA's margin stackup would increase to 0.064. Accordingly, instead of reducing the compliance margin at issue, EPA will need to provide an in-use compliance margin of approximately 0.065 g/bhp-hr (and likely even higher to cover ambient temperatures lower than those tested at SwRI) to ensure that the Agency's proposed NOx standards are feasible.

- Tests under similar cold ambient conditions over the Low Load Cycle resulted in even higher NOx increases. The Stage 3 RW engine's NOx over this cycle increased from 0.032 g/bhp-hr to as much as 0.105 g/bhp-hr.

- A copy of the PowerPoint presentation that SwRI has prepared regarding the results of its cold-ambient testing of the Stage 3 RW prototype is attached, and needs to be included in the underlying rulemaking record. EMA's updated margin stackup analysis reflecting these latest results is also attached.

- CARB contradicts their own assertion that data-based compliance margin allowances are unnecessary by suggesting that manufacturers could "establish a margin by deploying new emissions control technologies." CARB states that closed crankcase ventilation ("CCV") systems could be used to enable compliance, without regard to the fact that CCV is not commonly used on modern diesel engines (they refer to Cummins use of CCV on natural gas engines, which is an altogether different and less challenging application), without acknowledging that these systems are known to cause turbo compressor damage that leads to CO2 emissions increases, and without having developed a shred of emissions data showing that engines using CCV systems can withstand the rigors of heavy-duty engine service over the nearly-doubled useful life periods included in the proposal. Moreover, EPA did not include the cost of CCV components, nor the cost associated with their maintenance requirements, in the cost assessment for the CTP rulemaking.

- CARB also asserts that any pre-buy and no-buy responses to a stringent and costly low- NOx rule will be "small." That is not the case. As confirmed by a recent report prepared by ACT Research, "Bigger Than Ever?: The Higher the Cost, The Bigger the Prebuy," (a copy of which is attached for inclusion in the docket), a low-NOx rule that aligns with EPA's Option 1 or CARB's "Omnibus" regulations would result in "the largest truck prebuy ever, beginning sometime in 2025 or 2026."

- Another issue raised by CARB is that they disagree that current provisions related to the determination of data engines should be retained. EPA's CTP standards will be developed based on demonstrations using ratings typical of the current data engine provisions. Furthermore, neither EPA nor CARB has evaluated the emissions performance implications of revised data engine requirements. Setting up such a disparity between a feasibility demonstration to establish new emissions standards, and new rules regarding the engine rating selected to demonstrate compliance to those standards, would be unreasonable and unfair.

- Also raised in CARB's supplemental comments is an objection to "EMA's assertion that biodiesel specification regulations are needed as part of the CTP rulemaking." CARB is simply ignoring the fact that the Stage 3 RW demonstration, aged to 800,000 miles under conditions representative of operation on quality-controlled pure petroleum diesel, did not produce emissions results compliant with EPA's proposal throughout the proposed useful life period. Fuel contaminants in biodiesel, including biodiesel blends limited to B20, will further reduce the NOx conversion efficiency of those same SCR systems. Biodiesel fuel quality standards absolutely must be improved to enable compliance to the aggressive NOx standards EPA will establish in the final rule.

- Yet another objection raised by CARB is EMA's recommendation that EPA eliminate PM and NMHC testing when complying with an in-use test order. The basis for EMA's recommendation is clearly stated in our comments. Any suspicion on CARB's part concerning visual screening methods for PM exceedances on vehicles considered

> for in- use testing would not be rectified by requiring measurement of PM emissions during an in- use evaluation. EMA supports EPA's consideration to finalize the CTP regulation to require PM and/or NMHC emissions testing requirements only in cases where there is reason to believe exceedances may be present.

[Attachments omitted]

<u>EPA Response</u>

We appreciate the comments from EMA on the proposed rule. Regarding comments on the standards and in-use margin, see our response in preamble section III, and section 3 of this document. Regarding EMA's updated margin analysis, as discussed in preamble III.C and section 3 of this document, our assessment is that the final off-cycle standards that include margin also include the emissions impacts due to cold ambient temperature. Regarding comments on the definition of parent engine (data engines), see our responses to comments in section 29.3 of this document. As discussed in preamble section III and section 3 to this document, we have considered the emissions levels of other engine ratings within an engine family when setting the final standards. Regarding comments on closed crankcase systems, see our responses to comments in section 3.9 of this document. Regarding EPA's assessment of the costs of closed crankcase systems, see RIA chapters 3.1 and 7. Regarding comments on pre-buy and no-buy, see our responses to comments in section 25 of this document. Regarding comments on fuel quality and its effect on feasibility, see preamble Section III.B and III.C for more information on how we consider these elements in setting the standards. Regarding comments on PM and NHMC measurements for the heavy-duty in-use testing (HDIUT) program, see our responses to comments in section 11 of this document.

Organization: *Alliance of Nurses for Healthy Environments et al.: EPA-HQ-OAR-2019-0055-2879*

On behalf of 21 health, environmental, and community groups, please find the attached on the Environmental Protection Agency's Proposed Rule for Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, 87 Fed. Reg. 17,414.

The undersigned organizations representing millions of members respectfully urge that, by May of next year at the latest, EPA finalize rigorous and comprehensive standards for new medium- and heavy-duty vehicles that help to ensure levels of new zero emitting vehicles in 2029 are at least as great as those required by California's Advanced Clean Trucks Rule, if those standards applied nationwide. These standards must also be consistent with and help ensure that all new medium- and heavy-duty vehicles will be zero-emission by 2035. The Agency must, in setting these standards, consider the game-changing clean vehicle provisions of the Inflation Reduction Act (IRA), which dramatically accelerate the deployment of medium- and heavy-duty zero emission vehicles (ZEVs).

The IRA reinforces EPA's longstanding and well-established authority to adopt protective pollution standards for medium- and heavy-duty trucks and buses. It also turbocharges the availability of zero emitting solutions that eliminate lethal particulates, smog-forming nitrogen oxides and climate-destabilizing pollution, accelerating vital protections for communities who have been bearing the heavy burden of pollution for far too long, while mobilizing made-in-America manufacturing – and high-quality jobs across our nation.

Experts have already completed analyses of the significant benefits the IRA will have in accelerating ZEV deployment, including analysis by ERM concluding that the IRA will pull ahead price parity for medium- and heavy-duty ZEVs by 5 to 12 years and result, on average, in 29 percent baseline levels of new vehicle ZEV sales in 2029, without considering the role of EPA standards.1 Additional analysis by Roush Advanced Engineering has likewise found the IRA will result in many medium- and heavy-duty ZEVs reaching price parity in 2023, delivering substantial savings to truckers and fleets over those vehicles' lifetime and further underscoring the opportunity for protective standards.

> 1 Robo, Ellen and Seamonds, Dave. "EDF ZEV Baseline Technical Memo Addendum." ERM. 19 Aug 2022. https://www.erm.com/contentassets/154d08e0d0674752925cd82c66b3e2b1/edf-zev-baseline-technical-memoaddendum.pdf.

Recent reporting has suggested EPA plans to issue a supplemental proposal this December to consider the impacts of the IRA on EPA's proposed pollution standards for model years 2027-2029 vehicles.2 We respectfully urge EPA to finalize the MY 2027-2029 standards by May of next year at the latest. Swiftly finalizing these standards is consistent with the extensive information already in the record on the need for and feasibility of medium- and heavy-duty ZEV deployment3 and with the analysis that has likewise been developed documenting the substantial impacts of the IRA. Moreover, finalization by May is important to ensure EPA proposes and finalizes protective Phase 3 standards for MY 2030 and later vehicles on a timeline consistent with the President's August 2021 Executive Order and EPA's commitments in its regulatory agenda.

> 2 E.g., Shepardson, David, Exclusive U.S. EPA to consider tougher emissions rules for heavy trucks, (Sept. 21, 2022); https://www.reuters.com/business/sustainable-business/exclusive-us-epa-consider-tougher-emissions-rulesheavy-trucks-2022-09-21/.
>
> 3 See, e.g., Comments of Environmental Defense Fund, EPA-HQ-OAR-2019-0055-1265, https://www.regulations.gov/comment/EPA-HQ-OAR-2019-0055-1265.

In addition, EPA's supplemental proposal must help to ensure nationwide levels of ZEV deployment that are at least as great as those required by California's Advanced Clean Trucks Rule (adopted as feasible even before enactment of the Infrastructure Investment and Jobs Act and the IRA). The IRA analyses add to a significant and compelling body of information on the feasibility and benefits of ZEVs, including substantial investments and rapid introduction of new models by manufacturers in advance of the IRA's passage. Standards consistent with California's Clean Trucks Rule are critical to ensure America's communities and people realize the full health, climate, equity and economic benefits of the Inflation Reduction Act. The robust IRA programs enacted by Congress demonstrate the urgent need to dramatically reduce truck pollution now, and only strong standards will ensure that the IRA programs are fully subscribed and utilized.

There is a pivotal opportunity for EPA to finalize protective standards consistent with the game-changing provisions of the Inflation Reduction Act. Now is the time for action, and we look forward to EPA's response to these requests.

EPA Response

We appreciate the comments from Alliance of Nurses for Healthy Environments et al. in support of accelerating ZEV technologies adoption. As explained in preamble Sections III and IV and sections 3 and 12 of this document, we are not finalizing the proposed allowance for manufacturers to generate NO_X emissions credits from heavy-duty ZEVs and the final criteria pollutant standards are not based on projected utilization of ZEV technologies, although manufacturers may choose to comply with the standards through using ZEV technologies, or other technology pathways than included in our demonstration program. In section 3.1.1 of this document we respond to comments requesting that the final criteria pollutant standards be based on the projected utilization of ZEV technologies, which in part discusses the timing of the IRA relative to this final rulemaking. As noted in section 28 of this document, EPA is not taking final action at this time on the portion of the HD 2027 NPRM regarding proposed changes to HD GHG Phase 2 standards. EPA intends to undertake a separate rulemaking regarding more stringent HD GHG standards in the future (i.e., HD GHG Phase 3 standards) and may consider this comment in the development of that future rulemaking.

Appendix 1: Index of Commenters in Text

This appendix contains the following information:

- List of individual comments excerpted verbatim in this Response to Comment Document
- List of mass mailer comments (those received before the docket closed on May 16, 2022)
- List of late comments (received after docket closed thru October 4, 2022)
- Description of industry-related letter campaigns; a description of our approach to these campaigns is provided at the end of this appendix.
    - State Trucker Association (1)
    - State Trucker Association (2)
    - Engine and Truck Organizations
    - Motorcoach Companies.

List of Individual Comments

Organization	EPA Docket Document Number
350Marin	EPA-HQ-OAR-2019-0055-2474
Achates Power, Inc.	EPA-HQ-OAR-2019-0055-1216
Advanced Engine Systems Institute (AESI)	EPA-HQ-OAR-2019-0055-1281
Agricultural Retailers Association (ARA) (1241 and 1421)	EPA-HQ-OAR-2019-0055-1251
Agricultural Retailers Association (ARA) (1241 and 1421)	EPA-HQ-OAR-2019-0055-1421
Air Products and Chemicals, Inc. (Air Products)	EPA-HQ-OAR-2019-0055-1166
Alabama Trucking Association (ATA) - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1132
Ali P.	EPA-HQ-OAR-2019-0055-1031
Alliance for Automotive Innovation (Auto Innovators)	EPA-HQ-OAR-2019-0055-1303
Alliance for Vehicle Efficiency (AVE)	EPA-HQ-OAR-2019-0055-1280
Allison Transmission, Inc. (Allison)	EPA-HQ-OAR-2019-0055-1231
Amber Wheeldon	EPA-HQ-OAR-2019-0055-1154
American Automotive Policy Council (AAPC)	EPA-HQ-OAR-2019-0055-1293
American Bus Association (ABA) (1070 and 1308)	EPA-HQ-OAR-2019-0055-1070
American Bus Association (ABA) (1070 and 1308)	EPA-HQ-OAR-2019-0055-1308
American Council for an Energy Efficient Economy (ACEEE)	EPA-HQ-OAR-2019-0055-2852
American Farm Bureau Federation (Farm Bureau)	EPA-HQ-OAR-2019-0055-1163
American Fuel & Petrochemical Manufacturers (AFPM)	EPA-HQ-OAR-2019-0055-1262
American Honda Motor Co., Inc. (Honda)	EPA-HQ-OAR-2019-0055-1348
American Lung Association et al.	EPA-HQ-OAR-2019-0055-1240
American Lung Association et al.	EPA-HQ-OAR-2019-0055-1271
American Petroleum Institute (API)	EPA-HQ-OAR-2019-0055-1171
American Reliance Industries Co. (ARI)	EPA-HQ-OAR-2019-0055-1182
American Soybean Association (ASA)	EPA-HQ-OAR-2019-0055-1309

Organization	EPA Docket Document Number
American Truck Dealers (ATD)	EPA-HQ-OAR-2019-0055-1321
American Trucking Associations (ATA)	EPA-HQ-OAR-2019-0055-1326
AMPLY Power et al.	EPA-HQ-OAR-2019-0055-1236
Amy Lane	EPA-HQ-OAR-2019-0055-1217
Anne Mellinger-Birdsong	EPA-HQ-OAR-2019-0055-1244
Anonymous Public Comment	EPA-HQ-OAR-2019-0055-1032
Anonymous Public Comment	EPA-HQ-OAR-2019-0055-1035
Anonymous Public Comment	EPA-HQ-OAR-2019-0055-1038
Anonymous Public Comment	EPA-HQ-OAR-2019-0055-1091
Anonymous Public Comment	EPA-HQ-OAR-2019-0055-1412
Arizona Public Health Association	EPA-HQ-OAR-2019-0055-2114
Arizona Trucking Association - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1156
Arizona Trucking Association - State Trucker Associations (2)	EPA-HQ-OAR-2019-0055-1157
Autocar, LLC (Autocar)	EPA-HQ-OAR-2019-0055-1292
B & H Tractor & Truck	EPA-HQ-OAR-2019-0055-1751
Bar B Que Specialties, Inc.	EPA-HQ-OAR-2019-0055-2260
BBU Environmental Services	EPA-HQ-OAR-2019-0055-1020
BBU Environmental Services	EPA-HQ-OAR-2019-0055-1587
BorgWarner	EPA-HQ-OAR-2019-0055-1234
Brian Lopez	EPA-HQ-OAR-2019-0055-1040
Brooke S.	EPA-HQ-OAR-2019-0055-1033
BYD Motors, LLC (BYD)	EPA-HQ-OAR-2019-0055-1207
California Air Pollution Control Officers Association (CAPCOA)	EPA-HQ-OAR-2019-0055-1253
California Air Resources Board (CARB)	EPA-HQ-OAR-2019-0055-1186
California Association of Sanitation Agencies (CASA)	EPA-HQ-OAR-2019-0055-1301
California Trucking Association - State Trucker Associations (2)	EPA-HQ-OAR-2019-0055-1092
CALSTART	EPA-HQ-OAR-2019-0055-1313
Cameron Prescott	EPA-HQ-OAR-2019-0055-1058
Capital Area Council of Governments (CAPCOG) and Central Texas Clean Air Coalition (CAV)	EPA-HQ-OAR-2019-0055-1274
Carreras Tours, LLC (2032)	EPA-HQ-OAR-2019-0055-2032
Carreras Tours, LLC (2033)	EPA-HQ-OAR-2019-0055-2033
Center for Climate and Energy Solutions (C2ES)	EPA-HQ-OAR-2019-0055-1165
Center for Community Action and Environmental Justice (CCAEJ)	EPA-HQ-OAR-2019-0055-1258
Ceres BICEP (Business for Innovative Climate and Energy Policy) Network	EPA-HQ-OAR-2019-0055-2714
Champion Auto Carriers	EPA-HQ-OAR-2019-0055-2733
ChargePoint, Inc. (ChargePoint)	EPA-HQ-OAR-2019-0055-1294
Charter Township of Redford	EPA-HQ-OAR-2019-0055-1099
Chesapeake Bay Foundation, Inc. (CBF)	EPA-HQ-OAR-2019-0055-1295
Christopher Lish	EPA-HQ-OAR-2019-0055-1147

Organization	**EPA Docket Document Number**
City Council District 8, Pittsburgh, PA, Erika Strassburger	EPA-HQ-OAR-2019-0055-2233
City of Seattle, Office of Sustainability & Environment	EPA-HQ-OAR-2019-0055-1287
Clay Miller	EPA-HQ-OAR-2019-0055-1539
Clean Air Board of Central Pennsylvania	EPA-HQ-OAR-2019-0055-1305
Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club	EPA-HQ-OAR-2019-0055-1302
Clean Energy (CE)	EPA-HQ-OAR-2019-0055-1350
Clean Energy Ventures et al.	EPA-HQ-OAR-2019-0055-2339
Clean Fuels Alliance America (Clean Fuels)	EPA-HQ-OAR-2019-0055-1248
Clean Harbors Environmental Services	EPA-HQ-OAR-2019-0055-1063
CleanAirNow (CANKC)	EPA-HQ-OAR-2019-0055-1239
CleanEarth4Kids	EPA-HQ-OAR-2019-0055-1208
ClearFlame Engine Technologies (ClearFlame)	EPA-HQ-OAR-2019-0055-1261
ClearFlame Engine Technologies (ClearFlame), Remora, and SixWheel	EPA-HQ-OAR-2019-0055-1329
Climate 911	EPA-HQ-OAR-2019-0055-1578
Coach USA, Inc. (Coach USA)	EPA-HQ-OAR-2019-0055-1307
Coalition for Clean Air	EPA-HQ-OAR-2019-0055-1139
Coalition for Renewable Natural Gas (RNG Coalition)	EPA-HQ-OAR-2019-0055-1204
Coingecko Company Sa	EPA-HQ-OAR-2019-0055-1847
Colorado Energy Office, et al.	EPA-HQ-OAR-2019-0055-1297
Columbia River Plumbing	EPA-HQ-OAR-2019-0055-1014
Compass Coach Inc.	EPA-HQ-OAR-2019-0055-2120
Connecticut Department of Energy and Environmental Protection (CTDEEP)	EPA-HQ-OAR-2019-0055-1306
Consumer Energy Alliance (CEA)	EPA-HQ-OAR-2019-0055-1260
Consumer Reports (CR)	EPA-HQ-OAR-2019-0055-1285
Creation Justice Ministries	EPA-HQ-OAR-2019-0055-2482
CSM Trucking	EPA-HQ-OAR-2019-0055-2131
Cummins Inc. (Cummins)	EPA-HQ-OAR-2019-0055-1325
Daimler Truck North America LLC (DTNA) (1045 and 1168)	EPA-HQ-OAR-2019-0055-1045
Daimler Truck North America LLC (DTNA) (1045 and 1168)	EPA-HQ-OAR-2019-0055-1168
Dave Arndt	EPA-HQ-OAR-2019-0055-994
Dave Luedtke	EPA-HQ-OAR-2019-0055-1541
David Pedersen	EPA-HQ-OAR-2019-0055-1059
David Wong	EPA-HQ-OAR-2019-0055-1097
Deere & Company	EPA-HQ-OAR-2019-0055-2743
Delaware Department of Natural Resources and Environmental Control (DNREC)	EPA-HQ-OAR-2019-0055-1200
Delta Car Care LLC	EPA-HQ-OAR-2019-0055-2256
Department of Navy, Department of Defense (DoD)	EPA-HQ-OAR-2019-0055-1222
Diehl and Sons, Inc - Engine and Truck Organizations	EPA-HQ-OAR-2019-0055-1235

Organization	EPA Docket Document Number
Diesel Technology Forum	EPA-HQ-OAR-2019-0055-1004
Dipert Travel & Transportation, Ltd. - Motorcoach Companies	EPA-HQ-OAR-2019-0055-1170
District of Columbia Department of Energy and the Environment (DOEE)	EPA-HQ-OAR-2019-0055-1299
Eaton Vehicle Group (Eaton)	EPA-HQ-OAR-2019-0055-1252
Edison Electric Institute (EEI)	EPA-HQ-OAR-2019-0055-1282
Edwin J. Ward	EPA-HQ-OAR-2019-0055-1050
Elders Climate Action	EPA-HQ-OAR-2019-0055-1218
Energy Innovation, LLC	EPA-HQ-OAR-2019-0055-1310
Environmental Community Advocates of Galena Park	EPA-HQ-OAR-2019-0055-2825
Environmental Defense Fund (EDF) (1265 and 2855)	EPA-HQ-OAR-2019-0055-1265
Environmental Defense Fund (EDF) (1265 and 2855)	EPA-HQ-OAR-2019-0055-2855
Environmental Protection Network (EPN)	EPA-HQ-OAR-2019-0055-1233
Evangelical Environmental Network (EEN)	EPA-HQ-OAR-2019-0055-993
Evangelical Environmental Network (EEN)	EPA-HQ-OAR-2019-0055-1134
Evergreen Action	EPA-HQ-OAR-2019-0055-1289
Evolving Electric Motor Company	EPA-HQ-OAR-2019-0055-2488
Ezra Rumbold Trucking	EPA-HQ-OAR-2019-0055-1013
Faessler Farms LTD	EPA-HQ-OAR-2019-0055-2247
Farmington Road Wrecker Services	EPA-HQ-OAR-2019-0055-2264
FitzGerald Brothers Bus Co.	EPA-HQ-OAR-2019-0055-1149
Florida Council of Churches	EPA-HQ-OAR-2019-0055-1006
Florida Rock & Tank Lines, Inc. - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1161
Florida Trucking Association - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1085
Flower Shoppe & Gifts	EPA-HQ-OAR-2019-0055-2267
Ford Motor Company (Ford)	EPA-HQ-OAR-2019-0055-1300
Foxy Travel, Inc. dba FTI Coach	EPA-HQ-OAR-2019-0055-2060
Fuel Cell and Hydrogen Energy Association (FCHEA)	EPA-HQ-OAR-2019-0055-1187
Gardener Manjikian Consulting LLC	EPA-HQ-OAR-2019-0055-2599
Gary Frederick	EPA-HQ-OAR-2019-0055-1393
General Motors LLC (GM)	EPA-HQ-OAR-2019-0055-1246
George Agortsas	EPA-HQ-OAR-2019-0055-1023
Georgia Motor Trucking Association (GMTA)	EPA-HQ-OAR-2019-0055-1341
Georgia Motor Trucking Association (GMTA)	EPA-HQ-OAR-2019-0055-1342
Great Rivers Environmental Law Center and Dutchtown South Community Corporation (DSCC)	EPA-HQ-OAR-2019-0055-1323
Greg Pagliuzza	EPA-HQ-OAR-2019-0055-1215
Hawaii Transportation Association - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1075
Holiday Companies, Inc. - Motorcoach Companies	EPA-HQ-OAR-2019-0055-1135
Holiday Companies, Inc. - Motorcoach Companies	EPA-HQ-OAR-2019-0055-1199
Holiday Tours, Inc. - Motorcoach Companies	EPA-HQ-OAR-2019-0055-1150

Organization	EPA Docket Document Number
Hyliion, Inc.	EPA-HQ-OAR-2019-0055-1238
Idaho Trucking Association - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1087
Idaho Trucking Association - State Trucker Associations (2)	EPA-HQ-OAR-2019-0055-1101
Illinois Trucking Association - State Trucker Associations (2)	EPA-HQ-OAR-2019-0055-1133
Indiana Motor Truck Association (IMTA) - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1095
Ingevity Corporation (Ingevity)	EPA-HQ-OAR-2019-0055-1213
Institute for Policy Integrity at New York University School of Law (Policy Integrity)	EPA-HQ-OAR-2019-0055-1256
International Council on Clean Transportation (ICCT)	EPA-HQ-OAR-2019-0055-1211
International Union, United Automobile, Aerospace & International Union, United Automobile, Aerospace & Agricultural Implement Workers of America - UAW Region 1A	EPA-HQ-OAR-2019-0055-1062
International Union, United Automobile, Aerospace and Agricultural Implement Workers of America (UAW)	EPA-HQ-OAR-2019-0055-1138
Iowa Motor Truck Association - State Trucker Associations (2)	EPA-HQ-OAR-2019-0055-1089
J&M Tank Lines, Inc. - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1181
Jack Schneeman	EPA-HQ-OAR-2019-0055-1053
Jared Kurland	EPA-HQ-OAR-2019-0055-1388
Jessica Stevens	EPA-HQ-OAR-2019-0055-1028
K&M Outdoor, LLC	EPA-HQ-OAR-2019-0055-1008
Kali Bach	EPA-HQ-OAR-2019-0055-1390
Kennesaw Transportation Inc. - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1185
Kenny Sites	EPA-HQ-OAR-2019-0055-1495
King County, Washington County Executive	EPA-HQ-OAR-2019-0055-1188
Labor Network for Sustainability (LNS)	EPA-HQ-OAR-2019-0055-1257
Lake Michigan Air Directors Consortium (LADCO)	EPA-HQ-OAR-2019-0055-1034
Lawson Construction Group	EPA-HQ-OAR-2019-0055-1007
Lion Electric Co. USA Inc. (Lion)	EPA-HQ-OAR-2019-0055-1151
Lischkge Motors, Inc. - Engine and Truck Organizations	EPA-HQ-OAR-2019-0055-1419
Loren Marz	EPA-HQ-OAR-2019-0055-1394
Louisiana Monuments and Signs	EPA-HQ-OAR-2019-0055-1015
Lubrizol Corporation (Lubrizol)	EPA-HQ-OAR-2019-0055-1304
Lydia Heye	EPA-HQ-OAR-2019-0055-1397
Machinery Northwest Co.	EPA-HQ-OAR-2019-0055-1713
Maine Department of Environmental Protection (Department)	EPA-HQ-OAR-2019-0055-1288
Maine Motor Transport Association - State Trucker Associations (2)	EPA-HQ-OAR-2019-0055-1060
Manufacturers of Emission Controls Association (MECA)	EPA-HQ-OAR-2019-0055-1320
Marathon Cheese Transport	EPA-HQ-OAR-2019-0055-2516
Mar-Jac Transportation, LLC - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1174
Maryland Motor Truck Association - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1086
Maryland Motor Truck Association - State Trucker Associations (2)	EPA-HQ-OAR-2019-0055-1044
Mayer Automotive LLC	EPA-HQ-OAR-2019-0055-1018

Organization	EPA Docket Document Number
Mayor, City of Albuquerque, NM et al.	EPA-HQ-OAR-2019-0055-1316
Metropolitan Washington Air Quality Committee (MWAQC) et al.	EPA-HQ-OAR-2019-0055-996
Michigan Association of Timbermen	EPA-HQ-OAR-2019-0055-1169
Mid-America Regional Council (MARC) Air Quality Forum	EPA-HQ-OAR-2019-0055-1131
Midwest Bus & Motorcoach Association (MBMCA) - Motorcoach Companies	EPA-HQ-OAR-2019-0055-1158
Midwest Ozone Group (MOG)	EPA-HQ-OAR-2019-0055-1272
Minnesota Pollution Control Agency (MPCA)	EPA-HQ-OAR-2019-0055-1041
Minnesota Trucking Association (MTA) - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1167
Mississippi Trucking Association - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1128
Missouri Trucking Association - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1107
Motor & Equipment Manufacturers Association (MEMA)	EPA-HQ-OAR-2019-0055-1322
Motor Transport Association of Connecticut (MTAC) - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1088
Motorcycle Industry Council (MIC)	EPA-HQ-OAR-2019-0055-1212
Moving Forward Network (MFN)	EPA-HQ-OAR-2019-0055-1277
National Association of Chemical Distributors (NACD)	EPA-HQ-OAR-2019-0055-1279
National Association of Clean Air Agencies (NACAA)	EPA-HQ-OAR-2019-0055-1232
National Association of Clean Water Agencies (NACWA)	EPA-HQ-OAR-2019-0055-1343
National Association of Small Trucking Companies (NASTC)	EPA-HQ-OAR-2019-0055-1130
National Center for Health Research (NCHR)	EPA-HQ-OAR-2019-0055-1227
National Coalition for Advanced Transportation (NCAT)	EPA-HQ-OAR-2019-0055-1290
National Parks Conservation Association (NPCA)	EPA-HQ-OAR-2019-0055-1314
National Propane Gas Association (NPGA) and Propane Education & Research Council (PERC)	EPA-HQ-OAR-2019-0055-1263
National Religious Partnership for the Environment	EPA-HQ-OAR-2019-0055-1221
National Tribal Air Association (NTAA)	EPA-HQ-OAR-2019-0055-1382
National Tribal Air Association (NTAA)	EPA-HQ-OAR-2019-0055-2625
National Waste & Recycling Association (NWRA)	EPA-HQ-OAR-2019-0055-1242
Natural Gas Vehicles for America (NGVAmerica)	EPA-HQ-OAR-2019-0055-1330
Navistar, Inc. (Navistar)	EPA-HQ-OAR-2019-0055-1318
NC Chamber	EPA-HQ-OAR-2019-0055-1434
Neste US, Inc	EPA-HQ-OAR-2019-0055-1225
Nevada Trucking Association - State Trucker Associations (2)	EPA-HQ-OAR-2019-0055-1155
New Flyer of America Inc. (New Flyer) and Motor Coach Industries, Ltd. (MCI)	EPA-HQ-OAR-2019-0055-1064
New Jersey Motor Truck Association - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1104
New Jersey Motor Truck Association - State Trucker Associations (2)	EPA-HQ-OAR-2019-0055-1112
New Jersey Warehouse & Movers Association - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1110
New Jersey Warehouse & Movers Association - State Trucker Associations (2)	EPA-HQ-OAR-2019-0055-1111
New York Farm Bureau (NYFB)	EPA-HQ-OAR-2019-0055-1268

Organization	**EPA Docket Document Number**
Next Level Farmer, LLC	EPA-HQ-OAR-2019-0055-2785
North Carolina Assembly House of Representatives, John Faircloth	EPA-HQ-OAR-2019-0055-2446
North Carolina Federation of Republican Women	EPA-HQ-OAR-2019-0055-2450
North Carolina General Assembly, Philip E. Berger	EPA-HQ-OAR-2019-0055-1105
North Carolina House of Representatives, Office of the Speaker, Tim Moore	EPA-HQ-OAR-2019-0055-1146
North Carolina State House of Representatives, Larry W. Potts	EPA-HQ-OAR-2019-0055-1061
North Carolina Trucking Association	EPA-HQ-OAR-2019-0055-2888
North Central Texas Council of Governments (NCTCOG)	EPA-HQ-OAR-2019-0055-1254
Northeast States for Coordinated Air Use Management (NESCAUM)	EPA-HQ-OAR-2019-0055-1249
Northview Service Center	EPA-HQ-OAR-2019-0055-1016
NTEA - The Association for the Work Truck Industry	EPA-HQ-OAR-2019-0055-1164
NTH Equipment	EPA-HQ-OAR-2019-0055-1144
Nuss Truck & Equipment - Engine and Truck Organizations	EPA-HQ-OAR-2019-0055-1177
NW Navigator	EPA-HQ-OAR-2019-0055-2789
NW Navigator Luxury Coaches	EPA-HQ-OAR-2019-0055-1098
Odyne Systems, LLC (Odyne)	EPA-HQ-OAR-2019-0055-1264
Oklahoma Trucking Association - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1093
Old River Companies, Inc. - Engine and Truck Organizations	EPA-HQ-OAR-2019-0055-1420
Oshkosh Corporation	EPA-HQ-OAR-2019-0055-1226
Our Children's Trust	EPA-HQ-OAR-2019-0055-1317
Outdoor Power Equipment Institute (OPEI)	EPA-HQ-OAR-2019-0055-1205
Owner-Operator Independent Drivers Association (OOIDA)[75]	EPA-HQ-OAR-2019-0055-1266
Ozone Transport Commission (OTC) and Mid-Atlantic/Northeast Visibility Union (MANE-VU)	EPA-HQ-OAR-2019-0055-1250
PACCAR, Inc (PACCAR)	EPA-HQ-OAR-2019-0055-1346
Pennsylvania Chamber of Business and Industry	EPA-HQ-OAR-2019-0055-1319
Pennsylvania Motor Truck Association - State Trucker Associations (2)	EPA-HQ-OAR-2019-0055-1202
Pennsylvania Motor Truck Association (PMTA) - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1094
Peoria Charter Coach Company - Motorcoach Companies	EPA-HQ-OAR-2019-0055-1241
Performance Truck	EPA-HQ-OAR-2019-0055-1009
Pinnacle Converting Equipment & Services, LLC	EPA-HQ-OAR-2019-0055-1011
Port of Seattle, Port of Tacoma, and Northwest Seaport Alliance (NWSA)	EPA-HQ-OAR-2019-0055-1312
Proterra	EPA-HQ-OAR-2019-0055-1344
Public Citizen and Healthy Port Communities Coalition (HPCC)	EPA-HQ-OAR-2019-0055-1417
Randolph M. Lyon	EPA-HQ-OAR-2019-0055-1100
Red Fox Resources	EPA-HQ-OAR-2019-0055-1209
Repair Association/Repair.org	EPA-HQ-OAR-2019-0055-1036

[75] OOIDA provided individual comments from some of their members; these are included in the Response to Commend Document under the name of the commenter but with the OOIDA docket document number reference.

Organization	**EPA Docket Document Number**
Retail Industry Leaders Association (RILA)	EPA-HQ-OAR-2019-0055-1189
Rhode Island Trucking Association, Inc. - State Trucker Associations (2)	EPA-HQ-OAR-2019-0055-2051
Richard Leeds	EPA-HQ-OAR-2019-0055-1333
Rivian Automotive, LLC (Rivian)	EPA-HQ-OAR-2019-0055-1229
Rocknaks Hardware Plus	EPA-HQ-OAR-2019-0055-1019
Roush CleanTech (Roush)	EPA-HQ-OAR-2019-0055-1276
Royal Plastics, Inc.	EPA-HQ-OAR-2019-0055-1017
RV Industry Association (RVIA)	EPA-HQ-OAR-2019-0055-1270
S&P Global Mobility	EPA-HQ-OAR-2019-0055-1273
Saahil Pasha	EPA-HQ-OAR-2019-0055-1206
Sage Lincoln	EPA-HQ-OAR-2019-0055-1073
San Joaquin Valley Air Pollution Control District (District)	EPA-HQ-OAR-2019-0055-1291
Scruggs Company	EPA-HQ-OAR-2019-0055-2800
SEAM Group	EPA-HQ-OAR-2019-0055-2574
Sexton Farms LLC - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1178
Sierra Club, NJ Chapter	EPA-HQ-OAR-2019-0055-2558
Six Point Transport Incorporated	EPA-HQ-OAR-2019-0055-2591
Sophia Dowd	EPA-HQ-OAR-2019-0055-1043
South Carolina Trucking Association, Inc. - State Trucker Associations (2)	EPA-HQ-OAR-2019-0055-2854
South Coast Air Quality Management District	EPA-HQ-OAR-2019-0055-1201
Southern Environmental Law Center (SELC)	EPA-HQ-OAR-2019-0055-1247
State Soybean Associations	EPA-HQ-OAR-2019-0055-2035
States of California, et al. (The States)	EPA-HQ-OAR-2019-0055-1255
Stephen Jackson	EPA-HQ-OAR-2019-0055-1481
Straights Lawn & Garden	EPA-HQ-OAR-2019-0055-1723
Sustainable Solar Systems	EPA-HQ-OAR-2019-0055-2737
Taxpayers Protection Alliance (TPA)	EPA-HQ-OAR-2019-0055-1102
Tenneco	EPA-HQ-OAR-2019-0055-1284
Tesla, Inc. (Tesla)	EPA-HQ-OAR-2019-0055-1219
Todd Snyder	EPA-HQ-OAR-2019-0055-1391
Toyota Motor North America, Inc. (Toyota)	EPA-HQ-OAR-2019-0055-1224
Transteck, Inc. - Engine and Truck Organizations	EPA-HQ-OAR-2019-0055-1179
Tri-County Truck Center - Engine and Truck Organizations	EPA-HQ-OAR-2019-0055-2847
Truck & Equipment Corp. - Engine and Truck Organizations	EPA-HQ-OAR-2019-0055-2853
Truck and Engine Manufacturers Association (EMA)	EPA-HQ-OAR-2019-0055-1203
Truck Renting and Leasing Association (TRALA)	EPA-HQ-OAR-2019-0055-1180
Truck Trailers Manufacturers Association (TTMA)	EPA-HQ-OAR-2019-0055-1024
Trucking Association of New York (TANY) - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1183
Trucking Association of New York (TANY) - State Trucker Associations (2)	EPA-HQ-OAR-2019-0055-1184

Organization	EPA Docket Document Number
Truckload Carriers Association (TCA)	EPA-HQ-OAR-2019-0055-1160
U.S. Chamber of Commerce	EPA-HQ-OAR-2019-0055-1245
United Methodist Church - General Board of Church and Society	EPA-HQ-OAR-2019-0055-1042
United Motorcoach Association (UMA)	EPA-HQ-OAR-2019-0055-1311
University of California, Berkeley, The Goldman School, Center for Environmental Policy	EPA-HQ-OAR-2019-0055-1327
Ute Mountain Ute Tribe Environmental Programs Department	EPA-HQ-OAR-2019-0055-1259
Valeria Trujillo	EPA-HQ-OAR-2019-0055-1223
Valero Energy Corporation	EPA-HQ-OAR-2019-0055-1328
Vandalia Bus Lines, Inc.	EPA-HQ-OAR-2019-0055-2811
Vandalia Bus Lines, Inc.	EPA-HQ-OAR-2019-0055-1267
Vandalia Bus Lines, Inc.	EPA-HQ-OAR-2019-0055-1269
Vandalia Bus Lines, Inc. - Motorcoach Companies	EPA-HQ-OAR-2019-0055-1109
Various Academic Researchers	EPA-HQ-OAR-2019-0055-1220
Victoria D'Amico	EPA-HQ-OAR-2019-0055-1214
Virginia Motorcoach Association (VMA) - Motorcoach Companies	EPA-HQ-OAR-2019-0055-2715
Virginia Trucking Association - State Trucker Associations (1)	EPA-HQ-OAR-2019-0055-1106
Virginia Trucking Association - State Trucker Associations (2)	EPA-HQ-OAR-2019-0055-1071
Voigt Motorcoach Travel, Inc. - Motorcoach Companies	EPA-HQ-OAR-2019-0055-1198
Volkswagen Group of America, Inc., (Volkswagen) (VWGoA)	EPA-HQ-OAR-2019-0055-1296
Volvo Group	EPA-HQ-OAR-2019-0055-1324
Walmart	EPA-HQ-OAR-2019-0055-1191
Wayne Aarum	EPA-HQ-OAR-2019-0055-1405
WE ACT for Environmental Justice	EPA-HQ-OAR-2019-0055-1347
Western States Air Resources Council (WESTAR)	EPA-HQ-OAR-2019-0055-1230
Western Transport Logistics Inc.	EPA-HQ-OAR-2019-0055-2236
Westport Fuels Systems (WFS)	EPA-HQ-OAR-2019-0055-1278
White Pine Construction Corporation	EPA-HQ-OAR-2019-0055-1012
William F. Limpert	EPA-HQ-OAR-2019-0055-1190
Wisconsin Department of Natural Resources (WDNR)	EPA-HQ-OAR-2019-0055-1162
Wisconsin Motor Carriers Association - State Trucker Associations (2)	EPA-HQ-OAR-2019-0055-1048
World Resources Institute (WRI)	EPA-HQ-OAR-2019-0055-1298
Worldwide Equipment Enterprises, Inc.	EPA-HQ-OAR-2019-0055-1275
Wyoming Trucking Association, Inc. - State Trucker Associations (2)	EPA-HQ-OAR-2019-0055-1039
Yellowstone Integrated Architecture and Construction	EPA-HQ-OAR-2019-0055-2816
Zero Emission Transportation Association (ZETA)	EPA-HQ-OAR-2019-0055-1283

List of Mass Mailer Comments

Organization	EPA Docket Document Number
Mass Comment Campaign sponsored by American Lung Association (248)	EPA-HQ-OAR-2019-0055-1609
Mass Comment Campaign sponsored by Climate Action Campaign (15,000)	EPA-HQ-OAR-2019-0055-1612
Mass Comment Campaign sponsored by Climate Action Campaign (28)	EPA-HQ-OAR-2019-0055-1617
Mass Comment Campaign sponsored by Climate Action Campaign (7,549)	EPA-HQ-OAR-2019-0055-1615
Mass Comment Campaign sponsored by Climate Action Campaign (82)	EPA-HQ-OAR-2019-0055-1193
Mass Comment Campaign sponsored by Consumer Reports (CR) (17,499)	EPA-HQ-OAR-2019-0055-1613
Mass Comment Campaign sponsored by Environment America (11,390)	EPA-HQ-OAR-2019-0055-1611
Mass Comment Campaign sponsored by Evangelical Environmental Network (EEN) (67,755)	EPA-HQ-OAR-2019-0055-1610
Mass Comment Campaign sponsored by Moms Clean Air Force and Arizona Climate Action Coalition (198)	EPA-HQ-OAR-2019-0055-1192
Mass Comment Campaign sponsored by National Religious Partnership for the Environment (4,677)	EPA-HQ-OAR-2019-0055-1122
Mass Comment Campaign sponsored by Natural Resources Defense Council (28,240)	EPA-HQ-OAR-2019-0055-1614
Mass Comment Campaign sponsored by Neighbors for Clean Air and Elders Climate Action (43)	EPA-HQ-OAR-2019-0055-1619
Mass Comment Campaign sponsored by PennEnvironment (50)	EPA-HQ-OAR-2019-0055-1616
Mass Comment Campaign sponsored by Public Citizen (168)	EPA-HQ-OAR-2019-0055-1597
Mass Comment Campaign sponsored by Sierra Club (11,740)	EPA-HQ-OAR-2019-0055-1620
Mass Comment Campaign sponsored by The Climate Reality Project (10,820)	EPA-HQ-OAR-2019-0055-1083
Mass Comment Campaign sponsored by The Outreach Team (95)	EPA-HQ-OAR-2019-0055-1618
Mass Comment Campaign sponsored by Union of Concerned Scientists - 1 (13,985)	EPA-HQ-OAR-2019-0055-1194
Mass Comment Campaign sponsored by Union of Concerned Scientists - 2 (959)	EPA-HQ-OAR-2019-0055-1608
Mass Comment Campaign sponsoring organization unknown - 1 (2,443)	EPA-HQ-OAR-2019-0055-1594
Mass Comment Campaign sponsoring organization unknown - 2 (984)	EPA-HQ-OAR-2019-0055-1596
Mass Comment Campaign sponsoring organization unknown - 3 (605)	EPA-HQ-OAR-2019-0055-1606
Mass Comment Campaign sponsoring organization unknown - 4 (20)	EPA-HQ-OAR-2019-0055-1607
Mass Comment Campaign sponsoring organization unknown (1,027)	EPA-HQ-OAR-2019-0055-1598
Mass Comment Campaign sponsoring organization unknown (1,087)	EPA-HQ-OAR-2019-0055-1602
Mass Comment Campaign sponsoring organization unknown (1,357)	EPA-HQ-OAR-2019-0055-1603
Mass Comment Campaign sponsoring organization unknown (165)	EPA-HQ-OAR-2019-0055-1599
Mass Comment Campaign sponsoring organization unknown (2,804)	EPA-HQ-OAR-2019-0055-1605
Mass Comment Campaign sponsoring organization unknown (396)	EPA-HQ-OAR-2019-0055-1601
Mass Comment Campaign sponsoring organization unknown (4,668)	EPA-HQ-OAR-2019-0055-1604
Mass Comment Campaign sponsoring organization unknown (5,967)	EPA-HQ-OAR-2019-0055-1593
Mass Comment Campaign sponsoring organization unknown (52,051)	EPA-HQ-OAR-2019-0055-1600
Mass Comment Campaign sponsoring organization unknown (40)	EPA-HQ-OAR-2019-0055-1595

List of Late Comments

Organization	EPA Docket Document Number
LATE COMMENT California Air Resources Board (CARB)	EPA-HQ-OAR-2019-0055-2857
LATE COMMENT Truck & Engine Manufacturers Association (EMA)	EPA-HQ-OAR-2019-0055-2858
LATE COMMENT Sherrod Brown, et al., United States Senate	EPA-HQ-OAR-2019-0055-2958
LATE COMMENT ChargeEVC-NJ	EPA-HQ-OAR-2019-0055-1418
LATE COMMENT Truck & Engine Manufacturers Association (EMA)	EPA-HQ-OAR-2019-0055-2869
LATE COMMENT Martin L Dutcher	EPA-HQ-OAR-2019-0055-2870
LATE COMMENT Tracey Gold	EPA-HQ-OAR-2019-0055-2871
LATE COMMENT Catherine Horine	EPA-HQ-OAR-2019-0055-2872
LATE COMMENT Laura Urbasczewski	EPA-HQ-OAR-2019-0055-2873
LATE COMMENT Jan Hughes	EPA-HQ-OAR-2019-0055-2874
LATE COMMENT Jennifery Ryan	EPA-HQ-OAR-2019-0055-2875
LATE COMMENT Mass Comment Campaign Sponsor Unknown (96)	EPA-HQ-OAR-2019-0055-2876
LATE COMMENT Mass Comment Campaign Sponsor Unknown (157)	EPA-HQ-OAR-2019-0055-2877
LATE COMMENT Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club	EPA-HQ-OAR-2019-0055-2878
LATE COMMENT Alliance of Nurses for Healthy Environment et al.	EPA-HQ-OAR-2019-0055-2879
LATE COMMENT Clean Air for the Long Haul	EPA-HQ-OAR-2019-0055-2889
LATE COMMENT Nanette Diaz Barragan, et al., Members of Congress	EPA-HQ-OAR-2019-0055-2886

Description of Industry-Related Letter Campaigns

When reviewing the written comments posted to the docket for this proposal, we identified four industry-related letter campaigns that were not treated like mass comment campaigns by the EPA Docket Center:

- State Trucker Association 1
- State Trucker Association 2
- Engine and Truck Organizations
- Motorcoach Companies

To avoid repeating the same text up to 24 times in the same Response to Comment Section, we include it only once, with the Docket Number for the reference comment. In those cases where an individual comment provided additional information, the additional information is also included in relevant section with the docket ID number for that comment. Note that many companies submitted both the State Trucker Assn. 1 and State Trucker Assn. 2 comments. Some submitted separate documents to the docket; others provided both comments under one document. As a result, the same Docket ID number may occur in both lists. The letter campaigns are set out in the following table.

Comment Campaign	Docket ID	Company	Addt'l Info Provided
State Trucker Assn 1 (24 comments)	1075	Hawaii Transportation Assn.; REFERENCE COMMENT	
	1085	Florida Trucking Assn.	
	1086	Maryland Motor Truck Assn.	
	1087	Idaho Trucking Assn.	
	1088	Motor Transport Assn of Connecticut	Yes
	1093	Oklahoma Trucking Assn.	
	1094	Pennsylvania Motor Truck Assn.	
	1095	Indiana Motor Truck Assn.	Yes
	1104	New Jersey Motor Truck Assn.	
	1106	Virginia Trucking Assn.	
	1107	Missouri Trucking Assn.	
	1110	New Jersey Warehouse & Movers Assn.	
	1128	Mississippi Trucking Assn.	
	1132	Alabama Trucking Assn.	
	1156	Arizona Trucking Assn.	
	1161	Florida Rock & Tank Lines Inc.	
	1167	Minnesota Trucking Assn.	
	1174	Mar-Jac Transportation LLC	
	1178	Sexton	
	1181	J&M Tank Lines	Yes

Comment Campaign	Docket ID	Company	Addt'l Info Provided
	1183	Trucking Assn of New York	
	1185	Kennesaw Transportation Inc.	Yes
	1342	Georgia Motor Trucking	
	1092	California Trucking Assn.	
State Trucker Assn 2 (24 comments)	1039	Wyoming Trucking Assn.; REFERENCE COMMENT	
	1044	Maryland Motor Truck Assn.	
	1048	Wisconsin Motor Carriers Assn.	
	1060	Maine Motor Transport Association	
	1071	Virginia Trucking Assn.	
	1085	Florida Trucking Assn.	
	1089	Iowa Motor Truck Assn.	Yes
	1092	California Trucking Assn.	Yes
	1101	Idaho Trucking Assn.	
	1107	Missouri Trucking Assn.	
	1111	New Jersey Warehouse & Movers Assn.	
	1112	New Jersey Motor Truck Assn.	
	2888	North Carolina Trucking Association	
	1128	Mississippi Trucking Assn.	
	1132	Alabama Trucking Assn.	
	1133	Illinois Trucking Assn.	
	1155	Nevada Trucking Assn.	
	1157	Arizona Trucking Assn.	
	1174	Mar-Jac Transportation LLC	
	1178	Sexton	
	1184	Trucking Assn of New York	
	1202	Pennsylvania Motor Truck Assn.	Yes
	2854	South Carolina Trucking Assn.	
	1341	Georgia Motor Trucking	
	2051	Rhode Island Trucking Assn.	
Engine and Truck Organizations (8 comments)	1177	Nuss Truck & Equipment; REFERENCE COMMENT	
	1179	Transtek, Inc. (2 letters, Larry Hufford and Kenton Good)	Yes
	1235	Diehl & Sons, Inc.	Yes
	1419	Lischkge Motors, Inc.	
	1420	Old River Companies, Inc.	
	2847	Tri-County Truck Center	
	2853	Truck & Equipment Corp.	
	1135	Holiday Companies, Inc.	

Comment Campaign	Docket ID	Company	Addt'l Info Provided
Letter Campaign: Motorcoach Companies (12 comments)	1149	FitzGerald Brothers Bus Co.; REFERENCE COMMENT	
	1150	Holiday Tours, Inc	
	1170	Dan Dipert Coaches	
	1198	Voigt Motorcoach Travel, Inc.	Yes
	1199	Holiday Companies, Inc.	Yes
	1241	Peoria Charter Coach Company	Yes
	1267	Vandalia	Yes
	1269	Vandalia	
	2715	Virginia Motorcoach Assn.	Yes

Appendix 2: Other Comments Received, Not Reproduced Verbatim in Text

This appendix contains a list of comments that are general in nature and do not require detailed EPA response, and/or contain opinions or statements about issues without detailed information or reasonable specificity.

<u>Summary of Comments</u>

We characterize the nature of these comments by classifying the statements along seven dimensions based on whether one or more of the topics were mentioned (one statement may reflect several dimensions):

- Generally support
- Program not stringent enough
- Program too stringent
- Human Health and Welfare (including air quality, benefits)
- Environmental Justice
- Costs
- Owner/operator concerns

About 21% of these commenters were supportive of the proposed program; 59% said they would like EPA to adopt more stringent standards. Only 20% of these commenters expressed opposition to the proposal.
Of the commenters that were supportive, about 27% mentioned an aspect of the health and environmental impacts of emissions, and about 12% mentioned an aspect of environmental justice.
Of the commenters that requested EPA do more to control emissions from these sources, about 27% mentioned an aspect of the health and environmental impacts of emissions, and about 32% mentioned an aspect of environmental justice.
Of the commenters that said program is too stringent, 49% mentioned an aspect of owner/operator concerns and 42% mentioned an aspect of costs. In addition, of the commenters that cited owner/operator concerns, 57% mentioned an aspect of costs.
Finally, about 100 comments did not comment on any of the 7 topics. The statements made in these comments are outside the scope of this final rule; for example, they request EPA to regulate other sources than what is covered within the scope of this rulemaking (e.g., locomotives, stationary sources) or they provided opinions on the workings of EPA or the federal government generally on topics also outside the scope of this rulemaking.

<u>EPA Response</u>

See responses in Section 1 of this document.

List of Comments Not Reproduced Verbatim in the Response to Comments Document

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3	Abbey Conley	EPA-HQ-OAR-2019-0055-2722
4	Adam Burnett	EPA-HQ-OAR-2019-0055-2475
5	Adam Carter	EPA-HQ-OAR-2019-0055-1484
6	Adina Parsley	EPA-HQ-OAR-2019-0055-1125
7	Adrea Marilllero-Colomina	EPA-HQ-OAR-2019-0055-1436
8	Adrina Keller	EPA-HQ-OAR-2019-0055-2216
9	Agnes Puzak	EPA-HQ-OAR-2019-0055-1881
10	Ainslie Noble	EPA-HQ-OAR-2019-0055-1074
11	Al Neils	EPA-HQ-OAR-2019-0055-2061
12	Alan Carriere	EPA-HQ-OAR-2019-0055-2240
13	Alayna Nowak	EPA-HQ-OAR-2019-0055-1119
14	Albert Cheu	EPA-HQ-OAR-2019-0055-1872
15	Alex Razkowic	EPA-HQ-OAR-2019-0055-1822
16	Alexa Ross	EPA-HQ-OAR-2019-0055-1630
17	Alexa Ross	EPA-HQ-OAR-2019-0055-2462
18	Alexa Ross	EPA-HQ-OAR-2019-0055-2463
19	Alexandra Star Weckerly	EPA-HQ-OAR-2019-0055-2360
20	Alexanne Stone	EPA-HQ-OAR-2019-0055-2248
21	Alexis Toone	EPA-HQ-OAR-2019-0055-2608
22	Alice Madden	EPA-HQ-OAR-2019-0055-2219
23	Alice Nguyen	EPA-HQ-OAR-2019-0055-2074
24	Alice Nguyen	EPA-HQ-OAR-2019-0055-2330
25	Allan Cain	EPA-HQ-OAR-2019-0055-1554
26	Allan Williams	EPA-HQ-OAR-2019-0055-2022
27	Allen Braumiller	EPA-HQ-OAR-2019-0055-1446
28	Alston Anthis	EPA-HQ-OAR-2019-0055-2723
29	Amanda Blackburn	EPA-HQ-OAR-2019-0055-1820
30	Amanda Nichols	EPA-HQ-OAR-2019-0055-2724
31	Amy Hartsough	EPA-HQ-OAR-2019-0055-1711
32	Amy Henry	EPA-HQ-OAR-2019-0055-1797
33	Amy Lewark	EPA-HQ-OAR-2019-0055-1701
34	Amyana Trigg	EPA-HQ-OAR-2019-0055-2300
35	Andrea Thompson	EPA-HQ-OAR-2019-0055-2441
36	Andrew Bird	EPA-HQ-OAR-2019-0055-2690
37	Andrew McIver	EPA-HQ-OAR-2019-0055-1485
38	Andrew Millard	EPA-HQ-OAR-2019-0055-2689
39	Andrew Smith	EPA-HQ-OAR-2019-0055-2726
40	Andrew Walter	EPA-HQ-OAR-2019-0055-2170

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42	Angela Githens	EPA-HQ-OAR-2019-0055-2615
43	Angeline Fountadakis	EPA-HQ-OAR-2019-0055-1366
44	Angus Alberson	EPA-HQ-OAR-2019-0055-1452
45	Anisha Richardson	EPA-HQ-OAR-2019-0055-1957
46	Anita Dygert-Gearheart	EPA-HQ-OAR-2019-0055-1708
47	Ann Berry	EPA-HQ-OAR-2019-0055-2111
48	Ann Eachus	EPA-HQ-OAR-2019-0055-1656
49	Ann Littlewood	EPA-HQ-OAR-2019-0055-1747
50	Anna Larsson	EPA-HQ-OAR-2019-0055-2321
51	Anne Crowell	EPA-HQ-OAR-2019-0055-2688
52	Anne Whitefield	EPA-HQ-OAR-2019-0055-2687
53	Anonymous / Robert M Hughes	EPA-HQ-OAR-2019-0055-1588
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157	Anonymous public comment	EPA-HQ-OAR-2019-0055-1948
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164	Anonymous public comment	EPA-HQ-OAR-2019-0055-2001
165	Anonymous public comment	EPA-HQ-OAR-2019-0055-2017
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248	Ashley Orlet	EPA-HQ-OAR-2019-0055-2206
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250	Audrey Lima	EPA-HQ-OAR-2019-0055-1702
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252	Ayann Kadir	EPA-HQ-OAR-2019-0055-2818
253	Azusena Guerra	EPA-HQ-OAR-2019-0055-2224
254	B Pepowski	EPA-HQ-OAR-2019-0055-1695
255	Balmore A. Ramos	EPA-HQ-OAR-2019-0055-1103
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257	Barbara Mcnagny	EPA-HQ-OAR-2019-0055-2442
258	Barry Fass-Holmes	EPA-HQ-OAR-2019-0055-2370
259	Barry Peterson	EPA-HQ-OAR-2019-0055-2044
260	Bas Assaf	EPA-HQ-OAR-2019-0055-2570
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263	Ben Porter	EPA-HQ-OAR-2019-0055-2476
264	Ben Van Maren	EPA-HQ-OAR-2019-0055-2189
265	Benjamin Scott	EPA-HQ-OAR-2019-0055-2728
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272	Beverly Richards-Smith	EPA-HQ-OAR-2019-0055-1937
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274	Bill Blaquiere	EPA-HQ-OAR-2019-0055-1468
275	Blanche Scharf	EPA-HQ-OAR-2019-0055-2000
276	Bob Gruntmeir	EPA-HQ-OAR-2019-0055-1905
277	Bob Johnson	EPA-HQ-OAR-2019-0055-1835
278	Bob Seymour	EPA-HQ-OAR-2019-0055-1466
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285	Brad Coburn	EPA-HQ-OAR-2019-0055-1537
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288	Brenda Frey	EPA-HQ-OAR-2019-0055-2372
289	Brenda Montgomery	EPA-HQ-OAR-2019-0055-1917
290	Brent Hodson	EPA-HQ-OAR-2019-0055-2257
291	Brett Moore	EPA-HQ-OAR-2019-0055-2287
292	Brian Carey	EPA-HQ-OAR-2019-0055-1832
293	Brian Edler	EPA-HQ-OAR-2019-0055-2277
294	Brooke Pierce	EPA-HQ-OAR-2019-0055-1921
295	Bruce Plenk	EPA-HQ-OAR-2019-0055-2703
296	Bryan Bomberg	EPA-HQ-OAR-2019-0055-2682
297	Buck Schall	EPA-HQ-OAR-2019-0055-2369
298	Burt Feuerstein	EPA-HQ-OAR-2019-0055-2143
299	Burton Callicott	EPA-HQ-OAR-2019-0055-2096
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301	Caephren McKenna	EPA-HQ-OAR-2019-0055-1941
302	Caephren McKenna	EPA-HQ-OAR-2019-0055-2319
303	Caere Dunn	EPA-HQ-OAR-2019-0055-2710
304	Cale Ledford	EPA-HQ-OAR-2019-0055-2730
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309	Carl Hollis	EPA-HQ-OAR-2019-0055-2177
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311	Carl Ross	EPA-HQ-OAR-2019-0055-1958
312	Carl Wyant	EPA-HQ-OAR-2019-0055-0989
313	Carl Yarbro	EPA-HQ-OAR-2019-0055-1946
314	Carla Epstein-Teliha	EPA-HQ-OAR-2019-0055-1952
315	Carly Tanner	EPA-HQ-OAR-2019-0055-2077
316	Carol Hautau	EPA-HQ-OAR-2019-0055-1654
317	Carol Kiparsky	EPA-HQ-OAR-2019-0055-2395
318	Carol Lubkowski	EPA-HQ-OAR-2019-0055-2384
319	Carol Mead	EPA-HQ-OAR-2019-0055-2295
320	Carol Nelson	EPA-HQ-OAR-2019-0055-1801

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323	Caroline Francescutti	EPA-HQ-OAR-2019-0055-2348
324	Caroline Nyzgu	EPA-HQ-OAR-2019-0055-2211
325	Carolyn Ferdinand	EPA-HQ-OAR-2019-0055-1942
326	Carolyn Riggs	EPA-HQ-OAR-2019-0055-1930
327	Carrol Palmer	EPA-HQ-OAR-2019-0055-1498
328	Cassandra Carmichael	EPA-HQ-OAR-2019-0055-2435
329	Catherine Carter	EPA-HQ-OAR-2019-0055-2681
330	Catherine Kappel	EPA-HQ-OAR-2019-0055-2680
331	Catherine Nelson	EPA-HQ-OAR-2019-0055-2638
332	Catherine Siegl	EPA-HQ-OAR-2019-0055-2460
333	Cathy Penman	EPA-HQ-OAR-2019-0055-2009
334	Cathy Wootan	EPA-HQ-OAR-2019-0055-2820
335	Chad Anderson	EPA-HQ-OAR-2019-0055-1927
336	Charles Baldwin	EPA-HQ-OAR-2019-0055-2263
337	Charles Gilbert	EPA-HQ-OAR-2019-0055-2323
338	Charles Kaiser	EPA-HQ-OAR-2019-0055-1547
339	Charles Oliver	EPA-HQ-OAR-2019-0055-1954
340	Charles Powell	EPA-HQ-OAR-2019-0055-1715
341	Charles W Graham	EPA-HQ-OAR-2019-0055-1449
342	Chase Jubak	EPA-HQ-OAR-2019-0055-2269
343	Chelsea Faith	EPA-HQ-OAR-2019-0055-2582
344	Chelsea Hutton	EPA-HQ-OAR-2019-0055-2630
345	Cheryl Marcum	EPA-HQ-OAR-2019-0055-2425
346	Chhaya Youc	EPA-HQ-OAR-2019-0055-2583
347	Chloe McCabe	EPA-HQ-OAR-2019-0055-2542
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349	Chris Berg	EPA-HQ-OAR-2019-0055-2383
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352	Chris Thomas	EPA-HQ-OAR-2019-0055-2250
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358	Christopher Hannon	EPA-HQ-OAR-2019-0055-2679
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706	John Bailey	EPA-HQ-OAR-2019-0055-1196
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1050	Nancy Garret	EPA-HQ-OAR-2019-0055-1360
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1053	Nancy Pierpont	EPA-HQ-OAR-2019-0055-2455
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1059	Natalie Houghton	EPA-HQ-OAR-2019-0055-2629
1060	Natasha Smith Antenor	EPA-HQ-OAR-2019-0055-1029
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1384	Thomas Burtnett	EPA-HQ-OAR-2019-0055-1357
1385	Thomas DeWeerd	EPA-HQ-OAR-2019-0055-1967
1386	Thomas Eager	EPA-HQ-OAR-2019-0055-2568
1387	Thomas Hannan	EPA-HQ-OAR-2019-0055-2550
1388	Thomas Ohns	EPA-HQ-OAR-2019-0055-2146
1389	Thomas Owens	EPA-HQ-OAR-2019-0055-1114
1390	Thomas Radcliff	EPA-HQ-OAR-2019-0055-2809
1391	Thomas Remmel	EPA-HQ-OAR-2019-0055-1829
1392	Thomas Remmel	EPA-HQ-OAR-2019-0055-2195
1393	Thomas Remmey	EPA-HQ-OAR-2019-0055-1142
1394	Tiffany Howard	EPA-HQ-OAR-2019-0055-2545
1395	Tim Wright	EPA-HQ-OAR-2019-0055-2575
1396	Timothy Determan	EPA-HQ-OAR-2019-0055-1687
1397	Timothy Hahner	EPA-HQ-OAR-2019-0055-2168
1398	Timothy Jones	EPA-HQ-OAR-2019-0055-2845
1399	Tina Krauz	EPA-HQ-OAR-2019-0055-1932
1400	Tina Wilkinson	EPA-HQ-OAR-2019-0055-2552

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1401	Todd Feitl	EPA-HQ-OAR-2019-0055-2203
1402	Todd Jackson	EPA-HQ-OAR-2019-0055-1916
1403	Todd Snyder (not duplicate)	EPA-HQ-OAR-2019-0055-1559
1404	Tom Bennett	EPA-HQ-OAR-2019-0055-1482
1405	Tom Johnston	EPA-HQ-OAR-2019-0055-1673
1406	Tom Johnston	EPA-HQ-OAR-2019-0055-2102
1407	Tom S	EPA-HQ-OAR-2019-0055-1642
1408	Tom Sheafer	EPA-HQ-OAR-2019-0055-2209
1409	Tom Slater	EPA-HQ-OAR-2019-0055-2810
1410	Tony Clark	EPA-HQ-OAR-2019-0055-1469
1411	Tony Greiner	EPA-HQ-OAR-2019-0055-2548
1412	Tracey Katsouros	EPA-HQ-OAR-2019-0055-1790
1413	Tracey Katsouros	EPA-HQ-OAR-2019-0055-2431
1414	Tracy Musgrove	EPA-HQ-OAR-2019-0055-1027
1415	Tracy Pilson	EPA-HQ-OAR-2019-0055-2050
1416	Tracy Pilson	EPA-HQ-OAR-2019-0055-2846
1417	Tracy Wang	EPA-HQ-OAR-2019-0055-1195
1418	Tria Shaffer	EPA-HQ-OAR-2019-0055-2379
1419	Tristan Gonzalez	EPA-HQ-OAR-2019-0055-2598
1420	Troy French	EPA-HQ-OAR-2019-0055-2534
1421	TS CNC Works	EPA-HQ-OAR-2019-0055-1584
1422	Tyrus Sayeh	EPA-HQ-OAR-2019-0055-2543
1423	Ulysses Lateiner	EPA-HQ-OAR-2019-0055-2393
1424	Val Farrelly	EPA-HQ-OAR-2019-0055-2313
1425	Valerie Carrick	EPA-HQ-OAR-2019-0055-2546
1426	Valerie Lizárraga	EPA-HQ-OAR-2019-0055-2417
1427	Valley Paving	EPA-HQ-OAR-2019-0055-1497
1428	Victor von Salza	EPA-HQ-OAR-2019-0055-2544
1429	Victoria Hager	EPA-HQ-OAR-2019-0055-1707
1430	Victoria Partida	EPA-HQ-OAR-2019-0055-1005
1431	Victoria Usher	EPA-HQ-OAR-2019-0055-1576
1432	Vinay Nanani	EPA-HQ-OAR-2019-0055-2613
1433	Vince Menichino	EPA-HQ-OAR-2019-0055-2848
1434	Virginia Sivigny	EPA-HQ-OAR-2019-0055-1979
1435	Virginia Spencer	EPA-HQ-OAR-2019-0055-1810
1436	Vivian Christensen	EPA-HQ-OAR-2019-0055-1331
1437	Vladimir Sushko	EPA-HQ-OAR-2019-0055-1931
1438	W. E. Miller	EPA-HQ-OAR-2019-0055-1892
1439	Wa Yang	EPA-HQ-OAR-2019-0055-2812
1440	Wade Electric Company	EPA-HQ-OAR-2019-0055-1480

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1441	Wade Evans	EPA-HQ-OAR-2019-0055-2594
1442	Wallace Elton	EPA-HQ-OAR-2019-0055-1935
1443	Wallace Elton	EPA-HQ-OAR-2019-0055-1947
1444	Warren Gold	EPA-HQ-OAR-2019-0055-2813
1445	Warren Stewart	EPA-HQ-OAR-2019-0055-2528
1446	Wendy Rudder	EPA-HQ-OAR-2019-0055-2390
1447	Wendy Smith	EPA-HQ-OAR-2019-0055-1429
1448	Wesley Wharton	EPA-HQ-OAR-2019-0055-2849
1449	White's Construction Co., Inc.	EPA-HQ-OAR-2019-0055-1580
1450	Will Willis	EPA-HQ-OAR-2019-0055-2850
1451	William Drew	EPA-HQ-OAR-2019-0055-1589
1452	William Flegenheimer	EPA-HQ-OAR-2019-0055-2367
1453	William Gies	EPA-HQ-OAR-2019-0055-1731
1454	William Gies	EPA-HQ-OAR-2019-0055-2694
1455	William Hollingshead	EPA-HQ-OAR-2019-0055-2366
1456	William Kawecki	EPA-HQ-OAR-2019-0055-2814
1457	William Martin	EPA-HQ-OAR-2019-0055-1700
1458	William Martin	EPA-HQ-OAR-2019-0055-1980
1459	William Pugh	EPA-HQ-OAR-2019-0055-2535
1460	William Smith	EPA-HQ-OAR-2019-0055-2603
1461	William Squires	EPA-HQ-OAR-2019-0055-2815
1462	William Tang	EPA-HQ-OAR-2019-0055-2179
1463	Winnie Tat	EPA-HQ-OAR-2019-0055-2580
1464	Woozalia Staddon	EPA-HQ-OAR-2019-0055-2013
1465	Yating Liou	EPA-HQ-OAR-2019-0055-2851
1466	Yolanda Stern Broad	EPA-HQ-OAR-2019-0055-2567
1467	Zachary Boyd	EPA-HQ-OAR-2019-0055-2536
1468	Zachary Sack	EPA-HQ-OAR-2019-0055-1475
1469	Zama Noyer	EPA-HQ-OAR-2019-0055-1631

Appendix 3: List of Testifiers at Public Hearings

This appendix contains a list of individuals who testified at a virtual public hearing on the proposal, which was held on April 12, 13, and 14, 2022.[76] A redacted version of the hearing transcript can be found in the docket for this rule (EPA-OAQ-HQ-2019-0055-2867).[77]
Over the 3 days of the hearings, 278 testifiers provided statements voicing their support for or concerns about the proposal:

Number of Testifiers Per Day

Hearing Day	**Number of Testifiers**
May 12, 2022	108
May 13, 2022	103
May 14, 2022	67
Total	**278**

Most of those who testified, 212 people, spoke on behalf of or identified as a member of a specific organization. The remaining testifiers, 66, spoke in their personal capacity. The organizations that were affiliated with the largest number of testifiers are as follows:

Number of Testifiers Affiliated with Selected Organizations

Organization	**Number of Testifiers**
Moms Clean Air Force, various chapters	31
Sierra Club (Various Chapters)	19
Chispa (League of Conservation Voters, various states)	10
American Lung Association	8
Alliance of Nurses for Healthy Environments (ANHE)	5
CleanAirNow	5

Most of the hearing testimony is general in nature and does not require detailed EPA response, and/or contain opinions or statements about issues without detailed information or reasonable specificity. Those hearing statements that are more specific in nature and are not included written comments submitted by the testifier or the testifier's organization are included verbatim in this document.

<u>Summary of Testimony</u>

[76] The third day was added to accommodate the large number of people who requested to be able to testify, and the comment period for the rule was extended to accommodate that extra day of testimony.
[77] The transcript was redacted to remove potential Personally Identifiable Information (PII) pertaining to third parties.

We characterize the nature of the testimony by classifying the statements along seven dimensions based on whether one or more of the topics were mentioned (one statement may reflect several dimensions):

- Generally support
- Program not stringent enough
- Program too stringent
- Human Health and Welfare (including air quality, benefits)
- Environmental Justice
- Costs
- Owner/operator concerns

The vast majority of individuals, 87% testified on two or three topics, typically an aspect of human health and welfare (90%), Environmental Justice (50%), and/or or the program doesn't go far enough to reduce emissions (74%)
The breakdown of topic raised by the testifiers is as follows:

Number of Testifiers by General Topic

Topic	**Number of Testifiers**
Human Health and Welfare (including air quality, benefits)	249
Environmental Justice	138
Costs	35
Owner/operator concerns	10
Generally support	48
Program not stringent enough	207
Program too stringent	9

Many of those who stated that the program is not stringent enough also mentioned aspects of the impact of emissions on human health and welfare (197) and environmental justice (111). Similarly, many of those who expressed general support for the program also mentioned aspects of the effects of emissions on human health and welfare (39) and environmental justice (22). The 9 testifiers who said the program is too stringent mentioned owner/operator concerns (4) and/or costs (5).

EPA Response

See responses in Section 1 of this document.

List of Testifiers

Day	Docket Number	Page Numbers	Testifier Name	Affiliation
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	246-248	Ada Stepleton	Moms Clean Air Force, various chapters
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	289-291	Alex Schay	Northwest Alliance for Clean Transportation
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	301-304	Alison Jaslow	National Parks Conservation Association
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	293-297	Allen Schaeffer	Diesel Technology Forum
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	75-77	Almeta Cooper	Moms Clean Air Force, various chapters
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	107-109	Ana Rios	Moms Clean Air Force, various chapters
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	271-273	Andrea Vidaurre	People's Collective for Environmental Justice
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	277-280	Anjuli Ramos	Sierra Club (Various Chapters)
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	215-218	Ann Mellinger-Birdsong	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	206-207	Avery Lamb	Creation Justice Ministries
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	307-310	Beatriz Soto	Conservation Colorado
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	338--341	Bob Yuhnke	Elders Climate Action
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	170-174	Brian Urbaszewski	Respiratory Health Association
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	59-62	Britt Carmon	NRDC

Day	Docket Number	Page Numbers	Testifier Name	Affiliation
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	88-90	Brooke Petry	Moms Clean Air Force, various chapters
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	71-73	Bryan Burton	American Lung Association
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	51-53	Carolina Pena-Alarcon	Environmental Defense Fund
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	291-293	Carolyn Keiser	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	62-64	Celerah Hewes	Moms Clean Air Force, various chapters
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	111-115	Daniel Gage	NGVAmerica
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	182-186	Danny Schnautz	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	347-350	David Arndt	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	151-154	Dian Van Vleet	American Lung Association
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	64-68	Don Ross	National Waste and Recycling Association
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	162-165	Dr. Dave Cooke	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	78-90	Elizabeth Bechard	Moms Clean Air Force, various chapters
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	115-118	Elizabeth Brandt	Moms Clean Air Force, various chapters
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	103-106	Elizabeth Hauptman	Moms Clean Air Force, various chapters

Day	Docket Number	Page Numbers	Testifier Name	Affiliation
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	251-254	Emily Kent	Clean Air Task Force
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	35-38	Erik White	National Association of Clean Air Agencies
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	325-326	Faraz Rizvi	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	316-318	Gary Ewart	American Thoracic Society
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	364-365	Gloria Guardado	Chispa (League of Conservation Voters, various states)
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	94-96	Hazel Chandler	Moms Clean Air Force, various chapters
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	262-265	Janet McGarry	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	221-222	Jason O'Dell (Elliot)	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	84-87	Jed Mandel	Truck and Engine Manufacturers Association
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	193-196	Jenna Riemenschneider	Asthma and Allergy Foundation of America
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	81-84	Jill Aquino	Alliance of Nurses for Healthy Environments (ANHE)
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	39-41	Jimmy O'Dea	CALSTART
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	266-267	Joel Schroeder	Evangelical Environmental Network
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	129-131	Jonathan Walker	

Day	Docket Number	Page Numbers	Testifier Name	Affiliation
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	154-157	Josh Nassar	International Union, United Automobile Aerospace and Agricultural Implement Workers of America
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	259-261	Karen Campbell	Sierra Club (Various Chapters)
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	249-251	Karen Heuer	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	189-191	Karl Aldinger	Sierra Club (Various Chapters)
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	42-45	Katherine Garcia	Sierra Club (Various Chapters)
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	354-357	Kathryn Dorn	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	24-29	Kelly Crawford	District of Columbia Department of Energy & Environment
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	366-369	Kenneth Hammond	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	48-51	Kevin Brown	Manufacturers of Emission Controls Association
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	310-313	Kidest Gebre	Virginia Interfaith Power & Light (VAIPL)
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	229-231	Kim Anderson	Evangelical Environmental Network
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	176-179	Kim Gaddy	South Ward Environmental Alliance
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	54-57	Laura Bender	American Lung Association
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	186-188	Laura Haider	Fresnans Against Fracking

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1	EPA-HQ-OAR-2019-0055-2867 attachment-1	321-324	Laurie Anderson	Moms Clean Air Force, various chapters
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	342-344	Leigh Kauffman	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	360-362	Leslie Wharton	Elders Climate Action
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	298-301	Levi Kamolnick	Ceres
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	165-168	Lewie Pugh	Owner Operator Independent Drivers Association
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	193-196	Liane Randolph	California Air Resources Board
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	304-306	Lionel Mares	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	223-225	Louise Mehler	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	351-353	Maggie Segal	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	212-215	Manijeh Berenji	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	319-321	Margarita Parra	Clean Energy Works
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	135-137	Marguerite Pennoyer	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	344-347	Mark Rose	National Parks Conservation Association
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	140-143	Mary Greene	Consumer Reports

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1	EPA-HQ-OAR-2019-0055-2867 attachment-1	255-258	Michael Walsh	Environmental Protection Network
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	99-102	Molly Rauch	Moms Clean Air Force, various chapters
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	273-276	Nadine Young	Elders Climate Action
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	335-338	Nick Torres	American Lung Association
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	208-211	Nicole Marcot	Moms Clean Air Force, various chapters
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	326-328	Oscar Hauptman	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	29-31	Patrice Tomcik	Moms Clean Air Force, various chapters
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	277	Patricia Duncan	Citizens Climate Lobby
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	31-35	Paul Billings	American Lung Association
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	204-206	Pedro Hernandez	Central Valley Air Quality Coalition
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	138-140	Peggy Ann Berry	Alliance of Nurses for Healthy Environments (ANHE)
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	280-284	Perry Spring	City of Tacoma, Washington
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	313-316	Peter Bakken	Wisconsin Interfaith Power & Light
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	330-332	Phillip Streif	Vandalia Bus Lines

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1	EPA-HQ-OAR-2019-0055-2867 attachment-1	143-146	Quinta Warren	Consumer Reports
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	284-286	Rachel Cywinski	United Women in Faith
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	45-48	Rasto Brezny	Manufacturers of Emission Controls Association
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	357-360	Ray Minjares	International Council on Clean Transportation
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	236-238	Ray Pringle	Sierra Club (Various Chapters)
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	188-189	Rebecca O'Brien	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	226-228	Rene St. Julien	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	158-161	Reverend Mitchell Hescox	Evangelical Environmental Network
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	127-129	Reverend Richard Killmer	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	132-134	Rich Kassel	ClearFlame Engine Technologies
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	239-240 244-246	Sandra Purohit	Environmental Entrepreneurs (E2)
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	109-111	Sarah McBride	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	200-203	Sasan Saadat	Earthjustice
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	267-270	Scott Fenwick	Clean Fuels Alliance America

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1	EPA-HQ-OAR-2019-0055-2867 attachment-1	232-236	Sean Waters	Daimler Trucks North America
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	97-99	Shaina Oliver	Moms Clean Air Force, various chapters
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	179-180	Steven Sondheim	Sierra Club (Various Chapters)
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	218-220	Susan Pate	
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	121-126	Susie Robertson	Moms Clean Air Force, various chapters
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	68-71	Tiffany Werner	Environmental Law & Policy Center
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	91-93	Timothy Cronin	Health Care Without Harm
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	118-119	Valencia & Natalia Bednar	Moms Clean Air Force, various chapters
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	146-149	Wayne Nastri	South Coast Air Quality Management District
1	EPA-HQ-OAR-2019-0055-2867 attachment-1	174-176	William Beckett	Harvard Medical School
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	108-111	Adrian Shelley	
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	191-192	Alex Stavis	
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	325-327	Alexandra Tellez	
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	295-297	Amy Rogghe	

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2	EPA-HQ-OAR-2019-0055-2867 attachment-2	268-270	Ana Ramos	CleanAirNow
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	142-145	Anastasia Gordon	WE ACT for Environmental Justice
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	30-33	Andrea Marpillero-Colomina	GreenLatinos
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	242-245	Andy Su	Environmental Defense Fund
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	69-70	Ann Brown	Tri-Valley Air Quality Community Alliance
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	263-266	Atenas Mena	CleanAirNow
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	291-294	Avi Mersky	ACEEE
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	117-120	Ben Grumbles	Maryland Department of the Environment
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	63-65	Beth Jacobs	
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	272-274	Beto Lugo Martinez	CleanAirNow
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	337-339	Blanca Abarca	Chispa (League of Conservation Voters, various states)
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	216-221	Brandon Buchanan	American Bus Association
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	92-94	Brian Russo	
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	340-341	Candido Ramirez	Chispa (League of Conservation Voters, various states)

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2	EPA-HQ-OAR-2019-0055-2867 attachment-2	161-163	Cara Cook	
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	333-336	Carolina Chacon	
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	44-48	Cassandra Carmichael	National Religious Partnership for the Environment
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	301-303	Columba Sainz	Moms Clean Air Force, various chapters
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	103-106	Cynthia Rives	United Women in Faith
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	228-232	Dan Byers	U.S. Chamber of Commerce
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	42-43	Daniel Swartz	National Religious Partnership for the Environment
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	120-124	Darby Osnaya	Sierra Club (Various Chapters)
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	82-85	Debra Rowe	U.S. Partnership for Education for Sustainable Development
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	327-332	Doug O'Malley	Environment New Jersey
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	266-268	Elise Gard	CleanAirNow
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	209-212	Elizabeth Chun Hye	United Women in Faith
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	354-355	Elsa O'Malley	
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	222-226	Erandi Trevino	Moms Clean Air Force, various chapters

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2	EPA-HQ-OAR-2019-0055-2867 attachment-2	195-198	Eric Feeley	Oregon Department of Environmental Quality
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	279-281	Eric Sippert	Environmental Law & Policy Center
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	204-206	Eric Willadsen	Sierra Club (Various Chapters)
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	106-107	Erica Dodt	Sierra Club (Various Chapters)
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	353-354	Frank Beltran	Chispa (League of Conservation Voters, various states)
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	22-25	Gail Good	WI DNR
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	101-103	Gregg May	1000 Friends of Wisconsin
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	193-194	Griselda Sutton	
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	180-182	Heidi Leathwood	350 Colorado
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	342-344	Huda Alkaff	Wisconsin Green Muslims
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	287-289	Jacob Jones	NRDC
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	239-242	Jacqueline Gelb	Navistar
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	176-177	Jasmin Martinez	Central Valley Air Quality Coalition
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	270-272	Jayla Atkinson	CleanAirNow

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2	EPA-HQ-OAR-2019-0055-2867 attachment-2	317-320	Jennifer Cantley	Moms Clean Air Force, various chapters
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	46-48	Jessica Moerman	Evangelical Environmental Network
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	38-40	Jodie Teuton	American Truck Dealers
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	349-352	Joey Cantley-Saba	Moms Clean Air Force, various chapters
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	284-287	Johana Vicente	Chispa (League of Conservation Voters, various states)
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	303-308	John Sonin	
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	87-90	Jorge Vasquez	NRDC
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	74-76	Joseph Hoydilla	Sierra Club (Various Chapters)
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	153-155	Kabyn Vikesland	
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	76-78	Karen McElfish	United Women in Faith
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	141-142	Kathryn Westman	
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	85-87	Kaye Romans	NRDC
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	78-80	Kevin Goscila	Sierra Club (Various Chapters)
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	167-170	Kindra Weid	MI Air MI Health

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2	EPA-HQ-OAR-2019-0055-2867 attachment-2	173-174	Kristin Ziv	Moms Clean Air Force, various chapters
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	212-216	Larry Fromm	Achates Power
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	149-152	LaVaida Owens-White	Alliance of Nurses for Healthy Environments (ANHE)
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	177-179	Lily Zwaan	Moms Clean Air Force, various chapters
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	18-21	Liz Scott	American Lung Association
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	34-36	Lucia Valentine	Moms Clean Air Force, various chapters
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	156-158	Madison Lisle	
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	27-30	Maggie Stritz Calnin	Michigan Clean Cities Coalition and Southwest Detroit Environmental Vision
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	96-98	Margarita Chaidez	Chispa (League of Conservation Voters, various states)
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	183-185	Maria Reyes	Chispa (League of Conservation Voters, various states)
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	170-173	Mariela Ruacho	American Lung Association
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	257-260	Marla DiBenedetto	Sierra Club (Various Chapters)
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	253-256	Matthew Duffy	Ford Motor Company
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	70-73	Max Kiefer	

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2	EPA-HQ-OAR-2019-0055-2867 attachment-2	247-250	Maxine Lobel	Elders Climate Action
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	315-317	Mayela Bustos	Moms Clean Air Force, various chapters
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	60-62	Meredith Haines	
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	226-227	Michael A. McClain	National Baptist Convention USA
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	282-283	Michelle Freeman	Chispa (League of Conservation Voters, various states)
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	186-190	Michelle Uberuaga	Moms Clean Air Force, various chapters
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	132-135	Milagros Elia	
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	275-279	Molly Greenberg	Moving Forward Network
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	57-59	Patrick Quinn	Advanced Engine Systems Institute
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	201-204	Paul Cort	Earthjustice
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	139-140	Phil Hernick	
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	135-138	Rachel Meyer	Moms Clean Air Force, various chapters
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	251-253	Ramona Blaber	Sierra Club (Various Chapters)
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	232-236	Randolph Lyon	Sierra Club (Various Chapters)

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2	EPA-HQ-OAR-2019-0055-2867 attachment-2	308-311	Riva Fralick	Citizens Climate Lobby
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	236-238	Robert Speiser	
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	49-52	Russell Meyer	Florida Council of Churches
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	164-167	Sam Wilson	Union of Concerned Scientists
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	90-92	Seana Parker-Dalton	
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	321-324	Shelly Francis	EVHybridNoire
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	99-101	Susan Stanton	League of Women Voters
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	346-348	Takayla Antonio	Moms Clean Air Force, various chapters
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	198-102	Tiffany Hartung	Interfaith Power & Light
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	356-358	Tim Gould	Sierra Club (Various Chapters)
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	113-116	Tom Jordan	San Joaquin Valley Air Pollution Control District
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	127-131	Tracy Sabetta	Moms Clean Air Force, various chapters
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	124-127	Vanessa Lynch	Moms Clean Air Force, various chapters
2	EPA-HQ-OAR-2019-0055-2867 attachment-2	297-301	Will Barrett	American Lung Association

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2	EPA-HQ-OAR-2019-0055-2867 attachment-2	52-55	Yasmine Agelidis	EarthJustice
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	89-93	Alana Langdon	Nikola Corporation
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	48-50	Alejandro Ramirez-Zarate	Chispa (League of Conservation Voters, various states)
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	22-25	Amy Goldsmith	Clean Water Action & Clean Water Fund
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	98-101	Anastasia Montgomery	Union of Concerned Scientists
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	20-22	Angelle Bradford	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	77-79	Ann Jaworski	Environmental Law & Policy Center
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	228-230	April Griffith	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	94-96	Ariel Bethune-Crawford	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	16-19	Athena Motavvef	Earthjustice
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	164-166	Barbara Bauer	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	203-206	Bill Mcnally	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	156-158	Brian Daugherty	Motor and Equipment Manufacturers Association
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	26-28	Brian Ditzler	

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3	EPA-HQ-OAR-2019-0055-2867 attachment-3	30-33	Caia Farrell	Moms Clean Air Force, various chapters
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	168-170	Catherine Horine	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	209-213	Cemelli De Aztlan	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	172-175	Claire Morgan	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	73-76	Coralie Cooper	NESCAUM
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	184-187	Darien Davis	Climate & Clean Energy
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	192-194	David Offen-Brown	Consumer Reports
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	57-60	Dawn Fenton	Volvo Group North America
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	45-47	Dj Portugal	Chispa (League of Conservation Voters, various states)
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	190-191	Douglas Gruenau	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	170-172	Eva Hernandez-Thomas	Respiratory Health Association
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	105-108	Evan Brockman	Georgia Clinicians for Climate Action
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	41-44	Ezra Finkin	Renewable Energy Group
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	200-203	Francisco Sayu	RENEW Wisconsin

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3	EPA-HQ-OAR-2019-0055-2867 attachment-3	133-135	Frank Copple	Arizona Climate Action Coalition
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	219-222	George Agortsas	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	101-103	Gerald Pyle	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	120-124	Glen Kedzie	American Trucking Associations
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	154-155	Gloria E. Barrera	IASN
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	81-84	Heidi Adelsman	Alliance of Nurses for Healthy Environments (ANHE)
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	63-66	James Edwards	National Assoc. of Small Trucking Companies
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	127-129	Jennifer Rennicks	World Resources Institute
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	52-55	Jerome Paulson	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	137-139	Jessica Mengistab	Alliance of Nurses for Healthy Environments (ANHE)
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	217-219	Jessie Parks	Sierra Club (Various Chapters)
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	139-142	Joan Schiller	Moms Clean Air Force, various chapters
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	206-209	Joseph Gillis	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	37-38	Linda Smithe	Sierra Club (Various Chapters)

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3	EPA-HQ-OAR-2019-0055-2867 attachment-3	34-37	Lucia Rodriguez	Hispanic Access Foundation
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	117-118	Lyman Welch	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	111-114	Marcela Pinilla	Zevin Asset Management
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	108-110	Marianne Comfort	Sisters of Mercy of the Americas Justice Team
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	66-69	Martin Haverly	Renewable Energy Group
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	114-117	Melina Kennedy	Cummins Inc.
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	151-153	Michael Sauber	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	222-225	Michelle Jorgensen	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	124-126	Mihai Dorobantu	Eaton Vehicle Group
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	130-133	Morgan Folger	Environment America
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	179-181	Nancy Dodge	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	230-234	Neil Carman	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	214-216	Odile Coirier	Interfaith Power & Light
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	50-52	Patricia Keefe	Franciscans of Rochester, MN

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3	EPA-HQ-OAR-2019-0055-2867 attachment-3	159-164	Rev. J.D. Gee Iii	Eifort Elixers
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	225-227	Robert Sausedo	Carreras Tours LLC
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	144-147	Ronn Kistler	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	39-41	Sarah Clark	Colorado Sierra Club
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	195-199	Stacie Slay	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	142-144	Stephen Wyman	Evolving Electric Motor Company
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	85-89	Syndi Smallwood	National Tribal Air Association
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	182-184	Taylor Thomas	East Yard Communities for Environmental Justice
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	175-178	Will Anderson	Sierra Club (Various Chapters)
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	235-237	William Cox	
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	70-73	Wyatt Robinson	United Methodist Church, General Board of Church and Society
3	EPA-HQ-OAR-2019-0055-2867 attachment-3	187-190	Yassi Kavezade	Sierra Club (Various Chapters)

Appendix 4: General Statements Excerpted from the Detailed Comments Included in the Document

EPA categorized the content of detailed written comment received on this rule by topic area and assembled them for response in the various sections of this Response to Comment Document. In addition to detailed comments on specific aspects of the proposed rule, many commenters also provided general statements that indicate their support for the proposal as written, support for the proposal while also stating that the proposal doesn't go far enough or general opposition to the proposal. Because these statements are general in nature, they were not assigned to specific sections of the document. Instead, these statements are summarized in Section 1; full excerpts are provided in this Appendix for completeness.

Comments by Organization

Organization: *350Marin*

President Biden promised actions to transform the U.S. into a zero-emission economy by 2050 But these EPA proposals do not require zero emission trucks and buses even though zero emission vehicles are available now. Zero-emission electric trucks are the best available technology to both reduce harmful NOx and climate pollution. [EPA-HQ-OAR-2019-0055-2474, p.1]

Therefore, we urge this administration to set the strongest standards possible because many lives, especially our children and those most vulnerable in our communities, depend on it. The EPA must put the country's medium- and heavy-duty fleets on a pathway to 100% zero-emission all electric vehicles by 2035. [EPA-HQ-OAR-2019-0055-2474, p.1]

Organization: *350 Colorado*

[*From Hearing Testimony, April 13, 2022, Heidi Leathwood*] I am here in support of rules for clean trucks and to urge even more protective rules to address climate change and right the environmental injustice wrongs of the past and present. The effects of climate change are not confined to the future. They are already here. The American West is in the worst drought for 1,200 years, and here in Colorado we are having year-round wildfires that are burning down homes and killing people. Denver has very bad air pollution, a D rating from the American Lung Association, and our ozone non-attainment rating is severe. Transportation is one of the top causes of this. Here is my specific ruling representing 350 Colorado. Greenhouse gas standards should be made more stringent in model years 2027 to 2029 and beyond. The goal is to get gas and diesel vehicles off the road as soon as possible, but in the meantime adopt the strongest technologies for reducing pollution from these vehicles and for state-of-the-art monitoring and communication about the pollution. EPA should adopt provisions as strong or stronger than California for all states. Natural gas should not be encouraged or incentivized as a fuel in any way. Fuel transmission and combustion emissions would be locked into the 30- to 40-year life of the vehicle. Zero-emission vehicle purchases should be the priority of the rule. Testing should be conducted not only for engines alone but with the whole vehicle in use, and testing standards for particulates should not be reduced. Particulate pollution is a serious health threat. Cost should not be considered higher than protection of health. We support longer emissions warranty periods, and we support the strongest possible rules to prevent tampering and to detect system failures, also to ensure adequate maintenance of the vehicles and to ensure engine rebuilding does not result in higher pollution. The IPCC continue to get more and more urgent. We need to reduce greenhouse gasses now. Since the new rules cannot take effect until model year 2027, they need to be even stronger. I am here to urge you to strengthen the rules and to complete rulemaking in 2022. This will have a positive effect, not only on pollution but on the development of clean transportation resources that our country and the world need in order to stay under 1.5-degree of global warming. [EPA-HQ-OAR-2019-0055-2867]

Organization: *Achates Power, Inc.*

Achates Power has good and growing evidence that the CARB 2027 ultra-low NOx regulation and the EPA 2027 GHG II regulation and the most stringent EPA NOx proposal can be met with substantial compliance margin and with only existing conventional aftertreatment systems making the solutions cost-effective and robust while utilizing existing manufacturing, servicing, and fueling infrastructure. [EPA-HQ-OAR-2019-0055-1216-A1, p. 4]

Transportation is vital to prosperity as it provides access to education, jobs, markets, health care, and recreation. Yet our current modes of transportation inflict a heavy price in poor air quality, environmental harm, and poor human health, particularly among the most impacted. We need to take every reasonable measure to reduce the harmful impact of our transportation industry so all can continue to benefit from what our society has to offer. [EPA-HQ-OAR-2019-0055-1216-A1, p. 4]

As a industry we can plan and hope that battery electric or fuel cell technologies provide reliable, environmentally friendly, and cost-effective transportation solutions. But we cannot wait and need not wait until these technologies are proven capable and are widely adopted to meaningfully reduce the harmful impacts of transportation. [EPA-HQ-OAR-2019-0055-1216-A1, p. 4]

Achates Power has strong and growing evidence that meeting our near-term environmental goals by substantially reducing both criteria and CO2 emissions from commercial vehicles can be done quickly without an increase in either the cost to purchase or use those vehicles, and with existing facilities and infrastructure for manufacturing, distributing, fueling, and servicing. The EPA's most stringent option can be met in a practical and cost-effective manner, and its adoption will spur technology innovation to improve air quality and human health in the near term, with benefits compounding even while complementary zero-emission solutions are brought to market over an unknown and unknowable timeframe. [EPA-HQ-OAR-2019-0055-1216-A1, p. 4]

Organization: *Adrian Shelley, Citizen.*

[*From Hearing Testimony, April 13, 2022*] So I am joining today to a strong rule that limits NOx pollution and other pollutants as well from the heavy truck industry. I want to just start by noting that truck traffic is typically concentrated in what we think of as environmental justice communities, low-income, communities of color, and the presence of traffic, particularly heavy truck traffic, is often the result of structural racism, redlining, you know, a history of geographic marginalization of communities of color. So those impacts are still felt today. In my own work I have seen this in communities like Pasadena, in the East Harris County area, Galena Park, La Porte, Morgan's Point, Channelview. These are communities that deal with this truck traffic every single day. NOx improvements are obviously overdue and the strongest NOx standard possible will provide the most health benefits. And a lot of those benefits will come from co-pollutants. You know, particularly diesel particulates and ultrafine particulates are probably understated in their health impacts. You know, those impacts begin in the womb, with everything from brain development in infants to low birth weights to exacerbation of diabetes, stroke, heart attack, and all the way up to premature death. So, you know, heavy truck pollution kills, and it kills in a way that impacts certain communities the most, due to a history of injustice and structural racism. So I think we need to keep that in mind. With that in mind, the health impacts from just heavy truck pollution alone in a major U.S. city is going to be in the hundreds of millions to billions of dollars. The calculated health impacts of this rule, I think if you are just looking at NOx, show that it is outpaces the cost by billions of dollars. I want to encourage investment in inherently zero-emission technologies, electric trucks. You know, the emissions requirements can be met by other technologies but there are other consequences, you know, natural gas, for example, fracking, and whatnot. You know, hydrogen and other technologies might potentially have other impacts. So inherently zero-emission technology is what we prefer, and, you know, there are concerns with control technologies as well. There has been a long history of defeat devices, workarounds for equipment, BPS, and that sort of thing, and from outright cheating from companies. So we want to discourage that and inherently zero-emission vehicles are another way to do that. So, in conclusion, I support the strongest rule possible, mindful of the inequitable health impacts of heavy truck pollution in communities today. I encourage a transition toward electric vehicles, a good investment in zero-emission technologies and equitable investment in electrification in communities, and a swift transition away from polluting heavy trucks. [EPA-HQ-OAR-2019-0055-2867]

Organization: Advanced Engine Systems Institute (AESI)

AESI members are committed to the following principles, which should underlie EPA's final rule regulating NOx and GHG emissions from Heavy Duty vehicles and engines.

- ASEI members support the goals of clean mobility and reduced NOx and GHG emissions that lead to the decarbonization of the transportation sector and clean air. [EPA-HQ-OAR-2019-0055-1281-A1, p. 1]
- AESI supports technology neutral standards which are performance based and cost efficient. [EPA-HQ-OAR-2019-0055-1281-A1, p. 1]
- One set of National Standards for NOx is critical from the market perspective of suppliers. EPA has an opportunity to ensure a single harmonized national HD NOx standard by finalizing Option 1. A failure of EPA to align standards with the California Omnibus will result in a patchwork of state standards. This would create unacceptable market uncertainties; stifle innovation; and cause disruptions in freight with significant economic impacts. [EPA-HQ-OAR-2019-0055-1281-A1, p. 1]
- Long term regulatory certainty is essential for suppliers to make critical investment choices regarding advanced technology, product development and production. Regulatory

certainty stimulates investment and job creation. [EPA-HQ-OAR-2019-0055-1281-A1, p. 1]

- These regulations should drive simultaneous NOx and GHG reduction. Peer reviewed published data cited here (below) and elsewhere demonstrate multiple technology pathways are available to achieve simultaneous NOx and CO2 reductions from ICE-based powertrains. [EPA-HQ-OAR-2019-0055-1281-A1, p. 1]

AESI strongly supports EPA's proposed Option I to regulate NOx emissions and believe that it closely aligns with the California Omnibus Rule. Recently published data [Matheaus, A., Neely, G., Sharp, C., Hopkins, J. et al., "Fast Diesel Aftertreatment Heat-up Using CDA and an Electrical Heater," SAE Technical Paper 2021-01-0211, 2021, https://doi.org/10.4271/2021-01-0211] suggest that the stringent standards proposed in Option I can be achieved with a significant margin for compliance. These data should be considered by EPA in shaping the Final rule, which critically does not take effect for another 5 years during which further innovation will occur. Option II is a completely unacceptable outcome for AESI members. [EPA-HQ-OAR-2019-0055-1281-A1, pp. 1 - 2]

There are more data, including the comprehensive technology demonstration program at Southwest Research Institute (SWRI), underlying this rule than any in EPA's mobile source history; all of these data support Option I. [EPA-HQ-OAR-2019-0055-1281-A1, p. 2]

NOx emissions are a critical urban public health issue, which disproportionately effect frontline communities. Data cited here in the Eaton/SWRI manuscript and data generated by other suppliers, demonstrate that the Option 1 NOx standards can be achieved with a substantial compliance margin at a reasonable cost while simultaneously reducing CO2 emission from medium and heavy duty vehicles. The diesel trucks that are sold going forward should be as clean and fuel efficient as possible. This rule offers EPA perhaps the final opportunity to ensure that goal is achieved. [EPA-HQ-OAR-2019-0055-1281-A1, p. 2]

Organization: *Agricultural Retailers Association (ARA) (1251 and 1421)*

ARA supports practical, technologically feasible, and cost-effective efforts to promote newer technologies that will reduce emissions in heavy-duty trucks and other motor vehicles with the goal of cleaner air and healthier communities. However, the EPA's current proposals are not practical or cost-effective and not technologically feasible in the near term. These new EPA standards are being proposed at a time the United States continues to face record inflation and cost increases on new and used vehicles as well as every other essential consumer good. This proposal will lead to users keeping and maintaining older vehicles on the road longer, thereby keeping emissions high and running directly counter to the EP A's stated goals. ARA does not believe either Proposal 1 or 2 establish a practical timeline to ensure vehicle performance and reliability. [EPA-HQ-OAR-2019-0055-1251-A1, pp. 1 - 2]

To be effective, any final rule must result in new trucks that are:

- Affordable: If trucking companies choose not to purchase new trucks due to cost or reliability concerns, older trucks will stay on the road longer and environment goals will not be achieved;
- Durable: New, more expensive trucks are not purchased to sit in repair bays. Trucks are unproductive pieces of equipment unless they are moving freight;
- Safe: Safety is a top priority in every trucking operation. Putting off the purchase of the newest equipment will delay the use of the latest safety technologies; and
- Cleaner: An unworkable rule will delay fleet turnover and impede environmental progress. The long-term promotion of alternative, renewable fuels such as low-emission biofuels need to be part of any long-term solution to promoting cleaner air and healthier communities. [EPA-HQ-OAR-2019-0055-1251-A1, p. 4]

Fleets do not make trucks -- they are consumers that buy trucks. While this rule is directed at manufacturers, it is agricultural retailers, trucking companies, and other businesses buying modern technologies that determine the success or failure in the implementation of every truck emissions regulation. Fleets remain extremely sensitive to the many difficulties involved in running a company - a matter that is especially significant to the 97 percent of fleets classified as small businesses. [EPA-HQ-OAR-2019-0055-1251-A1, p. 4]

Here is a look at the numbers behind EPA's overly stringent proposed rule according to the Truck and Engine Manufacturers Association (EMA)3:

- 4.5 million: With more than 4.5 million medium- and heavy-duty trucks on the road today delivering 72% of the goods, services, and freight that consumers depend on every day, EPA's final rule would have a sweeping impact on the nation's economy.
- 98%: Almost all (98%) of U.S. fleet owners are small businesses operating fleets with 20 or fewer commercial vehicles. Nine out of ten of these fleets (91 %) operate six or fewer trucks.
- 11.6%: Research from Ramboll Group shows NOx emissions could actually increase by as much as 11.6% under EPA's more stringent rule because of delayed fleet turnover and older, higher-emitting trucks staying on the road longer.
- $42,000: Contrary to EPA's claims that per-unit truck cost increases will be minor, analysis from Ricardo Strategic Consulting found the per -unit cost increase for heavy-duty diesel engines could exceed $42,000, including increased operating costs, making it unlikely that fleet owners will be able to afford to purchase the new trucks. An earlier cost study that the California Air Resources Board commissioned from the National Renewable Energy Laboratory (NREL) reached similar conclusions.
- 221,000: ACT research found that, under one scenario, as many as 221,000 good-paying jobs in the truck and engine manufacturing industries could be at risk if EPA pursues a poorly designed rule such as the one it has proposed. [EPA-HQ-OAR-2019-0055-1251-A1, pp. 3 - 4]

3. http://www.truckandenginemanufacturers.org/file.asp?A=Y&F=EMA+Press+Release+on+EPA+Hearing%2Epdf&N=EMA+Press+Release+on+EPA+Hearing%2Epdf&C=documents

***Organization**: Ali P.*

We need to implement as many pollution and greenhouse gas reduction measures as possible and do so as quickly as we can to begin decreasing the detrimental effects that anthropogenic activities have on the planet. This proposed rule would bring us one small step closer to accomplishing this goal. It would begin reducing the negative effects that pollution has on people's overall health and on the state of the world's ecosystems. It would also help begin reducing the country's enormous volume of greenhouse gas emissions. It is a step towards better preservation of both humanity and the environment. While humans have destroyed much of the earth, it is not too late to actively work to restore it. But the time to act is now. Too many people are either refusing to work towards improving the environment or are treating its improvement as a lost cause. Both of these mentalities will result in our increase in global destruction and our eventual downfall. We need to make every effort that we can to save the environment and ourselves. Implementing policies such as this proposed rule should only be the beginning. [EPA-HQ-OAR-2019-1031]

***Organization:** Alliance for Vehicle Efficiency (AVE)*

AVE supports EPA's effort to reduce emissions, specifically nitrogen oxides (NOx), and particulate matter (PM) from this important segment of the transportation sector. [EPA-HQ-OAR-2019-0055-1280-A1, p. 1]

AVE urges EPA to move beyond tailpipe only definitions for ZEVs and integrate lifecycle analysis for future standards. [EPA-HQ-OAR-2019-0055-1280-A1, p. 5]

Defining ZEVs only at the tailpipe distorts the environmental gains of vehicles with known upstream emissions. Relying on the current definition of ZEVs serves as a barrier to automotive technologies that can deliver significant real-world emission reductions. For example, hydrogen combustion engines can deliver significant emission reductions, and when compared to other vehicles on a lifecycle basis, can match the environmental impact of vehicles currently defined as ZEVs. [EPA-HQ-OAR-2019-0055-1280-A1, p. 5]

Continuing to focus solely on tailpipe emissions for future standards also ignores President Biden's January 25, 2021, Executive Order, in which he stressed the need for environmental standards to account for all greenhouse gas emissions. [EPA-HQ-OAR-2019-0055-1280-A1, p. 5]

"Sec. 5. Accounting for the Benefits of Reducing Climate Pollution. (a) It is essential that agencies capture the full costs of greenhouse gas emissions as accurately as possible, including by taking global damages into account. Doing so facilitates sound decision-making, recognizes the breadth of climate impacts, and supports the international leadership of the United States on climate issues." 10 [EPA-HQ-OAR-2019-0055-1280-A1, p. 5]

10. 7040 Federal Register / Vol. 86, No. 14 / Monday, January 25, 2021 / Presidential Documents

Congress is also encouraging EPA to assess lifecycle emissions when setting future vehicle standards: [EPA-HQ-OAR-2019-0055-1280-A1, p. 5]

Vehicle Emissions Lifecycle Analysis. — The Committee believes it is essential that when setting future standards for reducing greenhouse gas emissions, the Agency fully evaluate emission impacts of vehicle technologies and transportation fuels (including electricity used as a fuel) from well to wheel, and the vehicle cycle through material recovery and vehicle disposal in order to capture the full impacts of greenhouse gas emissions as accurately as possible. The Committee encourages the Agency to develop standardized modeling to evaluate the full lifecycle of vehicle technologies and transportation fuels, as new standards to reduce pollutants are being developed, and to coordinate as necessary, with other federal agencies that are conducting similar models for vehicles in an effort to accurately determine the full impact of reducing greenhouse gas emissions when conducting cost-benefit analyses of regulatory and other actions. 11 (Emphasis added) [EPA-HQ-OAR-2019-0055-1280-A1, p. 5]

> 11. See, H. Rept. 117-83 – Dept. of the Interior, Environment, & Related Agencies Appropriations Bill, 2022 at P. 84.

In setting new national standards, AVE supports EPA adopting the most stringent standards that are technically feasible and cost-effective. EPA’s Proposal provides an excellent opportunity to target the largest segment of NOx and PM emissions across the majority of the country for the first time in almost 20-years and to provide much needed, cost-effective relief to states facing daunting Ozone-attainment challenges. [EPA-HQ-OAR-2019-0055-1280-A1, p. 8]

The investments made over the last decade by automotive suppliers has made more stringent standards possible. We believe that a strong and feasible national standard provides the greatest public health benefits while providing the much-needed regulatory certainty for the industry to continue to innovate and invest. [EPA-HQ-OAR-2019-0055-1280-A1, p. 8]

Organization: *Allison Transmission, Inc. (Allison)*

EPA should consider whether there are any additional quantitative or qualitative impacts that may be projected from imposing standards based on the control of criteria air pollutants like NOx versus impacting GHG emissions. In addition to any available data, this review could consider how the additional of additional emission control technology for criteria versus GHG impacts may be perceived in the marketplace. Considering the commercial vehicle end-user perspective there is significant capital involved in fleet-turnover that drives more caution and slower willingness to adopt significantly different technology that goes beyond the total cost of ownership (“TCO”) or purely economic comparisons. Consideration of the need to conduct trials and build confidence in technology prior to fleet turnover could drive a different estimates of ZEV adoption in the medium- and heavy-duty market compared with the passenger car market. This, in turn, reinforces the importance of a maintaining non-ZEV path for CO2 reduction based on more mature technology. Allison explores these issues further in Sections XVI and XVII of these comments.[EPA-HQ-OAR-2019-0055-1231-A1, p.22]

Additionally, it is clear that EPA and CARB will increasingly need to consider not only tailpipe and avoided GHG emissions, but also upstream components to the GHG profile of heavy-duty ZEVs. As EPA is well aware, the overall emissions impact of a ZEV is tied to the carbon content of the electricity used to charge its batteries; such content will vary across different areas of the country, resulting in very real differences in net climate benefits. These differences can be very substantial, varying from 12 grams of CO2 per kilowatt hour ("kWh")to 2.23 lbs. per kWh.69 While this rulemaking does not address this issue and the relative effect of upstream emissions from electricity generation is not a current, major concern given the relatively low penetration of ZEVs in the heavy-duty sector, by EPA's own estimates this effect will increase over time. EPA should therefore more proactively discuss this issue going-forward during the series of rulemakings that are currently part of its agenda in the HDV sector. [EPA-HQ-OAR-2019-0055-1231-A1, p.33]

> 69 Nationwide, CO2 emissions per kilowatt-hour ("kWh") averaged 0.85 lbs./kWh in 2020. But the rate varied from near-zero for certain forms of energy (e.g., from 48 gCO2eq/kWh for solar, 24gCO2eq/kWh for hydropower and 12gCO2eq/kWh for nuclear) as compared with 2.23 lbs./kWh for coal-fired power plants. See, e.g., eia.gov/tools/faqs; www.hydropower.org.

Beyond scope of Clean Air Act, ZEVs also face numerous other environmental issues, including the extent of recovery of battery materials, recyclability, and closed loop systems. Battery material reclamation is a very important consideration for the long-term sustainability of ZEV. [EPA-HQ-OAR-2019-0055-1231-A1, p.33]

While all of these issues may not be able to be addressed pursuant to the Agency's Clean Air Act authority, these impacts have associated costs and cannot be ignored over the long-term. Proactively discussing such issues would aid the vehicle manufacturing sector in planning for future design and sourcing agreements early within vehicle development cycles. Such an assessment should be performed prior to adoption of any explicit or implicit ZEV targets; EPA should not in this rulemaking attempt to align final regulations with the measures and timing contained in the CARB HD Omnibus regulation or the CARB Advanced Clean Trucks regulation. [EPA-HQ-OAR-2019-0055-1231-A1, p.33]

Organization: *Amber Wheeldon*

I have browsed the previously posted comments regarding the new rule being proposed by the EPA. It is abundantly clear that no person commenting in favor of stricter emission controls has any knowledge of the transportation industry. More stringent emission controls will be detrimental to the trucking industry. When the American trucking industry struggles, so do the American people. [EPA-HQ-OAR-2019-0055-1154]

Current emission controls already fail. They fail constantly. The technology we have currently for emission control products isn't working. How can we believe further controls will work? Large amounts of trucks are out of service in every state with emission control errors. The effects of trucks out of service can be seen in our already low inventory shelves in the grocery stores. But those inventories are also low for truck parts. For example, the truck parts necessary for repairing the trucks with emission control errors. Trucks can be put out of service for months waiting for repair. So, while the truck has no actual mechanical issues, it can't be used. Small fleet owners cannot afford to be out of service for long periods. There is a significant loss of income in just a few weeks. Once the parts are available, now they must pay high costs for the emission control products that will still continue to fail. Small fleet owners will be forced out of business because of the emission control failures. [EPA-HQ-OAR-2019-0055-1154]

Fleet Size Group	Fleet Size by Power Units	Number of Carriers	Carrier % of Total	Total Power Units	Power Unit % of Total
Very Small	1 to 6	502,626	86.00%	924,467	19.81%
Small	7 to 19	53,332	9.13%	583,105	12.49%
Medium	20 to 100	24,133	4.13%	955,280	20.47%
Large	101 to 2,000	4,212	0.72%	1,236,217	26.49%
Very Large	2,001 to 5,000	93	0.02%	278,517	5.97%
Mega	5,001+	41	0.01%	689,461	14.77%
Totals		**584,437**	**100.00%**	**4,667,047**	

Data Source: FMCSA, Motor Carrier Management Information System (MCMIS), data snapshot of interstate carriers as of December 2020

As seen in the table above, very small - medium fleets, that will be most affected by the new regulations, make up no small sum of the overall trucking numbers in America. More rigid controls on emissions will be disastrous for the over 580,000 small carriers. Everyone would agree that improving air pollution and greenhouse gases is a good thing. Unfortunately, this particular program is a failure. If the products cannot be manufactured now to work efficiently, we cannot move forward with more ineffective regulations that put small business owners out of work and moreover the American people out of the products they need on their shelves. [EPA-HQ-OAR-2019-0055-1154]

Rules and regulations are passed too often without being aware of the effects it passes down on the people. By passing more regulation that continues to fail them, it fails us all. [EPA-HQ-OAR-2019-0055-1154]

Organization: *American Bus Association (ABA) (1070 and 1308)*

Initially, ABA's overarching concern with the Proposal, and the EPA's review for that matter, is the apparent lack of understanding of the types of vehicles and industries that use and rely on heavy-duty, compression-ignition engines. Although the Proposal targets engine emissions by way of regulating engine manufacturers, in reality it is the use of these engines on the nations roadways that affects air quality. In the Executive Summary of the Notice, the Industry Overview focuses exclusively on property-carrying vehicles (Notice, Executive Summary Section A. 1.). A further description, and one of the few allusions to passenger transport, occurs in the Introduction, where middle weight class heavy-duty vehicles are described as those that tend to be used for municipal work to "transport people … locally and regionally…." (Notices, Section I. A.) A cursory reading of the lengthy Notice suggests the rulemaking has no bearing on engines or vehicles used by the private passenger-carrying motorcoach industry. Clearly this is not the case, as EPA does review a number of comments from motorcoach operators in discussing the negative impacts of its current inducement policy (See Notice, Section IV. D.). However, the emphasis on trucks or property-carrying vehicles, particularly in terms of data, does raise several questions and concerns about the underlying assumptions and analyses used to support the Proposal. [EPA-HQ-OAR-2019-0055-1308-A1, pp.2-3]

Further, if the Proposal degrades the motorcoach industry it will have an impact on the economy through job loss, reduced transportation capacity, and the loss of transportation options for the most vulnerable and price-sensitive communities who rely heavily on motorcoach transportation. In addition, the drivers of the motorcoach industry represent a diverse group, providing employment opportunities for underserved communities at rates that exceed the national averages for other industries. Meaning, that the loss of the motorcoach coach industry will lead to increased unemployment for communities of color, as well as women. It is an expressed goal of this Administration (see “Executive Order on Tackling the Climate Crisis at Home and Abroad,” January 2022) to create jobs in tackling climate initiatives, not take them away. Despite the driver shortage, over 90,000 motorcoach drivers are currently employed. [EPA-HQ-OAR-2019-0055-1308-A1, p.5]

Organization: *American Council for an Energy Efficient Economy (ACEEE)*

ACEEE supports EPA in its effort to limit NOx emissions as much as possible to protect the health of our communities. However, our comments are focused on the GHG components of the proposal as global climate change remains a major economic and national security threat. After a year of severe forest fires and flooding, EPA cannot miss an opportunity to make significant progress on emission reductions. The stringency and structure of these standards will have lasting impacts as they will determine which vehicles will be sold and used on the road for decades to come and will also set the baseline that the upcoming Phase 3 standards will start from. It is therefore crucial that EPA gets these standards right. Reducing carbon emissions is critical to tackling climate change but increasing HDV efficiency will also have significant benefits to air quality and reduce fueling costs for our nation’s trucks and delivery vehicles, costs that are passed onto the consumer in the form of higher prices for their everyday goods and groceries. Stricter GHG limits for heavy-duty vehicles will also decrease oil consumption. This is key to supporting vital US security interests including moderating oil prices and ensuring a stable oil supply for the US and allied nations. [EPA-HQ-OAR-2019-0055-2852-A1, p.2]

EPA’s medium- and heavy-duty vehicle emission standards are a vital tool to protecting vehicle owners, the environment, and the public. Standards that push technology forward help consumers save on fuel costs, reduce environmental damage, and reduce dangerous pollution that increases the risk of breathing-related illness. ACEEE believes that EPA has built a good framework in this proposed rule, but believes it needs to be more ambitious to reflect the White House’s new goals for emission reductions by 2030 and EV market development. [EPA-HQ-OAR-2019-0055-2852-A1, p.10]

Organization: *American Farm Bureau Federation (Farm Bureau)*

This rule has the potential to delay the turnover to newer vehicles with cleaner emission technologies, forcing vehicle owners to keep their higher-emitting trucks longer. This not only will delay EPA's anticipated environmental benefits, it also would cause environmental backsliding that seems to be in conflict with the goals of the agency. Furthermore, a poorly designed final rule will cause market disruptions, will delay or undermine the ability of manufacturers to recoup their investment in developing compliant technologies, and worse, could have significant adverse impacts on the economy. [EPA-HQ-OAR-2019-0055-1163-A1, p.1]

It is again important to emphasize that trucking is enormously important to the economy—the industry moves 72% of goods in America and is the foundation of a well-functioning supply chain. When trucking costs go up, the cost of nearly all goods go up with it. As the White House recently noted, trucking costs grew more than 20% last year, and we know that sharply increased fuel costs thus far in 2022 have only exacerbated economic burdens. [EPA-HQ-OAR-2019-0055-1163-A1, p.2]

Farm Bureau believes the proposed rule is not technologically feasible, cost-effective or acceptable to the needs of America's farmers and ranchers. Our policy, developed by hardworking farmers and ranchers, clearly enunciates opposition to any further attempt to restrict or regulate exhaust emissions on new or used farm equipment, heavy equipment or trucks. We therefore urge EPA to take extra caution to avoid requirements that could intensify the already challenging economic conditions facing rural America and the U.S. economy. [EPA-HQ-OAR-2019-0055-1163-A1, p.2]

Organization: *American Fuel & Petrochemical Manufacturers (AFPM)*

Finally, the Proposal's GHG provisions are reliant upon California's Advanced Clean Truck rule for significant BET sales even though there is no California waiver in place for Heavy Duty (HD) trucks. EPA is acting arbitrarily in depending on a preempted California standard to demonstrate regulatory achievability. [EPA-HQ-OAR-2019-0055-1262-A1, p.2]

Heavy duty trucks can be used for more than a million miles, and this will mean that for BETs, there will be several battery replacements during their lifetime. The battery is the energy storage media on the vehicle, just as the fuel is on a diesel ICE (internal combustion engine) vehicle. [EPA-HQ-OAR-2019-0055-1262-A1, p.2]

The analysis included in the Proposal does not assume battery replacements and essentially ignores an issue of key importance to the problem EPA is working to resolve. Lithium-ion batteries are made from critical minerals including cobalt, graphite, lithium, nickel, and manganese. Electric vehicles (EVs) require six times the mineral inputs of traditional internal combustion engines.3 One study suggests that the extraction and processing of critical minerals are responsible for approximately 20 percent of the GHG emissions associated with battery production.4 A typical light-duty lithium EV battery weighs about 1,000 pounds. While there are dozens of variations, a typical battery contains around 25 pounds of lithium, 30 pounds of cobalt, 60 pounds of nickel, 110 pounds of graphite, and 90 pounds of copper. Since ore grades vary, acquiring these five elements to produce a single battery requires mining about 90,000 pounds of ore.5 Roughly 90,000 pounds of ore requires digging and moving between 200,000 and over 1,500,000 pounds of earth, a rough average of more than 500,000 pounds per battery.6 These numbers are significantly higher for heavy-duty EV batteries. Further, the International Energy Agency (IEA) pins the average GHG intensity for production of lithium carbonate at around 5 metric tons of Carbon Dioxide Equivalent (CO2e) emitted per ton of metal, and approximately 15 CO2e metric tons per ton of cobalt sulfate.7 The mining of minerals for BETs typically occurs in countries where environmental, health, and safety precautions are significantly less stringent than those in the U.S.8,9 [EPA-HQ-OAR-2019-0055-1262-A1, p.3]

3 See IEA’s Critical Minerals Report at 28, https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf.

4 Kim et al., Cradle-to-Gate Emissions from a Commercial Electric Vehicle Li-Ion Battery: A Comparative Analysis, Environ. Sci. Technol 50 (2016), pp. 7715-7722. See also Volvo, Carbon footprint report: Volvo C40 Recharge at 5, https://www.volvocars.com/images/v/-/media/Market-Assets/INTL/Applications/DotCom/PDF/C40/Volvo-C40-Recharge-LCA-report.pdf ('The accumulated emissions from the Materials production and refining, Li-ion battery modules and Volvo Cars manufacturing phases of C40 Recharge are nearly 70 per cent higher than for XC40 ICE.'). The Volvo report notes that production of the Li-ion battery modules account for 30 percent of the footprint of the C40 Recharge. Id. at 6.

5 See Mark Mills, Mines, Minerals, and 'Green' Energy: A Reality Check, The Manhattan Institute (July 9, 2020), https://www.manhattan-institute.org/mines-minerals-and-green-energy-reality-check., last visited, May 16, 2022.

6 Id.

7 See IEA’s Critical Minerals Report, at 195.

8 See IEA’s Critical Minerals Report. See also Securing America’s Future Energy, The Commanding Heights of Global Transportation (2020), https://secureenergy.org/the-commanding-heights-of-global-transportation-2/,https://secureenergy.org/the-commanding-heights-of-global-transportation-2/, last visited, May 16, 2022.

9 In addition to GHG emissions, such mining activities are also responsible for PM emissions, NOx emissions, and other air pollutant emissions.

Organization: *American Lung Association et al.*

We view US EPA’s proposed Option 1 as a far more health-protective pathway to cleaning up trucking emissions than Option 2, which we do not believe is an appropriate pathway for health protection or technology availability or to a zero-emission trucking future. Adopting a stronger Option 1 is critical to reducing health and equity burdens and setting a stronger course to a sustainable transportation system. Of the two options proposed, Option 1 would provide greater health benefits than Option 2, including up to $33 billion in health benefits, and significant ozone-related health benefits up to: 2,100 premature deaths avoided 16,000 pediatric asthma cases avoided 2.8 million instances of asthma symptoms avoided 1.1 million lost school days avoided 3 [EPA-HQ-OAR-2019-0055-1271-A1, pp.1-2]

> 3 US EPA. Regulatory Impact Analysis Draft at page 394 (Note: additional particle pollution-related health endpoints are included in the analysis at page 393). March 2022. https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10144K0.pdf

In 2016, leading health and medical organizations called for stronger truck standards in a letter to then US EPA Administrator McCarthy, noting then that standard in line with the proposed Option 1 introduced in March 2022 was needed to protect health and align with the 2015 ozone standards. Once again, we call on US EPA to establish a health-protective standard for all new trucks. [EPA-HQ-OAR-2019-0055-1271-A1, p.2]

The final standards must ensure a 90 percent reduction in emissions from new trucks compared with the current standards, or 0.02 grams per brake horsepower hour of NOx emissions. The standards must include stronger provisions to address pollution caused throughout the operations of the truck, including low-load standards, idling and highway conditions. Option 1 must be strengthened and – at a minimum – harmonized with the California Low NOx Omnibus rule adopted in 2020 to deliver a 90 percent reduction in NOx emissions from new trucks as of 2027, along with the California low-load and idle emissions requirements. US EPA should accelerate Option 1 to align to this schedule. Further, we support the proposal to strengthen particle emission standards to 5 milligrams per mile to account for advances in engine designs and to protect against backsliding within any future engine technologies. Again, public health demands that US EPA act to establish a long-overdue, comprehensive, and health protective standard: **It is imperative that the US EPA strengthen and adopt Option 1 in 2022.** [EPA-HQ-OAR-2019-0055-1271-A1, p.2]

In summary, we urge US EPA to strengthen the Option 1 standard and to adopt the final rule this year to ensure implementation by 2027. We urge you to not only finalize strong standards, but also ensure real-world benefits by requiring pollution controls for the full lives of these vehicles and throughout all real-world operating conditions. [EPA-HQ-OAR-2019-0055-1271-A1, p.3]

Organization: *American Truck Dealers (ATD)*

Prospective purchasers and lessors apply rigorous total cost of ownership (TCO) and return on investment (ROI) decision-making when considering investments in new CMVs. Consequently, CMVs equipped with HDEs subject to new NOx emission reduction mandates must be affordable to buy or lease, must be cost effective to operate, and must offer acceptable levels of reliability (i.e., uptime). The trucking industry learned this firsthand with HDEs subject to EPA’s 2002-10 NOx standards. A study conducted in-house by ATD details the dramatic impact those standards had because they proved costly to comply with and degraded vehicle .4 The study found that EPA underestimated control strategy and technology compliance costs by a factor of 2-5, resulting in dramatically higher prices for new CMVs. It also found that EPA’s mandates resulted in significantly higher operating costs, due to increased maintenance requirements, reduced reliability, and lower fuel economy. [EPA-HQ-OAR-2019-0055-1321-A1, p. 2]

4. See Attachment B, Calpin and Plaza Jennings, A Look Back at EPA's Cost and Other Impact Projections for My 2004-2010 Heavy-Duty Truck Emissions Standards (2/13/12)

Organization: *American Trucking Associations (ATA)*

In its capacity as the national representative of the trucking industry, ATA regularly comments on matters affecting trucking's common interests and providing its expertise and understanding of the industry. While HD2027 is not specifically directed at trucking fleets, the trucking industry's purchasing decisions will ultimately decide the success or failure of this rule. The consistent messaging from fleets to EPA regarding HD2027 is clear – minimize purchase, maintenance, warranty, and operational costs; maximize performance, durability, and driver satisfaction; maintain fleet flexibility in technology and fuel choices; do not re-open the final Phase 2 rule; and do not create unintended consequences such as equipment pre-buys/low-buys or no-buys, alteration of fleet turnover cycles, and fuel economy degradation. ATA supports the underlying goals of HD2027 and appreciates EPA's receptiveness in receiving stakeholder input, including ATA's testimony during the agency's April 12-14 virtual public hearing. As always, ATA's path forward will be driven where the facts, science, and economics leads us. [EPA-HQ-OAR-2019-0055-1326-A1, pp. 2 - 3]

While ATA cannot address every aspect of HD2027, we are supportive of the underlying environmental objectives and several of the elements being proposed. ATA's areas of support include:

- EPA acknowledgement that cleaner diesel trucks will remain integral for the foreseeable near-term future as the nation transitions to the use of zero-emission vehicles ("ZEVs"). [EPA-HQ-OAR-2019-0055-1326-A1, p. 3]
- Allowing manufacturer flexibility in their technology platform pathways. [EPA-HQ-OAR-2019-0055-1326-A1, p. 3]

ATA has established 12 fleet Guiding Principles that should be considered in the development of HD2027 including:

• The rule should not be based on technology-forcing standards.

• Compliance pathways must remain fuel and technology neutral. [EPA-HQ-OAR-2019-0055-1326-A1, p. 5]

Organization: *Anne Mellinger-Birdsong*

I support this proposal and urges EPA to make it stronger. [EPA-HQ-OAR-2019-0055-1244]

Organization: *Anonymous 1032*

The EPA should absolutely increase the air pollution standards for heavy duty vehicles. Even a minor adjustment to the standards would have a noticeable positive effect on greenhouse gas emissions. According to the EPA, 29% of greenhouse gas emissions currently come from the transportation sector, and of that 29%, about 25% comes from heavy duty vehicles. This means that over 7% of America's greenhouse gas emissions come directly from heavy duty vehicles. [EPA-HQ-OAR-2019-1032]

Time is running out on mitigating the effects of climate change. If all greenhouse gas emissions were to cease this instant, the planet would still warm by approximately 0.6 degrees celsius. While it is not possible to cause this drastic reduction, it is absolutely necessary that we curb our emissions to a degree such that global warming will not exceed 1.5 degrees celsius. An increase of more than this amount would have catastrophic impacts on the global population, creating severe weather, drought, and rising sea levels that would leave countless people dead or without homes. Any viable options to reduce greenhouse gas emissions should be taken up as quickly as possible, which is the primary reason that the implementation of this program is so important. In terms of greenhouse gas reduction, the proposal would primarily be responsible for reductions in NOx emissions. This is important because while NOx gasses are less prevalent in the atmosphere than other common gasses like CO_2, they have much greater warming potential. The NOx global warming potential is 298 times that of CO_2, meaning that emissions standards that focus on that gas have the potential to have a large positive impact on mitigating our nation's carbon emissions. [EPA-HQ-OAR-2019-1032]

In addition, the emissions standards will have a positive effect on reducing the particulate matter emissions of heavy-duty vehicles. There are multiple size categories for particulate matter, those being 10 micrometers and 2.5 micrometers. Particulate emissions from heavy duty vehicles would be primarily 2.5 micrometers. These particles are incredibly dangerous because they are small enough that they can be inhaled and enter the bloodstream along with oxygen through the process of respiration. This can cause serious health issues such as asthma, cardiovascular disease, and lung cancer. PM 2.5 is responsible for approximately 95% of the public health consequences caused by air pollution, and thus it is incredibly important to reduce sources of this particularly damaging air pollutant. [EPA-HQ-OAR-2019-1032]

The proposal has the potential to have a really noticeable positive impact in the reduction of emissions. There are two different proposed options for the plan. The first is more drastic, and would cause a 50% reduction in NOx emissions from heavy-duty vehicles by the year 2045. The second less drastic option would still be able to create a 47% reduction. By this point in time, the majority of current vehicles will have outlasted their lifespan, and they will have been replaced by new vehicles that will have to be created in accordance with the emissions standards in the EPA's proposal. [EPA-HQ-OAR-2019-1032]

The calculated positive impact of reductions in air pollutants will be drastic as well. The feasibility of this plan can be calculated by weighing its expected loss (in the expenses of making drivers meet these more strict emissions standards) versus the expected benefits that come from implementing the action. Although it seems morbid to put value on human life, it is what must be done in order to evaluate the benefits of implementing the program. In the lives that would be saved from reducing the air pollution, the EPA calculated that approximately between 10 and 30 billion dollars would be saved annually, depending on discount rates and implemented options. Either one of the proposed options should logically be implemented, as they will cause net positive financial impacts with their implementation. By the year 2045 once the program has been fully implemented, annual net benefits would outweigh annual net costs. All aspects of this program were studied by the EPA and then peer reviewed, so it is clear that this information is accurate. [EPA-HQ-OAR-2019-1032]

Climate change is the most important issue of our generation, and anything that can be done to reduce its impact on society should absolutely be implemented. This proposed program has the potential to both positively impact human health through reductions in air pollution, as well as drastically reducing NOx emissions, which contribute significantly to climate change. The program has been carefully evaluated, and although it could be expensive to require these new increased emissions standards, the net benefits provided by the mortality reductions from the decreased air pollution are absolutely enough to justify the implementation of this program. I am strongly in favor of this EPA proposal, and I think anyone who takes the time to look over the benefits provided by these emission reductions will agree with me. [EPA-HQ-OAR-2019-1032]

Organization: *Anonymous 1091*

As a nation and throughout the world, it is imperative to adopt EPA's most stringent proposal, "Option 1," and aggressively pursue the follow-on programs of regulating GHG's and moving as quickly as possible toward electrification of heavy truck transportation systems. [EPA-HQ-OAR-2019-0055-1091]

My comments are in part a response to the Diesel Technology Forum testimony, April 12 2022 "Testimony of the Diesel Technology Forum Before the U.S. Environmental Protection Agency NOTICE OF PROPOSED RULEMAKING" [EPA-HQ-OAR-2019-0055-1091]

"The last thing anyone wants out of this is that truckers stop buying new trucks because they are too expensive, too unpredictable, and too complex." Actually, the last thing anyone wants is unbreathable air. The last thing anyone wants is a surface temperature of 140 degrees F as recently reported in India. The last thing anyone wants is the continued destruction of the global ecosystem. Ask people living in devastated wildfire zones, or coastal flood zones, what the last thing is that they want. Let's keep our eye on what's truly important and the reality of what people want and don't want. It is not the same as what the diesel fuels industry wants.
The last thing we want is delay, and complaints that it is "too expensive, too unpredictable, and too complex" to eliminate the carbon pollutants from the delivery chain. What we want is a responsible trucking and fuel industry that realizes ASAP that business as usual must come to an immediate halt. [EPA-HQ-OAR-2019-0055-1091]

It should also be remembered that when government and industry are compelled, or if there is enough profit to be made, nothing is too complex. Everyone says "Nothing stands in the way of American ingenuity and industriousness" when there is a lot of money to be made. An unimaginably complex global Internet gets built. Vaccines are developed in record time with national-government-scale support and privatized profits. Spacecraft are built by the private sector with unquantified benefit to mankind some time in an indeterminate future. If Business wants it, it gets done. If Government mandates and supports it, it gets done. Professing that a solution is too complex or too expensive is code for "We Don't Want To." [EPA-HQ-OAR-2019-0055-1091]

“A balanced rule will alleviate undesirable outcomes like swings in the new truck market.” The petroleum-based economy is out of time to make timid steps with “balanced” rules. Swings in the market seem acceptable to industries all the time, because that’s how a free market is supposed to work: the market converges on an equilibrium for all participants, not just new truck makers. [EPA-HQ-OAR-2019-0055-1091]

If the scope and rate of environmental and climate destruction were “balanced” perhaps we could afford to be “balanced” in our approaches to remediate it, but that opportunity ended decades ago. Obstruction and deception from hydrocarbon-vested interests over decades caused delays that eroded the bulwark of time available to mitigate and make slower, “balanced” changes. [EPA-HQ-OAR-2019-0055-1091]

In Silicon Valley, land of astronomical technical achievements and astronomical riches, the mantra is move fast and break things!” and up-and-coming groundbreaking developments are called “disruptive.” If that’s the much-vaunted and adored approach Silicon Valley uses, with its outsized share of spectacular successes of rapid adoption, why can’t hydrocarbon-based industries adopt this mantra as the way to get complicated expensive things done quickly? [EPA-HQ-OAR-2019-0055-1091]

Why is it good to disrupt workers with very complex robotic systems, replace drivers with labor-free self-driving, hugely complex autonomous trucks, but not good to replace diesel engines with electric ones? The hypocrisy is embarrassing. We don’t want “balanced rules” – we want disruption of the internal-combustion-engine sector, and we want it a decade ago. We don’t want “advanced diesel” or “renewable diesel” – we want radical change in improving and expanding electrification. Better diesel is a hard requirement anyway and must proceed post-haste, but it is not an excuse to delay urgent electrification efforts everywhere it can support the required carbon intensity mandates. [EPA-HQ-OAR-2019-0055-1091]

Since electrification of the heavy truck fleet at significant scale is an existential threat to the diesel fuel industry, of course they will push for ways to stay in the game and slow the inevitable, with costs borne by all other stakeholders. They aggressively market renewable lower-carbon fuels as a front-line solution, and issues pleas that more stringent standards are onerous, too expensive, too complex, and too costly. But they could, and should, instead be investing now in a different future: scrubbing, full- lifecycle optimization, sequestration of recovered hydrocarbons, and repurposed applications for hydrocarbon compounds, preventing them being burned on our streets and highways. The means exist to do this. “Move fast and break things. Nothing stands in the way of American ingenuity or industriousness.” [EPA-HQ-OAR-2019-0055-1091]

Mitigating the impacts of inadequate emissions reductions require solutions much more onerous, expensive, and complex than electrification of the heavy vehicle ecosystem. Any argument that claims the burden of implementing maximally stringent emissions requirements is too difficult for the hydrocarbon fuels, or any other industry, is dissembling. If they thought they could make enough money, and there was enough Government support, there would be no objection to whatever scale adaptation is required. Objections, obstructions, and slow-track recommendations socialize climate and ecological risks, putting them onto other industries, the public, and the systems that support life on Earth. [EPA-HQ-OAR-2019-0055-1091]

Organization: *Anonymous 1412*

I oppose. More restriction which usually results in less miles per gallon is just shortening service life of vehicles and causing more money to be spend on fuel. Focus your time on till-less planting and limiting city expansions and quit pretending vehicle emissions impact is a significant issue. This is a waste of time and money with the scope of what is available for you people to focus on. [EPA-HQ-OAR-2019-0055-1412]

Organization: *BorgWarner*

BorgWarner appreciates this opportunity to offer the following comments to the U.S. Environmental Protection Agency (EPA) and strongly supports efforts to reduce tailpipe emissions from Heavy-Duty Trucks, primarily nitrogen oxides (NOx) and particulate matter (PM). [EPA-HQ-OAR-2019-0055-1234-A1, p. 1]

BorgWarner supports lifecycle analysis for all future vehicle regulations. We support the transition from a tailpipe-based standard (i.e., tank-to-wheel) to a more holistic assessment (e.g., well-to-wheel emissions, or more completely, full lifecycle emissions) as the proper metric for determining the environmental impact of the vehicle as a product. This approach is consistent with technology neutrality, global carbon neutrality goals, and a holistic environmental impact assessment. [EPA-HQ-OAR-2019-0055-1234-A1, p. 3]

Organization: *B & H Tractor & Truck*

This rule will harm the trucking industry even more by pushing truck cost up and creating more expensive repairs. The smaller companies will not be able to do small repairs. DEF has added unreliability to trucks also making simple roadside repairs difficult. This will raise the cost of trucking to a point where the market cannot compete. [EPA-HQ-OAR-2019-0055-1751, p.1]

Organization: *Bar B Que Specialties, Inc.*

As a business owner who relies on the trucking industry to get my product to grocery stores, I feel this rule will kill American small business. Gas prices already are having a huge impact on the price of trucking, adding these emissions regulations will increase them even more. Small businesses can't absorb these costs which in turn will make us raise the price of our product which is a) make the price go up on the shelf b) increase the likelihood that businesses will not continue to carry the product and c) decrease online sales because people will not like the new price. No one wins in this situation. [EPA-HQ-OAR-2019-0055-2260, p.1]

Organization: *BYD Motors, LLC (BYD)*

In the United States, BYD employs 700 members of the Sheet Metal Air Rail and Transportation Workers Union in the manufacture of zero-emission transit buses and heavy-duty trucks that are not only Buy America compliant, but contributing to the everyday well-being of communities around the United States. [EPA-HQ-OAR-2019-0055-1207-A1, p. 1]

BYD supports the EPA's proposal to strengthen heavy-duty vehicle emission standards and, in support of a request by the Environmental Defense Fund, respectfully urges the agency to further strengthen the proposal in key areas. [EPA-HQ-OAR-2019-0055-1207-A1, p. 1]

There is an urgent need to set protective standards that achieve deep reductions in pollution from diesel and internal combustion vehicles, and to ensure greater pollution reductions via the deployment of zero-emission technologies like battery-electric vehicles. [EPA-HQ-OAR-2019-0055-1207-A1, p. 1]

Immediate emissions reductions are crucial to mitigating the effects of climate change and protecting public health -- especially in low-income communities and communities of color that are disproportionately affected by transportation air pollution. With continued commitment from your agency, it can be done. [EPA-HQ-OAR-2019-0055-1207-A1, p. 1]

Globally, BYD has committed to corporate social responsibility, deeply monitoring its supply chain in terms of human rights, environmental safety, hazardous substance control and intellectual property rights. The company only selects suppliers who share its commitment to just labor practices, human rights standards and the environment. [EPA-HQ-OAR-2019-0055-1207-A1, p. 2]

Organization: *California Air Pollution Control Officers Association (CAPCOA)*

On behalf of the California Air Pollution Control Officers Association (CAPCOA), I respectfully inform you of our strong support for the U.S. Environmental Protection Agency's (U.S. EPA) proposed rule "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards" published in the Federal Register March 28, 2022. [EPA-HQ-OAR-2019-0055-1253-A1, p.1]

Organization: *California Air Resources Board (CARB)*

Heavy-duty trucks are a dominant source of dangerous air pollution in California, and especially in communities already experiencing high levels of pollution along freight corridors. The Biden Administration's commitment to environmental justice, its responsibility under the Clean Air Act, and continuing technology improvements all support the strongest possible standards for these vehicles. [EPA-HQ-OAR-2019-0055-1186-A1, p.1]

CARB is committed to working with U.S. EPA to finalize a comprehensive and effective federal heavy-duty engine and vehicle program. [EPA-HQ-OAR-2019-0055-1186-A1, p.3]

CARB staff believes that the emissions standards and other emissions-related requirements associated with Option 1, in conjunction with CARB-staff-recommended modifications to other elements of the CTP that are described in greater detail in these comments, most closely conforms to U.S. EPA's obligations under the federal Clean Air Act (CAA), and that the corresponding emission reductions will provide significant emissions benefits needed to ensure the health and welfare of our nation's residents. CARB staff accordingly hopes that these comments will assist U.S. EPA. [EPA-HQ-OAR-2019-0055-1186-A2, p.10]

Organization: *California Association of Sanitation Agencies (CASA)*

The California Association of Sanitation Agencies (CASA) appreciates this opportunity to comment in support of the Proposed Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards (Proposed Standards) released on March 28 for comment. [EPA-HQ-OAR-2019-0055-1301-A1,p.1]

The updates to the Proposed Standards are intended to balance incentivizing zero and near-zero emissions vehicle (ZEV and NZEV) development with ensuring that the standards achieve an appropriate fleet-wide level of greenhouse gas (GHG) emissions reductions, while also achieving necessary reductions of nitrogen oxides (NOx) and particulate matter (PM) to satisfy existing regulations. This is critical and we strongly support the approach.[EPA-HQ-OAR-2019-0055-1301-A1, p.1]

Organization: *CALSTART*

We support strong actions from EPA to reduce air pollution and global warming emissions from vehicles and other sources. The transportation industry has made significant strides in developing innovative, cost-effective emissions-reducing technologies and zero-emission powertrains. Now we need the right balance of polices to encourage adoption of these technologies in the medium- and heavy-duty vehicle industry as soon as possible. [EPA-HQ-OAR-2019-0055-1313-A1, p.4]

In addition to zero tailpipe emissions, battery and fuel cell electric vehicles offer significant reductions in global warming emissions compared to combustion vehicles. As shown in Figure 2 below, with the average sources of electricity in the US, heavy-duty electric vehicles reduce global warming emissions by approximately 50 to 80 percent depending on a vehicle's average speed over the course of its trip (O'Dea, 2019). Emissions associated with charging electric vehicles will continue to decline as lowercarbon sources of electricity are required to be deployed through state laws. Heavy-duty fuel cell electric vehicles also offer emission reductions compared to vehicles fueled with diesel. For hydrogen generated from steam-reforming of methane, a fuel cell transit bus, for example, has life cycle GHG emissions 40 percent lower than a comparable diesel transit bus (Union of Concerned Scientists, 2016). Using hydrogen generated from electrolysis of water using renewable electricity will provide significantly lower life cycle GHG emissions. [EPA-HQ-OAR-2019-0055-1313-A1, p.6]

Organization: *Capital Area Council of Governments (CAPCOG) and Central Texas Clean Air Coalition (CAV)*

Since grants from the Texas Emission Reduction Plan (TERP) will enable accelerated replacement of older trucks with newer, cleaner trucks, the Austin-Round Rock-Georgetown MSA and other metro areas in Texas will be uniquely able to take advantage of these new standards quickly. [EPA-HQ-OAR-2019-0055-1274-A1, p.1]

The CAC supports this effort to further reduce NOx emissions from heavy-duty vehicles and urges EPA to promulgate new standards and test procedures as soon as possible so that communities like ours can benefit from cleaner air as soon as possible. [EPA-HQ-OAR-2019-0055-1274-A1, p.1]

Organization: *Cameron Prescott*

This rule proposes two options for feedback: Option 1 provides a more aggressive approach with two parts that will result in lower emissions in the years 2027-2030 and then even more of a reduction in the years 2031 and later; Option 2 provides a less aggressive approach that will result in a smaller emission reduction than Option 1 by 2027 and later. I am writing this comment to ask for a more aggressive response such as having net-zero emission goals rather than either option for the following reasons. [EPA-HQ-OAR-2019-1058]

1. Emissions from transportation vehicles currently account for 27 percent of all emissions in the United States alone. On a global scale transportation accounts for 41 percent of all emissions. This is a pressing issue due to the effects that the emission of greenhouse gasses are responsible for. The proposed options do not adequately account for the serious risks that greenhouse gasses from transportation create (EESI, 2015). [EPA-HQ-OAR-2019-1058]
2. Health issues resulting from heavy engine use are imminent if use is not monitored well. It has been studied that exposure to pollutants from cars, such as NOx and other GHG can ensue health problems such as asthma, lung disease, and cancer as well as others. Exposure to NOx, a major emission attempted to be regulated by this rule, has shown a plethora of health issues it exacerbates. NOx exposure can often result in bronchitis, emphysema, and heart disease (Ogunkle & Ahmed 2021). Additionally it has been stated by the World Health Organization that there are 4.2 million deaths each year globally that are due to pollution in the air (WHO). By not taking a more aggressive approach than the one currently listed in the EPA's proposed options to regulate emissions from heavy engines, the EPA is failing its responsibility to the U.S. citizens affected by this issue. [EPA-HQ-OAR-2019-1058]
3. The lack of regulations on greenhouse gasses inherently is prejudiced and affects minorities to a higher extent. Due to living conditions of minority populations in the U.S. from systemic racism and demographically living in more urbanized areas, there is more exposure to air pollution and climate affected areas. Beyond exposure, the populations of minorities often live in areas where climate change can have more intense effects on its populations. Statistics have shown that "black people are 40 percent more likely than other groups to live in paces where extreme temperatures driven by climate chane will result in higher mortality rates" (Fears & Grandoni,

2021). To not create a more aggressive option for emission regulation, particularly one that will eradicate emissions in general, is negligently ignoring the significant effect towards minorities from the lack of efficient policy. [EPA-HQ-OAR-2019-1058]

4. There is already technology in the realms of engines and heavy duty engines that have net-zero emissions. This is technology needs to be pressured further into the realm of heavy engines. By not creating an option that wants to achieve net-zero emissions, there is less incentive to move to this technology at the rate that is needed by the U.S. environment and its people. There is discussion that these engines are not feasible for companies to transfer to, but the cost of a safer environment for people and the climate are arguably more important. The costs of these engines will not compare to the preservation of the future of the U.S. in regards to citizens' health and the prevention of worsening climate catastrophes (Russel, et. al, 2021). [EPA-HQ-OAR-2019-1058]
5. The climate cannot handle weaker approaches to tackle climate change and GHG. Over the previous years, climate change's effects have only become worse. It is shown through various studies that in the upcoming years we are expected to see more climate disasters: floods, hurricanes, tropical storms, etc. By going with Option 1 or Option 2, the EPA is only prescribing a minimal change to emission regulations on the drastic issue. There needs to be an approach that advocates for more government pressure for companies to produce and use zero-emission engines for the preservation of the current environment in the U.S. to preserve safety and viability in the country's land (NASA 2021). [EPA-HQ-OAR-2019-1058]

Organization: *Carreras Tours, LLC (2033)*

Diesel pollution kills. Others face heart attacks, asthma, and respiratory conditions that damage their wellbeing and quality of life. The EPA's proposed rulemaking on diesel emissions is much needed. [EPA-HQ-OAR-2019-0055-2033, p.1]

While these rules are a good start, they don't go far enough. [EPA-HQ-OAR-2019-0055-2033, p.1]

EPA's plan needs to eliminate tailpipe emissions and transition the trucking industry to zero emissions. Many states have already required truck manufacturers to reduce NOx emissions by 90% by 2027. EPA can build on these standards by incorporating strong greenhouse gas standards in order to reach 100% clean trucking by 2035. [EPA-HQ-OAR-2019-0055-2033, p.1]

Organization: *Center for Climate and Energy Solutions (C2ES)*

As underscored by the most recent report from the Intergovernmental Panel on Climate Change (IPCC), it is imperative that we reduce global greenhouse gas emissions as swiftly as possible to keep global warming to 1.5 degrees Celsius above pre-industrial levels.1 In the United States, transportation is the largest sectoral source of emissions, and while medium- and heavy-duty vehicles make up only 5 percent of vehicles on the road, they account disproportionately for almost a quarter of all transportation emissions.2 Reducing the emissions from these vehicles must be central to the United State's decarbonization strategy. [EPA-HQ-OAR-2019-0055-1165-A1, p.2]

1 Intergovernmental Panel on Climate Change, 'Summary for Policymakers,' in Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, ed. [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, and J. Malley] (Cambridge, UK and New York: Cambridge University Press, 2022), https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_SummaryForPolicymakers.pdf.

2 U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020 (Washington,DC: U.S. Environmental Protection Agency, 2020), https://www.epa.gov/system/files/documents/2022-04/us-ghginventory-2022-main-text.pdf.

C2ES welcomes EPA's proposed updates to the heavy-duty emission control program, including the proposed updates to the emissions standards, test procedures, useful life, and other requirements. C2ES also supports the proposed targeted updates to the existing Heavy-Duty Greenhouse Gas Emissions Phase 2 program, particularly with regards to the greenhouse gas standards for school buses, transit buses, delivery trucks, and short-haul tractors. [EPA-HQ-OAR-2019-0055-1165-A1, p.2]

Recent geopolitical events have also demonstrated the need to accelerate the shift away from unabated fossil fuels, including by electrifying the U.S. vehicle fleet. Russia's invasion of Ukraine has sent shockwaves through the global energy system, which has exacerbated price volatility and exposed the economic and national security vulnerabilities of our dependence on petroleum, the price of which is set in global markets and influenced by the actions of hostile foreign powers. [EPA-HQ-OAR-2019-0055-1165-A1, p.3]

In addition to the climate impacts of burning gasoline and diesel, the fundamental role these fuels play in our transportation system only makes it more imperative that we reduce our reliance on them to bolster the resilience of the U.S. economy to future geopolitical shocks. Other agencies, including the Department of Energy, are taking action to secure domestic supplies of critical minerals used to produce batteries and are considering ways to onshore processing and domestic production capacity. [EPA-HQ-OAR-2019-0055-1165-A1, pp.3-4]

Given the benefits of improved efficiency and fuel savings as outlined in the draft regulatory impact analysis, EPA should adopt emissions standards at the more stringent end than the proposed range. Setting stringent standards will support both innovation and reduced fuel consumption across the medium- and heavy-duty transportation sector. [EPA-HQ-OAR-2019-0055-1165-A1, p.4] Both of EPA's proposed options, as well as the alternative, would significantly reduce NOx emissions over the coming decades. To address historic injustices, EPA should consider the most expedient course toward emission reductions, and should prioritize real-world emissions reductions in the use cases that most disproportionately harm historically marginalized communities. [EPA-HQ-OAR-2019-0055-1165-A1, p.4]

Organization: *Center for Community Action and Environmental Justice (CCAEJ)*

I am submitting this comments on behalf of the Center for Community Action and Environmental Justice working with communities here in the Inland Empire which have suffered under years of oppressive polluted and toxic air. While we are glad to see that some work is being done to tackle the issue and move forward, we do not feel that the current proposals are adequate enough for meeting the challenge. Instead, they provide too much leeway to polluters to continue to inject toxins into our communities. Zero must mean zero. We call for the EPA to move forward with a strong rule that the prioritizes community health and ends the onslaught of pollution. Despite improvements of the last several decades, we continue to suffer from some of the worst air quality in the nation, including a worsening of PM2.5. The EPA has an opportunity to make a generational investment in clean air and a livable planet for historically marginalized communities via this rulemaking. This means ensuring that it does not give a pass to false solutions such as natural gas that perpetuate fossil fuel usage. Instead, we need to see a zero emissions mandate to ensure that the communities will truly see the realization of the benefits that the rule intends to provide. Thank you for the opportunity to provide these comments and we look forward to a strong and transformative rule. [EPA-HQ-OAR-2019-0055-1258, p. 1]

Organization: *Ceres BICEP (Business for Innovative Climate and Energy Policy) Network*

On behalf of the Ceres BICEP (Business for Innovative Climate and Energy Policy) Network - a coalition of 75 major employers across the United States – I am writing to urge you to strengthen the proposed heavy-duty truck standards. [EPA-HQ-OAR-2019-0055-2714-A1, p.1]

BICEP Network members are committed to ambitious climate action, advocating for stronger climate and clean energy policies at the state and federal levels in the U.S. Our members see reducing greenhouse gas (GHG) emissions by transitioning to zero-emission medium- and heavy-duty vehicles (MHDVs) as a major economic opportunity. They recognize that zero-emission vehicles (ZEVs) bring significant economic and environmental benefits, including operational cost savings, improved air quality, and GHG reductions. However, while BICEP members are working to do their part as individual companies, strong standards are necessary to ensure the widespread availability of clean trucks in the U.S., as well as to drive the economies of scale that will reduce costs and accelerate the necessary transition to electrification. [EPA-HQ-OAR-2019-0055-2714-A1, p.1]

Thus, on behalf of the companies in the BICEP network, I urge EPA to strengthen the proposed standards, which are not sufficiently stringent to accelerate the cost-effective deployment of electric commercial trucks at the necessary rate and scale, are inconsistent with climate goals, and fail to adequately reduce air pollution in disadvantaged communities. Finally, given the urgency of the climate crisis, and of remedying longstanding negative health impacts in disadvantaged communities, we urge EPA to finalize the standards this year. [EPA-HQ-OAR-2019-0055-2714-A1, p.2]

As a representative of this coalition, I am writing to urge you to strengthen the proposed heavy-duty truck standards. Our members see climate change as a significant risk and reducing greenhouse gas (GHG) emissions as a major economic opportunity. [EPA-HQ-OAR-2019-0055-2714-A2, p.1]

Corporate Electric Vehicle Alliance members share a common goal of electrifying their on-road fleets and networked vehicles as well as reducing their transportation carbon footprint, and recognize that strong standards are necessary to affect this critical transition. In fact, a recent survey of Corporate Electric Vehicle Alliance members demonstrates robust demand for zero-emission vehicles (ZEVs) over the next five years. However, while some ZEV classes are becoming increasingly cost competitive with conventional models, electric medium- and heavy-duty vehicles can be up to three to four times the purchase price of a comparable conventional model. Strong policies are necessary to ensure the availability, adequate production volume, and sufficient variety of zero emission trucks to meet the needs of commercial fleets. [EPA-HQ-OAR-2019-0055-2714-A2, p.1]

While our members are working to do their part as individual companies, we need strong standards to ensure the widespread availability of clean trucks in the U.S., as well as to drive the economies of scale that will accelerate the necessary transition to electrification. The U.S. Environmental Protection Agency's (EPA) proposal projects a ZEV sales share of 1.5% in key market segments in 2027, which falls far short of corporate demand as well as what will be needed to meet climate goals and several states' regulatory requirements. [EPA-HQ-OAR-2019-0055-2714-A2, p.1]

In sum, on behalf of the Alliance, I urge EPA to strengthen the proposed standards, which are not sufficiently stringent to accelerate the cost-effective deployment of electric commercial trucks at the rate and scale that we envision, are inconsistent with climate goals, and fail to adequately reduce air pollution in disadvantaged communities. [EPA-HQ-OAR-2019-0055-2714-A2, pp.1-2]

As long-term investors with over $700 billion in assets under management, we are writing to urge you to strengthen the proposed heavy-duty vehicle (HDV) standards. As investors, we see climate change as a significant economic risk, and reducing greenhouse gas (GHG) emissions by transitioning to zero emission medium- and heavy-duty vehicles (MHDVs) as a major economic opportunity. The U.S.' ability to meet climate and public health goals, and the future global competitiveness of the U.S. truck industry, are contingent on strong engine and truck emission standards that will drive a rapid shift to zero emission vehicles (ZEVs) while reducing harmful emissions in the interim. Unfortunately, the proposed regulations are inconsistent with climate goals, the pressing need to improve air quality, particularly in disadvantaged communities which bear the brunt of truck pollution, and stated corporate and manufacturer global commitments. [EPA-HQ-OAR-2019-0055-2714-A3, p.1]

The demand for zero-emissions trucks is growing as fleet owners and shippers increasingly commit to net zero goals and recognize the economic benefits of ZEVs. For example, a recent survey of Corporate Electric Vehicle Alliance members demonstrates robust demand for ZEVs. In turn, major truck manufacturers are proposing ambitious goals; for example, Volvo has stated that 50% of its trucks sales will be ZEVs by 2030 globally and Daimler has set a goal of 60% ZEV truck sales globally. However, strong standards will be necessary to ensure the availability of ZEVs in the U.S., and to accelerate the transition to electrification at the rate and scale required by climate goals.[EPA-HQ-OAR-2019-0055-2714-A3, pp.1-2]

Robust truck standards are critical to meeting climate goals, ensuring the global competitiveness of the U.S. truck industry, and reducing air pollution in communities that have suffered too long from truck pollution. Accordingly, we urge you to significantly strengthen the proposed rules to realize these critical climate, economic and public health goals. [EPA-HQ-OAR-2019-0055-2714-A3, p.2]

Organization: *Christopher Lish*

I am glad that, after 20 years of delay, the Environmental Protection Agency has finally proposed stronger tailpipe toxic pollution standards for heavy-duty diesel trucks.
However, while these rules are a good start, they don't go far enough. Now is the time to eliminate toxic tailpipe emissions from trucks. Black, Latino, Asian American, and other marginalized communities living in highly trafficked areas have suffered the health impacts of diesel trucks for far too long. To deliver on the Biden Administration's environmental justice, public health, and climate goals, the Environmental Protection Agency must make the rules stronger and finalize a strong heavy-duty vehicle rule this year that sets us on a rapid path to cleaning up and electrifying the most polluting vehicles on the roads—our trucks and buses—by 2035, if not sooner. [EPA-HQ-OAR-2019-1147; see also Section 1.2/2.4]

I appreciate President Biden making clean transportation a day-one priority and the Environmental Protection Agency moving quickly to propose long-overdue regulations to clean up pollution from dirty heavy-duty vehicles. The Environmental Protection Agency's proposed rulemaking on diesel emissions is much needed. However, our communities and our planet require bolder standards that will reduce health-harming smog and cut greenhouse gas emissions to a degree that matches the urgency of the climate and public health crisis. That can only happen if both the nitrogen oxide (NOx) standard and the greenhouse gas standards are strong enough to make trucks cleaner while moving quickly to get zero-emission trucks on the road. I ask you to adopt the strongest possible standards to reduce pollution from diesel truck engines and establish a national zero-emissions truck sales requirement to help phase out fossil fuels and slash air pollution in the most-impacted communities more quickly. [EPA-HQ-OAR-2019-1147]

We will not be able to tackle the climate crisis without cleaner trucks on our roads. The transportation sector is our country's largest source of carbon pollution, with heavy-duty vehicles contributing substantially to our total greenhouse gas emissions. In order to curb our emissions by at least 50% by 2030, a pace that scientists agree is necessary to mitigate the worst effects of climate change, we must adopt the strongest possible standards for trucks and buses. This will promote a transition to fully electric vehicles and slow the sale of dirty diesel trucks over the next decade. [EPA-HQ-OAR-2019-1147]

Moreover, the standards must not be undermined by giveaways to an industry that would allow manufacturers to keep producing fossil fuel trucks far into the next decade. The Environmental Protection Agency must strengthen the final rule by accelerating the trajectory towards zero-emission vehicles and eliminating the various credit giveaways that significantly erode the standard. We cannot afford more loopholes and giveaways for multi-billion-dollar companies to get a pass on poisoning frontline communities in favor of increased profits. It's past time for the Environmental Protection Agency to expire all avenues for skirting pollution standards. [EPA-HQ-OAR-2019-1147]

Time is of the essence: the administration must finalize this proposal by the end of 2022 for the nation to realize the full health benefits of the rule. If the Environmental Protection Agency misses this window of opportunity, it will mean a full additional year of production of polluting trucks. This makes it critical to ensure that heavy-duty vehicles are as efficient as possible and that we adopt and enforce strict emissions limits as we shift away from fleets powered by fossil fuels. Our communities cannot afford to wait for cleaner air. [EPA-HQ-OAR-2019-1147]

Disappointingly, the strongest version of this proposed rule does not do enough to build on the work California and other states have already done to fight diesel pollution from trucks. The Environmental Protection Agency has a responsibility to slash air pollution, protect public health, and address the climate crisis all at once by pursuing strong standards for heavy-duty vehicle emissions. The science and economics clearly shows that zero-emission trucks can be deployed now. [EPA-HQ-OAR-2019-1147]

We have the technology and the ability to cut pollution and save money today. At this moment, electric trucks and buses are already capable of supporting the majority of the United States' freight, delivery, and transit uses and needs—and there are dozens more zero-emission vehicles coming to the market within a couple of years. Cleaner trucks are not only available and ready now, they also are projected to deliver critical cost savings for operators and drivers. Across nearly every vehicle class, zero-emission electric trucks and buses are projected to be cheaper to own and operate than their combustion engine counterparts within five years. [EPA-HQ-OAR-2019-1147]

Many states have already required truck manufacturers to reduce NOx emissions by 90% by 2027. The Environmental Protection Agency can build on these standards by incorporating strong greenhouse gas standards in order to reach 100% clean trucking by 2035, if not, preferably, sooner. [EPA-HQ-OAR-2019-1147]

Thank you for initiating action on this important issue. Zero-emission trucks will save lives. I look forward to the Environmental Protection Agency once again responding to health, equity, and environmental advocates, and particularly frontline communities bearing the brunt of the toxic diesel pollution, by making much-needed improvements to this rule. While Option 1 is a start, the standards should at least align with California's recent clean trucks rule. These standards must reduce deadly pollution from nitrogen oxides by 90% by 2027, and put our nation's buses and trucks on a clear path to 100% zero-emission all-electric vehicles by 2035. I urge the Environmental Protection Agency to protect our health and eliminate toxic tailpipe emissions from trucks by adopting a stronger rule that accelerates the rollout of zero-emission trucks and to boldly pursue environmental justice as it reduces diesel emissions and improves the health of communities near ports and freight corridors. Please finalize the strongest possible rule to deliver cleaner air. [EPA-HQ-OAR-2019-1147]

Organization: *ChargePoint, Inc. (ChargePoint)*

ChargePoint, Inc. appreciates the EPA's dedication to the decarbonization of the transportation sector and the opportunity to provide comments on the Notice of Proposed Rulemaking for the Control of Air Pollution from New Motor Vehicles: Heavy Duty Engine and Vehicle Standards as part of the "Clean Trucks Plan." ChargePoint applauds EPA's efforts to cut down on air pollution through emissions standards1 and continues to support efforts to reduce oxides of nitrogen (NOx) emissions in the medium and heavy-duty engines that traverse our nation's highways swiftly and effectively by finalizing emission standards encouraging a zero-emission medium and heavy-duty vehicle (MHDV) sector. [EPA-HQ-OAR-2019-0055-1294-A1, p. 1]

Organization: *City of Seattle, Office of Sustainability & Environment*

This proposed rule has monumental implications for cities across this country, as it sets the stage for the trucks and buses operating on our streets and in our neighborhoods for decades. As a Port-City, we understand the importance of trucks and cargo movement in a thriving economy and workforce. As we work to make our community strong, the City of Seattle urges you to adopt the strongest possible rule to cut deadly pollution from heavy-duty vehicles, so that all communities can thrive. [EPA-HQ-OAR-2019-0055-1287-A1, p.1]

Organization: *Clean Air Board of Central Pennsylvania*

The U.S. Environmental Protection Agency has proposed new vehicle emission standards for medium and heavy-duty trucks. The Clean Air Board welcomes the proposed rulemaking. The last medium and heavy-duty emission standards were established in 2002. Vehicles purchased in the next few years will be on the road for many years and potentially for decades. It is critically important to set standards now. This important rulemaking will help transition the transportation sector toward lower emissions of harmful air pollutants and greenhouse gases. [EPA-HQ-OAR-2019-0055-1305-A1, p.1]

The proposed standards would significantly reduce emissions of NOx from heavy-duty gasoline and diesel engines and set stronger greenhouse gas standards for heavy-duty vehicles. Updated NOx standards are technically feasible. Updated NOx standards are economically feasible. Stricter NOx regulations reduce cumulative heavy duty vehicle NOx emissions (from existing and new vehicles). [EPA-HQ-OAR-2019-0055-1305-A1, p.1]

Organization: *Clean Energy (CE)*

We support new EPA regulations for heavy-duty engines and vehicles which significantly reduce NOx emissions and encourage the deployment of scalable early compliant technologies. [EPA-HQ-OAR-2019-0055-1350-A1, p.1]

We support the Option 1 NOx standard. California state authorities have already adopted new engine standards that require moving to the 0.02 NOx level beginning in 2027. [EPA-HQ-OAR-2019-0055-1350-A1, p.5]

Organization: *Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club*

With this rulemaking, EPA has an opportunity to take critical steps toward addressing the public health burdens, environmental injustices, and climate dangers caused by heavy-duty vehicles (HDVs) powered by internal combustion engines. More than a decade after EPA's existing criteria pollutant standards took effect, communities continue to suffer the impacts of air pollution from these vehicles. EPA must set strong emissions standards for both criteria pollutants and greenhouse gases (GHGs) in this rulemaking to achieve critically necessary protections to public health and welfare, especially in light of the feasibility and increasing fleet penetration of zero-emission technologies. We also urge EPA to finalize the rule before the end of this calendar year, particularly the criteria pollutant standards given statutory lead time requirements, so that the new standards take effect in model year (MY) 2027. See 42 U.S.C. 7521(a)(3)(C). Finalizing quickly is critical to avoid unjustifiably withholding both necessary GHG reductions and the air quality benefits that overburdened communities need now. [EPA-HQ-OAR-2019-0055-1302-A1, p.7]

As detailed below, EPA must set protective, evidence-based standards in this rulemaking to comply with the Clean Air Act's statutory commands, act in accordance with principles of reasoned decisionmaking, and mitigate HDVs' contribution to ongoing public health and climate crises. [EPA-HQ-OAR-2019-0055-1302-A1, p.9]

First, Option 2's minimal emissions reductions are woefully inadequate in light of the clear endangerment that heavy-duty vehicles and engines pose to public health and welfare. See Sections II.C.1–2, supra (describing health impacts). EPA acknowledges the seriousness of these threats to public health and welfare and the need to achieve greater reductions in emissions. See generally 87 Fed. Reg. at 17,441–56; DRIA Ch. 4. And it correctly concludes, based on extensive data, that both Options 1 and 2 are technologically feasible. 87 Fed. Reg. at 17,436; see generally DRIA Ch. 3. Option 2, however, would unjustifiably allow much higher criteria pollutant emissions than Option 1 or a national program based on the Omnibus. See DRIA at 262, 277–87. In 2045 alone, Option 2 would create 120,000 tons more NOx than Option 1 and achieve only a 47% reduction in NOx emissions from the baseline, compared to Option 1's 61% reduction. 87 Fed. Reg. at 17,579–80; DRIA at 262 (Table 5-34). Option 2's higher emissions—nearly 1.25 million more tons of NOx between 2027–2045 than Option 1, see DRIA at 262 (Table 5-34)—translate into worse human health outcomes. [EPA-HQ-OAR-2019-0055-1302-A1, p.50]

Organization: *Clean Energy Ventures et al.*

We strongly support EPA's efforts to reduce emissions of nitrogen oxides (NOx) and greenhouse gases (GHGs) from our nation's heavy-duty engines and vehicles. We also strongly support the Biden administration's goal of reaching net zero GHG emissions by 2050. [EPA-HQ-OAR-2019-0055-2339-A2, p.1]

In sum, meeting the Biden administration's "net zero by 2050" goal requires EPA to implement a regulatory model that will maximize the scale and cost-effectiveness of potential GHG emissions reductions that are possible across the entire heavy-duty sector over the coming critical decade and longer, regardless of the fuel, power source, or technology deployed. [EPA-HQ-OAR-2019-0055-2339-A2, p.2]

We strongly encourage you to finalize the Proposal in a way that sends the right market signals and encourages data-driven innovation that is far more likely to result in greater and more cost-effective GHG emissions reductions than a technology-specific approach that rewards only two of the many decarbonization strategies being developed for the heavy-duty transportation sector. [EPA-HQ-OAR-2019-0055-2339-A2, p.2]

Organization: *Clean Harbors Environmental Services*

Clean Harbors has a shared interest in the proposed rule to establish a stronger national standard to reduce nitrogen oxides (NOx) emissions from heavy-duty trucks. We support the push for cleaner air and healthier communities for all and stand ready to serve as constructive partners as EPA develops a workable final rule that will achieve those results.[EPA-HQ-OAR-2019-0055-1063-A2, p.1]

To that end, we strongly encourage you to keep two key considerations in mind as you work toward a final rule. [EPA-HQ-OAR-2019-0055-1063-A2, p.1]

First, cleaner air and healthier communities for all require replacing older trucks with newer ones. Today, roughly half of the trucks on the road were built before 2010, and those older vehicles emit significantly more air pollutants than modern trucks equipped with effective emission reduction technology. If the new rule does not facilitate the development of affordable, durable trucks that can meet customer needs, fleet owners are more likely to hold onto their older, dirtier trucks longer – which could result in the loss of good-paying jobs. Most importantly, that also would delay the cleanest trucks from hitting the road and cause further harm in communities near highways, ports, and warehouses that historically and currently suffer from the highest concentration of air pollution. [EPA-HQ-OAR-2019-0055-1063-A2, p.1]

Second, we must ensure the final rule serves as a bridge, not a potential barrier, to a zero-emissions future. Zero Emission Vehicles (ZEVs) will eliminate all tailpipe emissions and dramatically reduce the nation’s reliance on burning fossil fuels, which will diminish our dependency on foreign energy sources and greatly benefit public health. [EPA-HQ-OAR-2019-0055-1063-A2, p.1]

We are committed to partnering with EPA and other stakeholders to further reduce emissions from heavy-duty trucks without diverting resources necessary to foster a phased transition to ZEVs. We look forward to working with you to finalize a cost-effective rule – informed by data and science – that will further reduce emissions, protect American jobs, and result in cleaner air and healthier communities for all.[EPA-HQ-OAR-2019-0055-1063-A2, p.2]

Organization: *CleanEarth4Kids*

It is critical that heavy-duty vehicles are as efficient as possible with strict limits on emissions as we move from fossil fuels. [EPA-HQ-OAR-2019-0055-1208-A1, p.1]

The EPA's proposed Heavy Duty Vehicle rule is not nearly strong enough. What is proposed is weaker than many existing state rules and fails to quickly deploy zero-emission trucks. The EPA must require a fast transition to zero-emission trucks by establishing a national zero-emissions truck sales requirement while cutting nitrogen oxide and particulate matter pollution, revise all exhaust emission standards, test procedures, and other emissions-related requirements for heavy-duty trucks starting in model years 2024 with no exceptions or loopholes. [EPA-HQ-OAR-2019-0055-1208-A1, p.1]

Organization: *ClearFlame Engine Technologies (ClearFlame), Remora, and SixWheel*

We strongly urge the EPA to expand this incentive program beyond BEVs and FCEVs. To maximize emissions reductions, this program should be fuel-neutral, technology-neutral, and should rely on measurable performance-based emissions standards. In particular, this approach should incorporate upstream emissions for all zero-emission and near-zero emission vehicles. For example, the carbon intensity of the grid should be reflected in the emissions assumptions of projected BEV sales, and a diesel engine running on biogenic carbon (e.g., ethanol) should get credit for the improvement to the overall emissions performance of the engine provided by the fuel. [EPA-HQ-OAR-2019-0055-1329-A2, p. 4]

Organization: *ClearFlame Engine Technologies (ClearFlame)*

ClearFlame Engine Technologies is pleased to present these comments1 in support of the U.S. Environmental Protection Agency's Clean Trucks Plan and EPA's proposal to reduce emissions of nitrogen oxides (NOx) and greenhouse gases (GHG) from our nation's heavy-duty trucks and buses.2 [EPA-HQ-OAR-2019-0055-1261-A1, p. 1]

> 1. These comments supplement the oral testimony provided to EPA at its virtual hearing on April 12, 2022, and a comment letter submitted by BJ Johnson into the ANPRM record dated February 20, 2022. The oral testimony is attached hereto as Appendix 1, and the February 20, 2022 letter is attached hereto as Appendix 2. Each document is hereby incorporated herein.
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> 2 "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards," Docket ID No. EPA-HQ-OAR-2019-0055 (hereinafter, the "Proposal)". Abbreviations and acronyms used herein that are not defined shall have the meaning attributed to them in the Proposal. For additional information about ClearFlame or our comments, please contact BJ Johnson at bj@clearflameengines.com or Rich Kassel at rich@clearflameengines.com.

EPA Should Finalize this Proposal and Draft Next Year's GHG Proposal to Encourage Near-Term GHG Reductions at Scale, This Decade. [EPA-HQ-OAR-2019-0055-1261-A1, p. 3]

Earlier this year, we all read the latest warning from the Intergovernmental Panel on Climate Change that we cannot wait any longer to deeply decarbonize the entire economy and take steps to adapt to a changing climate.3 The IPCC's message was clear: we need "urgent, more ambitious and accelerated action and, at the same time, rapid and deep cuts in greenhouse gas emissions. The quicker and further emissions fall, the more scope there is for people and nature to adapt."4 In short, we need to deeply decarbonize all segments of our economy this decade in order to avoid the worst impacts of climate change. [EPA-HQ-OAR-2019-0055-1261-A1, pp. 3 - 4]

3. IPCC, Climate Change 2022: Impacts, Adaptation and Vulnerability, Working Group II Report to the Sixth Assessment of the Intergovernmental Panel on Climate Change, April 2022. ("Climate Change 2022").

4. IPCC, Climate Change 2022, Frequently Asked Questions, accessed on May 15, 2022 at: https://www.ipcc.ch/report/ar6/wg2/about/frequently-asked-questions/keyfaq1

At ClearFlame, we could not agree more. While electrification appears to be the fastest pathway to decarbonizing passenger cars, transit buses, school buses, and certain commercial delivery vehicles, we must concurrently accelerate our efforts to deeply decarbonize the engines and vehicles that will continue to run on liquid fuels for decades to come. [EPA-HQ-OAR-2019-0055-1261-A1, p. 4]

This Proposal—and next year's expected proposal to reduce GHG emissions from all heavy-duty engines and vehicles—should encourage innovation that results in engines and vehicles that are dramatically lower in GHG emissions than the engines and vehicles they replace, and that can scale up this decade. Speed and scale matters – just as individuals cannot save enough for retirement by waiting until the last moment to invest in their future, we will not meet our societal responsibility by investing only in solutions that will not scale for many years to come. [EPA-HQ-OAR-2019-0055-1261-A1, p. 4]

Only by pursuing every pathway towards decarbonization at scale this decade—as a complement to longer-term electrification strategies—will we be able to address and meet the global challenge facing us. [EPA-HQ-OAR-2019-0055-1261-A1, p. 4]

As you finalize this proposal, we strongly urge EPA to finalize a rule that includes Option 1, and that reduces NOx emissions from new heavy-duty diesel engines by 90 percent, starting in MY 2027. As you update the Phase 2 GHG standards and develop the agency's approach for next year's expected Phase 3 GHG proposal, we strongly urge the agency to adapt the fuel-neutral/technology-neutral approach that has reduced diesel PM and NOx emissions so dramatically and cost-effectively over the past two decades to deeply reduce greenhouse gas emissions from all heavy-duty and nonroad diesel applications, not just those vehicles that are most ready for electrification. Towards that end, we ask that the final rule ensures that ethanol can be used to certify diesel engines that comply with the Clean Trucks Plan's emission standards, and that ethanol will be listed as a fuel that can be used by these engines throughout their useful lives. [EPA-HQ-OAR-2019-0055-1261-A1, p. 9]

We are confident that adopting these approaches will help ensure a final rule that will meet the administration's air quality, human health, and climate goals as quickly as possible – and more quickly and more cost-effectively than any approach that limits the technology choices in the marketplace and that hampers innovation by companies that are developing new approaches to emissions reduction. We are similarly confident that this approach will continue the agency's long track record of success that has become the model for nations around the world—and that has enabled American businesses to be the world leaders in emissions reduction technology. [EPA-HQ-OAR-2019-0055-1261-A1, pp. 9 - 10]

We look forward to working with the Agency towards a successful Clean Trucks Plan that improves air quality and health in disadvantaged and other communities across the country, and that decarbonizes all heavy-duty and nonroad engines and vehicles in years to come. [EPA-HQ-OAR-2019-0055-1261-A1, p. 10]

Organization: *Coach USA, Inc. (Coach USA)*

The Proposed Rule is almost entirely trucking-centric and, while apparently applicable to engines used in motorcoaches, devotes only sparse attention to the unique safety and other considerations surrounding passenger versus cargo transportation. [EPA-HQ-OAR-2019-0055-1307-A1, p. 2]

Organization: *Coingecko Company Sa*

Very interesting.
Very useful for the evolution of the planet. [EPA-HQ-OAR-2019-0055-1847, p.1]

Organization: *Colorado Energy Office, et al.*

Colorado data suggests that over 80% of our heavy duty truck traffic comes from vehicles that are not registered in Colorado. While Colorado can influence change for trucks registered in our state, strong EPA standards that improve the status quo for all trucks helps us to further improve air quality, and also helps ensure parity for Colorado companies versus those in neighboring states. [EPA-HQ-OAR-2019-0055-1297-A1, p.1]

We appreciate the Administration's efforts to re-establish the United States as a leader on climate, and to regain ground on clean transportation. The President's agenda - including the goal to ensure half of all new vehicles sold in 2030 are zero emission, and planned investments in the IIJA and proposed Build Back Better - would be transformational. We now urge the Administration to take the next step and codify this action by adopting the strongest national NOx and GHG standards possible for medium- and heavy-duty vehicles. We appreciate the Administration's leadership [EPA-HQ-OAR-2019-0055-1297-A1, p.3]

Organization: *Columbia River Plumbing*

I am absolutely against this clean air act regarding truck emissions going into for sore application. The American trucking industry is so much farther ahead than the rest of the world in a missions that until they catch up, do not hamper, hinder, or retard the American economy by inflicting heavy cost like this at this time. I'm all for clean air and responsibility, but not at the expense of our fragile economy right now. This is just one way to try pushing everything to an alternative fuel before we are ready for it. This will increase costs across the country in all products. Do not pass this new rule. [EPA-HQ-OAR-2019-0055-1014, p.1]

Organization: *Connecticut Department of Energy and Environmental Protection (CTDEEP)*

In this action, EPA seeks comment on the revised standards for nitrogen oxides (NOx) emissions from heavy-duty (HD) trucks. Connecticut strongly supports EPA's development of new engine and vehicle emission standards for heavy-duty trucks provided this action results in robust emission standards that significantly reduce emissions. Connecticut has urged EPA to promulgate robust federal emission standards to improve public health, advance environmental justice and to address our State's intractable ozone nonattainment challenge.1 [EPA-HQ-OAR-2019-0055-1306-A1, p.1]

1 NY-CT-NJ-Letter-RE-Heavy-Duty-Truck-NOx-Emission-Standards_112321.pdf

Organization: *Consumer Energy Alliance (CEA)*

On behalf of Consumer Energy Alliance (CEA), I write today regarding the development of the final rule on tailpipe emissions from heavy-duty trucks in support of a single national low-NOx rule that is technologically feasible, protects vital American jobs, and does not cause further damage to our critical supply chains. [EPA-HQ-OAR-2019-0055-1260-A1, p.1]

Our members support a rational, all-of-the-above energy policy that utilizes all our domestic natural resources – both traditional and renewable – while ensuring commonsense environmental protections are in place. Therefore, we support thoughtful emissions reduction strategies as we move towards a greener and cleaner future that keep the cost and reliability needs of the consumer in mind. [EPA-HQ-OAR-2019-0055-1260-A1, p.1]

Ninety-seven percent of trucking fleets are small, family-owned businesses that run on small margins and often face issues with competitive pricing that is hard to overcome in a normal market. With rising diesel prices and inflation, along with increased vehicle costs, family-owned trucking companies are simply not able to weather the storm like the larger carriers can and are now being forced to make difficult business decisions impacting the critical supply chains our country relies on. [EPA-HQ-OAR-2019-0055-1260-A1, p.1]

The U.S. EPA must consider these small businesses in order to further environmental progress without destroying jobs or damaging our fragile economic recovery. [EPA-HQ-OAR-2019-0055-1260-A1, p.1]

As such, a single national low-NOx rule must facilitate the development of affordable, durable commercial vehicles that can meet customer needs while serving as a bridge, not a potential barrier, to a zero-emissions future. [EPA-HQ-OAR-2019-0055-1260-A1, p.2]

Organization: *Consumer Reports (CR)*

While the proposal is a good start, it can and should go further to lower greenhouse gas (GHG) emissions and nitrogen oxides (NOx). Such reductions are imperative to lower dangerous tailpipe emissions, to increase adoption of zero-emission vehicles (ZEVs) and to achieve President Biden's goal of reducing greenhouse gas emissions by 50-52% compared to 2005 levels by 2030.1 Heavy-duty vehicles deliver consumer goods to warehouses and homes across the country. As e-commerce expands, consumer reliance on these trucks will grow. Such reliance has hidden costs in the form of harmful air pollution to consumers making purchases, and to communities living near freight routes. [EPA-HQ-OAR-2019-0055-1285-A1, p.1]

> 1 White House, Fact Sheet: Vice President Harris Announces Actions to Accelerate Clean Transit, Buses, School Buses and Trucks,(March 07, 2022). Available at: https://www.whitehouse.gov/briefing-room/statements-releases/2022/03/07/fact-sheet-vice-president-harris-announces-actions-to-accelerate-clean-transit-buses-school-buses-and-trucks/

CR supports a strong federal heavy-duty engine and vehicle (HDV) standard for NOx and GHG. [EPA-HQ-OAR-2019-0055-1285-A1, p.1]

CR is encouraged to see EPA working towards reducing tailpipe emissions that are dangerous to public health and the environment. However, given the outsized impact of these vehicles on air quality, EPA should go further to reduce emissions and to meet its obligations under the CAA to establish emission standards that 'reflect the greatest degree of emission reduction achievable through the application of technology.' [EPA-HQ-OAR-2019-0055-1285-A1, pp.10-11]

Organization: *Creation Justice Ministries*

It doesn't have to be this way. The movement of people and goods can be a good thing. It can be a blessing from God and a blessing to our world. But that's only if it is powered by clean and renewable energy. [EPA-HQ-OAR-2019-0055-2482, p.1]

That's why I'm submitting this comment on behalf of our Creation Justice community and the millions of caring Christians in this country. Together, we ask the EPA to create the strongest possible limits on heavyduty vehicle pollution and put our national bus and truck fleet on a clear path to 100% zero-emission all-electric vehicles by 2035. [EPA-HQ-OAR-2019-0055-2482, p.1]

Organization: *Cummins Inc. (Cummins)*

Cummins Inc. appreciates this opportunity to provide comments in response to the NPRM. This rulemaking provides a unique opportunity to achieve significant emissions reductions from heavy-duty vehicles as the country transitions to the zero-emissions future we all envision. To have a positive impact on the environment and communities, the final rule must be achievable with technologies our customers can readily adopt. [EPA-HQ-OAR-2019-0055-1325-A1, p. 20]

Additionally, we urge EPA and CARB to work together towards a single, nationwide standard. We are optimistic that all stakeholders can come together in support of a durable final rule that is a win for U.S. innovation, competitiveness, and the environment. [EPA-HQ-OAR-2019-0055-1325-A1, p. 21]

Organization: *Daimler Truck North America LLC (DTNA) (1045 and 1168)*

In the comments that follow, Daimler Truck suggests that the Proposed Rule can and should be improved by:

- Ensuring that EPA's next-tier emission regulations for HDVs are achievable and supported by sound technical analysis and demonstration;
- Providing market incentives for original equipment manufacturers (OEMs)—small and large—to develop and sell quality next-generation ZEVs;
- Developing a fulsome analysis of the real cost and market impacts of the standards and requirements proposed; and
- Striking the right balance between the environmental benefits and socio-economic impacts of stringent emission reduction regulations, bearing in mind the unique role that the heavy-duty (HD) freight sector as the literal 'engines' of the economy, particularly with respect to consumer goods. Daimler Truck appreciates EPA's consideration of the following comments and welcomes the opportunity for further engagement with the Agency on this important effort. We request that the Agency reconsider its Proposed Rule, that it take the time to engage with industry and stakeholders, and that it re-issue the proposal once it has fully considered the technical, cost, and market impact data gathered in this round of public comments. [EPA-HQ-OAR-2019-0055-1168-A1, p.2]

Daimler Truck is ready and able to build upon its previous efforts to help the Agency make needed changes to the Proposed Rule—potentially through the interim step of a supplemental proposal and another round of public comment—to ensure that the end result is a win for the environment and propels the industry towards investment in the technologies of the future. [EPA-HQ-OAR-2019-0055-1168-A1, p.5]

Not included in the ACT Research Impacts Study, but equally important for EPA's impact analysis, is the likelihood of diminished choices in the marketplace for new HDVs and related impacts on consumers. As emissions stringency drives up manufacturing costs, manufacturers are likely to decide that certain types of vehicles are simply not worth producing for commercial sale, as profit margins are too slim, and a business case to invest in these programs may not exist. The result will be significantly reduced product availability starting in the MY 2027 timeframe, as manufacturers struggle to justify investments across all applications or as technical solutions prove infeasible. This will almost certainly lead to decreased competition in the engine/vehicle market and an increase in vehicle prices. We believe this is already the case for MY 2024 engines and vehicles in markets that have adopted the California Omnibus rule; we urge EPA to study the impacts of the California Omnibus rule on product availability and to use this analysis to inform predictions about the market impacts of the Proposed Rule. [EPA-HQ-OAR-2019-0055-1168-A1, p.23]

Another impact that EPA appears not to have considered are the environmental disbenefits of the market shifts anticipated to follow from implementation of the Agency's proposed standards. Manufacturers who have traditionally focused on the production of diesel engines and vehicles may transition production to gasoline-powered products, to facilitate compliance with EPA's proposed standards. Daimler Truck has seen this transition take place in the marketplace already, with potentially unintended consequences: while the shift to gasoline in the HD market may help to reduce NOx emissions from the sector, it is at the expense of other pollutant emissions, most importantly CO2. EPA GHG Phase 2 standards allow higher CO2 emissions from gasoline-powered vehicles as compared to their diesel counterparts, in recognition of the inherent differences between gasoline and diesel combustion. Gasoline engines will have worse CO2 performance, thus EPA's NOx stringency proposal potentially creates perverse incentives to increase fleet contributions to climate change. [EPA-HQ-OAR-2019-0055-1168-A1, p.23]

Finally, EPA needs to evaluate the economic impact of the Proposed Rule in comparison to other regulatory or incentive programs that could achieve the same desired emission reductions for significantly less cost. Such analysis is necessary to ensure that any decision by the Agency to finalize its proposal is based upon a 'reasoned determination' that the benefits of the regulatory program justify its costs and that EPA has fully assessed available alternatives to direct regulation—such as economic incentives—as required under Executive Order 12866.62 For instance, the Agency should evaluate whether it may be more efficient and cost-effective to achieve the desired NOx and other pollutant reductions through a vehicle rebate program that would encourage older vehicles to be taken out of service. Indeed, it stands to reason that an incentive program that subsidizes the cost of turning over older, dirtier vehicles manufactured to much less stringent standards would be a better use of resources than utilizing the Agency's CAA Section 202(a) authority to target manufacturers, who are already looking beyond these next-tier standards to develop the zero-emission technologies of the future. [EPA-HQ-OAR-2019-0055-1168-A1, p.24]

> 62 See Executive Order 12,866, 'Regulatory Planning and Review' (Sept. 30, 1993) at Section 1.b(6) ('Each agency shall assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs.'); Section 1.b(3) ('Each agency shall identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior.').

In summary, EPA's cost-benefit and economic analyses are undermined by significant omissions and incomplete assumptions about what the impacts of the Proposed Rule will actually be. It thus appears that EPA has failed to use the best reasonably obtainable economic information concerning the consequences of the Proposed Rule, in contravention of the Agency's obligations under Executive Order 12866. Daimler Truck encourages the Agency to re-visit its impact analyses, to ensure that the real costs and likely impacts of the Proposed Rule are captured. [EPA-HQ-OAR-2019-0055-1168-A1, p. 24]

Organization: *Dave Arndt*

[*From Hearing Testimony, April 12, 2022*] We need to tackle all the pollution sources one by one. We have the technology today; electric trucks are a good start. Oh, by the why, I forgot to mention the climate crisis, most of these neighborhoods are on the water and are not prepared for the sea level rise caused by burning fossil fuels. Please pass at least option 1 this year, however please have it go into effect in 2024, we don't have time to wait. Please put the health of our citizens and the climate over the profits of companies. [EPA-HQ-OAR-2019-0055-2867; see also EPA-HQ-OAR-2019-0055-0994]

Organization: *David Pedersen*

I have been studying air pollution in-depth for over two years now and it is an issue that is of great concern to me. I am a pedestrian, and as a result I am forced to inhale diesel exhaust against my will, thereby depriving me of my constitutional and environmental rights. [EPA-HQ-OAR-2019-0055-1059]

I am strongly in favour of cleaning up emissions from the transportation sector. It is overwhelmingly obvious that mobile-source emissions pose real and immediate dangers to public health (I do not need to cite any studies here since it is considered common knowledge), especially to near-road communities (many of which are BIPOC, or racialized, which are already overexposed to air pollution). Furthermore, I am deeply concerned about the impacts of mobile-source emissions on my friends, acquaintances, and fellow activists – many of whom are forced to remain indoors because of the regular diesel emissions (among other sources) outside their homes. [EPA-HQ-OAR-2019-0055-1059]

However, I disagree with the idea of lowering allowable emissions rates if the permissible values are not reduced to zero. My reasoning for this is straightforward and grounded entirely in science: there is no safe level of air pollution1, so it does not matter how clean an engine is if it emits any harmful pollutants whatsoever. Indeed, as Barnett (2014) states:
Change is long overdue. Air pollution can be complex. There are multiple gases and metals that are measured on unfamiliar scales. Air pollution is often difficult to measure and many pollutants interact with the weather, meaning measurements just 100 metres apart can be ery different. However, the epidemiology of air pollution is simple: when average levels increase, the average health effects increase, and this association has been shown repeatedly around the world. I have lost count of the number of government-commissioned environmental reports that have used the safe or dangerous fallacy. The practice should have ended years ago and proper cost-benefit studies should be undertaken for the current massive projects that could affect many people's lives, such as the expansion (https://onlinelibrary.wiley.com/doi/epdf/10.1111/1753-6405.12264) [EPA-HQ-OAR-2019-0055-1059]

1 https://onlinelibrary.wiley.com/doi/epdf/10.1111/1753-6405.12264

Organization: *Delta Car Care LLC*

These additional regulations will do nothing but hurt the American people and the trucking industry! This will escalate costs of all of our consumer goods! Emissions have already been reduced a huge amount! It makes no sense to cause harm to the economy and the trucking industry over something like this. The natural disasters already cause much more issues than these trucks that are currently very clean already! [EPA-HQ-OAR-2019-0055-2256, p.1]

Organization: *Diesel Technology Forum*

Future Emissions Standards Must Encourage Continued Investment Through Proper Balance In Timing, Stringency And Other Factors

The last thing anyone wants out of this is that truckers stop buying new trucks because they are too expensive, too unpredictable, and too complex. A balanced rule will alleviate undesirable outcomes like swings in the new truck market including a pre-buying of current generation technology. We support the continued development of robust technologies that have proven they meet the challenges of reducing emissions. The value of the technologies will need to be obvious to the truckers in order to avoid outcomes that will be detrimental for jobs, the economy, and the environment. [EPA-HQ-OAR-2019-0055-1004 and Public Hearing Day 1 Testimony, EPA-HQ-OAR-2019-0055-2867]

Future And Zero Emission Vehicles

The agency’s decision not to pursue a ZEV mandate is appropriate because ZEV mandates effectively alter otherwise open markets and take away options and fuels that may be more desirable, available, and affordable. Regardless of what today’s studies and projections of total cost of ownership might show, there are many uncertainties about the ultimate timing and market for ZEVs, not the least of which is the adequacy and availability of the charging and fueling infrastructure. [EPA-HQ-OAR-2019-0055-1004 and Public Hearing Day 1 Testimony, EPA-HQ-OAR-2019-0055-2867]

Summary

Above all else, this proposed rule must enable continued investment in the next generation of diesel technology by manufacturers, suppliers, and their customers. Without that, none of the anticipated benefits will accrue, older trucks will stay on the road for longer, and both manufacturers and suppliers will not have the capital to invest in future fuels and technologies. [EPA-HQ-OAR-2019-0055-1004 and Public Hearing Day 1 Testimony, EPA-HQ-OAR-2019-0055-2867]

Organization: *Edison Electric Institute (EEI)*

EPA should finalize an ambitious rule. [EPA-HQ-OAR-2019-0055-1282-A1, p. 9]

Organization: *Engine and Truck Organizations*

[Comment provided by one company that joined this letter campaign:] As a whole, the trucking industry in Pennsylvania is more than significant, and impacts every citizen in our

Commonwealth and in the United States of America. Considering the state of affairs in this country today, why would we want to throw more disruption and costs to further disable the vital trucking industry in Pennsylvania and this Country? [See Engine and Truck Organization letter campaign at EPA-HQ-OAR-2019-0055-1177-A1, p.1; this comment is from EPA-HQ-OAR-2019-0055-1179]

Organization: *EVHybridNoire*

[*From Hearing Testimony, April 13, 2022, Shelly Francis*] Our mission is to increase awareness of electric vehicles and accelerate the adoption of those vehicles so that all communities have access to this new mobility. Our membership is made up of people and members who identify as black and brown, so our organization is the voice of this technology. I live in Atlanta, Georgia, but today, interestingly enough, I'm sitting in Cancer Alley in New Orleans, Louisiana, meeting with key stakeholders from around the country who look like me, along with many names you would recognize. We are also here with a number of allies who don't look like me, and we're discussing ways to further climate justice and environmental justice. This evening I am here first as a concerned citizen and then, second, as a public health and mobility expert. I want to thank the administration for making it a priority to update these outdated rules and urge the EPA to create the strongest possible ruling on heavy-duty vehicle pollution. These standards here in the states where we live and work will begin to provide the much-needed relief from the burden of diesel fumes and air pollution. Vehicle manufacturers have had the technology to meet stronger standards but have failed to act on their own without the guiding hand of the EPA. I am particularly concerned about transportation air pollution. As a child I was very active and loved to play outside with friends, and played a lot of sports, and it was only a few years ago that I began to use an inhaler and experience respiratory issues. I don't live next to a transportation corridor. I don't live next to a refinery or waste facility, but imagine if I did. I have to be careful when the air quality is poor because I will have respiratory programs. So this issue is critically important to me from a public health and justice perspective, but it is also very personal for me. This rule will set the standard for vehicles which will be on the road for decades to come. Families in diesel death zones and in environmental justice communities, whether they are in West Oakland [inaudible] or Cancer Alley, Houston, or eastern North Carolina, they have suffered for far too long and as a result they have increased risk for cardiovascular disease, lung cancer, and other respiratory health illness. Diesel emissions cause nearly 21,000 premature deaths each year and impact nearly 135 million Americans, with these majority of these individuals belonging to BIPOC communities, and that is black and indigenous people of color. I like to refer to this as the public health crisis that not enough people are talking about. So I conclusion, once again I want to strongly urge and encourage this administration to enact the strongest standards possible. Every day we fail to act more families are falling victim to preventable health diseases. Clean air is a necessity, and not a luxury. It's a human right. We need to reduce deadly NOx pollution by 90 percent within five years, and fully realize the positive health impacts of a 100 percent zero-emission vehicle fleet. If this administration wants to make good on its bold climate goals it will really have to prioritize people and communities first, not industry standard. [EPA-HQ-OAR-2019-0055-2867]

Organization: *Elders Climate Action*

To contribute to timely attainment of the ozone NAAQS for all Americans, and slow global warming and avoid the worst consequences of a warming climate, a zero emission standard for HDVs is urgently need to accelerate the transition to zero NOx, PM and GHG emissions from onroad transportation sources. EPA must signal now that the industry must plan for that transition by establishing a zero emission standard and phase-in schedule. [EPA-HQ-OAR-2019-0055-1218-A1, p. 28]

Organization: *Energy Innovation, LLC*

The EPA's proposed rules outline Option 1 as the more stringent between Option 1 and Option 2. However, both fall short of what is needed to meaningfully reduce harmful pollution from HDTs. To the extent the EPA receives evidence to support the technological availability to meet the more stringent Alternative Option, or more stringent standards beyond NOx reductions of 16.7 percent in CY 2030 and 61.3 percent in CY 2045, the EPA should pursue the highest possible stringency and should minimize the credits allocated to polluting vehicles. Ideally, EPA's standards should align with California's Heavy-Duty Omnibus requirement of 90 percent reduction in NOx emissions beginning in 2027.xlii [EPA-HQ-OAR-2019-0055-1310-A1, p.7]

> xlii California Air Resources Board, Facts about the Low Hox Heavy-Duty Omnibus Regulation, https://ww2.arb.ca.gov/sites/default/files/classic/msprog/hdlownox/files/HD_NOx_Omnibus_Fact_Sheet.pdf.

In conclusion, we appreciate the EPA's efforts to update and improve the rules governing the U.S. transportation sector and ensure new vehicles are built to high performance standards that reduce GHG emissions and improve air quality and public health. We recognize there are always tradeoffs in rulemaking, but accounting for the longterm impact of the actions made this decade is imperative to address the most pressing threat of our time. Incremental improvements will be insufficient to tackle climate emissions at the speed and scale necessary to avert climate disasters. Communities cannot be expected to endure another decade or more of harmful pollution due to inaction. We encourage the EPA to continue its laudable work to find cross-cutting solutions that achieve policy goals and benefit communities, while continuing to raise the bar for the private sector and technology innovation. [EPA-HQ-OAR-2019-0055-1310-A1, p.7]

Organization: *Environmental Defense Fund (EDF) (1265 and 2855)*

Environmental Defense Fund (EDF) respectfully submits the following comments in support of Environmental Protection Agency's (EPA) Proposed Rule, Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, 87 Fed. Reg. 17414 (Mar. 28, 2022) ('Proposal' or 'Proposed Standards'). EDF supports substantially strengthening the heavy-duty vehicle emissions standards and respectfully urges EPA to strengthen the Proposal in key respects. These comments highlight the importance and urgency of finalizing health protective standards that achieve deep reductions in pollution from diesel vehicles and that ensure greater pollution reductions through meaningful deployment of zero-emission technologies. Near-term emissions reductions are vital to mitigating the effects of climate change and to protecting public health, especially the health of low-income communities and communities of color disproportionately impacted by transportation air pollution. [EPA-HQ-OAR-2019-0055-1265-A1, p.1]

EDF supports EPA's and the Administration's vision to 'lead the world on clean and efficient cars and trucks' in order to 'improve our economy and public health, boost energy security, secure consumer savings, advance environmental justice, and address the climate crisis.'1 As both the Proposal and President Biden's August 5, 2021 Executive Order 14037 recognize, the substantial deployment of zero-emission vehicles ('ZEVs') will play an important role in achieving this goal.2 [EPA-HQ-OAR-2019-0055-1265-A1, p.1]

> 1 Executive Order 14037, Strengthening American Leadership in Clean Cars and Trucks, 86 Fed. Reg. 43583, 43583 (Aug. 10, 2021).
>
> 2 See id.

This Proposal is a critical piece of that overall vision, and indeed in his August 2021 Executive Order, the President expressly directed EPA to consider the role ZEVs can play in EPA standards for model years 2027-2029. However, the Proposal must be substantially strengthened to deliver critical climate reductions, protect public health, achieve the administration's above-described commitments, and provide a strong foundation for next generation standards that drive even deeper pollution reductions from these vehicles. [EPA-HQ-OAR-2019-0055-1265-A1, p.1]

We urge EPA to move forward swiftly with standards that protect human health and the environment for all people and all communities, by reducing harmful diesel pollution and ensuring greater deployment of ZEVs. We respectfully urge EPA to consider all available tools to achieve deep pollution reductions and rapid ZEV deployment as quickly as possible. These actions will save money for truckers and fleets, strengthen our energy security, and help to support and grow domestic jobs. [EPA-HQ-OAR-2019-0055-1265-A1, p.3]

Accordingly, we urge EPA to substantially increase its ZEV baseline projections, which, as proposed, fail to account for state and federal policies along with manufacturer and fleet commitments and investments, and to finalize performance-based pollution standards that substantially increase ZEV deployment beyond the baseline for model years (MY) 2027-2029. In particular, these performance-based standards must help to ensure 80 percent of new school and transit buses are ZEVs by MY 2029, which will protect America's children and transit riders and mobilize the billions of dollars invested in buses through the Bipartisan Infrastructure Law. To protect the millions of people afflicted by freight pollution we similarly encourage EPA to ensure its standards achieve 40 percent of new Class 4-7 vehicles and Class 8 short-haul tractors are ZEVs by 2029. [EPA-HQ-OAR-2019-0055-1265-A1, p.2]

> Protective multipollutant standards that ensure these levels of ZEV deployment are likewise critically important to provide a strong foundation for future Phase 3 standards that achieve 100 percent ZEV sales by 2035. To that end, we likewise urge EPA to commit to a swift and clear timeline for completing those critical next-generation

standards. Though, to be clear, those Phase 3 standards cannot substitute for the progress we must make now to deploy available, cost-effective, and life-saving ZEV technologies to reduce medium- and heavy-duty vehicle pollution. [EPA-HQ-OAR-2019-0055-1265-A1, p.2]

A rapid transition to ZEVs is critical to reduce climate pollution and protect public health, and this must be paired with the strongest possible NOx standards for diesel vehicles that achieve reductions consistent with the reductions that will be achieved by California's NOx Omnibus rule. To ensure maximum possible NOx reductions, we identify several areas where EPA's proposal must be strengthened, including recommending substantial adjustment to the credit provisions for NOx, updating the ZEV sales baseline to reflect current expert projections, and strengthening of the idle standards for NOx. [EPA-HQ-OAR-2019-0055-1265-A1, p.2]

Numerous recent cost studies, clear market trends, recent federal investments, and strong state actions all support the feasibility of significant near-term deployment of ZEVs.89 Analysis from ERM projects Class 4-8 ZEV sales as high as 34 percent in 2029. GHG standards must both incorporate adjustments to the baseline and likewise strengthen standards to secure reductions beyond business as usual levels. The attached EDF White Paper shows the significant environmental and health benefits and the broad economic savings that would accrue from ensuring some new ZEV sales by 2029. [EPA-HQ-OAR-2019-0055-1265-A1, p.19]

89 See supra Section I.B.

Establishing an accurate ZEV sales baseline is critical to the efficacy of EPA's NOx and GHG standards. EPA's proposal assumes a ZEV uptake of only 1.5 percent in several early-adopting market segments in MY 2027–2029. This estimate is far below the pace projected by industry experts. As cited extensively above, manufacturer, municipal, and federal electrification commitments together with state leadership and IIJA funding will continue to drive demand for purchase of new Class 4-8 electric trucks and buses between now and 2029. [EPA-HQ-OAR-2019-0055-1265-A1, p.19]

EDF commissioned a study from ERM to evaluate baseline sales of medium- and heavy-duty BEVs over the next 10 years given these trends.90 ERM evaluated five different scenarios encompassing different assumptions about how many states would ultimately adopt ACT regulations (the current six or a total of thirteen), as well as different assumptions for EV market growth in non-ACT states. Low growth assumptions were based on BEV sales projections in EIA's 2022 Annual Energy Outlook91 and high growth assumptions were based on a recent report from the National Renewable Energy Laboratory (NREL), which projects significantly higher annual sales due to most BEV trucks reaching cost parity with ICE vehicles by 2035.92 [EPA-HQ-OAR-2019-0055-1265-A1, p.19]

90 E. Robo and D. Seamonds, Technical Memo: Analysis on Alternative Medium- and Heavy-Duty ZEV Baseline, ERM for EDF, May 10, 2022.

91 Annual Energy Outlook 2021,' Reference Case Projections Tables, US Energy Information Administration (EIA), table 49, https://www.eia.gov/outlooks/aeo/tables_ref.php.

92 Ledna et al., Decarbonizing Medium- and Heavy-Duty On-road Vehicles: Zero-Emission Vehicles Cost Analysis, National Renewable Energy Laboratory, March 2022.

The ERM analysis indicates that for all new medium- and heavy-duty vehicles sold in 2029, midpoint scenarios project medium- and heavy-duty ZEV deployment in excess of 20 percent and more optimistic scenarios project ZEV sales of over 33 percent of all class 4-8 single unit trucks, short-haul tractor trailers and school and transit buses. These estimates far exceed EPA's assumption in the proposal. EPA must use the most current data and projections to update its ZEV sales baseline for the final rulemaking. Failure to establish an accurate baseline will significantly undermine the Agency's proposed standards. [EPA-HQ-OAR-2019-0055-1265-A1, p.20]

Zero-emission vehicles are already available and cost-effective. Deploying zero-emitting medium and heavy-duty vehicles is critical to reach our health and climate goals. EPA must seize this opportunity to protect human health and the environment for all people and all communities by setting standards that ensure greater deployment of zero-emission vehicles. [EPA-HQ-OAR-2019-0055-1265-A1, p.20]

The White Paper EDF is submitting along with these comments documents in detail issues surrounding cost, feasibility, and lead-time supporting the feasibility and reasonableness of EPA establishing performance-based pollution standards that help to ensure 40 percent of new class 4-7 and class 80 short haul vehicles are ZEVs by 2029 and 80 percent of new school and transit buses are ZEVs by that year.93 We don't reiterate those findings here, but note only that it provides extensive and well-documented evidence that, in the M/HDV market ZEV cost reductions, technology advancements, company ESG commitments, state goals and regulations, and federal funding under IIJA are all causing ZEV demand to increase. The increased ZEV demand has, in turn, resulted in major manufacturers of gasoline and diesel vehicles introducing ZEV models and making investments to increase ZEV production to meet the increased demand. While starting a few years later, this is the same positive feedback loop that is happening in the light-duty vehicle market. The light-duty ZEV market has dramatically accelerated in the past few years, and there are strong signs that similar acceleration will happen in the M/HDV market in the next few years. [EPA-HQ-OAR-2019-0055-1265-A1, p.20]

93 EDF, 'Medium- and heavy-duty ZEV market readiness summary,' (May 16, 2022). (Attachment I)

However, it is critical that EPA establish pollution standards to support and reinforce these trends, consistent with its statutory mandate. As ERM's baseline analysis makes clear, there are a wide range of potential baseline values that might occur absent protective EPA standards, and accordingly, EPA must act to provide a strong, clear, and realistic market signal to secure urgently needed pollution reductions, ensure ZEV deployment levels consistent with what is needed to protective communities and the climate, and provide a strong foundation for protective

Phase III standards going forward. Finally, while we have not included specific recommendations for standards in model years 2027 and 2028, we would respectfully recommend that EPA establish standards in those model years consistent with the above-describe lead time and feasibility considerations. [EPA-HQ-OAR-2019-0055-1265-A1, p.20]

Organization: *Environmental Entrepreneurs (ER)*

[From Hearing Testimony, April 12, 2022, Sandra Purohit] I urge the EPA to finalize a heavy-duty trucks rule this year that is stronger than both Option 1 and Option 2, as currently proposed. Just last week, in two new reports on climate, the Biden-Harris administration's Office Of Management And Budget and the United Nations International Intergovernmental Panel on Climate change made clear we simply do not have time for incremental change. Business leaders agree. Climate-driven floods, wildfires, hurricanes, and droughts already threaten businesses directly, disrupt supply chains, and drive up input costs by destroying raw materials from produce to lumber. In 2021, climate-related disasters cost our economy $145 billion, the highest in any -- of any country. Along with the critical climate need, the EPA must do more to address the air pollution that is driving workers, customers, and community members into hospitals. In particular, aggressive action is needed to make a long-overdue difference on the disproportionate impact of these emissions on workers, and communities of color, and low-income communities. A few key points to make. [Technical difficulties during the hearing here; resume testimony] Heavy-duty trucks are only 10 percent of the on-road vehicles but contribute 33 percent of mobile-source NOx emissions and are the second-largest contributor to mobile-source greenhouse gas emissions, the point being that strongest standards here can make a huge impact. We already have commercially-available zero-emission trucks that address NOx particulate matter and climate emissions. These trucks also lower fleet operating and maintenance costs. With a strong market signal from the EPA to help drive production, they will become even more affordable to make and buy. What we don't have is the luxury of time. EPA cannot lag behind the market or fail to advance the deployment of zero-emission trucks at the pace needed to address the urgent public health and climate crisis. As such, we urge EPA to disregard Option 2 as wholly inadequate and to strengthen Option 1 in three ways: to align with heavy-duty omnibus rules stringency in Model Year 2027; eliminate the credit mechanism better roads standard; and to adopt a zero-emission vehicle sales mandate. The greenhouse gas standards should be updated to reflect existing state requirements that will lead to higher penetration rates in Model Year 2027 and the 1.5 percent assumed by the Agency. The EPA has the mandate and the authority to set standards that more assertively scale up solutions and moves the needle on climate and public health-harming emissions. On behalf of E2 business leaders, we urge you to do so, and once again, thank you for the time. [EPA-HQ-OAR-2019-0055-2867]

Organization: *Environmental Protection Network (EPN)*

EPN recommends that EPA's decision be guided by the demonstrated need for very large NOx reductions from the heavy-duty (HD) sector. This need is especially great for those populations living near major traffic areas. The goal should be to achieve the lowest feasible NOx standard, which will provide California, other states, and disadvantaged communities the NOx reductions they desperately need. [EPA-HQ-OAR-2019-0055-1233-A1, p. 1]

EPN advocates that decisions on the level of the standards, the useful life period, the applicable Model Years (MY), and other standard-setting and compliance related issues should all be guided by this goal. This means that when EPA balances the various relevant factors, EPN recommends that EPA place great weight on the clear need for major NOx reductions to protect public health and welfare. EPN suggests that EPA should be clear in its reasoning that this factor appropriately carries great weight, and that it is an important part of EPA's justification for deciding to make changes in the direction of more, not less, reduction of NOx emissions. [EPA-HQ-OAR-2019-0055-1233-A1, p. 1]

EPN strongly recommends that EPA strengthen both the NOx and GHG requirements in the Final Rule in ways that maintain EPA leadership in improving air quality and public health and addressing the global climate crisis. [EPA-HQ-OAR-2019-0055-1233-A1, p. 4]

Organization: *Evangelical Environmental Network (EEN)*

Our children's lives, health, and future will be decided by reducing all forms of air pollution including climate change causing carbon. Addressing heavy-duty truck now, will go a long way in deciding our children's future. Please promulgate the strongest possible standards to save our kids, display our technical abilities to the world, and create a sustainable future with family supporting jobs for all. [EPA-HQ-OAR-2019-0055-0993-A1, p.2]

Once again, I urge this administration to set the strongest standards possible because many lives, especially our children and those most vulnerable in our communities, depend on it. Zero-emission electric trucks are the best available technology to both reduce harmful NOx and carbon pollution. The EPA must put our national bus and truck fleet on a clear path to 100% zero-emission all-electric vehicles by 2035. [EPA-HQ-OAR-2019-0055-1134-A1, p.2]

Organization: *Evergreen Action*

The most impactful way to reduce the public health burden from MHDV pollution and achieve national and international climate goals is to utilize zero emissions technologies which are now available for all heavy duty trucks. Zero emission heavy duty vehicles are increasingly becoming cost competitive and have better range and lower maintenance costs than traditional heavy duty vehicles. EPA's baseline analysis should reflect the growing market adoption of zero emission MHDVs given that this new standard will not become effective until 2027. [EPA-HQ-OAR-2019-0055-1289-A1, p.2]

Organization: *Ezra Rumbold Trucking*

Since 2007 emissions, our trucking industry has already cleaned up much of the air with DEF fluid along side the diesel fuel on all truck applications. We also have had the onerous regen feature which is inserting the exhaust fumes back through the engine for reprocessing a second time. We have already cleaned up the air for almost 15 years. [EPA-HQ-OAR-2019-0055-1013, p.1]

I'm not sure what this latest proposal would incur, however we are tapped out on further engine restriction! Thanks for listening to my concerns on this topic. [EPA-HQ-OAR-2019-0055-1013, p.1]

Organization: *Faessler Farms LTD*

I think there is enough burden on the truckers and we should leave well enough alone. It is getting harder and harder to get trucks and drivers because of all the regulations. Put yourself in their shoes and I bet you would feel differently about all your regulations that you impose on these hard working drivers trying to make a living. [EPA-HQ-OAR-2019-0055-2247, p.1]

Organization: *Farmington Road Wrecker Services*

As a small business owner, I’m concerned about what these new regulations would cost us and if we could even afford it right now because of the state of our economy. [EPA-HQ-OAR-2019-0055-2264, p.1]

Organization: *Florida Council of Churches*

I thank this administration for acting swiftly on clean trucks but urge EPA to create the strongest possible limits on heavy duty vehicle pollution. The EPA must put our national bus and truck fleet on a clear path to 100% zero-emission all-electric vehicles by 2035. Life and breath depend on this action. [EPA-HQ-OAR-2019-0055-1006, p.1]

The dirty air we breathe plays a major role in cutting lives short. Establishing clean exhaust regulations is a matter of life and breath for large numbers of Floridians. Removing the pollutants from fuel, especially from trucks and other large vehicles, will restore the breath of life to millions of people and the soil itself. The technology exists for clean vehicles. The market is ready for them. Clean standards will move us all forward in ways that lead to health and prosperity. Not to act now is to say we as a nation want those who bear the greatest burden of air pollutants to die early deaths and their children to struggle with acquired learning disabilities and other ailments. As a nation I know that is not who we are. EPA clean standards are life and breath to millions of people and the environment itself. The standards EPA sets should achieve 100 percent zero-emission truck sales by 2035. That sets a pace to deliver much needed health benefits to all of us and especially communities of color and the ground that sustains us. [EPA-HQ-OAR-2019-0055-1006, p.2]

Organization: *Flower Shoppe & Gifts*

Now is not the time to enact strict regulations on our national trucking system. We already face shortages and delays in receiving goods not to mention the increased costs that are placed upon us which drive up costs to our consumers. I strongly urge you to not pass these regulations on heavy duty engines. [EPA-HQ-OAR-2019-0055-2267, p.1]

Organization: *Foxy Travel, Inc. dba FTI Coach*

The number one issue with newer coaches center around the emissions system and it makes us hesitant to upgrade our older fleet. Countless times we have had buses shuttling in Boston where there is no place to do a parked regen and had to send a mechanic out to do a forced regen. We have had numerous times we have sent our coaches away and had a failed nox sensor take a bus out of service. Coaches were towed, other buses dispatched, passengers stuck on the side of the road, it can be an absolute nightmare! If a coach is on a 7 day trip, even 60 hours isn't enough to get it home and have it fixed. Instead we send out older coaches without the emissions systems because we can't trust little things like nox sensors or having proper places in major cities to do a regen. For the record, we use high quality DEF from Dennison Lubricants. [EPA-HQ-OAR-2019-0055-2060, p. 1]

Organization: *Gary Frederick*

While it is commendable that the EPA is seeking to tighten clean truck standards, we need to ensure that the rules do just that in a strong and meaningful way to truly tackle NOx and greenhouse gases. The most recent United Nations report bluntly states that we are almost out of time for curbing the worst effects of global warming. As such, each country, each state and each town must dramatically do what it can to avert a catastrophe. New Jersey has been on the front lines in the fight against global warming, with our large coastline, congested cities, and warming climate. Unfortunately, we've also been on the front lines of 18-wheel trucks heading up and down the Turnpike to New York City and beyond, immense FedEx, Amazon and other retail warehouses, and more SuperFund sites than most other states. [EPA-HQ-OAR-2019-0055-1393]

The trucks targeted by this rule change will be on the road for decades, so it imperative we take steps now to get dirty diesel trucks off the roads and replace them with cleaner trucks. There are many zero-emission trucks ready for the market now or in the near future. Not only are they projected to be cheaper to own and operate than their diesel engine counterparts, a recent Dept of Energy study projects that by 2030, zero-emission trucks could be 42% of sales. A meaningful rule change by the EPA could speed that along. [EPA-HQ-OAR-2019-0055-1393]

The proposed rule outlines two options for reducing NOx and other particulates. Option 1 is not as strong as California's Heavy Duty Omnibus Rule. And Option 2 does not go far enough in curtailing pollutants. It risks being a giveaway to the biggest polluters in the engine manufacturing industry. That surely cannot be the intent of the proposed rule changes. [EPA-HQ-OAR-2019-0055-1393] [EPA-HQ-OAR-2019-0055-1393]

I am urging the EPA to take strong action to curb pollution and tighten heavy-duty engine and vehicle standards, with a goal of 100% zero-emission electric vehicles by 2035. Zero-emission electric trucks remain our best way to curb harmful NOx and GHG emissions and do our part to avert the worst impacts of global warming.[EPA-HQ-OAR-2019-0055-1393]

Organization: *Greg Pagliuzza*

I am writing as a Christian, who after many years as an executive in hospital finance, has gotten involved in taking care of God's creation. I view the Earth as a patient which needs a lot of attention and requires all of us to invest back into preserving its health. It is comparable to the work and investment one needs to take care of patients but on a much grander scale. I am grateful that this administration is acting swiftly on clean trucks but urge EPA to create the strongest possible limits on heavy duty vehicle pollution. [EPA-HQ-OAR-2019-0055-1215]

I have lived the majority of my life in the Chicagoland area. As it is a hub for transportation, there are many trucks which leave their tell-tale signs of diesel discharge for all of us to breath. I recognize that my health and the health of my children and grandchildren has been negatively impacted by trucking's tailpipe discharges. I look forward to the day when those discharges and the negative impact it has on me, my family, my community, and the earth in total is eliminated. Climate change is the existential threat to God's creation. The sooner action is taken to eliminate the long-term threat of the polluting discharges from trucks and buses, the better it will be slow down the degradation to our environment. [EPA-HQ-OAR-2019-0055-1215]

As a former hospital CFO and financial expert, I have to note that investing in the future jobs of clean energy transportation will enhance the United States' economic strength for years to come. It will also require less investment of healthcare dollars to treat those who will be harmed by doing nothing. This is a message that both sides of the aisle should support wholeheartedly. [EPA-HQ-OAR-2019-0055-1215]

As a Christian, my specific concerns are:

- We have a moral and Biblical mandate to defend the health of all God's children, including from harmful air pollution from highly polluting heavy duty trucks and vehicles, which have an outsized influence on air pollution and climate change.
- As an evangelical Christian, I believe that all human life is sacred; that each person conceived is of equal and innate value and dignity, and that all human life is worthy of protection.
- Pro-life means protecting life - a theology shared by the National Association of Evangelicals and Catholic social teaching under the guidance of Pope Francis in his encyclical letter, Laudato si' on care for our common home.
- Jesus was especially concerned about vulnerable populations being denied abundant life. "Jesus said, 'Let the little children come to me, and do not hinder them, for the kingdom of heaven belongs to such as these.'" (Matthew 19:14)
- Medical research shows that ozone exposure increases the likelihood of reproductive and developmental harm, including reduced fertility, preterm birth, stillbirth and low birth weight
- Between 15,000 to 30,000 preterm births occur due to exposure to soot (PM2.5), that is also emitted by heavy duty trucks. Soot-related pre-term births cost approximately $4.33 billion to the United States economy — and 33% of these children die at birth or shortly after.1

1 Teresa M Attina, Russ Hauser, Sheela Sathyanarayana, Patricia A Hunt, Jean-Pierre Bourguignon, John Peterson Myers, Joseph DiGangi,R Thomas Zoeller, Leonardo Trasande, Particulate Matter Exposure and Preterm Birth:

I am writing because I know the following to be true and as man created this problem.

- Smog and soot air pollution caused by trucks and buses are among the greatest threats to public health for the more than 45 million people in the U.S. living within 300 feet of a major roadway or transportation facility.
- EPA has recognized that more than 13 million people (including 3.5 million children) live near major marine and inland ports or rail yards, and that these individuals are disproportionately low- income communities of color and susceptible to increased health risks from air pollution.
- Heavy duty vehicles spew dangerous nitrogen oxides and other pollution into our air, harming respiratory health, especially in marginalized communities.
- Diesel pollution from heavy duty trucks and buses is a massive public health threat.
- Diesel pollution worsens asthma and is particularly dangerous to children’s developing lungs.
- Dangerous nitrogen oxides and other pollution that heavy duty vehicles like trucks and buses spew into our air hurt low wealth communities first and worst.
- The transportation sector is the largest single source of heat-trapping greenhouse gases

Now man can work to correct it.

- We have the technology and the ability to cut pollution and save money today.
- Today, electric trucks and buses are already capable of supporting the majority of freight, delivery, and transit uses and needs.
- Today, electric trucks and buses are already capable of supporting the majority of freight, delivery, and transit uses and needs.
- Across nearly every vehicle class, zero-emission electric trucks and buses are projected to be cheaper to own and operate than their combustion engine counterparts within 5 years.
- In fact, a recent DOE study predicts that by 2030, zero-emission trucks could grow to 42% of sales just based on the fact that they will be cheaper to buy and own, but we need strong policies to achieve this reality.

The bottom line is, I urge this administration to set the strongest standards possible as soon as possible because many lives depend on it. It’s past time to clean-up our air and defend our children and families from harmful traffic emissions that threaten our health and fuel global warming. These standards must accomplish two things: 1) reducing deadly NOx pollution 90% by 2027, and 2) putting our national bus and truck fleet on a clear path to 100% zero-emission all-electric vehicles by 2035. [EPA-HQ-OAR-2019-0055-1215]

Organization: *Hyliion, Inc.*

First, we write to thank the EPA for ongoing efforts to reduce emissions of toxic diesel particulates and smog-forming oxides of nitrogen. It is clear that to achieve National Ambient

Air Quality Standards (NAAQS), emissions from medium and heavy-duty vehicles must decrease to zero and near zero levels. [EPA-HQ-OAR-2019-0055-1238-A1, p. 1]

Organization: *International Union, United Automobile, Aerospace & International Union, United Automobile, Aerospace & Agricultural Implement Workers of America - UAW Region 1A*

Frankly, we are very concerned that the proposed rule from EPA on tailpipe emissions from heavy-duty trucks as part of the 'Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards,' may not be technologically feasible. That means Original Equipment Makers (OEMs) will spend hundreds of millions of dollars chasing at worst an impossible standard, and at best a costly standard, rather than strategically deploying critical resources on proven technologies. [EPA-HQ-OAR-2019-0055-1062-A1, p.1]

We share, of course, your commitment to the environment and applaud the accomplishments already achieved by commercial vehicle manufacturers to reduce nitrogen oxides (NOx) emissions from heavy-duty trucks. We support the ongoing efforts for cleaner air and healthier communities for all. However, we also recognize the importance of preserving – not effectively dismantling through higher costs and wasted expenditures – this critical industry. [EPA-HQ-OAR-2019-0055-1062-A1, p.1]

We urge you to amend the proposed rule so that it reduces emissions, protects American jobs, and results in cleaner air and healthier communities for all. [EPA-HQ-OAR-2019-0055-1062-A1, p.1]

To be effective, the final rule must be: Environmentally beneficial. An unworkable rule will delay fleet turnover and prevent environmental progress, creating greater harm in communities most at-risk for high air pollution. [EPA-HQ-OAR-2019-0055-1062-A1, pp.1-2]

Organization: *International Union, United Automobile, Aerospace and Agricultural Implement Workers of America (UAW)*

We support and value the EPA's mandate through the Clean Air Act to regulate harmful pollutants and greenhouse gas emissions to protect communities from negative health effects and address the threat of climate change. [EPA-HQ-OAR-2019-0055-1138-A1, p.2]

The UAW supports using regulations that help bring innovative technologies to heavy-duty fleets, so long as the technologies are proven and cost-effective, regulatory timelines are feasible, and manufacturers have flexibility to meet stringency requirements through multiple technology paths. [EPA-HQ-OAR-2019-0055-1138-A1, p.3]

Additionally, if regulations result in high regulatory costs and reduced vehicle sales, it could place financial constraints on the industry at a time when companies require capital to make major investments in new technologies. Truck manufacturers have shown a commitment to major investments to transition to zero-emission vehicles, but that transition will require significant financial resources. Poorly designed regulations could have the unintended consequences of hampering the industry's ability to invest in the technologies of the future and build them here in the U.S. [EPA-HQ-OAR-2019-0055-1138-A1, pp.4-5]

We urge the EPA ensure new regulations do not create economic hardship for working families by creating significant market disruptions. To achieve this goal, the final rule must be consistent with the following principles:

- Create regulatory certainty and avoid disruptions to the trucking market
- Provide manufacturers with the necessary lead time and flexibility to meet stringency standards
- Work towards a single national standard that is harmonized with existing regulations
- Build upon realistic analysis of the feasibility, cost, and market potential of new technologies [EPA-HQ-OAR-2019-0055-1138-A1, p.5]

UAW commends the EPA's continued efforts to incorporate stakeholder input and create a national program that incentivizes investment in US manufacturing, promotes US leadership in advanced technology, supports fuel efficiency and reduced emissions, and provides the industry flexibility to meet those standards. We believe a negotiated national standard derived from a consensus-driven process that includes meaningful engagement with all stakeholders, including states, workers, manufacturers, suppliers, environmental advocates, and fleet operators, working together to reach an agreement on regulations will help the economy and the environment. [EPA-HQ-OAR-2019-0055-1138-A1, p.5]

Organization: *Jack Schneeman*

I have always been a staunch supporter of using regulations to alleviate the effects of climate change, and for this reason I fully support this proposed rule. Pollutants from heavy-duty engines, such as those used in semi-trucks and other diesel engines, are a known threat to the environment and to public health. According to the Congressional Research Service, these engines are the biggest contributors to emissions of Nix, which was roughly 32% in 2017 (CRS). Nix reacts in the atmosphere to form harmful pollutants such as smog (ozone) and particulate matter (soot). Furthermore, heavy-duty engines emitted roughly 457 million metric tons of carbon dioxide in 2019, equating roughly 25% of US CO_2 emissions from the transportation sector. [EPA-HQ-OAR-2019-0055-1053]

The adverse effects these pollutants have on human health and the environment is extreme, to say the least. According to the Centers for Disease Control, ground level smog (ozone) and particulate matter (soot) have the potential to cause many health problems for humans. Estimates that contain no regulatory updates (meaning should this rule not be implemented) suggest that roughly 1000-4300 additional premature deaths may be cause by the presence of smog and soot by 2050 (CDC). Furthermore, health related costs of ozone air pollution have been estimated at nearly 7 billion USD from a period between 2000 and 2002. Further, the Environmental Protection Agency itself estimates that smog and soot cause other adverse health effects, including premature death, respiratory illness (including childhood asthma), cardiovascular problems, and other adverse health impacts. Thus, the impact of heavy-duty engines is clear, and must be addressed. The effects of carbon dioxide produced by heavy-duty engines also pose a threat to public health and to the global environment and ecological systems as well. According to Proceedings of the National Academy of Sciences of the United States of America (PNAS), unregulated carbon dioxide emissions will cause irreversible damage to the planet's environment for up to 1000 years after CO2 emissions are curbed altogether (PNAS). The presence of greenhouse gasses in the atmosphere is a direct contributor to climate change, which has already caused a great deal of damage to the environment due to global warming. If CO2 emissions are not regulated, the planet will see an increase in the melting of polar ice caps, causing sea levels to rise, an increase in precipitation levels causing the potential for massive floods, increasing natural disasters such as hurricanes, wildfires, and tornadoes, and the global death of millions of species, which would cause irreversible damage to ecosystems and food supply necessary to sustain human life (PNAS). Essentially, it is imperative greenhouse gas emissions are regulated in order to ensure the survival of the human species. Thus, it is clear that the EPA's proposed rule must be implemented. [EPA-HQ-OAR-2019-0055-1053]

The EPA seeks to change emissions standards to heavy-duty engines through the power vested in it by the Clean Air Act of 1963 and Executive Order 14307: "Strengthening American Leadership in Clean Cars and Trucks" (CRS). This rule relates to companies that manufacture, sell, or import into the United States new heavy-duty highway engines, and would require them to meet certain efficiency and emissions standards in order to sell, import, or manufacture new heavy-duty engines for usage in the United States. According to the EPA, implementation of this rule would reduce heavy-duty engine emissions by roughly 50% by 2040 and 60% by 2045, which would be greatly beneficial for public and environmental health. [EPA-HQ-OAR-2019-0055-1053]

While it is difficult to ascertain the overall public reaction to this rule, I would argue that implementation of this rule would be very popular with the public. According to the Pew Research Center, 2/3 of Americans believe that the government should do more to address climate change, and thus targeting one of the biggest factors in emissions would be very popular the overall population, although less popular for the companies targeted by this rule proposal.

However, the complaints of these companies must be ignored in order to promote public and environmental health. [EPA-HQ-OAR-2019-0055-1053]

Thank you for giving me the opportunity to express my support for this rule proposal. In order to better secure a future in which public and environmental health is more valued, I express my support for this rule and urge its implementation by the EPA. Attached below are references to the sources I consulted in order to further research this rule proposal. [EPA-HQ-OAR-2019-0055-1053; references omitted]

Organization: *Jared Kurland*

The EPA’s new proposed rule on the control of air pollution from large heavy duty motor vehicles and vehicle standards sounds like a great idea on the outside. Reducing air pollution from highway bound heavy duty engines and vehicles is most certainly a benefit to society and the world. The reduction of dangerous air pollutants to the ozone layer and we as humans sounds great. Yet after reading several other public comments it seems as though the people who work firsthand with large engines are not happy with how this action is going to affect them. These changes will increase the challenges small business have in competing with big trucking companies. As a supporter in small business, I would hope that the EPA is working to support smaller trucking companies while still achieving their goal of making the engines cleaner. [EPA-HQ-OAR-2019-0055-1388]

Organization: *Jessica Stevens*

Considering the risks the emissions the transportation sector has on public health and the environment, I would urge the Environmental Protection Agency to pass this regulation. However, I would also encourage some adjustments to be made to the regulation. Particularly, I recommend even stronger regulations to be put in place not only on heavy duty trucks, but on all forms of transportation that are carbon and greenhouse gas producing. According to the Intergovernmental Panel on Climate Change, we must keep global warming below 1.5 degrees celsius to avoid catastrophic changes to our planet (Cho). This would require emissions to fall to half of production by 2030 and to zero by 2050. Although 136 countries pledged to this at the COP26, I believe that we still need to take strong steps as a country to get there, with the hope that other countries will follow in suit. This is why I do not think making standards, test procedures, life use, warranty, and other outline requirements in the proposal for only heavy duty trucks is enough to make sufficient progress against our climate crisis. I acknowledge that it is a step in the right direction, which is why I am endorsing this regulation, but I am recommending that further policies are put into place to make more progress in reducing our carbon footprint. [EPA-HQ-OAR-2019-0055-1028]

Additionally, I propose that more consideration is put into the economic strain this might place on the transportation and connected industries. I do not think they should have to foot the costs for the amendments made to requirements; the government should provide some form of subsidies because it is moving the future of our country and planet in a safer direction. [EPA-HQ-OAR-2019-0055-1028]

All in all, I support the implementation of this regulation. Transportation is the largest sector responsible for the production of greenhouse gasses, which has severe negative consequences on public health and environmental health. Furthermore, I urge that regulations are passed on a wider range of the transportation sector as greenhouse gasses must be reduced to prevent global warming from producing catastrophic impacts. [EPA-HQ-OAR-2019-0055-1028]

Organization: *K&M Outdoor, LLC*

This regulation will hurt the trucking industry that is already struggling due to high fuel prices and supply chain issues. Not only will this cause the cost of trucking to skyrocket but it will directly impact the consumer which would only add fuel to the fire we already have also considered 'Inflation'. Please do not do this to our trucker, they are the ones keeping the economy moving...without them or by hurting them we will cause great harm to everyone in this country. [EPA-HQ-OAR-2019-0055-1008, p.1]

Organization: *Kali Bach*

I believe this rule is an excellent start to keeping our air clean and breathable for all, especially for communities along the highways or busy roadways. One suggestion I would like to throw in is a tax incentive for truck manufacturers and companies to not only comply with the new law, but if they go beyond the requirements. If we can lessen our dependence on oil in this sector of the economy, then I hope we can move towards fully electric trucks in the near future to have a zero-emission fleet. This rule, in the meantime, is a good steppingstone towards that goal. [EPA-HQ-OAR-2019-0055-1390]

Organization: *Kimmons, Kenneth (OOIDA)*

I have been in the trucking business since 1966.My brother an uncle since the 40’s. Have watched the cost of equipment myself increase near tenfold since the mid 60’s. Reliable on the trucks gotten worse, repairs increasing yearly. Fancy so called emissions standards increasing at expense of the owners of sad equipment. Will it never end? All this talk about cleaner air, I’m all for it, but quit hitting trucks with more and more regulations. Great suggestion here for you in DC that knows nothing about an owner-operator’s daily problems. Shut it all down, no more trucks burning diesel or any gas. No cars on the road no trains just shut it all down. Return to horse and wagon, mules and horses pulling plows of farmers. No coal electric plants, no nuclear power plants. Return to coal oil lamps and wood burning stoves an fire places to cook an heat homes. Emissions problem solved. Back to our forefather’s ways of life, sailing ships etc. See how you like it then, good clean air you say, life expectancy mid 30-40. World population will drop by 60-70 percent within 18 months. Wake up folks got to be better solutions, quit regulating us out of business an into the poor house. [EPA-HQ-OAR-2019-0055-1266-A2, p.4]

Organization: *King County, Washington County Executive*

As the elected leader of King County, Washington, the nation’s 12th most populous county, I urge the Environmental Protection Agency (EPA) to finalize the strongest possible heavy-duty vehicle requirements via the Clean Trucks Plan, now released as a Notice of Proposed Rulemaking (NPRM) Docket ID No. EPA-HQ-OAR-2019-0055. Passage of strong requirements is essential to protect residents from the harmful impacts of air pollution, advance environmental justice, and slow the release of global warming emissions. [EPA-HQ-OAR-2019-0055-1188-A2, p.1]

The heavy-duty rule must accelerate deployment of zero-emission vehicles in order to safeguard clean air and improve public health in our communities. Our residents cannot wait a decade for cleaner air. [EPA-HQ-OAR-2019-0055-1188-A2, p.1]

There is no time to wait; we must move with urgency to reduce emissions from the transportation sector and protect the health of our most vulnerable communities. There is a critical need for the EPA to take swift action towards a zero-emissions future in order to ensure a safe environment for current and future generations. I am confident that you agree on the urgency of this issue and I urge you to finalize a strong rule. [EPA-HQ-OAR-2019-0055-1188-A2, p.2]

Organization: *Labor Network for Sustainability (LNS)*

EPA's Proposed Rule and accompanying Regulatory Impact Assessment (RIA) (herein 'the Proposed Rule') inadequately address the dangers of greenhouse gas and other polluting emissions from fossil fuel powered medium and heavy duty vehicles and thus falls short of the administration's commitment. LNS supports the rapid transition to zero-emissions vehicles (ZEVs) that would eliminate these emissions. However, we defer to other community and technical experts to address the shortcomings of the proposed final rulemaking with respect to its impacts on environmental and public health. We incorporate by reference the comments, testimony and recommendations submitted by the more than 50 organizations that make up the Moving Forward Network (MFN) who have submitted individual/organizational comments, as well as MFN's own comprehensive comment and public testimony. [EPA-HQ-OAR-2019-0055-1257-A1, p.2]

Given the realities of the independent contractor model, the Proposed Rule will likely result in increased cost burdens on these already devalued drivers rather than where the cost burdens of regulation should be placed, specifically the logistics corporations who fundamentally control the operations of medium and heavy-duty fleets from seaport to consumer. [EPA-HQ-OAR-2019-0055-1257-A1, pp.2-3]

Increasing cost burdens on devalued drivers risks undermining the objectives of the Proposed Rule and is likely to inhibit progress on our environmental justice, climate, and public health goals. [EPA-HQ-OAR-2019-0055-1257-A1, p.3]

Specifically, LNS recommends the following actions:

- EPA must not leave emission reductions and requirements to future rule and should transition to zero-emission trucks and buses by setting stringent emission standards and zero-emission-vehicle sales mandates now.
- EPA should require that all new trucks have zero emissions beginning in 2035 and retire all combustion trucks before 2045. [EPA-HQ-OAR-2019-0055-1257-A1, p.15]

Organization: *Lawson Construction Group*

We have enough regulations already! The impact has been very detrimental on our industry. Our carbon footprint is the smallest in the world. To fix the world's environmental issues in the United States alone is idiotic. Leave the industry be. [EPA-HQ-OAR-2019-0055-1007, p.1]

Organization: *Lion Electric Co. USA Inc. (Lion)*

As the United States moves towards a zero-emission future at an accelerated rate, it is even more crucial that appropriate incentives are offered to facilitate this transition. Many states have adopted their own zero-emission attainment goals and large numbers of fleet owners are eager to comply ahead of schedule. However, price remains the deciding factor for many of these operations, especially for small fleets with 10 or fewer heavy-duty vehicles. Lion assists fleet owners throughout the United States to leverage local, State, and Federal funding towards new zero-emission vehicles; however, there are often limitations that make funding difficult to obtain. [EPA-HQ-OAR-2019-0055-1151-A2, p. 2]

For example, the scrappage requirement for many programs, such as the California Air Resources Board (CARB) Statewide Carl Moyer Program, or the Volkswagen Mitigation Fund, renders many applicants ineligible. Narrow eligibility windows can exclude many fleets with old diesel vehicles that do not qualify for funding. Without feasible financial options for replacement, these vehicles may remain on the road long past their useful life, releasing harmful emissions into the environment. Alternatively, small fleets or newer businesses may not have vehicles available to scrap at all. For these reasons, we ask that the EPA to reconsider how to apply scrappage requirements for future funding programs, and to consider offering flexible options for applicants to meet them. [EPA-HQ-OAR-2019-0055-1151-A2, p. 2]

Lion cautions the EPA against providing high incentives for hybrid vehicles either as opposed to or in addition to zero-emission vehicles. With the end goal being a maximum reduction in air pollutants, the best way to achieve this is to encourage the adoption of all-electric vehicles. With the proper incentives, many fleet owners can move straight into zero-emission, ensuring early compliance with state goals and achieving the highest possible emission reduction. [EPA-HQ-OAR-2019-0055-1151-A2, p. 3]

Organization: *Louisiana Monuments and Signs*

Business's will be crippled if this is passed. One more thing struggling business's will have to struggle with, so many people will lose their jobs. I am a small business and the struggle is real on so many levels. This would be the last thing I would need to deal with. After struggles with 2020 situations still lingering. I Cant afford to buy a fleet of new trucks. I would be forced to shut down both of my small business's. [EPA-HQ-OAR-2019-0055-1015, p.1]

Organization: *Loren Marz*

I generally support the proposed action (Option 1) as presented in the proposed rule, although it appears that regulated levels of non-GHG emissions are approaching diminishing returns. [EPA-HQ-OAR-2019-0055-1394]

Organization: *Lubrizol Corporation (Lubrizol)*

We commend EPA on a Proposal that will deliver critically-needed environmental benefits, as soon as MY 2027. We support a final rule that includes Option 1 for NOx reduction, assuming suitable cost-effective technologies are available in time for the MY 2027 implementation of the new NOx standard. [EPA-HQ-OAR-2019-0055-1304-A1, pp.1-2]

Organization: *Machinery Northwest Co.*

I truly believe that we are the golden standard that all other industries and county’s around the world should want to have the same or better standards. We should not be forcing anyone industry in the USA to conform or change their current good practices until the rest of the work is able to catch up with and apply the same or better standards in there countries. [EPA-HQ-OAR-2019-0055-1713, p.1]

Organization: *Manufacturers of Emission Controls Association (MECA)*

The Manufacturers of Emission Controls Association (MECA) is pleased to provide comments in strong support of the U.S. EPA's notice of proposed rulemaking (NPRM) to revise oxides of nitrogen (NOx) emission standards for heavy-duty on-highway engines as well as update greenhouse gas (GHG) emission standards for heavy-duty on-highway vehicles. We believe an important opportunity exists to continue to reduce NOx and GHG emissions from heavy-duty engines and vehicles due to the evolution of engine and aftertreatment technologies in the 12 years since the last standards were fully implemented. In addition, we support continued reductions in GHG emissions from medium- and heavy-duty engines and vehicles through the application of innovative technologies and fuels. [EPA-HQ-OAR-2019-0055-1320-A1, p.1]

MECA thanks EPA for building upon the historic comprehensive test program that has demonstrated pathways for heavy-duty engines to achieve ultra-low NOx levels without impacting GHG emissions and provided data on end-of-life durability, performance over real-world cycles, in-use system compliance with the new moving average window requirements, emission sensor measurement capability, among others. MECA supports EPA's Proposed Option 1 with some modifications, which we feel will strengthen the regulation. We also support EPA's amendments of the Phase 2 MY 2027 GHG vehicle standards and have some suggestions on how the NPRM treats credits from electric vehicles [EPA-HQ-OAR-2019-0055-1320-A1, p.2]

Organization: *Marathon Cheese Transport*

We do these things because of cost savings and safety of our drivers and public, and yet more regulations that hamper the transportation industry, not help them. I do not support regulations that add higher costs but little value to my business. California's CARB system shows the imperfection of a standard that has pushed many trucking companies out of business or across state lines to set up businesses and still run miles in state of CA. [EPA-HQ-OAR-2019-0055-2516, p.1]

Organization: *Mass Comment Campaign sponsored by American Lung Association (248)*

As physicians, nurses, public health professionals and healthcare workers dedicated to providing our patients with a healthy future, we urge you to finalize strong emissions standards for heavy-duty vehicles and to move toward a zero-emission trucking sector. [EPA-HQ-OAR-2019-0055-1609-A1, p.1]

We thank the U.S. Environmental Protection Agency (EPA) for proposing rules to slash NOx emissions from new heavy-duty vehicles, recognizing the need to immediately curb pollution from the millions of heavy-duty vehicles on the roads today. We also appreciate the agency continuing to lay the groundwork to transition to zero-emission vehicles by updating greenhouse gas standards within this proposal. [EPA-HQ-OAR-2019-0055-1609-A1, p.1]

The health community is calling for EPA to choose the most health-protective option possible, achieve a 90% reduction in NOx pollution and finalize the rules by the end of 2022. We urge you to not only finalize strong standards, but also ensure real-world benefits by requiring pollution controls for the full lives of these vehicles and in realistic operating conditions.[EPA-HQ-OAR-2019-0055-1609-A1, p.1]

Finally, we then urge EPA to move forward with the next phase of setting strong greenhouse gas standards for medium and heavy-duty vehicles to drive the nationwide transition to zero-emission vehicles. [EPA-HQ-OAR-2019-0055-1609-A1, p.1]

Organization: *Mass Comment Campaign sponsored by Climate Action Campaign (82)*

I'm writing today to urge the EPA to create the strongest possible limits on heavy duty vehicle pollution to limit dangerous diesel pollution like nitrogen oxides (NOx). We need solutions for pollution, and these standards will provide much needed relief from the burden of diesel and other air pollution. The reality is that trucks regulated by this standard will be on the road for decades, so these vehicles must be cleaned up as soon as possible. [EPA-HQ-OAR-2019-0055-1193, p.1]

The bottom line is that zero-emission electric trucks are the best available technology to both reduce harmful NOx and carbon pollution. There are dozens of zero-emission medium- and heavy-duty trucks already available or coming to the market within a couple of years, and across nearly every vehicle class, zero-emission electric trucks and buses are projected to be cheaper to own and operate than their combustion engine counterparts within 5 years. [EPA-HQ-OAR-2019-0055-1193, p.1]

Strong pollution limits on heavy duty vehicles are a solution for pollution, and the EPA can and should use these standards to accelerate the transition to electric trucks. These standards must accomplish two things: 1) reducing deadly NOx pollution 90% by 2027, and 2) putting our national bus and truck fleet on a clear path to 100% zero-emission all-electric vehicles by 2035. [EPA-HQ-OAR-2019-0055-1193, p.1]

Organization: *Mass Comment Campaign sponsored by Climate Action Campaign (15,000)*

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- Families in diesel death zones, particularly communities of color and low wealth communities, have suffered long enough and cannot wait extra model years for clean air, and drivers cannot wait extra model years for more efficient, pollution-free trucks.
- Cleaner trucks are not only available and ready now, they also are projected to deliver critical cost savings for operators and drivers.
- Across nearly every vehicle class, zero-emission electric trucks and buses are projected to be cheaper to own and operate than their combustion engine counterparts within five years.

- Smog and soot air pollution caused by trucks and buses are among the greatest threats to public health for the more than 45 million people in the U.S. living within 300 feet of a major roadway or transportation facility.

The bottom line is that zero-emission electric trucks are the best available technology to both reduce harmful NOx and carbon pollution. There are dozens of zero-emission medium- and heavy-duty trucks already available or coming to the market within a couple of years, and across nearly every vehicle class, zero-emission electric trucks and buses are projected to be cheaper to own and operate than their combustion engine counterparts within 5 years. Strong pollution limits on heavy duty vehicles are a solution for pollution, and the EPA can and should use these standards to accelerate the transition to electric trucks. These standards must accomplish two things: 1) reducing deadly NOx pollution 90% by 2027, and 2) putting our national bus and truck fleet on a clear path to 100% zero-emission all-electric vehicles by 2035. [EPA-HQ-OAR-2019-055-1612]

Organization: *Mass Comment Campaign sponsored by Climate Action Campaign (7,549)*

I'm writing today to urge the EPA to create the strongest possible limits on heavy duty vehicle pollution to limit dangerous diesel pollution like nitrogen oxides (NOx). We need solutions for pollution, and these standards will provide much needed relief from the burden of diesel and other air pollution. The reality is that trucks regulated by this standard will be on the road for decades, so these vehicles must be cleaned up as soon as possible.

- Families in diesel death zones, particularly communities of color and low wealth communities, have suffered long enough and cannot wait extra model years for clean air, and drivers cannot wait extra model years for more efficient, pollution-free trucks.
- Cleaner trucks are not only available and ready now, they also are projected to deliver critical cost savings for operators and drivers.
- Across nearly every vehicle class, zero-emission electric trucks and buses are projected to be cheaper to own and operate than their combustion engine counterparts within five years.
- Smog and soot air pollution caused by trucks and buses are among the greatest threats to public health for the more than 45 million people in the U.S. living within 300 feet of a major roadway or transportation facility.

The bottom line is that zero-emission electric trucks are the best available technology to both reduce harmful NOx and carbon pollution. There are dozens of zero-emission medium- and heavy-duty trucks already available or coming to the market within a couple of years, and across nearly every vehicle class, zero-emission electric trucks and buses are projected to be cheaper to own and operate than their combustion engine counterparts within 5 years. Strong pollution limits on heavy duty vehicles are a solution for pollution, and the EPA can and should use these standards to accelerate the transition to electric trucks. These standards must accomplish two things: 1) reducing deadly NOx pollution 90% by 2027, and 2) putting our national bus and truck fleet on a clear path to 100% zero-emission all-electric vehicles by 2035. [EPA-HQ-OAR-2019-055-1615]

Organization: *Mass Comment Campaign sponsored by Climate Action Campaign (28)*

I'm writing today to urge the EPA to create the strongest possible limits on heavy duty vehicle pollution to limit dangerous diesel pollution like nitrogen oxides (NOx). Here in STATE, we need solutions for pollution, and these standards will provide much needed relief from the burden of diesel and other air pollution. The reality is that trucks regulated by this standard will be on the road for decades, so these vehicles must be cleaned up as soon as possible. The bottom line is that zero-emission electric trucks are the best available technology to both reduce harmful NOx and carbon pollution. There are dozens of zero-emission medium- and heavy-duty trucks already available or coming to the market within a couple of years, and across nearly every vehicle class, zero-emission electric trucks and buses are projected to be cheaper to own and operate than their combustion engine counterparts within 5 years. Strong pollution limits on heavy duty vehicles are a solution for pollution, and the EPA can and should use these standards to accelerate the transition to electric trucks. These standards must accomplish two things: 1) reducing deadly NOx pollution 90% by 2027, and 2) putting our national bus and truck fleet on a clear path to 100% zero-emission all-electric vehicles by 2035. [EPA-HQ-OAR-2019-055-1617]

Organization: *Mass Comment Campaign sponsored by The Climate Reality Project (10,820)*

Even more important, accelerating the transition to 100% electric trucks would help protect the 72 million Americans who live by freight routes not just from NOx but also from soot and other pollutants spewing out of tailpipes. As you know, those affected are overwhelmingly people of color and poor families, making this not just about climate action and public health, but about basic justice for Americans. [EPA-HQ-OAR-2019-0055-1083-A1,p.2]

Yes, the timeline is aggressive. But the health of millions depends on it, and with more and more electric trucks options entering the market, we know we can do it. [EPA-HQ-OAR-2019-0055-1083-A1, p.2]

Organization: *Mass Comment Campaign sponsored by Environment America (11,390)*

We write to urge you to create the strongest possible limits on heavy-duty vehicle pollution. [EPA-HQ-OAR-2019-0055-1611-A1, p.1]

I urge the EPA to create the strongest possible limits on pollution from heavy-duty trucks and buses. Trucks create pollution that is warming our planet and polluting our communities. Smog pollution from trucks is a threat to public health, causing childhood asthma, cancer and even premature death. To protect our health and fight climate change, you must strengthen the proposed heavy-duty truck rule. [EPA-HQ-OAR-2019-0055-1611-A2, p.1]

Organization: *Mass Comment Campaign sponsored by Moms Clean Air Force and Arizona Climate Action Coalition (198)*

Thank you for your recently announced proposal to address pollution from medium and heavy-duty trucks. We, the undersigned Arizona community organizations, elected officials, and community members are joining together to ask for stronger heavy-duty engine and vehicle standards. We are concerned about the impacts of the climate crisis on our children and communities, and do not feel that the proposal goes far enough to address the urgency we are facing. [EPA-HQ-OAR-2019-0055-1192-A1,p.1]

We are writing to you today to ask that you please consider strengthening the proposed standards before they are finalized. The transportation sector is the leading source of climate pollution in the US.[EPA-HQ-OAR-2019-0055-1192-A1, p.1]

Organization: *Mass Comment Campaign sponsored by National Religious Partnership for the Environment (4,677)*

The Environmental Protection Agency has an opportunity to help address the injustice of pollution and climate change by enacting the strongest possible heavy duty truck standards. The standards EPA sets should achieve 100 percent zero-emission truck sales by 2035, which would be at a pace that would deliver much needed health benefits to communities of color. With zero emission trucks, which are commercially available, pollution from these trucks can be eliminated in our neighborhoods. [EPA-HQ-OAR-2019-0055-1122-A1, p.1]

We strongly urge the EPA to advance its environmental justice mandate by prioritizing zero emissions from heavy duty trucks and producing strong heavy duty truck standards that reduce pollution. [EPA-HQ-OAR-2019-0055-1122-A1, p.2]

Organization: *Mass Comment Campaign sponsored by Natural Resources Defense Council (28,240)*

Please accept these 28,240 public comments from members and online activists of the Natural Resources Defense Council (NRDC) asking you to adopt the strongest possible standards to reduce pollution from diesel truck engines and establish a national zero-emissions truck sales requirement to help phase out fossil fuels and slash air pollution in the most-impacted communities more quickly. [EPA-HQ-OAR-2019-0055-1614, p.1]

EPA has a responsibility to slash air pollution, protect public health, and address the climate crisis all at once by pursuing strong standards for heavy-duty vehicle emissions. [EPA-HQ-OAR-2019-0055-1614, p.1]

While we commend your agency for undertaking this effort, we are concerned that your draft proposal doesn’t go far enough and needs to be significantly strengthened. [EPA-HQ-OAR-2019-0055-1614, p.1]

Even with strong emissions standards in place, it will take years for the benefits to reach the people who need them most. That's why we also need a zero-emissions truck mandate. [EPA-HQ-OAR-2019-0055-1614, p.1]

By adopting the two abovementioned policies, we can make progress towards our climate goals and protect the communities most at-risk. [EPA-HQ-OAR-2019-0055-1614, p.1]

Organization: *Mass Comment Campaign* ***sponsored by PennEnvironment (50)***

We the undersigned organizations, businesses, and community leaders are writing to respectfully urge EPA to create the strongest possible limits on pollution from heavy-duty trucks and buses. EPA's proposal to rein in pollution from heavy-duty trucks and buses must be strengthened to truly protect public health from air and global warming pollution. Trucks create pollution that is warming our planet and polluting our communities. As the largest source of global warming pollution in the nation, we must zero out climate emissions from our transportation sector by 2050 to avoid the worst impacts of climate change. That means replacing trucks, buses, freight vehicles, delivery vans, and other vehicles that rely on fossil fuels with clean, electric versions of those vehicles. Smog pollution from trucks is also a threat to public health, causing childhood asthma, cancer and even premature death. To protect our health and fight climate change, EPA must strengthen the proposed heavy duty truck rule. While the limit on smog-forming nitrogen oxides (NOx) in EPA's proposed rule is a start, it doesn't go nearly far enough to protect public health. We call on the EPA to revise and improve the rule, and require NOx emissions to be reduced by 90% by 2027 for heavy duty trucks and buses. The greenhouse gas emission standard in the proposed rule is also far too weak, and must be improved to reduce global warming pollution and accelerate the market for electric trucks. EPA must enact standards that put the American truck and bus fleet on a clear roadway to 100% zero-emission sales by 2035. Vehicle manufacturers have the technology to meet stronger standards than those currently put forth by EPA in its proposed rule, and many recent analyses have shown that fully zero-emission trucks will be cheaper to purchase and operate than diesel-trucks within the timeframe of these standards. Cleaner trucks can deliver cleaner air. EPA can and must initiate a stronger rule that will quickly cut harmful emissions, meet the climate crisis, and protect the health of communities across the state and country. [EPA-HQ-OAR-2019-0055-1616]

Organization: *Mass Comment Campaign sponsored by Public Citizen (168)*

While these rules are a good start, they don’t go far enough. I call on the EPA to make the rules stronger. [EPA-HQ-OAR-2019-0055-1597-A2,p.1]

EPA’s plan needs to urgently eliminate tailpipe emissions and transition the trucking industry to zero emissions. Many states have already required truck manufacturers to reduce NOx emissions by 90% by 2027. EPA can build on these standards by incorporating strong greenhouse gas standards in order to reach 100% clean trucking by 2035. [EPA-HQ-OAR-2019-0055-1597-A2,p.1]

Organization: *Mass Comment Campaign sponsored by Union of Concerned Scientists - 1 (13,985)*

I am glad that, after 20 years, you have proposed stronger tailpipe toxic pollution standards for heavy-duty diesel trucks. But the rule falls short. [EPA-HQ-OAR-2019-0055-1194-A1, p.1]

I urge you to protect our health and eliminate toxic tailpipe emissions from trucks by adopting a stronger rule that accelerates the rollout of zero-emission trucks. [EPA-HQ-OAR-2019-0055-1194-A1, p.1]

Organization: *Mass Comment Campaign sponsored by Consumer Reports (CR) (17,499)*

I urge the EPA to set the strongest standards possible to reduce greenhouse gas and nitrogen oxides emissions from medium- and heavy-duty trucks manufactured in 2027 and beyond. [EPA-HQ-OAR-2019-0055-1613-A1, p.1]

It has been more than 10 years since these standards were updated, and we need the strongest rules possible to protect our health, air, and climate. [EPA-HQ-OAR-2019-0055-1613-A1, p.1]

Organization: *Mass Comment Campaign sponsoring organization unknown (20)*

I support because Climate change action can't wait! [EPA-HQ-OAR-2019-0055-1607, p.1]

Organization: *Mass Comment Campaign sponsoring organization unknown (5,967)*

Thank you for your recently announced proposal to address pollution from medium and heavy-duty trucks. I am worried about the impacts of the climate crisis on the health of our communities, and I'm concerned that the proposal does not go far enough. I'm writing to you today to ask that you please consider strengthening the final standards. The transportation sector is the leading source of climate pollution in the US. The climate crisis is harming our families and our communities today, and heavy-duty vehicles are a major contributor to this pollution. In fact, despite making up only 10% of the total number of vehicles on the road, medium- and heavy-duty trucks contribute a quarter of the total climate pollution from the transportation sector. Trucks are also major sources of other deadly air pollution. Medium and heavy-duty trucks are major contributors to NOx emissions, a potent precursor to ground-level ozone pollution, and they account for more than 60% percent of the deadly particle pollution that comes from vehicles. Particle pollution cuts short tens of thousands of lives in the US every year and contributes to the heavy burden of asthma on our nation's children. Moreover, air pollution impacts are inequitably distributed and disproportionately harm Blacks and Latinos compared to whites. That's why the U.S. should enact standards that put the American truck and bus fleet on a clear roadway to 100% zero-emission sales by 2035. To protect the health of our communities, and to address environmental injustices, EPA must take urgent action to strengthen the proposed standards today to reduce health-harming pollutants, including NOx and PM and greenhouse gasses from medium and heavy-duty combustion vehicles — while continuing to accelerate our transition to zero-emissions vehicles. By taking these steps, the U.S. will be well positioned to protect our family's health, reduce fuel costs for truckers and fleets, strengthen our energy security, and advance environmental justice. [EPA-HQ-OAR-2019-055-1593]

Organization: *Mass Comment Campaign sponsoring organization unknown (40)*

Thank you for your recently announced proposal to address pollution from medium- and heavy-duty trucks. As a parent concerned about the impacts of the climate crisis on our children and communities, I'm concerned that the proposal does not go far enough. I'm writing to you today to ask that you please consider strengthening the proposed standards before they are finalized. The transportation sector is the leading source of climate pollution in the US. The climate crisis is harming our families and our communities today, and heavy-duty vehicles are a major contributor to this pollution. In fact, despite making up only 10% of the total number of vehicles on the road, medium- and heavy-duty trucks contribute a quarter of the total climate pollution from the transportation sector. Trucks are also major sources of other deadly air pollution. Medium- and heavy-duty trucks account for more than 60% percent of the deadly particle pollution that comes from vehicles. Particle pollution cuts short tens of thousands of US lives per year and contributes to the heavy burden of asthma on our nation's children. Moreover, this type of pollution is inequitably distributed and disproportionately harms Blacks and Latinos compared to whites. To protect our children's health and future, and to address environmental injustice, EPA should take urgent and bolder action and strengthen the proposed standards today to reduce health-harming pollutants, including NOx and PM, and greenhouse gases from medium- and heavy-duty vehicles. Thank you for your dedication to protecting public health and to advancing justice and equity. [EPA-HQ-OAR-2019-055-1595]

Organization: *Mass Comment Campaign sponsoring organization unknown (984)*

We are attaching to this email a list of names of community leaders who are urging the EPA to adopt clean truck standards. We know that by adopting clean standards, that will reduce air pollution by 90% by 2027 and put us on a path so that by 2035 all-new trucks and buses are zero-emission. [EPA-HQ-OAR-2019-055-1596]

Organization: *Mass Comment Campaign sponsoring organization unknown (396)*

I find the proposed rule to be weak and urge EPA to withdraw it. I believe it would be better to establish a zero emission standard for all HDVs, for which zero emissions power trains are now commercially available, beginning with model year 2027. The current proposal would reduce CO_2 emissions by less than 1% compared to the existing rule, thereby allowing 2027 HDVs to emit an estimated 28,088,000 metric tons of CO_2 annually. That's 1.78 billion metric tons over a 20-year useful vehicle lifespan and is unacceptable! Many HD vehicle types are currently available with zero emission technology. By setting a zero emission standard for those vehicles now available, EPA could reduce by about 2/3 the total greenhouse gas emissions from this type of vehicle. Doing so would enable us to avoid roughly 1.25 billion metric tons of emissions between now and 2050, which is the equivalent of shutting down five large coal-fired power plants. The most recent IPCC report has told us that the climate crisis is accelerating and that we are out of time to take action. We must not forego these easily-achievable reductions. We must have a zero emission standard now! [EPA-HQ-OAR-2019-055-1601]

Organization: *Mass Comment Campaign sponsoring organization unknown (1,357)*

After decades of inaction that has allowed a growing fleet of dirty diesel trucks to pollute our communities, EPA must enact strict emission reductions and accelerate the transition to zero emissions trucks. I appreciate your agencys efforts in addressing these long-overdue updates to emission standards, but the proposed rule fails to set the ambitious standards required to rapidly adopt zero emissions requirements and address climate change. I urge EPA to propose stronger standards that will protect the health of my community and support the progress in achieving the pollution reduction goals laid out in the Chesapeake Clean Water Blueprint. Nitrogen oxides released from diesel engines contribute nitrogen to the waters of the Chesapeake Bay, which fuels harmful algae blooms and dead zones. If we are going to achieve and maintain the pollutant cuts needed to improve Bay water quality and restore this national treasure, EPA must do their part by adopting the strongest possible standards for heavy-duty truck emissions. Strengthened standards for greenhouse gas emissions are vital to put us on a path to zero-emissions trucks, tackling climate change impacts that are already threatening the Chesapeake region. Further, the dangerous air pollution from these heavy-duty vehicles disproportionately impacts BIPOC and lower income communities and communities of color, that are often the least able to advocate for better environmental conditions. I urge you to propose tougher and more ambitious standards, putting us on a path to zero-emissions from heavy-duty vehicles. This is a crucial opportunity to tackle the urgent threat of climate change, improve water quality in the ecologically and economically important Chesapeake Bay, and protect the health of our most vulnerable communities. I followed a tipper truck in MD yesterday that, whenever it accelerated it emitted more black exhaust smoke than a WW2 Destroyer laying a smoke screen to protect a convoy from enemy action. For decades now some European countries have had toll-free phone numbers for public use to report licence plate numbers of smokey diesel vehicles to their environmental protection authorities. Time to set that up here. [EPA-HQ-OAR-2019-055-1603]

Organization: *Mass Comment Campaign sponsoring organization unknown (**2,433**)*

Every year semi-trucks, busses, and other heavy-duty vehicles emit millions of tons of nitrogen oxides (NOx) and other greenhouse gas pollutants driving climate change. NOx air pollution from heavy-duty vehicles contributes to ozone and fine particulate pollution, which are unsafe to breathe, especially for the young and elderly and anyone exercising outdoors. This pollution is particularly dangerous for communities located close to high truck traffic areas, affecting millions of people that live near highways, warehouses, or ports. In our national parks it harms plants, trees, insects and other animals and it reduces the ability of visitors to see and appreciate the views of our treasured park landscapes. Heavy-duty vehicles are also one of the nation's top sources of climate pollution. Nearly all of America's national parks are threatened by the symptoms of a warming climate including more frequent heat waves, drought, sea level rise, coastal flooding, and extreme wildfires. To tackle this threat, the Biden administration must pursue the strongest possible NOx and greenhouse standards for heavy-duty vehicle engines. Any standards adopted should achieve a 90% reduction in NOx pollution from new heavy-duty vehicles by no later than 2027, which has already been implemented in a half-dozen states and counting. Moreover, the administration should strengthen the rule's greenhouse gas requirements to set us on a path towards 100% zero-emission heavy-duty vehicle sales by 2035. [EPA-HQ-OAR-2019-0055-1594]

Organization: *Mass Comment Campaign sponsoring organization unknown (1**65**)*

My faith urges me to care God's creation and protect human health. Doing so means attending to climate change and addressing environmental justice. Therefore, I join United Women in Faith and urge the Environmental Protection Agency to strengthen the current EPA proposed rule on heavy-duty trucks to move the US to 100% zero-emission trucks by 2035. Trucks and buses produce nearly 25 percent of the transportation sector's greenhouse gases, but only account for 4 percent of vehicles on the road. Smog and soot air pollution caused by trucks and buses are among the greatest threats to public health for the more than 45 million people in the U.S. Because of discriminatory transportation practices, highways and transportation depots are often placed near and through communities of color, placing these communities in greater danger from vehicle pollution. Reducing diesel emissions would not only address climate change but significantly reduce pollution in communities of color. Cleaner trucks are not only available and ready now, they are also projected to deliver critical cost savings for operators and drivers. Today, electric trucks and buses are already capable of supporting the majority of freight, delivery, and transit uses and needs. Across nearly every vehicle class, zero-emission electric trucks and buses are projected to be cheaper to own and operate than their combustion engine counterparts within 5 years. I urge the Environmental Protection Agency to address the injustice of pollution and climate change by enacting the strongest possible heavy duty truck standards to achieve 100 percent zero-emission truck sales by 2035.We absolutely need cleaner vehicles moving the vast amount of "stuff" in this country. When driving behind a truck now, it's easy to see the air pollution that it emits. If we are to have a more sustainable world, then changes need to be made quickly!! [EPA-HQ-OAR-2019-0055-1599]

Organization: *Mass Comment Campaign sponsoring organization unknown (**52,051**)*

Since the earliest days of his presidency and through subsequent executive orders, President Biden and his administration promised bold action to set strong rules and standards to lower emissions from the transportation sector, including heavy-duty vehicles. However, the EPA's proposed Heavy Duty Vehicle (HDV Ruling) provides weak regulations to ensure the damages of trucking pollution stop harming our community. I believe that the EPA needs to hear that the cleanest possible standards are urgently needed. We need a 90% reduction in diesel truck emissions. Time is of the essence: the administration must finalize this proposal by the end of 2022 for the nation to realize the full health benefits of the rule. If the agency misses this window of opportunity, it will mean a full additional year of production of polluting trucks. This makes it critical to ensure that heavy-duty vehicles are as efficient as possible and that we adopt and enforce strict emissions limits as we shift away from fleets powered by fossil fuels. Our communities cannot afford to wait for cleaner air. Black and Brown communities need a rapid transition to zero-emitting trucks and a clear path towards 100% electrification of polluting big rigs, trucks, and buses. Finally, we cannot afford more loopholes and giveaways for multi-billion dollar companies to get a pass on poisoning frontline communities in favor of increased profits. It's past time for the EPA to expire all avenues for skirting pollution standards. [EPA-HQ-OAR-2019-0055-1600]

Organization: *Mass Comment Campaign sponsoring organization unknown (**1,087**)*

As a person of faith and conscience, I recognize that we have a moral obligation to cut carbon emissions and other pollutants that harm our health and our communities. People of all faiths and spiritual traditions share a common bond to care for their neighbor and this planet we all share. To stop climate change and ensure our national security we MUST get off fossil fuels! It's NOT an option! That means electric vehicles. Again, NOT an option. This is a NECESSITY. Stop denying the obvious, bite the bullet, do what needs to be done, and switch to electric vehicles! Don't waste our time and money on fossil fuel vehicles when you KNOW our use of fossil fuels has a very limited shelf life at this point (because if they don't, WE DO). President Biden's larger climate agenda cannot be accomplished without a strong rule on America's 13million heavy-duty trucks and buses. I view much of this rule as a good starting point, but I would like to see it strengthened given the urgency of the climate crisis, the rapid advancement of EV technology and the increasingly understood human health impacts, particularly on communities of color and our most vulnerable residents. The EPA should use these standards to rapidly accelerate the transition to electric trucks and put our nation's medium- and heavy-duty vehicles on a pathway to 100% zero-emission electric vehicles by 2035. I urge the EPA to set the strongest standards possible recognizing the health and well being of current and future generations who will be impacted by this rule. It is essential that the final standards reduce dangerous NOx pollution 90% by 2027 and put our buses and trucks on a clear path to 100% zero-emission all-electric vehicles by 2035. [EPA-HQ-OAR-2019-0055-1602]

Organization: *Mass Comment Campaign sponsoring organization unknown (**2,804**)*

Diesel pollution kills. Nearly 10,000 people in the United States die each year from exposure to diesel emissions from the transportation sector, and hundreds of thousands of others face heart attacks, asthma, and respiratory conditions that damage their wellbeing and quality of life. The EPA's proposed rulemaking on diesel emissions is much needed. I appreciate the EPA for proposing these new standards to better protect the climate and the health of people. Diesel emissions most severely harm communities of color and working class communities, and cleaning up dirty diesel pollution helps to create a more just society. Having failed to act for so long to a health problem long recognized, these rules are at last a good start, but they fall well short of what is needed. I call on the EPA to make the rules stronger. EPA's plan needs to urgently eliminate tailpipe emissions and transition the trucking industry to zero emissions. Many states have already required truck manufacturers to reduce NOx emissions by 90% by 2027. EPA can build on these standards by incorporating strong greenhouse gas standards in order to reach 100% clean trucking by 2035. Improving these standards will improve health outcomes for communities hardest hit by diesel pollution. EPA should adopt requirements to address disproportionate health impacts so that those who are most harmed by diesel pollution can find relief quickly. I encourage the EPA to boldly pursue environmental justice as it reduces diesel emissions and improves the health of communities near ports and freight corridors. [EPA-HQ-OAR-2019-0055-1605]

Organization: *Max Keifer, Retired (CDC NIOSH).*

[*From Hearing Testimony, April 13, 2022*] It is heartening to see the administration acting on clean truck standards, and I would very much like to see the EPA establish stronger limits on heavy-duty vehicle pollution. I have an undergraduate degree in environmental health and a graduate degree in industrial hygiene and toxicology, and recently retired after a career in public health. As such, I have a strong interest in regulatory efforts to reduce or eliminate exposure to pollution from vehicles and other sources. I spent most of my working lifetime investigating worker health concerns and evaluating exposure to a wide variety of contaminants, including diesel and gas engine combustion products in trucking depots, bus maintenance facilities, and fire stations. I am acutely aware of the adverse health effects that can occur from exposure to heavy-duty vehicle exhaust, particularly to workers, who are the most heavily exposed. In addition to reducing the significant contribution of greenhouse gasses, the public health code benefits of strong regulation to reduce or eliminate emissions from heavy-duty trucks cannot be overstated. Without further reductions, heavy-duty vehicles will continue to be one of the largest contributors to mobile source emissions of oxides of nitrogen, greenhouse gasses, and particulate matter. Vehicle exhaust emissions consist of a complex mixture of combustion products that have been linked to adverse health effects such as eye and nose irritation, headaches, nausea, and asthma. Emissions from heavy-duty vehicles contribute to poor air quality and health across the country, especially in overburdened and underserved communities. The National Toxicology Program, EPA, and IARC have all found that exposure to diesel exhaust is reasonably anticipated to be a human carcinogen. The benefits of reducing exposure to these emissions cannot be overstated. It is important that this proposed rule protects both people from both oxides of nitrogen pollution and puts us on a path to having all trucks sold be zero-emission by 2035. Electric trucks and buses are already available and capable of supporting most freight, delivery, and transit uses and needs. Across nearly every vehicle class, zero-emission electric trucks and buses are projected to be cheaper to own and operate than their combustion engine counterparts within five years. The agency's most stringent proposal, Option 1, is insufficient and should be significantly strengthened as it would result in higher emissions of smog and oxides of nitrogen than that permitted by the California Heavy-Duty Omnibus Rule. Option 2 would result in unacceptably high levels of oxides of nitrogen pollution, and should not be considered. Again, I urge this administration to set the strongest possible emission standards to ensure 90 percent oxides of nitrogen reduction by 2027, and establish a clear roadmap to 100 percent zero-emission vehicles by 2035. EPA last revised the oxides of nitrogen standards for on-highway, heavy-duty trucks and engines in 2001, more than 20 years ago, and new technologies that are available today can help achieve the additional reductions we need. [EPA-HQ-OAR-2019-0055-2867]

Organization: *Mayer Automotive LLC*

I am all for clean air, but the cost of what they are proposing ? It will drive up cost of goods. And with driver shortages it will magnify the problem. [EPA-HQ-OAR-2019-0055-1018, p.1]

Organization: *Mayor, City of Albuquerque, NM et al.*

In our shared effort to protect our residents from air pollution, advance environmental justice, and confront the climate crises, we urge the Environmental Protection Agency (EPA) to finalize the strongest possible heavy-duty vehicle requirements via the Clean Trucks Plan, now released as a Notice of Proposed Rulemaking (NPRM) Docket ID No. EPA-HQ-OAR-2019-0055. [EPA-HQ-OAR-2019-0055-1316-A1, p.1]

Thank you for your consideration. There is no time to wait; there is a critical need for the EPA to take swift action moving towards a zero-emissions future in order to protect the health and safety of environmental justice communities. We are confident that you agree on the urgency of this issue and we urge you to finalize a strong rule. [EPA-HQ-OAR-2019-0055-1316-A1, p.2]

Organization: *Metropolitan Washington Air Quality Committee (MWAQC) et al.*

On behalf of the Metropolitan Washington Air Quality Committee (MWAQC), the National Capital Region Transportation Planning Board (TPB), and the Metropolitan Washington Council of Governments' (COG) Climate, Energy and Environment Policy Committee (CEEPC), we are writing to offer our support for the proposed rule to change the heavy-duty emission control program -- including the standards, test procedures, regulatory useful life, emission-related warranty, and other requirements -- to further reduce the air quality impacts of heavy-duty engines across a range of operating conditions and over a longer period of the operational life of heavy-duty engines. We also support the proposed targeted updates to the existing Heavy-Duty Greenhouse Gas (GHG) Emissions Phase 2 program that will further GHG reductions in the model year (MY) 2027 timeframe. [EPA-HQ-OAR-2019-0055-0996-A1, p. 1]

Organization: *Michigan Association of Timbermen*

On behalf of the membership of the Michigan Association of Timbermen, we would like to go on record as opposing final rule on tailpipe emissions from heavy-duty trucks as part of the 'Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards.' [EPA-HQ-OAR-2019-0055-1169-A1, p.1]

We urge you to amend the proposed rule so that it reduces emissions, protects American jobs, and results in cleaner air and healthier communities for all. [EPA-HQ-OAR-2019-0055-1169-A1, p.1]

Specifically, the EPA must reject Option 1 and revise Option 2. An overly aggressive standard will result in higher costs for fleet operators, jeopardize thousands of good-paying jobs, slow the transition to zero-emission vehicles, and fail to achieve the desired environmental benefits. [EPA-HQ-OAR-2019-0055-1169-A1, p.1]

Instead, the EPA must recognize the importance of a single-step, national rule. To be effective, the final rule must be:

- Customer-acceptable. If truck owners and operators choose not to purchase new trucks due to cost or reliability concerns that result from a bad federal rule, older trucks will stay on the roads longer and environment goals will not be achieved.

- Economically viable. If the final rule results in higher costs for manufacturers and fleet owners, manufacturers and small business owners may have no choice but to lay off workers and eliminate jobs.

- Environmentally beneficial. An unworkable rule will delay fleet turnover and prevent environmental progress, creating greater harm in communities most at-risk for high air pollution.

- A bridge to a zero-emissions future. The final rule must not prevent continued progress toward zero-emission commercial vehicles by forcing excessive, costly redesigns of traditional combustion engines at the expense of investments in the research and development of zero-emission vehicles. [EPA-HQ-OAR-2019-0055-1169-A1, p.1]

Under this proposed rule, we could see an increase in truck costs for 2027 models of between $35,000 and $45,000 per unit under just Phase 1. Phase 2 would require additional costs to our businesses. [EPA-HQ-OAR-2019-0055-1169-A1, p.2]

Organization: *Mid-America Regional Council (MARC) Air Quality Forum*

The Air Quality Forum commends the EPA for undertaking emission reductions from heavy-duty vehicles after last setting heavy-duty truck standards over twenty years ago. The benefits of this proposed rule support the Air Quality Forum's mission to maintain the health-based National Ambient Air Quality Standards for the Kansas City region and make progress in decreasing emissions from heavy-duty trucks that disproportionately impact people of color and low-income communities in the Kansas City region. [EPA-HQ-OAR-2019-0055-1131-A1, p. 1]

Despite heavy-duty vehicles representing only 5-percent of vehicles on the road, they have an outsized emissions impact--contributing roughly a quarter of transportation sector GHG emissions in the United States. Furthermore, we feel the proposed standards do not reflect the urgency of the climate crisis and rapid advancement of zero-emission truck technology. Therefore, the Air Quality Forum encourages the EPA to be more aggressive and adopt even more stringent limits than those currently proposed under Option 1 as an update to Phase 2 emissions standards. [EPA-HQ-OAR-2019-0055-1131-A1, p. 2]

Organization: *Motor & Equipment Manufacturers Association (MEMA)*

Therefore, more stringent HD NOx emissions standards and a comprehensive HD rulemaking have enormous implications on the motor vehicle supplier industry. The regulatory process provides the industry the needed certainty to develop and improve future products and systems. [EPA-HQ-OAR-2019-0055-1322-A1, p. 2]

As we have advocated in the past, it would also be beneficial to look at the entire lifecycle rather than just "tailpipe" emissions. As vehicles become significantly more fuel efficient, both upstream and downstream emissions become much more important when attempting to truly compare them. Significant infrastructure requirements would also come along with these rules, so if EPA were to try to match CARB there would need to be significant coordination with DOE in terms of planning for the national electric grid. [EPA-HQ-OAR-2019-0055-1322-A1, p. 8]

Per EPA's request for information on heavy-duty electric vehicle sales projections, including for what HD vehicle types, to help inform their HD electric vehicle sales projections in the MY 2024 through MY 2029 timeframe, MEMA urges the EPA to avoid regulations that allow backsliding on ICE technologies to make sure that ICE vehicles are as clean as current technology will allow. [EPA-HQ-OAR-2019-0055-1322-A1, p. 9]

Organization: *Moving Forward Network (MFN)*

For decades, communities across the country have been fighting for the right to breathe clean air. They have been forced to hold their breath for over 20 years as EPA has delayed adopting new standards that will once and for all clean up the deadly emissions from heavy-duty trucks and buses. The Administration and EPA often note their commitment to place environmental justice at the center of policies and programs, yet time and again, these efforts come up unacceptably short. As MFN Campaign Director and environmental justice advocate Angelo Logan put it, "the obvious answer is to dramatically speed up the use of zero-emission equipment—from the ships entering the ports, to the cargo handling vehicles at the docks, to the rail terminals and heavy-duty trucks moving goods to communities all over the country."1 The question is not about how—we have the zero-emission, life-saving technology to make sure every person in the United States can breathe clean air. The question is whether the EPA and this Administration are willing to take the necessary action that prioritizes the health and well-being of communities and the planet over industry. 2 [EPA-HQ-OAR-2019-0055-1277-A1, pp. 1 - 2]

1. https://thehill.com/opinion/energy-environment/592963-bidens-opportunity-to-end-diesel-pollution-of-port-communities/

2. https://thehill.com/opinion/energy-environment/592963-bidens-opportunity-to-end-diesel-pollution-of-port-communities/

As it stands, the current proposed criteria pollutant standards, both Option 1 and especially Option 2, will not relieve the daily burdens caused by the freight transportation system, felt by environmental justice communities but in fact risk an increase in these burdens from this polluting industry. The EPA's weak proposal is indefensible given the very real opportunity to bring zero emissions into the freight transportation system. Critical to implementing this Rule and subsequent Rules, the EPA must ensure that reductions in medium- and heavy-duty vehicle emissions occur within environmental justice communities. Unless and until EPA's proposal is significantly strengthened, this rule will, either perpetuate an already dangerous status quo and/or increase the impacts from medium and heavy-duty trucks and buses that are killing people. [EPA-HQ-OAR-2019-0055-1277-A1, p. 2]

The EPA needs to:

1. enact the most protective and stringent emission standards that ensure emission reductions in environmental justice communities;

2. transition to zero emission trucks and buses by setting stringent emissions standards and adopting a sales mandate;

3. require that all new trucks are zero emission by 2035 with intermediate targets and prioritization for deployment of in EJ communities;

4. retire all combustion trucks on or before 2045; and

5. Ensure that its rules do not allow for false solutions like natural gas. [EPA-HQ-OAR-2019-0055-1277-A1, p. 2]

As we documented in our October 26, 2021 letter to EPA,3 EPA's legal duty is clear: the agency must adopt emission standards that reflect "the greatest degree of emission reduction achievable." But the agency's proposal is a far cry from meeting this obligation. [EPA-HQ-OAR-2019-0055-1277-A1, p. 2]

3. MFN Letter to Administrator Regan: https://www.movingforwardnetwork.com/wp-content/uploads/2021/11/MFN-Zero-Emission-in-Freight-Letter-to-EPA-10_26_21.pdf

Zero-emission trucks are commercially available,4 economically compelling,5 and the single most effective solution for reducing freight emissions.6 Advances in this technology are outpacing even the best estimates from just a few years ago—cost and technology assessments of battery-electric trucks from 2018 are already becoming obsolete. The barriers that once relegated ZEVs to a niche solution are shrinking, allowing zero-emission trucks to become a real solution in our battle against air and climate pollution. At every regulatory opportunity, EPA must include policies that center environmental justice solutions and rapidly advance ZEVs not just in certain market segments but for the entire truck sector. [EPA-HQ-OAR-2019-0055-1277-A1, pp. 2 - 3]

4. See MJ Bradley & Associates, Medium- & Heavy-Duty Vehicles (July 2021) http://blogs.edf.org/climate411/files/2021/08/EDFMHDVEVFeasibilityReport22jul21.pdf.

5. See Amol Phadke et al, Why Regional and Long-Haul Trucks are Primed for Electrification Now (Mar. 2021) https://etapublications.lbl.gov/sites/default/files/updated_5_final_ehdv_report_033121.pdf

6. OECD, International Transport Forum, Transport Outlook - 2019, at 157 https://doi.org/10.1787/transp_outlook-en-2019-enstating "[s]caling up decarbonisation measures for road freight transport that have already been tested and are comparatively easy to introduce is one of the most immediate actions required."

MFN calls for the final proposal to include strong targets, including zero-emission targets, that reflect the technical feasibility and availability of zero-emission heavy-duty technology:

1. MFN urges EPA to finalize standards that include a separate standard for ZE trucks and require an increasing annual minimum number of ZE truck sales.

2. A zero-emission requirement should be separate and in addition to stronger heavy-duty combustion engine requirements to ensure maximum emission reductions are achieved to cut emissions from new combustion engines.

3. Barring a specific requirement for ZE trucks, EPA must lower the NOx standard to reflect feasible ZE trucks sales. If EPA insists on retaining ZE trucks in a vehicle NOx standard, EPA must lower the NOx standard to reflect the greatest degree of emission reductions achievable across the entire truck fleet based on the feasibility of widespread transition to ZE trucks.

4. Unless EPA intends to drive ZEV adoption, ZEV credits must be excluded from the NOx compliance calculation. Given the myriad risks posed by EPA's proposed averaging scheme, if EPA refuses to adopt more stringent standards that reflect the feasibility of achieving significant emissions reductions through the application of ZE truck technologies, EPA must remove ZEV credits from the NOx compliance calculations. [EPA-HQ-OAR-2019-0055-1277-A1, p. 3]

On October 26, 2021, the Moving Forward Network presented a letter to EPA detailing recommendations to address the disproportionate burdens caused by the freight transportation system on environmental justice communities. EPA must address the cumulative burdens across the entire freight sector and, while these comments will focus on the proposed Heavy Duty Truck Rule, we maintain that EPA must work from a "whole of government" approach and make intentional efforts to address the pollution and public health threats impacting environmental justice communities everyday. MFN's goals, priorities, and demands are summarized below:

1. First and foremost, any and all emission standards must eliminate all pollutant emissions, rather than focusing solely on reducing or eliminating carbon emissions. In this rulemaking, EPA should require that all new trucks be zero-emissions beginning in 2035, with robust interim targets before then. EPA should also set standards that require the retirement of all combustion trucks on or before 2045.

2. EPA must ensure that any new emission standards drive the market for zero-emission truck and bus technology.7

3. In setting these standards across the freight sector, EPA must consider environmental justice impacts and priorities "from source to tailpipe to grave."8 Put another way, the agency must carefully consider any unintended consequences of the proposed regulatory design. For example, regulations must avoid promoting false solutions (e.g., carbon trading and/or "greenwashed" energy that comes from non-renewable and heavy-polluting sources such as natural gas, biomass, etc.) that will only lead to further burdening our environmental justice communities.

4. Transportation electrification must be accompanied by standards and regulations that support renewable electricity generation, i.e., wind and solar,9 that will not further burden environmental justice communities. The EPA and its sister agencies should coordinate with environmental justice leaders in determining the siting details for the supporting electricity infrastructure to ensure that this does not lead to additional cumulative impacts and instead ensure mandatory emissions reductions for EJ communities. [EPA-HQ-OAR-2019-0055-1277-A1, pp. 6 - 7]

7. Regulations must avoid promoting false solutions, (e.g., carbon trading and/or "greenwashed" energy that comes from nonrenewable and heavy-polluting sources such as natural gas, biomass, etc.), that will only lead to further burdening our environmental justice communities

8. "To grave" means that how and where waste from retired zero emission and diesel vehicles is considered in the planning and implementation of zero emission policies and programs.

9. Renewable energy may have many definitions based on the source of energy. MFN considers solar and wind to be renewable energy. However, there are important EJ and equity implications that come from these "cleaner" energy sources (i.e siting, manufacturing, shipping, etc). All of these must be considered with EJ leadership before endorsing specific renewable energy recommendations.

Moreover, MFN and its members have and continue to emphasize that a cumulative impact framing is so critical because it demonstrates the need to move away from fragmented, limited approaches as “solutions”, and towards a more holistic, big-picture approach that will actually be able to address the real-world harms environmental justice communities face. [EPA-HQ-OAR-2019-0055-1277-A1, p. 11]

Along with the announcement for this rule the EPA shared the Transportation and Environmental Justice resource. In this document the EPA highlighted the impacts from the freight transportation system on environmental justice communities and their “comprehensive” approach to address the impacts from Medium- and Heavy-Duty Trucks. The above critical recommendations on how EPA needs to strengthen this rule and move in an intentional and significant way to zero emission vehicles does just that. The current two Options for emissions standards fall dangerously short and leave environmental justice communities and the millions of people who live in them at great risk for many years to come. The zero emissions component and proposed averaging scheme in no way aims to drive ZE sales and in fact could lead to increased emissions in environmental justice communities. MFN is committed to working with EPA to ensure that the regulations around freight impacts does actually meet the intended call to action that the Present set forth. We need EPA to act as the leaders the President is referencing and prioritize solutions which protect and prioritize overburdened and underserved communities. This Rule in its current draft does not meet this call to action. We cannot wait for future rules or proposals to address these impacts. We need EVERY rule, program, incentive that comes from EPA to prioritize addressing environmental racism, and protect environmental justice Now. The lives of our communities are at stake. [EPA-HQ-OAR-2019-0055-1277-A1, p. 60]

Organization: *National Association of Chemical Distributors (NACD)*

We agree that vehicle emissions should be reduced in the long term as emissions from heavy-duty vehicles impact the communities of NACD member employees and drivers. However, they must be reduced in a way that accounts for full economic impacts and allows for a realistic path to compliance. NACD looks to government regulators to consider and implement policy that provides for some level of reasonableness, certainty, and predictability. These three elements are lacking in the proposed rule, and NACD urges EPA to rework the proposal to include them to provide clarity and facilitate compliance. [EPA-HQ-OAR-2019-0055-1279-A1, p. 5]

Organization: *National Association of Clean Air Agencies (NACAA)*

We urge EPA to work thoughtfully and quickly to issue a final rule this year – incorporating NACAA’s recommendations – so that NOx emission standards and related program requirements apply beginning with MY 2027. [EPA-HQ-OAR-2019-0055-1232-A1, p. 17]

The gravity of timely compliance with the NAAQS requires this federal action. The protection of public health and welfare, particularly in overburdened communities across the nation, demands it. [EPA-HQ-OAR-2019-0055-1232-A1, p. 17]

Organization: *National Center for Health Research (NCHR)*

NCHR agrees with the Environmental Protection Agency (EPA) that the proposed truck pollution standards, which would reduce emissions of smog- and soot-forming nitrogen oxides, are a crucial step towards EPA's commitment to climate, clean air and environmental justice. However, in light of the ongoing health and climate crisis, the proposed standards fall short of a zero-emission transportation future, and we urge EPA to further strengthen the proposed standards. This has also long been requested by environmental justice communities across the country, because while truck pollution has been devastating the health of communities across the country, it has a disproportionate impact on communities of color. [1 [EPA-HQ-OAR-2019-0055-1227-A1, p.1]

> [1] Moving Forward Network. Demand Zero Emission Freight Now. https://www.movingforwardnetwork.com/zero-emissions/.We are particularly concerned that zero-emission trucks are not the number one priority of the proposed standards, even though electric trucks are already available today. Zero-emission trucks been shown to improve health outcomes, and new research demonstrates that by 2027 pollution-free trucks will be cost competitive with diesel over the lifetime of the vehicle. [2] The rule should also require the maximum possible reduction of emissions from diesel trucks. Diesel trucks are proven to contribute to smog and pollution, causing thousands of premature deaths nationwide each year [3]. [EPA-HQ-OAR-2019-0055-1227-A1, p.1]
>
> [2] Environmental Defense Fund. New Study Finds Rapidly Declining Costs for Zero-Emitting Freight Trucks and Buses. https://www.edf.org/media/new-study-finds-rapidly-declining-costs-zero-emitting-freight-trucks-and-buses. February, 2022.
>
> [3] Union of Concerned Scientists. Electrifying Trucks and Buses. https://ucsusa.org/resources/electrify-trucks. February, 2022.

Strengthened truck standards are an integral aspect of ensuring the health of our nation, and research has shown that pollution-free truck standards are feasible. Pollution also has long had a disproportionate effect on communities of color, making the issue even more pressing. We thus urge EPA to ensure that the proposed truck pollution standards are further strengthened so that they can have the necessary impact in order to protect public health and to set the United States on a path to a zero-emissions transportation future. [EPA-HQ-OAR-2019-0055-1227-A1, p.2]

Organization: *National Coalition for Advanced Transportation (NCAT)*

NCAT strongly supports EPA adopting strong heavy-duty vehicle standards, including a ZEV sales mandate that would culminate in 100 percent of new heavy-duty vehicle sales be ZEVs. To lay the foundation for such an approach, NCAT encourages EPA to consider strengthening the standards described in the proposal. Heavy-duty ZEVs are poised to play a bigger role in the near future than the agency currently assumes for Model Year 2027, supporting greater stringency in the standards. Five states have already adopted California's Advanced Clean Trucks rule and additional states are poised to adopt this rule in the coming years. [EPA-HQ-OAR-2019-0055-1290-A1, p. 2]

In conclusion, NCAT strongly urges EPA to strengthen NOx and GHG emissions standards for heavy-duty vehicles and to pursue a longer-term heavy-duty vehicle ZEV sales mandate to transition new heavy-duty vehicle sales to 100 percent ZEV by 2035. [EPA-HQ-OAR-2019-0055-1290-A1, p. 9]

Organization: *National Parks Conservation Association (NPCA)*

This EPA rule represents a necessary step to reduce NOx and greenhouse gas emissions from heavy-duty vehicles but falls short of CAA requirements and what is needed to ensure the health and welfare of our parks, communities and climate. [EPA-HQ-OAR-2019-0055-1314-A1, p.7]

Organization: *National Religious Partnership for the Environment*

To uphold our moral obligations to God's creation and protect the health and wellbeing of all human communities, the Environmental Protection Agency must move to zero-emission medium- and heavy-duty trucks by 2035. Electrifying these vehicles across the U.S. is key to improving air quality and saving lives in communities with some of the dirtiest air in the nation. It is also essential to achieving emission reductions needed to avoid the worst consequences of climate change and its impacts. [EPA-HQ-OAR-2019-0055-1221-A1, p.1]

A climate and pollution response grounded in justice demands that we move towards clean transportation. Enacting strong medium- and heavy-duty truck standards that prioritize zero emission vehicles will help ensure a more just future for communities of color and help protect all of God’s creation. [EPA-HQ-OAR-2019-0055-1221-A1, p.2]

Organization: *National Tribal Air Association (NTAA)*

NTAA was encouraged by EPA’s commitment expressed on March 7, 2022, that 'This proposed rule would ensure the heavy-duty vehicles and engines that drive American commerce and connect people across the country are as clean as possible…'. While this regulation proposed just three weeks later is an important step in reducing emissions of the many harmful pollutants from these vehicles, it would not achieve all that is possible. For example, - Given that proposed requirements begin with vehicle model year 2027, emissions reduction technologies and strategies should mandate those that are most current and rapidly developing.[EPA-HQ-OAR-2019-0055-1382-A2, p.2]

While acknowledging emerging engine technologies including electric and fuel cell, (see FR pages 17417 through 17418), the proposed rule is focused on promoting emissions reduction technologies, operation, and maintenance of diesel-fueled and, to a lesser extent gasoline fueled, vehicles. [EPA-HQ-OAR-2019-0055-1382-A2, p.2]

Climate change stimulated by emissions of greenhouse gases from many sources including heavy-duty vehicles and engines impacts and threatens Tribal communities throughout the United States. NTAA supports Executive Order 14037, the Clean Trucks Plan and EPA’s commitment to requirements that vehicles be 'as clean as possible'. This rule should be promulgated consistent with these commitments. [EPA-HQ-OAR-2019-0055-1382-A2, p.2]

Organization: *National Waste & Recycling Association (NWRA)*

As the industry that facilitates and conducts recycling throughout the country, NWRA members support EPA's goals to make the environment a better place and increase the cleanliness and efficiency of the vehicles their companies produce and operate. NWRA does not want to have a regulation that limits the strides our manufacturers and operating companies are already taking to incorporate zero emission vehicles (ZEV) into our fleets. An overly burdensome prescriptive standard could limit or slow down the momentum that is currently occurring in the transition to battery electric vehicles. NWRA-member truck manufacturers are already seeing an uptick in the request and ordering of ZEVs. NWRA requests that EPA institute a technologically feasible rule. [EPA-HQ-OAR-2019-0055-1242-A1, p. 1]

Organization: *Natural Gas Vehicles for America (NGVAmerica)*

NGVAmerica supports EPA finalizing regulations that encourage much needed emission reductions, are based on realistic expectations about the pace and cost of technology, and that encourage engine makers and vehicle manufacturers to deploy a variety of available, scalable, and cost-effective technologies. [EPA-HQ-OAR-2019-0055-1330-A1, p.1]

NGVAmerica supports the EPA's efforts in this rulemaking to promulgate more stringent NOx and greenhouse gas emission standards for heavy-duty engines and vehicles. As highlighted in EPA's notice, trucks and buses powered by medium- and heavy-duty engines contribute a disproportionate amount of pollution in urban areas throughout the U.S. In many cases, trucks and buses are the most significant contributors to ozone pollution and smog. This is not because cleaner technology does not exist but rather because cleaner technology is not being deployed in effective numbers and older, higher polluting vehicles remain on our roads and in-use. [EPA-HQ-OAR-2019-0055-1330-A1, pp.2-3]

The emissions impact of battery materials and battery production are not inconsequential. An ATRI study released this month 'found that while electric trucks have no direct tailpipe emissions, CO2 production associated with vehicle, battery and electricity production would only result in a 30 percent decrease in CO2 emissions when compared to a standard diesel truck.'14 According to ATRI, 'the marginal environmental benefits of electric trucks are due, in large part, to lithium-ion battery production – which generates more than six times the carbon of diesel truck production.' A story published by Politico included this significant datapoint: 'a thousand-pound electric car battery requires the moving of 500,000 pounds of earth in the course of mining.'15 The Financial Times has reported that 'between 5 and 15 tonnes of CO2 are produced per tonne of lithium extracted. This is equal to the total electric usage of between 1 and 2 U.S. homes for a whole year.'16 [EPA-HQ-OAR-2019-0055-1330-A1, p.7]

> 14 https://truckingresearch.org/2022/05/03/understanding-the-co2-impacts-of-zero-emission-trucks/
>
> 15 'The Major Problems Blocking America's Electric Car Future,' Politico, August 31, 2021

16 'Financial Times, October 5, 2021. Available at: https://ig.ft.com/electric-car/

Organization: *Navistar, Inc. (Navistar)*

EPA’s proposed changes include not only new NOx certification standards, but also fundamentally new test procedures, and extended useful life and warranty requirements. Navistar is concerned that in setting the proposed NOx compliance standards and in-use emission limits that EPA did not fully take into account the cumulative effect of all of these new proposed requirements on HDOH engine and vehicle manufacturers. When all of these changes are combined, the magnitude of EPA’s proposed rule is unprecedented, raising significant feasibility and implementation concerns. In addition, the proposed rule has the effect of potentially slowing the progress of Navistar’s electrification and zero emission vehicle (“ZEV”) development efforts by requiring Navistar to divert significant time and capital resources to products that will provide only limited NOx emission reduction benefits. [EPA-HQ-OAR-2019-0055-1318-A1, p. 2]

While Navistar does not support EPA’s proposed rule as currently drafted, we remain hopeful that a consensus set of standards can be reached, which balances the priorities as described in this comment letter. [EPA-HQ-OAR-2019-0055-1318-A1, p. 2]

While Navistar supports EPA’s ultimate emissions reduction and climate change goals, there are a number of issues requiring clarification or modifications in the final rule. We remain hopeful that a consensus set of standards can be reached that balances the priorities we have described. [EPA-HQ-OAR-2019-0055-1318-A1, p. 7]

Organization: *Neste US, Inc*

Neste has a demonstrated interest in sustainability and supports EPA’s emphasis on reducing NOx and GHG emissions from heavy-duty vehicles. As a company, Neste supports more electrification and other zero-emission vehicle (ZEV) solutions because, fundamentally, they provide a net benefit for addressing climate change. However, going 'all-in' on one potential solution that won’t be ready for decades, means ignoring proven, low-emission solutions that work and are available today. [EPA-HQ-OAR-2019-0055-1225-A1, p.1]

Neste urges the Agency not to adopt what is effectively an electric vehicle (EV) mandate at the expense of clean, renewable diesel. While EVs and other zero emissions vehicles may be able to reduce emissions from the transportation sector, replacement of existing fleets with entirely new vehicles and technology will require significant time, financial investments, and other resources. [EPA-HQ-OAR-2019-0055-1225-A1, p.1]

Neste does not oppose EPA’s proposal to impose more stringent GHG standards on heavy-duty vehicles. Nor does Neste oppose EPA’s endorsement of EVs as a method to reduce emissions. However, Neste urges EPA to acknowledge the value of renewable diesel as an accompanying measure to achieve immediate GHG emissions reductions with no additional infrastructure, particularly as EV technologies continue to evolve.

EV benefits overinflated, while negative impacts overlooked

First, the benefits of EVs are often overinflated while the negative impacts are overlooked. EPA's focus on EV's lack of tailpipe emissions fails to adequately account for the economic impact of EVs or the lifecycle emissions associated with EVs, including the upstream emissions from charging batteries. [EPA-HQ-OAR-2019-0055-1225-A1, p.2]

The California Air Resources Board (CARB) recently conducted economic modeling of four GHG emissions reduction scenarios encompassing a range of sectors. CARB concluded that all four emissions reductions scenarios would slow job and economic growth. However, Alternative 1, which mandates carbon neutrality and 100% electrification of all sectors by 2035, would slow employment growth by nearly five times and economic growth by six times more that Alternative 3, which uses a broad portfolio of GHG reduction measures, including existing and emerging fossil fuel alternatives, electrification, and other technologies. See Figures 1 (employment) and 2 (state domestic product). [EPA-HQ-OAR-2019-0055-1225-A1, p.2]

Given the significant benefits associated with renewable fuels and the uncertainties regarding the climate and economic benefits and drawbacks of focusing on EVs, EPA should not favor EVs over other vehicle categories in planning for the de-carbonization of the U.S. transportation sector. [EPA-HQ-OAR-2019-0055-1225-A1, p.3]

Organization: *New York Farm Bureau (NYFB)*

While air quality is of upmost importance to New York farmers, there are several concerns with the proposed rule. This rule has the potential to delay the turnover to newer vehicles with cleaner emission technologies, forcing vehicle owners to keep their higher-emitting trucks longer and not update to model year (MY) 2027 in heavy-duty vehicles. This not only will delay EPA's anticipated environmental benefits, it also would cause environmental backsliding that seems to be in conflict with the goals of the agency. Furthermore, a poorly designed final rule will cause market disruptions, will delay or undermine the ability of manufacturers to recoup their investment in developing compliant technologies, and worse, could have significant adverse impacts on the economy. [EPA-HQ-OAR-2019-0055-1268-A1, p. 1]

As emphasized previously, heavy-duty trucks are the lifeblood not only of farms, but also throughout the entire supply chain. Increasing costs, decreasing availability and potentially encouraging negative environmental impacts through public policy should always be avoided. Yet, this proposed rule would multiply the supply chain, inflationary and input pressures New York farmers and consumers are already facing. More needs to be done to invest in infrastructure, vehicle and engine technology advancement and incentive programs before this rule is considered. While New York State has its own program for financial incentives for cleaner vehicle technology through the New York Truck Voucher Incentive Program (NYTVIP), the program is often over prescribed, and it's unclear if such a program could be replicated at the federal level. [EPA-HQ-OAR-2019-0055-1268-A1, p. 2]

It is again important to emphasize that trucking is enormously important to the economy—the industry moves 72% of goods in America and is the foundation of a well-functioning supply chain. When trucking costs go up, the cost of nearly all goods go up with it. As the White House recently noted, trucking costs grew more than 20% last year, and we know that sharply increased fuel costs thus far in 2022 have only exacerbated economic burdens. [EPA-HQ-OAR-2019-0055-1268-A1, p. 2]

NYFB believes the proposed rule is not technologically feasible, cost-effective or acceptable to the needs of farmers. Our policy, developed by hardworking farmers, clearly enunciates opposition to any further attempt to restrict or regulate exhaust emissions on new or used farm equipment, heavy equipment or trucks. NYFB therefore urges EPA to take extra caution to avoid requirements that could intensify the already challenging economic conditions facing rural communities and the U.S. economy. NYFB appreciates EPA's consideration of agriculture's concerns. [EPA-HQ-OAR-2019-0055-1268-A1, p. 2]

Organization: *Next Level Farmer, LLC*

Diesel truck emissions are just a small part of the problem. Plus, the USA is experiencing high rates of inflation because, of elevated fuel prices. All of America would be affected and most surely the working class would go bankrupt with additional demands on their razor-thin budgets. These bankruptcies would collapse the USA economy. [EPA-HQ-OAR-2019-0055-2785, p.1]

Organization: *North Carolina Assembly House of Representatives, John Faircloth*

Please do not discount the concerns expressed by commercial vehicle manufacturers. The economy of North Carolina – indeed, the entire country – is dependent on their continued growth, research, and reinvestment as we collectively work toward a cleaner environment. [EPA-HQ-OAR-2019-0055-2446, p. 2]

Organization: *North Carolina Federation of Republican Women*

The U.S. economy has suffered a mortal blow with runaway inflation exacerbated by ever-increasing fuel costs. Our nation cannot afford further financial damage, especially in an industry that is vital to our survival. Historically vital industries were protected from unnecessary damage from government regulations. In this proposed tightening of government standards, our vital trucking industry will be forced to adopt new technologies that will cripple smaller businesses and cause a jump in consumer prices. Truckers are the backbone of America and are rightly proud of their role in clean air success. At this moment of crisis when container ships are stranded off our coasts, we need to keep vital trucks rolling across America to feed our families and move needed goods in our economy. The 2,600 members of the North Carolina Federation of Republican Women urge the EPA to delay implementing these rules. Thank you. [EPA-HQ-OAR-2019-0055-2450, p. 1]

Organization: *North Carolina General Assembly, Philip E. Berger*

Commercial vehicle manufacturers are committed to partnering with EPA and other stakeholders to further reduce emissions from heavy-duty trucks without diverting resources necessary to foster a phased transition to ZEVs. We urge you to work with them - not against them - to finalize a cost-effective rule that will further reduce emissions, protect American jobs, and result in cleaner air and healthier communities for all. [EPA-HQ-OAR-2019-0055-1105-A1, p. 2]

Please do not discount the concerns expressed by commercial vehicle manufacturers. The economy of North Carolina - indeed, the entire country - is dependent on their continued growth, research, and reinvestment as we collectively work toward a cleaner environment. [EPA-HQ-OAR-2019-0055-1105-A1, p. 2]

Organization: *North Carolina House of Representatives, Office of the Speaker, Tim Moore*

Commercial vehicle manufacturers are committed to partnering with EPA and other stakeholders to further reduce emissions from heavy-duty trucks without diverting resources necessary to foster a phased transition to ZEVs. We urge you to work with them - not against them - to finalize a cost-effective rule that will further reduce emissions, protect American jobs, and result in cleaner air and healthier communities for all. [EPA-HQ-OAR-2019-0055-1146-A1, p. 2]

Please do not discount the concerns expressed by commercial vehicle manufacturers. The economy of North Carolina - indeed, the entire country - is dependent on their continued growth, research, and reinvestment as we collectively work toward a cleaner environment. [EPA-HQ-OAR-2019-0055-1146-A1, p. 2]

Organization: *North Carolina State House of Representatives, Larry W. Potts*

Please do not discount the concerns expressed by commercial vehicle manufacturers. The economy of North Carolina - indeed, the entire country- is dependent on their continued growth, research, and reinvestment as we collectively work toward a cleaner environment. [EPA-HQ-OAR-2019-0055-1061-A1, p. 2]

Organization: *Northeast States for Coordinated Air Use Management (NESCAUM)*

NESCAUM supports the adoption of a 0.020 gram NOx engine standard in 2027 at intermediate useful life and a 0.035 gram NOx standard at full useful life as specified in CARB's Omnibus regulation. Ample data from CARB, EPA, and other research programs exist supporting the feasibility of introducing a 0.020 gram NOx standard at intermediate useful life in 2027.19,20,21,22,23,24 EPA also released a memo on May 3, 2022 presenting heavy-duty diesel engine test results similarly indicating that current engines are already approaching this NOx standard, therefore supporting its feasibility by MY2027.25[EPA-HQ-OAR-2019-0055-1249-A1, p. 9]

> 19 Manufacturers of Emission Controls Association, "Technology Feasibility for Heavy-Duty Diesel Trucks in Achieving 90% Lower NOx Standards in 2027," February 2020. Available at https://www.meca.org/wp-content/uploads/resources/MECA_2027_Low_NOx_White_Paper_FINAL.pdf (accessed May 4, 2022).
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> 20 Southwest Research Institute, "Update on Heavy-Duty Low NOx Demonstration Programs at SwRI," November 2019. Available at https://ww3.arb.ca.gov/msprog/hdlownox/files/workgroup_20190926/guest/swri_hd_low_nox_demo_programs.pdf (accessed May 12, 2022).

21 Sharp, C.; Neely, G.; Rao, S.; Zaval, B., "An Update on Continuing Progress Towards Heavy-Duty Low NOx and CO2 in 2027 and Beyond," Southwest Research Institute, WCX, Detroit, Michigan, April 5-7, 2022.

22 U.S. EPA, "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards Draft Regulatory Impact Analysis," March 28, 2022. Available at https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10144K0.pdf.

23 Achates Power, "Heavy Duty Opposed Piston Engine Demonstration," CRC Real World Emissions Workshop, March 15, 2022.

24 Mendoza Villafuerte, P.; Demuynck, J.; Bosteels, D., "Ultra-Low NOx Emissions with a Close-Coupled Emission Control System on a Heavy-Duty Truck Application," Society of Automotive Engineers, September 21, 2021. Available at https://www.aecc.eu/wp-content/uploads/2021/09/2021-01-1228.pdf (accessed April 25, 2022).

25 U.S. EPA, "Test Results from EPA Diesel Engine Demonstration," Memorandum from J. Sanchez, OAR/OTAQ/ASD, to Docket EPA-HQ-OAR-2019-0055, May 3, 2022. Available at https://www.regulations.gov/document/EPA-HQ-OAR-2019-0055-1082 (accessed May 12, 2022).

Organization: *Northview Service Center*

The current regulations that are in effect are stringent enough and it would put most small operators out of business if there is a requirement to upgrade old equipment before that business is ready financially to purchase new or newer vehicles. These vehicles will eventually come out of service over time and be upgraded. [EPA-HQ-OAR-2019-0055-1016, p.1]

Organization: *NTH Equipment*

Against. These changes and new technologies need vetted by the industry for affectiveness. The last change with the uria requirements failed and caused major damage to engines and have and still cost millions upon millions to the industry and in turn the end users and add to inflation. We do not need to cause more cost to be added to the every day persons lives and that is exactly what more regulation will do. This is not the time to do this. [EPA-HQ-OAR-2019-0055-1044-A1, p.1]

Organization: *Odyne Systems, LLC (Odyne)*

Odyne applauds the efforts of the Environmental Protection Agency (EPA) to work with industry to reduce air pollution from highway heavy-duty vehicles and engines, including ozone, particulate matter, and greenhouse gases. [EPA-HQ-OAR-2019-0055-1264-A1, p.1]

Organization: *Our Children's Trust*

As the Nation's only law firm dedicated to representing youth whose constitutional rights are being infringed by their government's conduct that causes climate change, we write to advise EPA to set stronger nitrogen oxide ('NOx') and other greenhouse gas ('GHG') standards and further strengthen its heavy-duty greenhouse gas emission standards for MYs 2027-2029 and beyond to align with the swift emission reductions needed to correct Earth's energy imbalance and stabilize the climate system, and to abide by the constitutional, public trust, and legal obligations that constrain EPA's actions.1 [EPA-HQ-OAR-2019-0055-1317-A1, p.1]

> 1 Our comments here apply equally to the limited amendments to regulations for air pollutant emission standards for the other sectors referenced, including 'light-duty vehicles, marine diesel engines, locomotives, various types of non road engines, vehicles, and equipment.'

Organization: *Outdoor Power Equipment Institute (OPEI)*

OPEI largely supports the Proposed Rule. OPEI is primarily seeking clarification with these comments. [EPA-HQ-OAR-2019-0055-1205-A1, p.1]

Organization: *Owner-Operator Independent Drivers Association (OOIDA)*

The regulatory options presented in the NPRM maintain an impractical approach to achieving emissions reductions that discounts the contributions of the trucking industry, ignores realities from previous flawed emissions rulemakings, and does not thoroughly contemplate the operational impacts on small trucking businesses. [EPA-HQ-OAR-2019-0055-1266-A1, p.2]

Clean air is a priority for everyone, including truckers, but the technology used in heavy-duty trucks to improve air quality has to be affordable and reliable. Small-business truckers and owner-operators should not be used as trial cases for testing new technology, while getting priced out of business in the process. Unfortunately, each of the proposed timelines to achieve nitrogen oxides (NOx) emissions reductions leave us wondering if the same mistakes from previous rulemakings will be repeated. [EPA-HQ-OAR-2019-0055-1266-A1, p.2]

EPA must consider a more feasible implementation timeline that would provide reliable and affordable heavy-duty vehicles for consumers, particularly small trucking businesses and individual owner-operators. We believe there is a more realistic path forward to reducing commercial vehicle emissions that involves listening to the men and women of the trucking industry. EPA should continue seeking out feedback from these stakeholders as the agency develops any final rule. Truckers know all too well that poorly implemented regulations will result in breakdowns, downtime, and ultimately set back the goal of achieving cleaner air. [EPA-HQ-OAR-2019-0055-1266-A1, p.2]

As currently proposed, both option 1 and option 2 introduced in the NPRM fail also fail to provide adequate production timelines to ensure vehicle reliability for motor carriers. Again, other hurried emissions timelines have led to breakdowns, downtime, and ultimately set back the goal of achieving cleaner air. [EPA-HQ-OAR-2019-0055-1266-A1, p.5]

OOIDA has supported the administration's emphasis on improving driver recruitment and retention. The trucking profession is by no means an easy one. Our members spend on average 250 nights on the road each year, keeping them away from family, friends, and the comforts of home. They often work between 60 and 80 hours each week - a demanding schedule that is rarely reflected in their paychecks. Instead of taking actions to benefit those who make their living behind the wheel such as expanding truck parking capacity, increasing driver compensation, and improving working conditions, this proposed rule would make small-business truckers' jobs more difficult and push some out of the industry. The final rulemaking should reflect more practical timelines that do not force drivers out of business or make it more challenging for new drivers to enter the industry. [EPA-HQ-OAR-2019-0055-1266-A1, p.6]

OOIDA believes that industry stakeholders, specifically small-business truckers and owner-operators, will be an invaluable resource for EPA as the agency develops any final Heavy-Duty NOx emissions rulemaking. We appreciate the agency's willingness to hear from professional drivers that have real-world experience with emissions technologies. Moving forward, EPA must prioritize affordability, reliability, and serviceability in order to achieve practical standards that will reduce NOx emissions for heavy-duty vehicles. These objectives cannot be met until a comprehensive Regulatory Flexibility Act analysis is completed that addresses the Rule's impact on small-business truckers. [EPA-HQ-OAR-2019-0055-1266-A1, pp.12-13]

Organization: *Ozone Transport Commission (OTC) and Mid-Atlantic/Northeast Visibility Union (MANE-VU)*

The OTC and MANE-VU strongly support EPA's efforts to develop new heavy-duty engine and vehicle emission standards and test procedures that will reduce NOx emissions from heavy-duty trucks. NOx emissions are a primary precursor to the formation of ground-level ozone and secondary fine particulate matter (PM2.5) and contribute to acid deposition, eutrophication, and visibility impairment in the OTC region. [EPA-HQ-OAR-2019-0055-1250-A1, p.1]

The Clean Air Act requires ozone NAAQS attainment as 'expeditiously as practicable,' and EPA's proposed Options 1 and 2 do not meet this requirement. The introduction of effective and available heavy-duty engine and vehicle pollution reduction technologies will assist jurisdictions in the OTR in reaching attainment of the ozone standards. This is the most 'expeditiously as practicable' path called for by the Clean Air Act and anything less than this will not be acceptable. [EPA-HQ-OAR-2019-0055-1250-A1, p.13]

Organization: *PACCAR, Inc (PACCAR)*

PACCAR generally supports the goals of EPA's Proposed Rule, including many specific elements and proposed regulatory changes. [EPA-HQ-OAR-2019-0055-1346-A1, p.59]

Organization: *Pennsylvania Chamber of Business and Industry*

We strongly encourage EPA to modernize and streamline effective and durable nitrogen oxide (NOx) emission standards for heavy-duty highway engines, and to work with states and stakeholders so as to recognize cost-effective, technology-based requirements to achieve reductions that will facilitate an improvement in air quality and continued economic expansion. The options outlined in the most recent Notice of Proposed Rulemaking, published in the Federal Register this past March, are simply unworkable and overly aggressive, as we will describe below. [EPA-HQ-OAR-2019-0055-1319-A1, p.1]

With respect to air quality, the PA Chamber advocates for cost effective air laws, regulations and policies based on sound principles that are reasonable and technologically and economically feasible to protect and enhance public health and the environment without placing in-state businesses at a competitive disadvantage. The PA Chamber supports regulatory policy which balance societal environmental, energy, and economic objectives, fit rationally within any finally adopted and applicable national or international strategy, and capitalize on the availability of Pennsylvania's diverse natural resources to facilitate economic development in the Commonwealth. It should be noted that this approach to economic growth and environmental stewardship is also written into the Clean Air Act itself, where Section 101(b) directs EPA to implement the provisions of the Act in a manner 'to promote public health and welfare and the productive capacity of [the] population.' [EPA-HQ-OAR-2019-0055-1319-A1, p.2]

Organization: *Peoria Charter Coach Company*

In conclusion, now is time for the EPA to help our industry in regard to pollution. For, the air coming out of one of my vehicles is cleaner than the air (in certain cities} going in. I appreciate your consideration in altering the current ruling based on the most current data. [EPA-HQ-OAR-2019-0055-1241]

Organization: *Performance Truck*

This in no way going to help anyone.. the systems on these truck are prone to fail and end up costing the consumer and businesses thousands of dollers Remember we are a government for the people,,, YOU are making it AGAINST the people I look forward to the day when we start over [EPA-HQ-OAR-2019-0055-1009, p.1]

Organization: *Pinnacle Converting Equipment & Services, LLC*

As a small business owner in the US, please do not impose additional restrictions on trucking emissions. There are not enough trucks on the road today and the economic impact will be quite adverse in a time where the country has 1) not enough truck drivers and 2) not enough trucks to transport the good we have currently in our ports. [EPA-HQ-OAR-2019-0055-1011, p.1]

Additionally, with inflation running rampant and fuel prices over $6/gallon for diesel, the cost benefit analysis does not favor any additional regulation. [EPA-HQ-OAR-2019-0055-1011, p.1]

Instead of this regulation on American owned and operated vehicles, please consider imposing additional regulations on imports from China and India. Both countries have very different air quality requirements from the US. [EPA-HQ-OAR-2019-0055-1011, p.1]

Organization: *Port of Seattle, Port of Tacoma, and Northwest Seaport Alliance (NWSA)*

On behalf of the Port of Seattle, the Port of Tacoma, and The Northwest Seaport Alliance (NWSA), we are writing in support of this important effort to strengthen emission standards for criteria air pollutants and greenhouse gases from heavy duty engines and vehicles. The proposed rules align well with our own clean air, climate, and environmental justice goals, and will help advance the ambitious vision of our recently updated clean air strategy: to eliminate emissions from all seaport activities by 2050. From our perspective as one of the country's largest cargo gateways, the transition to cleaner – and, ultimately, zero-emission – heavy duty trucks and equipment will require significant financial, technical, and policy assistance from the U.S. government to facilitate and accelerate the procurement of cleaner/zero-emission trucks and equipment and the development of the necessary charging and fueling infrastructure here in the Puget Sound region and Washington State. [EPA-HQ-OAR-2019-0055-1312-A1, p.1]

Organization: *Proterra*

Proterra thanks the EPA for its commitment to protecting the environment and human health, and for the opportunity to comment on this rulemaking which represents a good first step in the right direction towards a cleaner transportation future. [EPA-HQ-OAR-2019-0055-1344-A1, p.1]

Proterra has entered into partnerships to develop or supply battery systems with more than a dozen OEMs across 19 vehicle programs, powering zero-emission electric delivery vehicles and work trucks, semi-trucks, construction and mining equipment, port container handlers and forklifts, school and coach buses, and low-floor cutaway shuttles. [EPA-HQ-OAR-2019-0055-1344-A1, p.1]

These partnerships have signaled the readiness of various medium- and heavy-duty sectors to electrify, from Class 3 to Class 8. Proterra has invested to meet this customer demand. Several states have also exhibited leadership in the move toward zero emission transportation. California has led with the implementation of the Innovative Clean Transit rule for public transportation, the Zero-Emission Airport Shuttle rule for airport shuttles, and the Advanced Clean Truck rule for vehicle manufacturers, demonstrating the readiness of the market to meet clean transportation needs. [EPA-HQ-OAR-2019-0055-1344-A1, p.1]

Other states like Oregon, Washington, New York, New Jersey and Massachusetts have also led with the adoption of the Advanced Clean Truck rule first modeled by California. New York State has led with a plan to fully electrify every school bus in the state by 2035. [EPA-HQ-OAR-2019-0055-1344-A1, p.2]

These state level efforts can be complemented with national leadership by EPA to create regulatory certainty via this rulemaking and to encourage the further implementation of zero emission vehicles across the country and further investments in US technology development and job creation as the world moves toward an electric transportation future. [EPA-HQ-OAR-2019-0055-1344-A1, p.2]

Organization: *Public Citizen and Healthy Port Communities Coalition (HPCC)*

We appreciate the Proposal put forth and support the need for urgent emission reductions from the heavy-duty vehicle sector. We urge the EPA to strengthen the proposed rule and to move quickly to finalize, implement, and enforce strong standards that will protect the health of the 72 million people living within one tenth of a mile of truck routes and quickly reduce greenhouse gas emissions in order to limit global temperature rise to 1.5° Celsius. [EPA-HQ-OAR-2019-0055-1417-A2, p. 1]

Organization: *Randolph M. Lyon*

EPA is to be commended for assessing these issues and proposing a stronger regulatory posture. The analysis presented to date, however, focuses on two options, termed Option 1 and Option 2 by EPA. Option 1 is the stronger of these two options and it has positive economic net benefits and important health and social equity impacts under the different discount rates and other technical assumptions considered. Also, significantly, Option 1 has greater net benefits than Option 2 under the assumptions considered. The relative net benefits of the two main options and the proposed rule's limited published information on greenhouse gas (GHG) emissions raise several important questions that EPA should consider.

1. <u>What would be the effects on net benefits, social equity, and public health of an option that provides even stronger environmental protection than Option 1</u>? Based on the information provided with the current proposed rule, it is possible that a stronger option would provide net economic, social equity, and public health benefits that are even greater than those of Option 1. Once other collateral benefits, such as those from GHG reductions, are considered, this possibility is likely to become even more likely.

2. <u>What are the specific greenhouse gas reductions, in terms of tonnages and climatic impacts, associated with different options</u>? At a minimum, the specific tonnages should be presented to enable analysts and policy makers to evaluate the net benefits associated with these emission reductions.

3. <u>What would be the effects on net benefits, social equity, and public health of considering a positive economic value for GHG reductions in the analysis</u>? EPA should include results that present monetized values of the GHG reductions. If appropriate, these values could consider a range of benefit estimates per ton to give policymakers an understanding of the sensitivity (or insensitivity) of the results to different assumptions.

4. <u>What would be the net benefit, social equity, public health, and other characteristics of considering an option to parallel the more stringent rules adopted by California and several other states</u>? While the current proposed rule and regulatory impact analysis

mention the California rule, they do not present a clear and transparent analysis—including tables and figures with air quality, public health, and economic effects—of expanding the California rule nationwide. Among other things, EPA should consider the regulatory and zero-emission vehicle market development benefits of having a common national standard. The State of Maryland Department of the Environment, for example, submitted comments (EPA-HQ-OAR-2019-0055- 1025) to this Docket supporting adoption of the California rule on a national basis on April 22, 2022.

5. <u>If deemed necessary, what adjustments could be considered to the California framework to best extend it to a nationwide mandate if there are concerns about the extent of vehicle availability in specific model classes and years</u>? If EPA determines there are practical uncertainties that suggest considering variants of the California rule, such as a longer phase in for certain specific classes of vehicles, those options could be discussed.

6. <u>Would anticipated or potential co-investments, such as build-out of a nationwide system of electric vehicle charging stations, change the feasibility of any options</u>? For example, does the enactment of the Infrastructure Investment and Jobs Act (P.L. 117-58) on November 15, 2021, increase the expected availability of a nationwide network of charging stations in a manner that would facilitate adoption of zero-emission long-haul trucks?

My expectation is that these additional analyses would support a stronger regulatory framework than Option 1 and serious consideration of a framework similar to the one adopted by California and, in turn, several other states. Thank you for preparing the proposals and analyses shared to date and for seeking these comments. [EPA-HQ-OAR-2019-0055-1100, p. 1-2]

Organization: *Repair Association/Repair.org*

These comments are made in support of making repair more accessible in an environment where increased use of digital components is extending control of the vehicles by the manufacture and limiting agricultural producers repair service providers or indeed the ability to self-repair the equipment they own. [EPA-HQ-OAR-2019-0055-1036-A1, p.1]

Organization: *Retail Industry Leaders Association (RILA)*

In conclusion, RILA appreciates the invitation to submit comments on the proposed rule. We welcome further opportunities for input and dialogue, where the transporation practitioners of the retail industry can be a resource to help facilitate commonsense and realistic approaches to reducing transporation emissions. We share the goal of developing a final rule that will not create or increase barriers to emissions reduction, but will help industry pave the way for a zero emissions future.[EPA-HQ-OAR-2019-0055-1189-A2, p.9]

Organization: *Rivian Automotive, LLC (Rivian)*

While the options considered by the agency move in the right direction, Rivian believes EPA should consider its current lineup of alternatives and proposals as a floor and demonstrate greater ambition in the final rule. [EPA-HQ-OAR-2019-0055-1229-A1, p.1]

In 2020, approximately 60 percent of those NOx and PM emissions occurred in urban areas.2 Electrifying MHD vehicles has particular benefits for neighborhoods and populations of concern in and around America’s major cities. [EPA-HQ-OAR-2019-0055-1229-A1, p.2]

The NPRM rightly describes an “historic opportunity” for bold action as the industry embarks on a “significant transition” to zero-emissions vehicles (“ZEVs”).3 Rivian applauded Executive Order 14,037, which identified several potential regulatory actions for EPA to consider in accelerating progress toward a zero-emission MHD sector.4 The agency’s proposal for new criteria pollutant standards and revised GHG standards was well received and comes as a growing list of product launches and manufacturer commitments underscores the readiness of the MHD sector to electrify more quickly than previously thought.[EPA-HQ-OAR-2019-0055-1229-A1, p.2]

> 3 Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, 87 Fed. Reg. 59, 17,419 (Mar. 28, 2022) (revising 40 C.F.R. Parts 2, 59, 60, 80, 85, 86, 87, 600, 1027, 1030, 1033, 1036, 1037, 1039, 1042, 1043, 1045, 1048, 1051, 1054, 1060, 1065, 1066, 1068, and 1090).
>
> 4 Exec. Order No. 14,037, 86 Fed. Reg. 151 (Aug. 10, 2021).

EPA’s proposed rule raises the bar. Rivian welcomes the increased stringency identified in Option 1 for criteria emissions and appreciates the tighter GHG standards proposed. We also recognize that the EPA and the Biden Administration more broadly view this rule as just the first regulatory action among several, including a fresh look at MD standards for MY27 and later as well as HD GHG standards for MY30 and beyond. Certainly, Rivian agrees that more ambitious regulatory action will be necessary for EPA’s rules to proactively move the market forward and deliver emissions reductions that protect public health and the climate. We look forward to those future proposals.[EPA-HQ-OAR-2019-0055-1229-A1, p.2]

However, important steps to strengthen this proposal can also be taken now. Our analysis of the proposed rule found that EPA likely underestimated the pace of electrification that is feasible over the timeframe in question. We have also identified provisions in the rule that appear likely to soften the regulation’s impact and result in delays to the stated goals of this administration. These proposed provisions are not necessary given the rapidly growing availability of ZEVs in the MHD market. A simpler regulatory framework aligned with industry’s recent investments and commitments will make the proposed rule even stronger, reducing emissions from the transportation sector at a faster pace to better protect our climate and public health. [EPA-HQ-OAR-2019-0055-1229-A1, p.3]

Rivian views both the NOx and GHG proposals in the NPRM as a floor for EPA's deliberations on a final rule. EPA should consider strengthening both standards to ensure the agency is doing more than just keeping pace with trends toward electrification and maximizing the environmental and public health benefits of this rule. In addition, we also encourage EPA to take a different approach to the amendments proposed regarding LDV GHG and fuel economy testing procedures, allowing manufacturers more time and flexibility. [EPA-HQ-OAR-2019-0055-1229-A1, p.7]

Organization: *Richard Leeds*

Kudos to the EPA for issuing regulations to reduce pollution from trucks and buses, and that advance the transition to zero-emissions transportation. [EPA-HQ-OAR-2019-0055-1333]

While the proposed level of regulation, and the rate of implementation are an improvement over prior regulations, they will permit the continued use of poorly maintained vehicles for too long, where research has shown that poorly maintained vehicles generate 10 to 100 times as much unhealthy exhaust as a well maintained vehicle. Permitting poorly maintained vehicles to continue operating in cities and highway will deny healthy lives to millions of people. [EPA-HQ-OAR-2019-0055-1333]

Further, delaying changeover to electric vehicles will exacerbate the climate crisis, desertification, severe weather, fresh water shortages, fire disasters, sea level rise, and the climate refugees that we are already seeing. Our failure to act at this time will cause longterm damage the global habitat for humans and the variety of species on this planet, in perpetuity. [EPA-HQ-OAR-2019-0055-1333]

I ask that the EPA adopt the Alternative Option with stricter emission standards and earlier implementation. [EPA-HQ-OAR-2019-0055-1333]

If the EPA determined that it is not possible to adopt the Alternative Option, I ask that the EPA adopt Option 1 as a minimum to begin to exercise the EPA's governmental responsibilities to provide for a healthy future.

Organization: *Rocknaks Hardware Plus*

I own a business that depends on the trucking company. One of our deliveries this past week was three days late do to a breakdown. The breakdown resulted in another truck and driver to come from Minnesota to Montana to pick up the trailer and complete the delivery. This was caused by the original truck shutting down to an emissions program that failed. This country depends on our trucks, if we continue to handcuff and require more complex circuitry we will have bigger issues to deal with in the future. [EPA-HQ-OAR-2019-0055-1019, p.1]

Organization: *Roush CleanTech (Roush)*

ROUSH appreciates the EPA's thoughtful efforts to develop a strategy to best mitigate emissions from internal combustion engines. Specifically, we recognize the importance of granting eligibility to a wide array of advanced technologies to provide the best options for fleets, and flexible regulatory structure for compliance. By doing so, we believe the overall air quality benefits are maximized, as manufacturers can provide cost-effective solutions which consumers are most likely to adopt and utilize. [EPA-HQ-OAR-2019-0055-1276-A1, p.1]

Organization: *Royal Plastics, Inc.*

I understand that there is concern for air pollution, etc. However, there needs to be a balance between both the regulations and what is going to be economical for the trucking industry. There is a lot of transportation in the US that is dependent upon truck drivers that are either individual drivers or drivers that work for a small operation. If the expenses outweigh profitability for these small businesses, they will close, and we will be even shorter on transportation in an already short industry. And trying to subsidize with government funding is not the answer either. We are already way overspending taxpayer dollars with fewer people working and paying into the tax system. So, if there needs to be standards imposed, then they need to phase them in over an extended period of time so the cost burden will be reasonable for the smaller operations to handle. [EPA-HQ-OAR-2019-0055-1017, p.1]

Organization: *RV Industry Association (RVIA)*

RVIA has reviewed the proposal published March 28 and has serious concerns about the cost impact of the proposed regulations as they apply to motorhomes. Whereas EPA recognized in the Phase 2 GHG rule2 that certain segments of the medium- and heavy-duty vehicle sector deserve to be assigned unique standards, the agency has does not propose to address the implications of its proposal for motorhomes and other vehicle types that were included in the so-called 'custom vocational chassis' category in the GHG rule. We request the agency either retain existing standards for motorhomes or create new standards that are commensurate with the benefits that are to be derived from more stringent standards for motorhomes. We ask that the agency avoid a 'one-size fits all' approach that has the potential to seriously harm the RV community. [EPA-HQ-OAR-2019-0055-1270-A1, p. 1]

> 2. EPA/NHTSA joint final rule establish Phase 2 GHG / Fuel Consumption standards for medium- and heavy-duty trucks, 81 FR 73478, Oct. 25, 2016.

For a diesel motorhome costing $150,000 today, this would represent a massive cost increase of over 10%. Unfortunately, motorhomes are subject to other EPA and NHTSA regulations that will result in other price increases in the same 2027 timeframe (e.g., EPA’s Phase 2 GHG rule and NHTSA’s forthcoming automatic emergency braking mandate). Motorhome costs are also subject to other inflationary price pressures, not the least of which today is the ongoing chip shortage. Cumulatively, regulatory changes like those proposed, when stacked on top of other inflationary pressures, will result in product prices that are likely to significantly reduce the percentage of people that can afford a motorhome. Being the discretionary purchases that they are, motorhome sales are likely to be substantially reduced from current levels. This reduction in sales will have a deleterious impact on jobs tied to the production, distribution, and sale of motorhomes. The ability of average Americans to afford an alternative means of recreation that became increasingly popular with the advent of the Covid-19 virus will be diminished. Operators of campgrounds and recreation areas such as our National Parks will be negatively impacted. [EPA-HQ-OAR-2019-0055-1270-A1, p. 3]

EPA can and should do what it did in the Phase 2 GHG rule. It should go beyond setting 'one-size fits all' standards that will significantly harm the motorhome community and instead, either maintain the existing standards or establish standards that are commensurate with the benefits to be derived from regulating motorhomes. Looking at the Phase 2 GHG as an example, EPA established custom vocational vehicles standards which it projected would incrementally increase the cost of 2027 model year motor home chassis by approximately $900. This contrasted to an estimated cost increase of $5,670 for other categories of 2027 model year heavy duty trucks (a savings of $4,770 per vehicle)12. [EPA-HQ-OAR-2019-0055-1270-A1, p. 4]

> 12. Table 7 - Summary of Final 2027 Custom Chassis Vocational Standards Including Average Per Vehicle Costs and Projected Improvement, Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles - Phase 2 Regulatory Impact Analysis, EPA-420-R-16-900, August 2016, page ES-16.

RVIA believes that a program like what was established in 2016 for custom vocational chassis is necessary and appropriate. We ask that the EPA either retain its existing standards for motorhomes or modify its proposal and establish standards for motorhomes that have costs that are fitting with the benefits to be derived and not unduly harm the motorhome community. [EPA-HQ-OAR-2019-0055-1270-A1, p. 5]

Organization: *S&P Global Mobility*

S&P Global Mobility supports the Environmental Protection Agency’s (EPA) Notice of Proposed Rulemaking for Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards (NPRM), specifically the provisions related to production volume data being considered emissions data not subject to confidential treatment. This letter is only intended to comment on the treatment of production volume data. [EPA-HQ-OAR-2019-0055-1273-A1, p. 1]

Organization: *Saahil Pasha*

Air pollution and ground-level ozone are a major problem for all people living the United States. Moreover, people living in urban communities are more impacted by heavy traffic. These communities are disproportionately affected and consist of minority and low-income individuals. The trucking and freight industries increase the level of risk as the vehicles emit large amounts of pollutants. Nitrogen oxide emissions pose a significant threat to the lung and airway health for many people. When exposed to these pollutants consistently, these issues further lead to chronic conditions and a significant burden on the healthcare industry and economy. [EPA-HQ-OAR-2019-0055-1206]

Although Air North Texas encourages every individual to contribute towards reducing emissions and air pollution, it is necessary for the EPA, as an executive agency, to enforce an industry wide standard and uphold its mission of protecting the environment and public welfare. [EPA-HQ-OAR-2019-0055-1206]

I firmly support the proposed rules by the EPA. To reduce emissions, Air North Texas recommends that North Texans should try to bike or walk, reduce engine idling, work from home, carpool, use local transit system, and limit outdoor activities during high pollution times of the day ("How to take action | Air north Texas," n.d.). Therefore, the proposal put forth by the EPA to reduce nitrogen oxide, greenhouse gas, and particulate matter emissions would significantly reduce pollution and improve pollution related health outcomes in the North Texas area. In the proposed rule the EPA has provided information about the various projected health benefits that are expected in 2045, when the program is fully implemented. [EPA-HQ-OAR-2019-0055-1206]

While the transportation industry may have reservations regarding the proposed rule, the EPA is acting within its granted authority to propose regulations that contribute to improved air standards and the protection of public health. Furthermore, the EPA has conducted cost benefit analyses and considered the viability of the options to the trucking industry (EPA-HQ-OAR-2019-0055-0983, p. 17,415 - 17,416). Nonetheless, a collaborative approach to proposing a rule may encourage stronger compliance from industry partners to transition towards vehicles that work to achieve the goal of reduced emissions. [EPA-HQ-OAR-2019-0055-1206]

Organization: *Sage Lincoln*

As a member of the Bicycle Coalition of Greater Philadelphia, I am submitting comments in response to the EPA’s proposed changes to the heavy-duty emission control program. I strongly support strengthening emissions standards and urge you to select Option 1 and implement the most stringent standards possible. [EPA-HQ-OAR-2019-0055-1073]

Organization: *San Joaquin Valley Air Pollution Control District (District)*

Given the importance of reducing heavy-duty truck emissions in meeting federal air quality standards in the San Joaquin Valley (Valley), the District submitted a petition to EPA on June 22, 2016, requesting that EPA undertake rulemaking to establish new national standards for heavy-duty trucks, and we appreciate and support EPA’s response and efforts through the proposed rule to address this important issue. [EPA-HQ-OAR-2019-0055-1291-A1, p.1]

It has been nearly six years since the District petitioned EPA to begin rulemaking for onroad heavy-duty trucks, and we appreciate the opportunity to support your action on this today. [EPA-HQ-OAR-2019-0055-1291-A1, p.3]

Organization: *SEAM Group*

SEAM Group supports the adoption of heavy duty electric vehicles as a replacement for Class 2b-8chassis [EPA-HQ-OAR-2019-0055-2574, p.1]

Organization: *Sierra Club, NJ Chapter*

This proposed rule has monumental implications because it sets the stage for trucks and buses that will be on the road for the next 20 years. To put that into a clearer perspective, that is after 2050. We all know the immediate and drastic action required by all of us on a national, state and local scale in order to tackle climate change, and to try to mitigate as much as possible of the already incoming disastrous environmental and community impacts. Thus, clean buses and trucks policy, which has not seen a change since 20 years ago, will have a massive impact on this necessary climate action. [EPA-HQ-OAR-2019-0055-2558, p. 1]

Organization: *Sophia Dowd*

The proposed rule is sufficient for the reduction of air pollutants, specifically NOx.

While reviewing the proposed rule, it is clear the efforts to amend standards of heavy-duty vehicles to reduce emission impact are satisfactory. Our environment is now in crisis and the toxic air pollutants that are emitted by these heavy-duty vehicles directly impact the ozone layer while also having an immediate impact on human health. [EPA-HQ-OAR-2019-0055-1043]

According to the University of Toronto near-road air pollution study, “If we were able to reduce emissions of pollutants like black carbon, we would also see an immediate climate benefit”.1 This is critical to understanding the stakes of this proposed rule for the environment. The proposed rule acknowledges the implications of heavy-duty vehicles on air pollutants and the immediate benefits of reducing pollutants from these vehicles. The climate crisis has been avoided for far too long, and this proposal is a sufficient remedy regarding the issue of heavy-duty vehicle pollution. [EPA-HQ-OAR-2019-0055-1043]

The proposal takes into consideration the implications of these new standards on the trucking and agricultural industry as well. While these proposals are focused on transitioning to reduce vehicle emissions, this will not have an adverse effect on companies or small business vehicles. The timeline provided allows for ample time to replace the vehicles and even notes that many vehicles will need to be replaced before the proposed timelines. [EPA-HQ-OAR-2019-0055-1043]

Implementing this rule will create a nationwide standard for heavy-duty vehicles which will aid in regulations regarding future manufacturing of these vehicles. This is essential when looking at nationwide standards that will translate to the largest emission reduction we currently know of. [EPA-HQ-OAR-2019-0055-1043]

This proposal reflects on the NOx emissions, which are not emitted as frequently as CO2 but are still responsible for warming. Effects of warming from emissions include temperature rises, water shortages, increased fire threats, drought, weed and pest invasions, intense storm damage and, salt invasion, etc.2 By 2045, when the proposal will be in full effect, the net benefits would outweigh the costs. While there are some concerns from those who believe the vehicles have no chance of being replaced without economic sacrifices, the plan properly relies on equity to allow for these vehicles to reach a specific mileage and allow for replacement time. [EPA-HQ-OAR-2019-0055-1043]

The other portion of this proposed rule looks at the impact on human health. According to the European Environment Agency (EEA), fine particulate matter causes the most substantial impact of all air pollution- the same pollution these vehicles emit. These impacts include stroke, chronic obstructive pulmonary disease, trachea, bronchus, lung cancers, aggravated asthma and lower respiratory infections.3 This does not include the exacerbated impact of already diagnosed diseases as well: chronic exposure can affect every organ in the body. This is a critical public health issue that is being addressed by reducing air pollutants from heavy-duty vehicles. The European Commission set a goal of 2030 to reduce PM (particulate matter) by 55%. This is comparable to this proposed rule, and premature deaths attributed to PM exposure fell by 33%.4 [EPA-HQ-OAR-2019-0055-1043]

The need for standards that reflect the urgency of the climate situation is present within this proposed rule. By comparing the repair costs and operating costs of heavy-duty vehicles, it is clear that the benefits will outweigh the costs. Concerns about how this rule's implementation will affect the current industries that rely on heavy-duty vehicles are ignoring the equitable timeline this rule has in place so companies and small business owners are able to financially afford the transition to vehicles that follow the standards. It is vital these propositions turn into regulations that help reduce climate change for future generations. [EPA-HQ-OAR-2019-0055-1043]

1Do, Liz. "Large trucks are biggest culprits of near-road air pollution: U of T Engineering study." University of Toronto Engineering News, 10 September 2018, https://news.engineering.utoronto.ca/large-trucks-are-biggest-culprits-of-near-road-air-pollution-u-of-t-engineering-s tudy/.

2WWF Australia. "Impacts of global warming." WWF-Australia, https://www.wwf.org.au/what-we-do/climate/impacts-of-global-warming Accessed 28 April 2022.

3Europe Environmental Agency. "Air pollution: how it affects our health — European Environment Agency." European Environment Agency, 1 December 2021, https://www.eea.europa.eu/themes/air/health-impacts-of-air-pollution Accessed 28 April 2022.

4 Id.

Organization: *Southern Environmental Law Center (SELC)*

The proposed standards are an important step to promote cleaner cars and trucks, and we welcome EPA's plans to update the current standards.2 Under the Clean Air Act, the medium and heavy-duty vehicle emissions standards are 'technology-forcing' standards and technology that eliminates, not just minimizes, tailpipe pollution from these vehicles already exists.3 Yet EPA's proposal fails to accelerate the transition to zero-emission vehicle (ZEV) technology in this key part of the transportation sector. Vehicles sold while this rule is in effect will be on the road for decades. Given the serious public health and environmental impacts of tailpipe pollution from medium- and heavy-duty vehicles and the availability of technology that eliminates this pollution, we urge EPA to adopt the strongest possible standards under the Clean Air Act and to finalize the rule by the end of this calendar year. [EPA-HQ-OAR-2019-0055-1247-A1, p.1]

2 Exec. Order No. 14037 (Aug. 5, 2021).

3 '[Clean Air Act] section 202(a)(3)(A) is a technology-forcing provision and reflects Congress' intent that standards be based on projections of future advances in control capability, considering costs and other statutory factors.' Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, 87 Fed. Reg. at 17436.

Organization: *State Soybean Associations*

The State Soybean Associations approve of EPA's intention to reduce NOx and GHG emissions from heavy-duty transportation industry. Yet EPA must not to rely on electrification at the expense of the biodiesel and renewable diesel industries, and EPA should use alternative authorities, such as the Energy Policy and Conservation Act, if it wishes to force a mandate for EVs; it should not perpetuate the fiction that it is setting tailpipe emission standards under the Clean Air Act. We hope EPA will acknowledge the value of using biodiesel and renewable diesel as an immediately available strategy to address GHG emissions, particularly while EV technologies continue to evolve. [EPA-HQ-OAR-2019-0055-2035-A1, p.3]

Organization: *States of California, et al. (The States)*

The States commend EPA's efforts to strengthen criteria pollutant emission standards for heavy-duty engines for the first time in almost 20 years. Heavy-duty engines are a significant source of pollutants that contribute to ambient levels of ozone and particular matter that are linked to premature death, respiratory illness including childhood asthma, cardiovascular problems, and other adverse health impacts.2 Indeed, on-road heavy duty vehicles are the largest mobile-source contributor of emissions of nitrogen oxides (NOx)—an ozone precursor—in the country.3 [EPA-HQ-OAR-2019-0055-1255-A1, pp. 1 - 2]

2. 87 Fed. Reg. at 17,444.

3. Id. at 17,418. Ozone is created by a chemical reaction in the presence of sunlight between NOx and volatile organic compounds.

Finally, due to statutory lead time requirements for model year 2027, the States note the importance of finalizing the Proposed Rule as soon as possible but by the end of this year at the latest. [EPA-HQ-OAR-2019-0055-1255-A1, p. 3]

Organization: *Straights Lawn & Garden*

WE SHOULD NOT BE CONSIDERING ANY NEW AIR POLLLUTION CONTROLS. WE ARE IN ATERRIBLE INFLATION AND FUEL SHORTAGE, WE SHOULD ADDRESS THE REOPENING OFOUT PIPE LINES AND ADDRESSING INFLATION INSTEAD OF TRYING TO MAKE MORECOSTLY RULES AND REGULATIONS, [EPA-HQ-OAR-2019-0055-1723, p.1]

Organization: *Taxpayers Protection Alliance (TPA)*

The proposed changes would significantly alter the program by introducing new requirements relating to test procedures, emission-related warranties, and underlying standards. While TPA believes that Nitrogen Oxide emissions pose long-term health hazards for the U.S. population, increasing regulatory costs will only succeed in creating unintended consequences that will ultimately hamper the Environmental Protection Agency (EPA) and Biden administration's goals. Therefore, TPA opposes the proposed rule and urges a more measured and holistic approach to abate emissions and keep costs under control. [EPA-HQ-OAR-2019-0055-1102-A1, p.1]

Organization: *Tesla, Inc. (Tesla)*

Given the acceleration of public health and welfare impacts associated with climate change, it is incumbent upon the EPA to recognize the appropriate role battery electric vehicle (BEV) technology plays today and how widespread commercial availability of BEVs in the U.S. today should inform the implementation of far more stringent finalized standards as part of this rulemaking. As provided below, Tesla strongly supports efforts to address the significant public health and community impacts of air pollution associated with the current heavyduty vehicle fleet and encourages the agency to finalize nitrogen oxide (NOx) and greenhouse gas (GHG) standards that are far more stringent than contained in Option 1 of the proposal by, at a minimum, aligning with the stringency of the California Heavy-Duty Omnibus NOx Rule beginning in MY 2027.4 [EPA-HQ-OAR-2019-0055-1219-A1, p.1]

4 See, California Air Resources Board, Heavy Duty Omnibus Regulation.

Tesla believes these changes will significantly reduce emissions, result in increased deployment of the best available emissions reduction technology (BEVs), maintain U.S. manufacturing leadership in medium and heavyduty BEV technology, and ensure the Administration is meeting it statutory mandate to protect the public health and welfare from the significant and accelerating impacts from criteria air pollution and climate change. [EPA-HQ-OAR-2019-0055-1219-A1, p.24]

In sum, electrifying the medium- and heavy-duty sector will provide significant improvements in air quality and benefits to all Americans through reduced NOx, PM and GHG emissions. Tesla believes it is essential for EPA to establish longer-term medium- and heavy-duty emission standards that actively embrace a more wholesale transition to BEVs, and that the time for doing so is now. EPA's failure to finalize a NOx and GHG rule that substantially puts the heavy-duty sector on a path to full electrification and sufficiently reduces U.S. emissions commensurate with the country's commitment to holding global warming to well below 2 degrees Celsius would not meet the legal benchmark of protecting the public health and welfare. [EPA-HQ-OAR-2019-0055-1219-A1, p.8]

As the agency discusses, the ACT regulation will drive significant emission reductions and medium- and heavy-duty vehicle electrification through Model Year (MY) 2035.77 Additionally, five states – Massachusetts, New Jersey, New York,78 Oregon, and Washington – have already adopted the standards starting in MY 2025. Several additional states are expected to adopt the rule starting in MY 2026. In California alone, the ACT rule is estimated to require the deployment of 100,000 heavy-duty ZEVs in 2030 and 300,000 by 2035.79 There is simply no justification for not including this deployment of vehicles into the NOx proposal baseline. If the seventeen states80 that have adopted the current California light duty ZEV standards also adopt California's ACT rule, it is estimated that 1 in 8 trucks sold in 2030 will be electric.81 Moreover, this adoption would yield significant NOx, PM, and CO2 emission benefits.82 Importantly, the ACT rule incentivizes early action from manufacturers, further supporting a significant increase in deployment of zero emissions trucks in the near term in states that adopt the ACT rule. [EPA-HQ-OAR-2019-0055-1219-A1, p.10]

77 87 Fed. Reg. at 17597; See also, CARB Advanced Clean Trucks Fact Sheet (Aug. 20, 2021).

78 See, ICCT, Benefits of Adopting California Medium- and Heavy-Duty Vehicle Regulations In New York State (May 27, 2021).

79 CalMatters, California Mandates Zero-exhaust Big Rigs, Delivery Trucks (July 6, 2020).

80 CARB, States that have Adopted California's Vehicle Standards under Section 177 of the Federal Clean Air Act (updating to include New Mexico's recent adoption of the standards).

81 Union of Concerned Scientists, We Can Electrify One in Three Heavy Duty Trucks by 2030: Here's How. (Mar. 22, 2022).

82 ICCT, Update: Benefits of Adopting California Medium- and Heavy-Duty Vehicle Regulations Under Clean Air Act Section 177 (December 2021).

While the agency also notes the multi-state NESCAUM Memorandum of Understanding (MOU),83 it should ensure that the deployment of BEV technology envisioned under the agreement is included in the NOx (and GHG) baseline assessment. More specifically, in July 2020,84 fifteen states and the District of Columbia announced that they entered the joint MOU wherein they committed to working together the advance and accelerate the market for electric medium- and heavy-duty trucks. The parties agreed to a goal that 100% of new medium- and heavy-duty vehicle sales would be zero emission by 2050, with an interim goal of 30% sales by 2030. A recent analysis found that expanding the MOU nationally would result in more than half of the fleet being electric by 2045 and reduce annual GHG emission reductions 5% of U.S. truck emissions in 2035 increasing to an 18% reduction in U.S. truck emissions in 2045.85 Another found that these states adopting the ACT rule would lead to over 756,000 medium- and heavy-duty ZEVs deployed between 2024 and 2035.86 [EPA-HQ-OAR-2019-0055-1219-A1, p.10]

83 87 Fed. Reg. at 17598 (This effort was organizing by the Northeast States for Coordinated Air Use Management (NESCAUM). The state signing on to the MOU were California, Connecticut, Colorado, Hawaii, Maine, Maryland, Massachusetts, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, and Washington.).

84 NESCAUM, 15 States and the District of Columbia Join Forces to Accelerate Bus and Truck Electrification (July 14, 2020).

85 Rhodium Group, States Pave the Way for a Zero-Emission Vehicle Future (Aug. 13, 2020).

86 CALSTART, Zeroing in on Zero Emission Trucks (Jan. 2022) at 21.

Interest in the MOU and its goals continues to expand. 87 In September 2021, the Province of Quebec signed on to the MOU. Virginia followed suite in December 2021, and Nevada just joined at the end of March 2022, bringing the total number of signatories to 17 states, one province, and the District of Columbia. The signatory states have committed to working together through the existing multi-state ZEV Task Force88 to develop and implement an Action Plan to help states meet these ambitious goals. In March, the Draft Multi-State Medium and Heavy-Duty Zero-Emission Vehicle Action Plan was released for public comment.89 Notably, the first recommendation in the draft Action Plan called for the signatory states to adopt the ACT regulation. As noted in the plan: While market-enabling programs such as incentives are also important, regulatory requirements mandating MHD ZEV sales provide market certainty needed to drive investments in zero emission technologies and charging and fueling infrastructure at the pace and scale required for rapid electrification. Indeed, the ZEV sales mandate for passenger vehicles, established by California and adopted by other states, has prompted unprecedented investment in light-duty zero-emission technologies and substantial growth in the market share of light-duty ZEVs. The ACT regulation may be an even more important driver of electrification of the MHD vehicle sector given the costs and characteristics of trucks and buses.90 [EPA-HQ-OAR-2019-0055-1219-A1, p.11]

87 Transport Dive, States band together to push for nationwide fleet electrification (May 5, 2022)

88 NESCAUM, ZEV Task Force, Multi-State ZEV Action Plan (2018).

89 NESCAUM, Releases Draft Multi-State Medium-and Heavy-Duty Zero-Emission Vehicle Action Plan for Public Comment (March 10, 2022).

90 NESCAUM, Multi-State Medium- and Heavy-Duty Zero-Emission Vehicle Action Plan (March 10, 2022) at 25.

Moreover, a new analysis indicates adoption of the ACT rule in these states would significantly expand the BEV market and lead to 36% of all new medium- and heavy-duty vehicles being powered by zero-emission engines in 2030.91 [EPA-HQ-OAR-2019-0055-1219-A1, p.11]

91 ICCT, Benefits of the 2020 Multi-State Medium- and Heavy-Duty Zero-Emission Vehicle Memorandum of Understanding (Apr. 27, 2022).

Additionally, the EPA should also consider the plans and tenor of the Regional Electric Vehicle Midwest Coalition (REV Midwest). In September 2021, five midwestern states – Illinois, Indiana, Michigan, Minnesota, and Wisconsin – entered this MOU. According to the agreement, the states will ‘work together to enable an equitable transition to electric vehicles for all with specific consideration for communities that are historically disadvantaged. REV Midwest will position states in the Midwest region to leverage and collectively increase public and private investment in electric vehicles and electric vehicle infrastructure.’92 Specifically, in terms of accelerating medium and heavy- duty fleet electrification, the states will remove barriers to adoption by coordinating on optimizing charging infrastructure, and deployment strategies. [EPA-HQ-OAR-2019-0055-1219-A1, p.11]

92 Regional Electric Vehicle Midwest Coalition, Memorandum of Understanding Between Illinois, Indiana, Michigan, Minnesota, and Wisconsin (Sept. 30, 2021) at 1-2.

The agency’s NOx proposal baseline also does not consider the role electrification of the federal medium- and heavy-duty fleet will play in driving the transition to electrification. In late 2021, the President issued Executive Order 14057 directing all federal agencies, inter alia, to maximize acquisition and deployment of zero emission medium- and heavy-duty vehicles.93 In seeking to decarbonize the federal fleet, the President directed the U.S. Government to procure ‘100 percent zero-emission vehicle acquisitions by 2035.’94 Turning over the U.S. Government fleet will require the transition of 103,00 medium-duty trucks and 39,000 heavy duty trucks.95 Not only will this significantly reduce the fleets’ cost per mile to operate the vehicles and the fleet’s collective GHG emissions, these procurement policies will further accelerate the deployment of BEV medium- and heavy-duty technologies.96 [EPA-HQ-OAR-2019-0055-1219-A1, pp.11-12]

93 President Biden, E.O. 14057, 'Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability,' 86 Fed. Reg. 70935 (Dec. 13, 2021) at 204.

94 Id. at 102(a)(ii).

95 McKinsey, Net-zero emissions in US government fleets (April 18, 2022).

96 Id.

Under Clean Air Act 202(a)(3)(A), EPA is directed to set the proposed NOx emission standard based upon the ‘greatest degree of emission reduction achievable . . .’ Simply put, BEVs – with zero NOx and PM emissions – represent the best available technology upon which to base the standard and provide the greatest achievable reduction in NOx emission by removing diesel from the heavy-duty equation altogether. As discussed supra, the rapid electrification of the heavy-duty fleet will demonstrably reduce NOx emissions and at a far greater pace than conventional technologies.129 [EPA-HQ-OAR-2019-0055-1219-A1, p.14]

> 129 Utility Dive, Cleaner by the mile: Electric trucks can have outsized environmental and health benefits (April 14, 2021); Texas A&M, Tailpipe Emission Benefits of Medium- and Heavy-Duty Truck Electrification in Houston, TX (Apr 14, 2021).

Despite the clear advantages that BEVs offer in terms of NOx mitigation, EPA’s proposed standard does not include BEVs in the baseline130 and does not set the emission standards and limits in the proposal commensurate with the expected level of BEV uptake in the coming years. EPA’s final rule should correct this omission. Failure to include a role for BEVs in setting the NOx standard both ignores the agency’s statutory directive and results in a proposal that is far less stringent and protective of public health and welfare than is feasible. [EPA-HQ-OAR-2019-0055-1219-A1, pp.14-15]

> 130 See 87 Fed. Reg. at 17561, fn. 707.

To address this shortcoming, Tesla strongly encourages EPA to finalize the proposed option for BEVs to be included in the NOx emission standards baseline and to prevent backsliding by substantially increasing the stringency in the NOx standards well beyond levels proposed in Option 1. In accurately reflecting the expected penetration of BEVs in the baseline, the agency can act to deliver a standard with the maximum health benefits. Accordingly, the family emission limit (FEL)131 cap should be lowered, and levels set substantially below Option 1 and be harmonized as close as possible with the stringency established in the recent California Heavy-Duty Omnibus NOx rules.132 [EPA-HQ-OAR-2019-0055-1219-A1, p.15]

> 131 See generally, 87 Fed. Reg. at 17552; 87 Fed. Reg. at 17560-61 (discussion on FEL caps).

> 132 See, California Air Resources Board, Heavy-Duty Engine and Vehicle Omnibus Regulation (establishing NOx standards that cut below current standards 90 percent below current standards in 2027.)

Tesla welcomes the proposal to reduce GHG emission standards in many sub-categories. Further, it encourages the agency to quickly develop more stringent Phase 3 GHG emissions standards for heavy-duty engines and vehicles implement standards well-before MY 2030. To that end, Tesla encourages the agency to amend the current GHG emission standards to reach stringency levels that ensure BEV deployment reaches the levels in California’s ACT rule for MY 2027-2029.144 [EPA-HQ-OAR-2019-0055-1219-A1, p.18]

144 See generally, CARB, Advanced Clean Trucks Fact Sheet (Aug. 20, 2021) (Zero-emission truck sales: Manufacturers who certify Class 2b-8 chassis or complete vehicles with combustion engines would be required to sell zero-emission trucks as an increasing percentage of their annual California sales from 2024 to 2035. By 2035, zero-emission truck/chassis sales would need to be 55% of Class 2b – 3 truck sales, 75% of Class 4 – 8 straight truck sales, and 40% of truck tractor sales).

In its proposal, EPA lays out several factors it utilizes when assessing the 'requisite technology' that will support establishing a level of stringency in the standard. When analyzing feasibility and these factors, it should be clear that electrification technology – which is already commercialized – should form the basis for the agency implementing a far stronger GHG standard than proposed. As discussed *supra*, in considering all these factors, the agency should recognize that its proposed increases to the various sub-category stringency levels are inadequate and need to be strengthened. [EPA-HQ-OAR-2019-0055-1219-A1, p.18]

Tesla believes these changes will significantly reduce emissions, result in increased deployment of the best available emissions reduction technology (BEVs), maintain U.S. manufacturing leadership in medium and heavyduty BEV technology, and ensure the Administration is meeting it statutory mandate to protect the public health and welfare from the significant and accelerating impacts from criteria air pollution and climate change. [EPA-HQ-OAR-2019-0055-1219-A1, p.24]

Organization: *Todd Snyder*

As a stakeholder, I urge the EPA A to act aggressively on the toxic tailpipe emissions from heavy trucks choking our communities and changing our climate.

EPA's proposed rule, option one, requiring all new heavy trucks cut NOx pollution by 90% by 2031 and cut greenhouse gas emissions is a critical first step toward the 100% electric truck system we need to protect our communities' health and the planet we share.

We know we can move even faster and do even better.

As you know, several states require new heavy trucks reach this 90% benchmark by 2027. Pairing this goal with strong GHG standards, we can accelerate the electrification of trucking already happening in the market and reach 100% clean trucking by 2035

Robust national standards will not only help reduce greenhouse gas emissions at a critical time, but prevent thousands of asthma cases – especially among children – hospital visits, and even deaths.

Even more important, accelerating the transition to 100% electric trucks would help protect the 72 million Americans who live by freight routes not just from NOx but also from soot and other pollutants spewing out of tailpipes. As you know, those affected are overwhelmingly people of color and poor families, making this not just about climate action and public health, but about basic justice for Americans.

Yes, the timeline is aggressive. But the health of millions depends on it, and with more and more electric trucks options entering the market, we know we can do it.

Most important, we call on you to reject option two for the rule, which will not meaningfully cut either emissions or the NOx pollution poisoning our communities.

You've made fighting for climate action and environmental justice a cornerstone of EPA's work and I stand with millions of Americans in honoring and applauding that effort. Now I'm calling for you to take the next step and adopt a standard reducing NOx 90% by 2027 and working to reach 100% clean trucks by 2035. [EPA-HQ-OAR-2019-0055-1391]

Organization: *Toyota Motor North America, Inc. (Toyota)*

Toyota supports EPA's efforts to reduce emissions from HD vehicles and supports this rule. [EPA-HQ-OAR-2019-0055-1224-A1, p.1]

Organization: *Truck Renting and Leasing Association (TRALA)*

Furthermore, Option 1 can only be viewed as inflationary for the supply chain. As we are currently seeing, many of the issues that are leading to inflation are related to transportation and it is unlikely that all of those issues will be gone by the time these rules take effect. TRALA members, and the trucking industry at large, are having to wait longer to receive new trucks once being ordered due to labor and chip shortages. Additionally, the longer-term impact of the driver shortage has increased the cost of moving goods across this country, and it is unlikely that the trucking industry will be able to increase the supply of drivers in order to meet the demand for goods. If EPA adopts Option 1, it will cause artificial increases to the cost of a new diesel truck through the regulatory process. Federal and state governments are enacting environmental policies that will lead to even greater inflation while also creating a patchwork of conflicting rules for the industry to comply. The cost of shipping goods will inevitably increase for all consumers. [EPA-HQ-OAR-2019-0055-1180-A1, pp. 2 - 3]

Organization: *Truckload Carriers Association (TCA)*

TCA consistently advocates that the trucking community continue to work to reduce greenhouse gas emissions to address the developing climate crisis. However, TCA is disappointed with the proposed standards put forth by the EPA because the measure does not fully appreciate current market and technology constraints within the trucking industry. TCA believes the regulations would limit equipment options for carriers, as well as worsen environmental outcomes in the long run by applying unmanageable pressure on pricing and disincentivizing fleet turnover. [EPA-HQ-OAR-2019-0055-1160-A1, p. 1]

The proposed standards would require considerable expenditure by motor carriers to invest in newer-model vehicles and engines. However, problems affecting the supply chain, like labor and semiconductor chip shortages1, are already causing a lack of availability that is hindering the reasonable purchase of technology and parts. Recent data found that a Class 8 power unit order placed in December 2021 would not be delivered until February 20232, compelling many motor carriers to rely on older model engines, either by maintaining their current fleets or buying used. In fact, as of now, only 50 percent of fleets have acquired 2010-or-newer model engines3 – highlighting the need to improve access to newer, lower-emitting equipment, rather than restrict availability with the new proposed standards. [EPA-HQ-OAR-2019-0055-1160-A1, pp. 1 - 2]

1. United States, Department of Commerce, "Results from Semiconductor Supply Chain Request for Information", January 25, 2022, https://www.commerce.gov/news/blog/2022/01/results-semiconductor-supply-chain-request-information

2. Alan Adler, "Inability to produce pushes Class 8 orders to lowest November in 26 years", FreightWaves, December 4, 2021, https://www.freightwaves.com/news/inability-to-produce-pushes-class-8-orders-to-lowest-november-in-26-years

3. David Shepardson, "U.S. EPA proposing rules to cut emissions from heavy trucks", March 7, 2022, Reuters, https://www.reuters.com/article/us-usa-autos-emissions-idTRNIKBN2L41Y9

TCA stresses that it is a precarious time to risk motor carrier operations by applying upward influence on pricing and not adequately considering the present limitations on availability. Trucking companies, 97 percent of which are small business5, are working tirelessly to serve the nation, already in the face of expanding market pressures, with the industry currently over 80,000 drivers short of demand6 and freight projected to grow 25.6 percent by 20307. [EPA-HQ-OAR-2019-0055-1160-A1, p. 2]

5. American Trucking Association (ATA), "Economics and Industry Data", https://www.trucking.org/economics-and-industry-data

6. ATA, "Driver Shortage Update", October 25, 2021, https://www.trucking.org/sites/default/files/2021-10/ATA%20Driver%20Shortage%20Report%202021%20Executive%20Summary.FINAL_.pdf

7. ATA, "ATA Freight Transportation Forecast: 2019 to 2030", August 21, 2019, https://www.trucking.org/news-insights/latest-freight-forecast-projects-256-increase-tonnage-2030

TCA is concerned that the proposed standards could potentially disrupt the pathway to a zero-emissions future, by prematurely diverting industry investment into incremental, short-term fleet transitions and away from long-term solutions. As it stands now, considerable investment, innovation, and testing is required to lower costs and expand capacity for zero-emission trucks, as well as strengthen our national charging infrastructure to ensure accessible and reliable power. TCA holds that a more comprehensive strategy is needed to guide fleet advancements that realistically accounts for and encourages solution-maximizing technology in the long run. [EPA-HQ-OAR-2019-0055-1160-A1, p. 3]

In sum, moving forward with these inadvisable standards would worsen market conditions, harm carrier operations, and, in practice, disincentivize fleet turnover. TCA appreciates the effort of the EPA to protect the environment and our association hopes to work together to put standards in place that move the industry forward by reducing emissions and advancing climate-positive outcomes in a progressive, but manageable manner that roundly considers material and financial limitations. [EPA-HQ-OAR-2019-0055-1160-A1, p. 3]

Organization: *United Methodist Church - General Board of Church and Society*

The United Methodist Church understands 'climate justice not simply as an environmental or economic concern but rather as a deep ethical and spiritual concern that the Church must address so that abundant life is ensured for our children and future generations' (2016 Book of Resolutions #1035 Climate Change and the Church’s Response). Grounded in this belief, and in response to the ongoing harm and future threats posed by greenhouse gas emissions, the General Board of Church and Society - the agency of our church entrusted with the responsibility to advocate for the official positions of The United Methodist Church - supports the Environmental Protection Agency’s proposed rule: Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards (EPA–HQ–OAR–2019–0055; FRL–7165–03– OAR). [EPA-HQ-OAR-2019-0055-1042-A1, p.1]

The General Board of Church and Society supports standards set at a pace that would achieve 100 percent zero-emission truck sales by 2035. We believe it is our moral responsibility to address the adverse effects of greenhouse gasses from the transportation industry on our planet and those people and communities that are most vulnerable to climate change's worst effects. We believe these regulations are a critical step on the path to protect the basic right of clean air that God has given us and more fully live into Jesus’ command to love our neighbor as we love ourselves. [EPA-HQ-OAR-2019-0055-1042-A1, p.1]

Organization: *United Motorcoach Association (UMA)*

While UMA is not speaking to the technological feasibility of further NOx emissions reductions, we do question the impact of diverting research and development resources of alternative and zero emissions fuels and power. [EPA-HQ-OAR-2019-0055-1311-A1, p.2]

We recommend EPA consider the disruptions to the overall economy, job loss, and impact to the supply chain. [EPA-HQ-OAR-2019-0055-1311-A1,p.2]

Organization: *U.S. Chamber of Commerce*

As the agency proceeds with this rulemaking, we encourage adherence to the following objectives that should serve as the foundation of an effective rulemaking:

• Regulatory certainty and durability are key not only to achieving sustained emissions reductions over the proposed rule’s implementation timeline, but also to creating a stable business environment needed for large investments to meet these types of regulatory requirements.

• Cost-effective, technologically achievable standards that facilitate fleet turnover necessary to drive real-word emissions reductions.

• National harmonization that avoids a patchwork of requirements and compliance obligations among states will help reduce unnecessary regulatory burdens on manufacturers, ultimately speeding implementation.

• Sufficient lead-time and compliance flexibility to allow manufacturers and other stakeholders to plan, adapt, and invest in heavy-duty engine and vehicle technologies in a manner that does not divert resources away from the longer-term transition to zero-emissions vehicles. [EPA-HQ-OAR-2019-0055-1245-A1, p. 2]

By EPA's own admission, implementing the framework described in Option 2 would also drive more emissions reductions sooner compared with Option 1, helping increase the associated health benefits of the rule to the communities that need it most. This not only would further support the administration's goals to improve air quality, but is expected to reduce the exposure of underserved groups living near areas with large numbers of medium- and heavy-duty traffic. [EPA-HQ-OAR-2019-0055-1245-A1, p. 8]

Organization: *U.S. Partnership for Education for Sustainable Development and National Clean Energy Workforce Alliance*

[*From Hearing Testimony, April 13, 2022, Debra Rowe*] As a life-long resident of Detroit and a professor of sustainable energies for 44 years, I know the technology is available for the EPA to create the strongest possible standards to reduce air pollution and diesel fumes. Many analyses have supported the cost-effectiveness of these zero-emission trucks as the cheaper alternative for the U.S., as we build a healthier population and a stronger economy. I am also here today because I have worked with environmental justice organizations in Detroit and I have been a convener and facilitator of the Detroit Green Skills Alliance, where we came together across NGOs, government corporations, small businesses, and neighborhoods to create the environmental and climate action plan for Detroit to reduce the existing pollution that is highlighted in our famous Toxins Tour, and advocate for the necessary policies. This hearing is about those necessary policies, a key portion of them. If you create the strongest possible standards you will improve our economy and our environment simultaneously. So my main requests are two key items in the standards. Reduce the deadly NOx pollution by 90 percent by 2027, and move the whole national bus and truck fleet to 100 zero-emission, all-electric vehicles by 2035. This is doable. It is smart. Just some additional points. The trucks regulated by this rule will be on the road for decades, so now is the time. They have to be cleaned up as soon as possible. And today I have a son who runs a manufacturing facility that builds these electric trucks. These electric trucks and buses are already capable of supporting the majority of freight, delivery, transit use and needs, and they are cost-effective. So another couple key points. Your proposed Option 1 is a start, but it should be significantly strengthened. And Option 2 should not be seriously considered. I won't go into the details why but glad to talk to you more about it if you want. I'm sure you know. On the greenhouse gas rule, the agency's minor adjustments to the existing Phase 2 greenhouse gas standards, they are just weak. They are just not strong enough. It wouldn't get a passing grade if I was teaching the class. And they reflect neither the urgency of the climate crisis nor the rapid advancement in zero-emission truck technology. [EPA-HQ-OAR-2019-0055-2867]

Organization: *Ute Mountain Ute Tribe Environmental Programs Department*

The Ute Mountain Ute Environmental Programs Department urges the U.S. EPA, Congress and States to do more to protect the health and quality of life of our members. Concurrently, Tribes are doing their part to reduce emissions including the many harmful pollutants from heavy-duty vehicles. For example, 119 Tribes and Alaska Native Villages have reduced diesel emissions through use of the VW settlement fund. Even more have participated, and continue to participate, in EPA's Diesel Emissions Reduction Act (DERA) program. [EPA-HQ-OAR-2019-0055-1259-A1, p. 2]

The Ute Mountain Ute Environmental Programs Department 1s encouraged by EPA' s commitment expressed on March 7, 2022, that 'This proposal would ensure the heavy-duty vehicles and engines that drive American commerce and connect people across the country are as clean as possible ... ' We support this important goal and the necessary actions to protect our health and quality of life. [EPA-HQ-OAR-2019-0055-1259-A1, p. 2]

While this specific regulation is an important step in reducing emissions of the many harmful pollutants from these vehicles, it would not achieve all that is possible. For example,

- Given that proposed requirements begin with vehicle model year 2027, emissions reduction technologies and strategies should mandate those that are most current and rapidly developing. [EPA-HQ-OAR-2019-0055-1259-A1, p. 2]
- While acknowledging emerging engine technologies including electric and fuel cell, (see FR pages 17 417 through 17 418), the proposed rule is focused on promoting emissions reduction technologies, operation, and maintenance of diesel-fueled and, to a lesser extent gasoline-fueled, vehicles. [EPA-HQ-OAR-2019-0055-1259-A1, p. 2]

Climate change stimulated by emissions of greenhouse gases from many sources including heavy-duty vehicles and engines threatens our fundamental way of life. The Ute Mountain Ute Environmental Programs Department supports Executive Order 14037, the Clean Trucks Plan and EPA's commitment to requirements that heavy-duty engines and vehicles be 'as clean as possible'. This rule should be promulgated consistent with the commitments. [EPA-HQ-OAR-2019-0055-1259-A1, p. 3]

Organization: *Valero Energy Corporation*

Valero urges EPA not to revise the heavy-duty truck standards as proposed. Instead, EPA should adopt standards that will provide a level playing field in which different vehicle designs, fuel types, and technologies can compete fairly to meet an appropriate performance target. [EPA-HQ-OAR-2019-0055-1328-A2, p.9]

Organization: *Victoria D’Amico*

I am writing in strong support of EPA-HQ-OAR-2019-0055. I appreciate the Biden administration’s commitment to cleaner energy. It’s also appreciated how the administration is committed to aiding in environmental justice issues as climate change will disproportionately affect lower income families and POC. Climate change is an alarming threat to public health and safety and the environment. We should be doing all we can to address climate change to lessen the effects it will have. I have two criticisms of the rule: 2027 is too long to wait to address this issue and small businesses should receive some sort of aid for the expenses of transitioning their parts. [EPA-HQ-OAR-2019-1214]

The year 2027 is too far off for these changes to be implemented. Time is of the essence in regards to climate change action. According to BBC News (2022), the latest IPCC report states that in order to avoid catastrophic climate events, temperatures must remain under 1.5C in this century. Doing this requires immediate reduction of CO_2 emissions. I understand time is needed to get through some red tape and ensure the safety standards are met, but this action must be the highest priority to lessen the drastic effects of climate change. [EPA-HQ-OAR-2019-1214]

I support the overall goal of this proposal and hope to see it implemented in the near future. Combatting climate change immediately is imperative to ensuring a better world for people and the environment. Moving up the timeline this is enforced is significant in lowering emissions in a timely manner. Assisting small businesses is important for maintaining public support and looking out for our fellow citizens. I look forward to seeing this rule in action. [EPA-HQ-OAR-2019-1214]

Organization: *Volvo Group*

We urge EPA to take a holistic view of the regulation's implications. If the goal is to improve air quality while simultaneously addressing climate change and moving towards a ZEV future, the final regulation must not:

- lead fleets to massively pre-buy trucks to avoid technology they do not trust and cannot afford, thereby repeating the nearly 50% production workforce reduction the Volvo Group experienced because of the EPA's last technology-forcing regulation in 2007;
- encourage fleets to hold on to older trucks and impede the integration of new generation trucks in the marketplace, similar to what we see today, with approximately 50% of previous generation trucks still operating more than 12 years after the beginning of the last NOx regulation in 2010; nor
- force truck manufacturers like the Volvo Group to divert limited investment dollars away from the accelerated development of battery-electric and hydrogen fuel cell trucks, which environmental justice advocates want to see across a broad range of applications in their local communities. [EPA-HQ-OAR-2019-0055-1324-A1, p. 2]

In addition to these technological challenges, an ultra-low emission level will impose excessive costs on fleets, due primarily to the extended emission warranty and useful life provisions. As past is prologue, we can expect these higher costs to bring even graver economic and environmental consequences than what was experienced in 2006-2008 during the last major technology forcing regulation. In 2006, the year before the new EPA Particulate Matter regulation came into force, the trucking market hit its historical high for truck sales as fleets anticipated technology forcing solutions and accelerated their purchases to forgo new technology vehicle purchases until the technology was proven. [EPA-HQ-OAR-2019-0055-1324-A1, p. 4]

Truck sales plummeted in 2007 and 2008 because of the regulation and this behavior led to a reduction in force for Volvo Group UAW-represented production workers in our three truck and engine plants from more than 4600 jobs in 2006 down to only 2300 jobs in June 2008 (before the great recession began) representing a 50% loss of good paying union jobs. These production job losses were not fully recouped until seven years later (i.e., 2014). [EPA-HQ-OAR-2019-0055-1324-A1, p. 4.]

From an environmental perspective, we are still bearing the ramifications of this situation as evidenced by the fact that approximately 50% of the fleet on the road today have the previous generation NOx technology more than 12 years after it was mandated by regulation. The reduction in emissions that could be realized by accelerating the turnover of these older vehicles would far exceed that which will be achieved by the delta between a 75% reduction and a 90% reduction of the last remaining 1-2% of NOx emissions.[EPA-HQ-OAR-2019-0055-1324-A1, p. 5]

Organization; *Wayne Aarum*

I am opposed to the new rules for Heavy-Duty engines. This rule will only increase inflation and harm the middle class even more. This appears to be virtue signaling for the sake of the left wing of the political spectrum. If the Biden administration truly cared about emissions and pollution they would be going after China and India - the world's biggest polluters, not hard working American citizens. This rule is just one more layer of regulations that will hurt the average American citizen. [EPA-HQ-OAR-2019-0055-1405]

Organization: *WE ACT for Environmental Justice*

Our communities have contended with the cumulative exposure and impacts of pollution for far too long.13 Eliminating tailpipe emissions from medium- and heavy-duty vehicles is required to deliver much needed health benefits from reductions in harmful NOx and particulate matter exposures. Zero-emission, electric trucks and buses are ready and available now and can replace more than 50% percent of vehicles in each category of vehicle14 on the road today. With ever improving economics and capabilities,15 electric models can reach cost parity with conventional diesel vehicles by 2035, even without incentives.16 The shift to all-electric trucks and buses is inevitable and will occur rapidly. The clean trucks rule is a prime opportunity to reduce truck pollution, safeguard the lives of communities adversely affected by truck pollution, and fulfill federal commitments to the climate, cleaner vehicles, and environmental justice. [EPA-HQ-OAR-2019-0055-1347-A1, p.2]

13 https://www.scientificamerican.com/article/people-of-color-breathe-more-unhealthy-air-from-nearly-all-polluting-sources/

14 https://rmi.org/insight/electrify-trucking/?utm_medium=email&utm_source=spark&utm_content=spark&utm_campaign=2022_05_05&utm_term=button

15 https://blogs.edf.org/climate411/files/2022/02/EDF-MDHD-Electrification-v1.6_20220209.pdf

16 https://www.nrel.gov/docs/fy22osti/82081.pdf

We commend the EPA for taking steps to update the Heavy Duty Vehicle standards for the first time in 20 years. While the Agency's modeling estimates that by 2045, the largest improvements in ozone and particulate matter emissions and public health benefits from the proposed rule will occur in communities of color with the worst air quality,17 our communities need the associated public health benefits of these standards sooner rather than later. We cannot allow dirty diesel tricks to be sold for another decade. **We urge the Agency to expeditiously finalize and issue the strongest and most protective emissions reduction standards by the end of 2022 and to put us on a fast track towards the transition to zero-emission, electric trucks and buses by 2035**. [EPA-HQ-OAR-2019-0055-1347-A1, pp.2-3]

17 https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10144K0.pdf

Reducing NOx and greenhouse gas emissions from the medium- and heavy-duty vehicle sector and transitioning away from dirty, diesel- and gasoline- trucks and buses is essential to tackling climate change and protecting environmental justice communities throughout the country. Once again, we urge the EPA to finalize the strongest possible rule and to continue meaningful engagement, early and often with overburdened communities and environmental justice advocates in its implementation and as the Agency begins to think about greenhouse gas standards for the truck manufacturing industry for model year 2030. [EPA-HQ-OAR-2019-0055-1347-A1, p.6]

Organization: *Wendy*

Zero emission trucks of all classes should be included in this rule with a start date no later than 2025. California and 5 other states have already adopted Advanced Clean Truck rules requiring zero emission trucks. The federal government should follow suit. The regulations must drive the market. People are dying and the planet is warming. We can't wait for the market to come up with solutions. [EPA-HQ-OAR-2019-0055-1578]

Organization: *Western Transport Logistics Inc.*

The EPA is looking to overstep common sense and logic with the proposed NOx regs. This nation runs on diesel and is powered by 18 wheelers. Not only would the proposal hurt small businesses in the trucking industry, but that pain would cause further inflation and goods shortages due to less trucks running on the roads. This is not good policy for our nation. [EPA-HQ-OAR-2019-0055-2236, p.1]

Organization: *Westport Fuels Systems (WFS)*

Westport supports EPA finalizing regulations that encourage much needed emission reductions. We believe these reductions must be based on realistic expectations about the pace and cost of technology and encourage engine makers and vehicle manufacturers to deploy a variety of available, scalable, and cost-effective technologies. [EPA-HQ-OAR-2019-0055-1278-A1, p.1]

Key WFS commentary/observation highlights include:

- A tailpipe only perspective on CO2 emissions does not directly correlate to the true CO2 emissions reductions of technologies, nor is it a reliable method for guiding climate change mitigation policies. [EPA-HQ-OAR-2019-0055-1278-A1, p.6]

Organization: *White Pine Construction Corporation*

While we are behind the push for better air quality, we have concerns over the costs the new regulations will bring. We need to ensure that new rules won't lead to hurting the reliability of the trucks and trailers we purchase, nor imposing unreasonable or unworkable costs on our industry. The trucking industry has been hit hard enough with covid regulations and fuel prices we cannot afford to continue to take hits to our bottom line. [EPA-HQ-OAR-2019-0055-1012, p.1]

Organization: *World Resources Institute (WRI)*

We applaud the Biden administration for acting swiftly to address pollution from trucks and buses and urge EPA to strengthen and finalize the strongest rule possible for reducing pollution from medium- and heavy-duty vehicles while taking into consideration two underlying factors:

- The urgency of addressing transportation inequities for communities long overburdened by air and climate pollution, and
- The opportunities electrification offers to transform our fleets, particularly for school and transit buses where electrification is advancing at a more rapid pace. [EPA-HQ-OAR-2019-0055-1298-A1, p.1]

EPA has the opportunity — and the responsibility — to finalize and implement the strongest rule possible to (1) mitigate the disproportionate health impacts that air toxics, particulate matter, and climate-changing greenhouse gas pollution from medium- and heavy-duty vehicles have on low-income communities and communities of color and to (2) accelerate our transition to zero-emission light-, medium- and heavy-duty vehicles that offer a plethora of benefits while providing relief from the volatility of gas prices that are hurting everyday Americans. [EPA-HQ-OAR-2019-0055-1298-A1, p.4]

We support EPA's proposal to tighten the Phase 2 GHG standards for the subcategories of vehicles that reflect the rapid market shifts to zero-emission technologies. Additionally, given the commercial viability of both electric school and transit buses, we urge EPA to further increase the stringency of the GHG standards and CO2 standards for these vehicle classes for MYs 2027 through 2029 based on the technologies available. [EPA-HQ-OAR-2019-0055-1298-A1, p.4]

The World Resources Institute commends the EPA for its efforts to promote clean air and reduce pollution from medium- and heavy-duty vehicles and engines with stricter, new standards and stands ready to offer our assistance and staff expertise in further strengthening this rule. [EPA-HQ-OAR-2019-0055-1298-A1, p.4]

Organization: *Worldwide Equipment Enterprises, Inc.*

Regulated businesses simply hope for consistent and reality-based regulatory proposals when regulations by the federal government are warranted. Unfortunately, proposed regulations such as this one is prepared by government bureaucrats with no business experience within this or other businesses that they regulate. That creates the unfortunate situation of unrealistic proposals, no regard to either the cost of these regulations to the regulated businesses or consumers or determining whether what is pointed to as the new requirement is even available or not. [EPA-HQ-OAR-2019-0055-1275-A1, p.2]

Organization: *Yellowstone Integrated Architecture and Construction*

The EPA must not delay in the adoption of their proposed rule to regulate pollution from Heavy Duty Vehicles or standards or the next round starting in 2030. [EPA-HQ-OAR-2019-0055-2816, p.1]

These changes will drive a green economic boom that will help out our country get back on top as leaders in electrification, including battery production. [EPA-HQ-OAR-2019-0055-2816, p.1]

Our future generation depends on our actions for their health and economic stability. [EPA-HQ-OAR-2019-0055-2816, p.1]