Summary and Analysis of Comments: Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder

United States
Environmental Protection
Agency

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

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EPA-420-R-09-015
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Introduction

On December 7, 2007, EPA released an Advance Notice of Proposed Rulemaking (ANPRM) to encourage full participation in the development process of a rulemaking for new marine compression-ignition engines with per cylinder displacement at or above 30 liters (called Category 3 marine diesel engines). The comment period officially remained open through March 6, 2008. Many comments were received during that period, and others were received beyond that, through stakeholder outreach.

On June 26, 2009, the Administrator signed a Notice of Proposed Rulemaking (NPRM) for proposed emission standards for new Category 3 marine diesel engines installed on U.S. vessels, under section 213 of the Clean Air Act (CAA or "the Act"). In that notice, we also proposed a change to our diesel fuel program. On July 1, 2009, this NPRM and supporting documentation was posted on EPA's web site. On that day a message was sent to interested stakeholders notifying them of the availability of this material for review and comment. On August 28, 2009, the NPRM was published in the ***Federal Register***. This rule is part of a coordinated strategy to ensure that all ships that affect U.S. air quality meet stringent NO_X and fuel sulfur requirements.

We held two public hearings on the NPRM; one in New York, New York on August 4, 2009 and one in Long Beach, California on August 6, 2009. At those hearings, oral comments on the NPRM were received and recorded. A written comment period remained open until September 28, 2009. A complete list of organizations and individuals that provided comments on the NPRM is contained in the following table. Abbreviations for the organization names are also included.

This Summary and Analysis of Comments contains a detailed summary of all comments we received on the NPRM as well as our analysis of each comment and our response. The reader should also refer to the final rulemaking notice in the ***Federal Register*** as well as the Final Regulatory Impact Analysis.

List of Commenters

Commenter	Abbreviation	Docket ID Number
Agri-Fine		OAR-2007-0121-0315
American Association of Port Authorities	AAPA	OAR-2007-0121-0232
American Great Lakes Ports Association		OAR-2007-0121-0262
American Iron and Steel Institute		OAR-2007-0121-0295
American Lung Association with Environmental Defense Fund	ALA/EDF	OAR-2007-0121-0366 and -0227
American Maritime Officer Services		OAR-2007-0121-0364
American Maritime Officers of the Great Lakes		OAR-2007-0121-0318
American Thoracic Society		OAR-2007-0121-0227
American Petroleum Institute	API	OAR-2007-0121-0354
American Waterways Operators	AWO	OAR-2007-0121-0272
ArcelorMittel USA		OAR-2007-0121-0280
Association of American Railroads	AAR	OAR-2007-0121-0358
AutoCar		OAR-2007-0121-0254
Begich, Mark, United States Senator (AK)		OAR-2007-0121-0322
Belco		OAR-2007-0121-0362
Calumet Area Industrial Commission		OAR-2007-0121-0332
Canadian Shipowners' Association		OAR-2007-0121-0227, 0245 and 0297 (dup)
Canadian Steel Producers Association		OAR-2007-0121-0359
Carbon War Room		OAR-2007-0121-0267
Central Marine Logistics, Capt. Tom Wiater	CML	OAR-2007-0121-0276 and 0304 (dup)
Central Marine Logistics, Employees of	CMLEmp	OAR-2007-0121-0234, 0236, 0237, 0238, 0239, 0240, 0260, 0293, and 0371
Chamber of Marine Commerce	CMC	OAR-2007-0121-0353
Chamber of Shipping of America	CSA	OAR-2007-0121-0256 and -0227
City of Juneau, AK		OAR-2007-0121-0298 and 0372 (dup)
City of Ketchikan, AK		OAR-2007-0121-0294 and 0375 (dup)
City of New York, NY		OAR-2007-0121-0227
City of Sarnia, ON, CAN		OAR-2007-0121-0306
City of Superior, WI		OAR-2007-0121-0352
Clean Air Task Force	CATF	OAR-2007-0121-0264, 0227 and 0335 (dup)
Cleveland Port Authority		OAR-2007-0121-0310

Cliffs Natural Resources Inc., ArcelorMittel USA, US Steel Corp.		OAR-2007-0121-0376
Coalition for a Safe Environment		OAR-2007-0121-0232
Coalition for Clean Air	CCA	OAR-2007-0121-0220 and -0232
Communities for Clean Ports		OAR-2007-0121-0232
Council of Great Lakes Industries		OAR-2007-0121-0296, 0312 (dup) and 0363 (dup)
Cruise Lines International Association	CLIA	OAR-2007-0121-0278
CSX Transportation		OAR-2007-0121-0300
Cummins		OAR-2007-0121-0277
Daimler Trucks		OAR-2007-0121-0284, 0286 (dup) and 0303 (dup)
Detroit Regional Chamber		OAR-2007-0121-0248 and 0274 (dup)
The Development Association		OAR-2007-0121-0279 and 0290 (dup)
DTE Energy		OAR-2007-0121-0328
Duluth Chamber of Commerce		OAR-2007-0121-0282
Duluth Propeller Club		OAR-2007-0121-0292, 0313 (dup) and 0399 (dup)
Duluth Seaway Port Authority		OAR-2007-0121-0283
Egan, Dennis, State Senator (AK)		OAR-2007-0121-0323
Electro-Motive Diesel, Inc		OAR-2007-0121-0250 and 0378 (dup)
Engine Manufacturers' Association	EMA	OAR-2007-0121-0265 and 0377
Euromot		OAR-2007-0121-0243
Exhaust Gas Cleaning Systems Association	EGCSA	OAR-2007-0121-0305
Friends of the Earth, Center for Biological Diversity, and Earth Justice	FOE	OAR-2007-0121-0320
Gas Turbine Association		OAR-2007-0121-0253
General Electric Transportation	GE	OAR-2007-0121-0271
Great Lakes Maritime Task Force	GLMTF	OAR-2007-0121-0269 and -0329
Great Lakes Metro Chambers Coalition		OAR-2007-0121-0258
Greater Cleveland Partnership		OAR-2007-0121-0330
IMPCO Technologies		OAR-2007-0121-0379
Independent Fuel Terminal Operators Association		OAR-2007-0121-0333
Industrial Truck Association		OAR-2007-0121-0228 and 0337 (dup)

Interlake Steamship		OAR-2007-0121-0268 and -0357 (dup)
International Association of Drilling Contractors		OAR-2007-0121-0247
International Council on Clean Transportation	ICCT	OAR-2007-0121-0227
Johnson Matthey		OAR-2007-0121-0227
Kanjorski, FN, Congressman (PA)		OAR-2007-0121-0327
Keystone Shipping Company		OAR-2007-0121-0273, 0311 (dup), and 0349
Kinder Morgan		OAR-2007-0121-0326
Kindra Lake Towing		OAR-2007-0121-0291
Krystallon, Ltd.		OAR-2007-0121-0229
Lafarge North America		OAR-2007-0121-0383
Lake Carriers' Association	LCA	OAR-2007-0121-0233 and 0345
Liberty Maritime Corporation		OAR-2007-0121-0347
Long Beach Alliance for Children with Asthma	LBACA	OAR-2007-0121-0232 (8 speakers)
Lower Lakes Towing		OAR-2007-0121-0230
Maersk		OAR-2007-0121-0227 and 0261
Manufacturers of Emission Control Association	MECA	OAR-2007-0121-0227 and 0319
Marine Engineers Beneficial Association		OAR-2007-0121-0259
Maritime AFL-CIO		OAR-2007-0121-0321
Matson Navigation		OAR-2007-0121-0281 and 0346 (dup)
Midwest Energy Resources Co.		OAR-2007-0121-0342
Minnesota Chamber of Commerce		OAR-2007-0121-0350
Munoz, Cathy, Representative, AK House of Rep.		OAR-2007-0121-0317, 0331 (dup), 0373 (dup)
Murkowski, Lisa, United States Senator (AK)		OAR-2007-0121-0384
Murphy Oil		OAR-2007-0121-0301
National Association of Clean Air Agencies	NACAA	OAR-2007-0121-0227 and -0246
National Marine Manufacturers Association	NMMA	OAR-2007-0121-0242
Natural Resources Defense Council	NRDC	OAR-2007-0121-0227 and 0232
Navistar		OAR-2007-0121-0263 and -0308 (dup)
Northeast States for Coordinated Air Use Management	NESCAUM	OAR-2007-0121-0227 and -0356

Ohio Environmental Council, Earth Day Coalition, Marsh Area Regional Council, Ohio League of Conservation Voters	Ohio Environmental Council et al	OAR-2007-0121-0314
Outdoor Power Equipment Institute	OPEI	OAR-2007-0121-0235
Ozinga Materials		OAR-2007-0121-0343
Ozone Transport Commission	OTC	OAR-2007-0121-0227
Pacific Merchant Shipping Association	PMSA	OAR-2007-0121-0232 and 0275
Parnell, Sean, Governor, State of Alaska		OAR-2007-0121-0287, 0316 (dup) and 0374 (dup)
Port of Anchorage		OAR-2007-0121-0299 and 0360 (dup)
Port of Long Beach		OAR-2007-0121-0232 and 0365
Port of Los Angeles and American Association of Port Authorities		OAR-2007-0121-0232
Raffin Construction Co.		OAR-2007-0121-0344
Resource Development Council		OAR-2007-0121-0288
River Adventures		OAR-2007-0121-0244
Robertson, Paul, Economic Minister, Government of Canada		OAR-2007-0121-0252
Santa Barbara Air Pollution Control District	SBAPCD	OAR-2007-0121-0231
Seaworthy Systems		OAR-2007-0121-0266
Shipping Federation of Canada		OAR-2007-0121-0270
Sitka Chamber of Commerce		OAR-2007-0121-0307
Solar Turbines		OAR-2007-0121-0249
Soo Marine Supply Inc.		OAR-2007-0121-0351
South Coast Air Quality Management District	SCAQMD	OAR-2007-0121-0309 and -0232
Southwest Research Institute	SwRI	OAR-2007-0121-0255 and 0285 (dup)
Stupak, Bart, Representative, US Congress (MI)		OAR-2007-0121-0338
Texas Commission on Environmental Quality	TCEQ	OAR-2007-0121-0334, 0340 (dup) and 0341 (dup)
Texas Legislative Air Quality Caucus		OAR-2007-0121-0367
Totem Ocean Trailer Express	TOTE	OAR-2007-0121-0289 and 0361 (dup)
Transportation Institute		OAR-2007-0121-0302 and 0355 (dup)
Two Harbors Area Chamber of Commerce		OAR-2007-0121-0324
United States Navy		OAR-2007-0121-0241

Volvo / Mack		OAR-2007-0121-0336 and 0348 (dup)
Warner Petroleum Corporation		OAR-2007-0121-0251
Wisconsin Commercial Ports Association		OAR-2007-0121-0368
Worksafe, Inc.		OAR-2007-0121-0369
World Shipping Council	WSC	OAR-2007-0121-0227 and 0325
Young, Don, Representative, United States Congress (AK)		OAR-2007-0121-0382
General comments from unaffiliated individuals		OAR-2007-0121-0224, 0226, 0227, 0232, 0257, 0370 (dup of 0257), 0339, 0380, and 0381

We also received comments after the close of the comment period. These comments are also included in the docket and discussed in this document.

List of Late Commenters

Commenter	Date	Subject	Docket ID Number
Samuel (no surname)	October 17, 2009	Fuel standards	OAR-2007-0121-0397
Ryan (no surname)	October 23, 2009	Coordinated strategy	OAR-2007-0121-0396
K. Bernhard-Ihde	October 26, 2009	Great Lakes	OAR-2007-0121-0398
Senator Murkowski on behalf of Totem Ocean Trailer Express	November 10, 2009	Coordinated strategy	
Governor of Hawaii	November 25, 2009	Coordinated strategy	OAR-2007-0121-0400
Canadian Shipowners' Association	November 30, 2009	Addendum to earlier comments	
Robynn Andracsek on behalf of the SS. Jeremiah O'Brien	December 11, 2009		

List of Acronyms

µm	Micrometers
b_{ext}	Light-Extinction Coefficient
µg	Microgram
µg/m3	Microgram per Cubic Meter
ABT	Average Banking and Trading
ACS	American Cancer Society
AE	Alaska Southeast Region
AE	Auxiliary Engine
AEO	Annual Energy Outlook (an EIA publication)
AESS	Automatic Engine Stop/Start System
AFC	Average Daily Fuel Consumption
AIM	Aerosol Inorganics Model
AIRS	Aerometric Information Retrieval System
AMVER	Automated Mutual-Assistance Vessel Rescue
APHEA	Air Pollution and Health: A European Approach
APU	Auxiliary Power Unit
AQ	Air Quality
AQCD	Air Quality Criteria Document
AQMTSD	Air Quality Modeling Technical Support Document
ARB	Air Resources Board (California)
ASPEN	Assessment System for Population Exposure Nationwide
ATAC	Average Total Cost
avg	Average
AW	Alaska West Region
BAF	Bunker Adjustment Factor; a surcharge reflecting the fluctuation in fuel cost
BenMAP	Benefits Mapping and Analysis Program
bhp	Brake Horsepower
BNSF	Burlington Northern Santa Fe
BSFC	Brake Specific Fuel Consumption
BTS	Bureau of Transportation
C	Celsius
C1	Category 1 (marine diesel engines with capacity of 7 liters per cylinder or less; used to power vessels such as tugboats, fishing vessels, and other commercial vessels in and around U.S. ports, or as stand-alone generators for auxiliary electrical power on many types of vessels)
C2	Category 2 (marine diesel engines with an engine capacity over 7 liters per cylinder but less than 30 liters per cylinder; used to power vessels such as tugboats, fishing vessels, and other commercial vessels in and around U.S. ports, or as stand-alone generators for auxiliary electrical power on many types of vessels)
C3	Category 3 (marine diesel engines with per-cylinder displacement at or above 30 liters; very large marine diesel engines used on ships such as container ships, oil tankers, and cruise ships); also called “ocean-going vessels”
CA	California
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule (CAIR) (70 FR 25162, May 12, 2005)
CAMR	Clean Air Mercury Rule
CAND	Clean Air Nonroad Diesel rule (69 FR 38957, June 29, 2004)
CARB	California Air Resources Board
CASAC	Clean Air Scientific Advisory Committee
CAVR	Clean Air Visibility Rule
CB	Chronic Bronchitis
CCV	Closed Crankcase Ventilation
CDC	Centers for Disease Control
CDPF	Catalyzed Diesel Particulate Filter
CEA	Cost Effective Analysis

CES	Constant Elasticity of Substitution
CFR	Code of Federal Regulations
CI	Compression Ignition (i.e., diesel engines)
CI	Confidence Interval
CIMT	Carotid Intima-Media Thickness
CITT	Chemical Industry Institute of Toxicology
CMAQ	Community Multiscale Air Quality
CMB	Chemical Mass Balance
CMV	Commercial Marine Vessel
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COI	Cost of Illness
COPD	Chronic Obstructive Pulmonary Disease
CPI-U	Consumer Price Index - All Urban Consumers
C-R	Concentration Response
CSS	Coastal Sage Scrub
CUA	Cost Utility Analysis
cyl	Cylinder
D	Demand
DE	Diesel Exhaust
DEM	Domestic Engine Manufacturer
DDHS	Diesel Driven Heating System
diff	Difference
disp	Displacement
DM	Distillate Marine Grade
DOC	Diesel Oxidation Catalyst
DOE	Department of Energy
DOT	Department of Transportation
DPF	Diesel Particulate Filter
DPM	Diesel Particulate Matter
DR	Discount Rate
DRIA	Draft Regulatory Impact Analysis
DSP	Deep Sea Port
DV	Design Values
DWT	Dead Weight Tonnage
EAC	Early Action Component
EC	East Coast Region
EC	Elemental Carbon
ECA	Emission Control Area
EDHS	Electric Driven Heating System
EEZ	Exclusive Economic Zone
EF	Emission Factor
EGR	Exhaust Gas Recirculation
EIA	Energy Information Administration (part of the U.S. Department of Energy)
EIA	Economic Impact Analysis
EIM	Economic Impact Model
EMD	Electromotive Diesel
EMS-HAP	Emissions Modeling System for Hazardous Air Pollution
EO	Executive Order
EPA	Environmental Protection Agency
EPAct	Energy Policy Act of 2005
ESPN	EPA speciation network
F	Fahrenheit
FEM	Foreign Engine Manufacturer
FEV	Functional Expiratory Volume
FR	Federal Register
FRM	Final Rulemaking
FRP	Fiberglass-Reinforced Plastic

g	Gram
g/bhp-hr	Grams per Brake Horsepower Hour
g/kW-hr	Grams per Kilowatt Hour
gal	Gallon
GAO	Government Accountability Office
GC	Gulf Coast Region
GDP	Gross Domestic Product
GEOS	Goddard Earth Observing System
GETS	General Electric Transportation Systems
GI	Global Insight
GIS	Geographic Information System
GL	Great Lakes Region
GRT	Gross Registered Tonnage
GT	Gas Turbine
H_2	Hydrogen Gas
HAD	Diesel Health Assessment Document
HAP	Hazardous Air Pollutant
HC	Hydrocarbon
HD	Heavy-Duty
HE	Hawaii East Region
HEI	Health Effects Institute
HEP	Head End Power
HES	Health Effects Subcommittee
HFO	Heavy Fuel Oil
hp	Horsepower
hp-hrs	Horsepower Hours
hrs	Hours
HW	Hawaii West Region
IACS	International Association of Classification Societies
IARC	International Agency for Research on Cancer
ICD	International Classification of Diseases
ICOADS	International Comprehensive Ocean-Atmospheric Data Set
IFO	Intermediate Fuel Oil
IMO	International Maritime Organization
IMPROVE	Interagency Monitoring of Protected Visual Environments
IRIS	Integrated Risk Information System
ISCST3	Industrial Source Complex Short Term Model
ISO	International Standardization Organization
ISORROPIA	Inorganic Aerosol Thermodynamic Model
ITB	Integrated Tug Barge
JAMA	Journal of the American Medical Association
K	Kelvin
k	Thousand
km	Kilometer
kts	Knots
kW	Kilowatt
kWH	Kilowatt Hour
L	Liter
L/cyl	Liters Per Cylinder
lb	Pound
LCO	Light Cycle Oil
LF	Load Factor
LGC	Large Gas Carrier
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LRS	Lower Respiratory Symptoms
LSD	Low Sulfur Diesel fuel
m3	Cubic Meters

MARAD	U.S. Maritime Administration
MARPOL	The International Convention for the Prevention of Pollution of Ships
MC	Marginal Cost
MCIP	Meteorology-Chemistry Interface Processor
MDO	Marine Diesel Oil
ME	Main Engine
MECA	Manufacturers of Emission Controls Association
mg	Milligram
MGO	Marine Gas Oil
MDO	Marine Diesel Oil
MI	Myocardial Infarction
MILY	Morbidity Inclusive Life Years
min	Minute
MM	Million
MM-1	Inverse Megameter
MOBILE6	Vehicle Emission Modeling Software
MRAD	Minor Restricted Activity Days
MSAT	Mobile Source Air Toxic
MSAT1	2001 Mobile Source Air Toxics Rule
MSB	Major Shipbuilding Base
MSD	Medium Speed Diesel
MSDS	Material Safety Data Sheet
MVUS	Merchant Vessels of the U. S.
MW	Megawatt
MW-hrs	Megawatt Hours
N	Nitrogen
N_2	Nitrogen Molecule
NA	Not Applicable
NAAQS	National Ambient Air Quality Standards
NAICS	North American Industry Classification System
NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration
NASSCO	National Steel and Shipbuilding Company
NATA	National Air Toxic Assessment
NBER	National Bureau of Economic Research
NCAR	National Center for Atmospheric Research
NCDC	National Clean Diesel Campaign
NCI	National Cancer Institute
NCLAN	National Crop Loss Assessment Network
NEI	National Emissions Inventory
NESCAUM	Northeast States for Coordinated Air Use Management
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NH_3	Ammonia
NIOSH	National Institute of Occupational Safety and Health
NLEV	National Low Emission Vehicle
NM	Nautical Mile
NMHC	Nonmethane Hydrocarbons
NMIM	National Mobile Inventory Model (EPA software tool)
NMIM2005	National Mobile Inventory Model Released in 2005
NMMA	National Marine Manufacturers Association
NMMAPS	National Morbidity, Mortality, and Air Pollution Study
NO	Nitrogen Oxide
NO_2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NONROAD	EPA's Non-road Engine Emission Model
NONROAD2005	EPA's Non-road Engine Emission Model Released in 2005
NOx	Oxides of Nitrogen
NP	North Pacific Region

NPRM	Notice of Proposed Rulemaking
NPV	Net Present Value
NRC	National Research Council
NRLM	Nonroad, Locomotive and Marine diesel fuel
NRT	Net Registered Tonnage
NRT4	Nonroad Tier 4 Rule
NSTC	National Science and Technology Council
NTE	Not To Exceed
NWN	National Waterway Network
O&M	Operating and maintenance
O_3	Ozone
OAQPS	Office of Air Quality Planning and Standards
OC	Organic Carbon
ºCA	Degree Crank Angle
OEHHA	Office of Environmental Health Hazard Assessment
OEM	Original Equipment Manufacturer
OGV	Ocean-Going Vessel
OMB	Office of Management and Budget
OTAQ	Office of Transportation and Air Quality
P	Price
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PGM	Platinum Metals Group
PM	Particulate Matter
PM AQCD	EPA Particulate Matter Air Quality Criteria Document
PM/NMHC	Particulate Matter to Non-Methane Hydrocarbon Ratio
PM10	Coarse Particulate Matter (diameter of 10 µm or less)
PM2.5	Fine Particulate Matter (diameter of 2.5 µm or less)
PMM	Post-Manufacturer Marinizer
PMNAAQS	Particulate Matter National Ambient Air Quality Standards
POM	Polycyclic Organic Matter
POLA/LB	Ports of Los Angeles, Long Beach
ppb	Parts per Billion
PPI	Producer Price Index
ppm	Parts per Million
psi	Pounds per Square Inch
PSR	Power Systems Research
Q	Quantity
QALY	Quality Adjusted Life Years
R&D	Research and Development
RfC	Reference Concentration
RFA	Regulatory Flexibility Analysis
RFS	Renewable Fuels Standard
RIA	Regulatory Impact Analysis
RM	Residual Marine
rpm	Revolutions per Minute
RPO	Regional Planning Organization
RRF	Relative Reduction Factors
RSZ	Reduced Speed Zone
RV	Revision
RVP	Reid Vapor Pressure
S	Sulfur
S	Supply
SAB	Science Advisory Board
SAB-HES	Science Advisory Board - Health Effects Subcommittee
SAE	Society of Automotive Engineers
SAPS	Sulfated-Ash, Phosphorus, and Sulfur Content
SBA	Small Business Administration

SBREFA	Small Business Regulatory Enforcement Fairness Act
SCC	Source Classification Code
SCR	Selective Catalyst Reduction
SFC	Specific Fuel Consumption
SI	Spark Ignition
SIC	Standard Industrial Classification
SiC	Silicon Carbide
SMAT	Speciated Modeled Attainment Test
SO_2	Sulfur Dioxide
SOx	Oxides of Sulfur
SOA	Secondary Organic Carbon Aerosols
SOF	Soluble Organic Fraction
SP	South Pacific Region
SSD	Slow Speed Diesel
ST	Steam Turbine
STB	Surface Transportation Board
STEEM	Waterway Network Ship Traffic, Energy and Environment Model
SVOC	Semi-Volatile Organic Compound
SwRI	Southwest Research Institute
TBN	Total Base Number
TCC	Total Compliance Cost
TCM	Total Carbon Mass
TDC	Top Dead Center
TEU	Twenty-foot Equivalent Unit; basic container measurement used in the shipping industry
THC	Total Hydrocarbon
TSD	Technical Support Document
TVCC	Total Variable Compliance Cost
ULCC	Ultra Large Crude Carrier
ULSD	Ultra Low Sulfur Diesel fuel
URS	Upper Respiratory Symptoms
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
UV	Ultraviolet
UV-b	Ultraviolet-b
VLCC	Very Large Crude Carrier
VLGC	Very Large Gas Carrier
VOC	Volatile Organic Compound
VOF	Volatile Organic Fraction
VOS	Voluntary Observing Ships
VSL	Value of Statistical Life
WLD	Work Loss Days
WTP	Willingness-to-Pay
$2006	U.S. Dollars in calendar year 2006

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CHAPTER 1: Need for Emission Controls; Form of Controls

What We Proposed:

The comments in this section generally correspond to Sections I, II and VIII of the preamble to the proposed rule, where we describe the need for controls from ships, the various legal authorities under which we are taking action, and the air quality and health impacts of the proposed rule. Some comments discussed below also correspond to Sections X and XI of the preamble, where we describe administrative aspects of this rulemaking process. The Regulatory Impact Analysis (RIA) describes the health and air quality benefits in Chapters 2 and 6.

1.1 Public Health Need for a Domestic Emission Control Program for Category 3 Marine Diesel Engines

1.1.1 Emissions from Category 3 marine diesel engines pose a serious health threat.

What Commenters Said:

NACAA commented that emissions from C3 marine engines lead to adverse health impacts and that an array of studies confirms that exposure to these pollutants can increase mortality, cancer risk and respiratory illnesses, and substantially raise healthcare costs.

ALA/EDF commented that the pollutants addressed in this rule are associated with significant health problems, including premature mortality, aggravation of respiratory and cardiovascular disease, changes in lung function and increased respiratory symptoms, chronic bronchitis, altered respiratory defense mechanisms, altered lung development, adverse reproductive outcomes, and altered fetal development.

ALA commented at the hearing that "the emissions from these pollutants cause coughing and wheezing, triggering asthma attacks, heart attacks and strokes, cause cancer and can kill. Breathing these pollutants increases the likelihood that someone will have to rush to the emergency room or enter the hospital. Children who grow up breathing these pollutants may face an increased life-long risk of lung disease because of the impact on the growth of their lung function. People who breathe these pollutants may also face higher risk of lung infections, including influenza. People that are most at risk include children and teens, older adults, and people with chronic lung disease such as asthma and chronic obstructive pulmonary disease, also called COPD, people with cardiovascular disease and diabetes. In addition, people who work or exercise outdoors also face higher risk." In addition ALA testified that "Pollution from these vessels can trigger heart attacks and strokes and can even shorten life. As a thirty year volunteer with the lung association, I have seen firsthand the impact of air pollution on people with lung disease. I know that pollution can make healthy people cough and wheeze, and send people with asthma or chronic pulmonary obstructive disease to the hospital." ALA also commented that "…nitrogen dioxide is dangerous. Science tells us that this noxious gas makes people cough and wheeze and inflames the lung tissue. Nitrogen dioxide triggers asthma attacks and increases the likelihood that asthma suffers will have to rush to the emergency department or be admitted to

the hospital. I highlighted that millions of people face higher risk of health problems from having to breathe dangerous levels of nitrogen dioxide."

FOE commented that "NO_X is a precursor in the photochemical reaction that causes ground-level ozone or smog. Smog causes harmful respiratory effects including chest pain, coughing, shortness of breath, exacerbation of asthma, decreased lung function, inflammation of the lung tissue, permanent lung damage, aggravation of existing respiratory diseases, and may impair the body's immune system defenses. 68 Fed. Reg. at 9751. Exposure to smog leads to increased hospital admissions and emergency room visits and increases the use of medications. *Id.* Children, outdoor workers, and people with compromised respiratory systems are most severely impacted by these health effects. *Id.* Recent studies have also linked ozone exposure to increased cardiopulmonary mortality, especially when combined with exposure to PM. 72 Fed. Reg. at 69532."

FOE also commented that secondary and directly-emitted PM from marine diesel engines are of particular concern to public health. "Recent studies have shown that exposure to fine particles, such as those emitted by Category 3 marine diesel engines, have been associated with mortality from cardiopulmonary diseases and lung cancer, and with effects on the respiratory system, such as decreased lung function and the development of chronic respiratory disease. 71 Fed. Reg. 61144, 61152-54 (October 17, 2006) (EPA's recent revision to the national ambient air quality standards for PM). Exposure to fine PM can also lead to increased asthma, coughing, wheezing, and difficulty breathing, increased allergenicity, and premature death. 68 Fed. Reg. at 9752."

Stephen Crane of the American Thoracic Society commented that exposure to NO_X is bad for your health and that studies have linked NO_X exposure with worsening asthma, reduced lung function and increased ER visits. He commented that PM also has been associated with a broad range of health effects, both respiratory and cardiovascular, and that research has linked exposure to PM with premature mortality. In addition, he provided two recent editorials that summarize key findings on health effects of NO_X and PM pollution.

SCAQMD commented that marine vessels significantly contribute to health impacts.

The City of New York commented that even modest reductions in $PM_{2.5}$ levels would have substantial public health benefits for New York City.

CATF commented that diesel emissions endanger public health and must be substantially reduced.

Ryan Wiggins of the Communities for Clean Ports commented that numerous studies have confirmed the significant negative effects of diesel PM on public health.

Ricardo Pulido with the Coalition for a Safe Environment submitted an appendix listing references to 158 studies about health impacts, PM and traffic.

Many commenters (listed below) said that they themselves, their families and people in their communities are suffering from serious health problems caused or exacerbated by air pollution coming from ships.

Commenters:

Alyssa Trujillo (0232)
Elena Rodriguez with Alliance for Citizens of Long Beach (0232)
Yolanda Chavez (0232)
Maria Lopez (0232)
Teresa Trujillo (0232)
Concepcion Garcia with Long Beach Alliance for Children with Asthma (0232)
Maria Alcazar (0232)
Sandra Johnson with Long Beach Alliance for Children's Asthma (0232)
Martha Cota (0232)
Juan Garibay with Coalition for a Safe Environment (0232)
Sofia Carillo with Coalition for a Safe Environment (0232)
Jesse Marquez with Coalition for a Safe Environment (0232)

Our Response:

We agree with the commenters that emissions from marine vessels generate significant emissions of fine particulate matter ($PM_{2.5}$), sulfur oxides (SO_X) and oxides of nitrogen (NO_X). NO_X is a key precursor to ozone and secondary PM formation. Ozone and $PM_{2.5}$ are associated with serious public health problems including premature mortality, aggravation of respiratory and cardiovascular disease, aggravation of existing asthma, acute respiratory symptoms, chronic bronchitis, and decreased lung function. In addition, these emissions contribute to nonattainment of the National Ambient Air Quality Standards for $PM_{2.5}$ and ozone and to deposition of nitrogen, sulfur and PM, visibility degradation and impacts on vegetation due to ozone.

1.1.2 Diesel Exhaust Emissions pose a serious health threat

What Commenters Said:

The Ohio Environmental Council commented that diesel emissions endanger public health and must be substantially reduced. They go on to note that diesel emissions contain over 40 different toxics and these compounds are known or suspected human or animal carcinogens, or have serious non-cancer effects.

Friends of the Earth commented that diesel exhaust is toxic and carcinogenic and that exposure to diesel exhaust can cause increased risk of lung cancer, adverse pulmonary effects, and allergenic effects such as those associated with asthma or immunologic effects. They also commented that marine diesel engines produce other air toxics, such as benzene, 1,3-butadiene, formaldehyde, acetaldehyde, acrolein, polycyclic organic matter, and naphthalene, exposure to which can cause or contribute to cancer and non-cancer health effects.

ALA/EDF commented that because diesel air pollution is a complex mixture of chemicals, exposure to diesel air pollution is associated with a wide range of non-cancer health effects, including pulmonary disease, cardiovascular effects, neurotoxicity, low birth weight in infants, premature births, congenital abnormalities, and elevated infant mortality rates. They also commented that diesel exhaust contains more than 40 toxic chemicals and that since diesel exhaust is a highly complex and variable mixture containing numerous carcinogenic compounds, it is difficult to quantify the cumulative health effects. Therefore it is very likely that significant

health benefits will accrue with reduced diesel emissions beyond what is measurable in any current regulatory efforts.

CATF commented that diesel exhaust is highly toxic. "Dozens of toxic air contaminants are found in diesel exhaust, including a variety of highly toxic carbon-core particulate and gas phase organic carbon compounds such as benzene, formaldehyde, acetaldehyde, 1,3-butadiene, acrolein and polyaromatic hydrocarbons. These compounds are known or suspected human or animal carcinogens, or have serious non-cancer health effects. Of particular concern in diesel exhaust are a broad array of polycyclic aromatic hydrocarbons (PAH) which are emitted as gases and also are adsorbed onto the surface of diesel exhaust particles where they may be carried deep into the lung and bloodstream. Medical studies suggest PAH compounds are genotoxic and form DNA adducts that have been associated with increased risk of a variety of cancers, including lung, prostate, and breast.

Commenters:

ALA/EDF
CATF
Friends of the Earth
Ohio Environmental Council et al

Our Response:

We agree that diesel exhaust from diesel engines is a serious public health concern and that there are public health benefits from the final rule as described in Chapter 2 of the RIA. The final rule will reduce harmful emissions and protect sensitive groups such as outdoor workers, children, asthmatics and those with existing heart and lung disease, as well as those in close proximity to marine ports.

1.1.3 Cancer Risk Associated with Diesel Exhaust Emissions

What Commenters Said:

David Marshall, of the Clean Air Task Force, commented upon the fact that a number of domestic and international organizations, including The National Institute for Occupational Safety and Health, International Agency for Research on Cancer, Health Effects Institute, World Health Organization, U.S. Department of Health and Human Services National Toxicology Program, and the U.S. Environmental Protection Agency, have all determined that diesel exhaust is a probable or likely human carcinogen—that is, it is likely to cause lung cancer. The commenter also noted that studies conducted by California as well as the South Coast Air Quality Management District have estimated that the average cancer risk from diesel particulate matter is about 70% of the cancer risk from all air toxics. According to the commenter, in New York County, 96% of the air cancer risk is due to mobile sources. Specifically, diesel emissions are the hazardous air pollutant with the highest contribution to cancer risk—by more than an order of magnitude.

CATF and FOE mention in their comments that California has done work looking at impacts on people living near large diesel emission sources like ports. They refer to a CARB

study that indicates that port emissions result in elevated cancer risk within the entire 20 mile by 20 mile study area.

The SCAQMD commented that average cancer risks due to air pollution exceed 1,200 in a million, with higher risks near transportation facilities like ports.

The ALA and EDF commented that diesel air pollution adds to cancer risk all around the country. Specifically, in Seattle diesel soot accounts for between 70 and 85% of the total cancer risk from air toxics, and in the south coast air basin diesel exhaust contributes about 84% of the cancer risk from air toxics. ALA/EDF also commented that "The Agency's failure to quantify a unit cancer risk for diesel exhaust is inconsistent with the extensive body of science in fact demonstrating such a risk. EPA must promptly move forward and quantify the number of cancer cases associated with the exposure to diesel exhaust, as this is imperative to better assess the full health effects of diesel emissions, as well as the benefits of reducing these emissions. This analysis should account for the advances in diesel engines and the impact of these advanced technologies in reducing or altering cncer risk. Finally, the fact there is uncertainty involved in quantifying the dose response relationship does not in any way mean that a rigorous and quantified cancer risk analyses cannot be produced while accounting appropriately for uncertainties".

NRDC commented that Long Beach is in the "diesel death zone" and cited the AQMD MATES III report which includes information on cancer risk from air toxics.

Commenters:

American Lung Association
Clean Air Task Force
Environmental Defense Fund
Natural Resources Defense Council
Ohio Environmental Council and others
South Coast Air Quality Management District

Our Response:

We agree that exposure to diesel exhaust has been classified by EPA as being likely carcinogenic to humans, and our Assessment Document for Diesel Engine Exhaust (Diesel HAD) provides substantial evidence to support this claim.[1] We have reviewed the documents cited that provide a numerical estimate of cancer risk attributable to exposure to diesel exhaust. The Agency does not believe that at this time the data support a confident determination of a unit risk for diesel exhaust and therefore the cancer-related mortality or morbidity associated with diesel exhaust exposure cannot be determined quantitatively. However, the Agency has determined that the carcinogenic risk from diesel exhaust may be as high as 10^{-3} to 10^{-5} but a zero risk cannot be ruled out. The basis for these determinations is provided in Chapters 8 and 9 of the Diesel HAD.

[1] U.S. EPA. Health Assessment Document for Diesel Engine Exhaust. EPA/600/8-90/057F. http://www.epa.gov/ncea.

We also agree that diesel exhaust from diesel engines is a serious public health concern and that there are public health benefits from the final rule as described in Chapter 2 of the RIA. The final rule will reduce harmful emissions and protect sensitive groups such as outdoor workers, children, asthmatics and those with existing heart and lung disease, as well as those in close proximity to marine ports.

1.1.4 Health Effects and Need for Reduction of Emissions Locally

What Commenters Said:

ALA commented that "Houston has some of the dirtiest air in the country. People living there face that fact day after day. They have heard for years about the enormous health consequences of the ozone smog from notorious traffic, the petrochemical industry and the vessels in the ship channel."

ALA also commented that "Cruise ships, container ships, tankers and other oceangoing vessels release tons of diesel exhaust pollution into the atmosphere, the air we breathe. These ships dock at over one hundred ports along our coastline and along navigable waterways far inland. Here in New York we have shipping traffic that goes to the ports in Brooklyn and Staten Island, as well to Manhattan, as well as to the Port of Newark/Elizabeth-Port Authority Marine Terminal in New Jersey."

ALA also commented that "The EPA's own proposal noted that 36 million people live near highways, railroads or ports where they breathe air that is consistently more polluted than in other parts of the country."

Many citizens (see list below as well as other comments summarized in this section) commented at the hearings that their communities are being negatively impacted by the Ports of Long Beach and Los Angeles. These citizens described their experiences with health impacts including asthma, nose bleeds, heart disease, lung cancer and others. The citizens implored EPA to finalize this rule and help reduce harmful emissions from ships. Several of the citizens urged EPA to make the rule even more stringent. See Section 3.2 of the S&A for more information on the stringency of the standard.

Juan Garibay of the Coalition for a Safe Environment supports the rule and commented that air pollution in environmental justice harbor communities has been increasing for 30 years and the communities are facing a public health crisis due to international shipping and trade.

Ricardo Pulido with the Coalition for a Safe Environment submitted an appendix with references to 158 studies about health impacts, PM and traffic.

David Pettit from NRDC commented that although the hearing was held in a nice hotel room, when you walk outside in Long Beach you enter the "diesel death zone".

Commenters:

Alyssa Trujillo (0232)
Elena Rodriguez with Alliance for Citizens of Long Beach (0232)
Ms. Chavez (0232)

Maria Lopez (0232)
Teresa Trujillo (0232)
Concepcion Garcia with Long Beach Alliance for Children with Asthma (0232)
Maria Alcazar (0232)
Sandra Johnson with Long Beach Alliance for Children's Asthma (0232)
Martha Cota (0232)
Juan Garibay with Coalition for a Safe Environment (0232)
Sofia Carillo with Coalition for a Safe Environment (0232)
Ricardo Pulido with Coalition for a Safe Environment (0232)
Jesse Marquez with Coalition for a Safe Environment (0232)
Ryan Wiggins with Communities for Clean Ports (0232)
Christopher Patton with Port of Los Angeles (0232)
Martin Schlageter with the Coalition for Clean Air (0232)
NRDC (0232)

Our Response:

We agree with the commenters that the emissions from C3 marine vessels can cause serious health effects. The requirements in this rule will result in substantial benefits to public health and welfare through significant reductions in NO_X, SO_X and diesel PM. Diesel exhaust is of specific concern because it has been judged to likely pose a lung cancer hazard for humans as well as a hazard from noncancer respiratory effects. A discussion of the health effects associated with pollutants being reduced in this final rule can be found in Chapter 2 of the RIA or Section II of the preamble.

1.1.5 Environmental Justice

What Commenters Said:

FOE commented that "While the impacts from marine diesel emissions can affect all people, those facing the challenges of poverty, poor access to medical care, very low rates of insurance coverage, and virtual exclusion from public policy decisions that most impact them, are most likely to live and work near pollution sources such as ports, transportation corridors, freeways, and industrial centers. Environmental justice communities often suffer from disproportionately high cancer, disease, and death rates as they are exposed to the highest levels of carcinogenic, toxic, and hazardous chemicals. Without a drastic and immediate reduction in the emissions coming from Category 3 marine engines, millions of people will continue to be exposed to ever-increasing amounts of deadly air pollution and many thousands will continue to die."

ALA/EDF commented that "Communities adjacent to ports, identified in the American Association of Port Authorities map of U.S. Ports, copied below, are likely to be severely impacted by OGV air emissions. As EPA explains in the NPRM, recent studies show that populations living near large diesel emission sources such as major roadways, rail yards, and marine ports are likely to experience greater diesel exhaust exposure levels than the overall U.S. population, putting them at greater health risks. But toxic diesel emissions from OGV not only impact local air quality; the emissions also impact air quality along coastlines adjacent to shipping lanes".

NACAA commented that in many neighborhoods adjacent to marine ports, which are environmental justice communities, the health risks from exposure to diesel exhaust greatly exceed levels considered acceptable.

The CATF commented that toxic diesel emissions pose a great danger to human health, especially in urban areas where diesel engines and emissions are concentrated in populated neighborhoods.

Mr. R. Kassel, of the National Resources Defense Council, testified at the New York hearing that it's hard to find a better deal in the public health world than $30 worth of benefits for every dollar spent [referring to the benefit-cost comparison associated with implementing the coordinated strategy]. He continued by stating that with the nation engaging in critical debate on rising health care costs and concerns about an aging population, achieving these health impacts at such minimal cost is a critically urgent need. He viewed this proposal not just as important for the nation but also for low income communities of color that typically border many port communities. He urged EPA representatives to walk around the residential neighborhoods close to the port terminals of Newark, Elizabeth and Staten Island where you can clearly see that communities in those areas bear the brunt of port emissions.

Alyssa Trujillo, testifying at the Long Beach hearing, stated that Wilmington, Long Beach and parts of San Pedro had been suffering from what she defined as an environmental inequality, or, in her words, “environmental racism.” She believed that if these communities

were affluent and well-to-do, they wouldn't have had a problem bringing this issue to the forefront.

Our Response:

EPA agrees that environmental justice is an important issue. EPA determined that this rule does not have a disproportionately high and adverse human health or environmental impact on minority or low-income populations. Information on how EPA has appropriately addressed these items can be found in Section XII of the Preamble.

EPA recently updated a screening analysis of selected marine port areas to begin to understand the populations living near marine ports. Of the 45 marine ports studied, the results indicate that at least 18 million people, including a disproportionate number of low-income households, African-Americans, and Hispanics, live in the vicinity of these facilities and are being exposed to annual average ambient DPM levels that are 2.0 $\mu g/m^3$ and 0.2 $\mu g/m^3$ above levels found in areas further from these facilities. Considering only ocean-going marine engine DPM emissions, the results indicate that 6.5 million people are exposed to annual average ambient DPM levels that are 2.0 $\mu g/m^3$ and 0.2 $\mu g/m^3$ above levels found in areas further from these facilities. Because those populations exposed to DPM emissions from marine ports are more likely to be low-income and minority residents, these populations will benefit from the coordinated strategy.

With regard to children, this analysis shows that at least four million children live in the vicinity of the marine ports studied and are also exposed to annual average ambient DPM levels that are 2.0 $\mu g/m^3$ and 0.2 $\mu g/m^3$ above levels found in areas further from these facilities. Of the 6.5 million people exposed to DPM emissions from ocean-going vessel emissions, 1.7 million are children. The age composition of the total affected population in the screening analysis matches closely with the age composition of the overall U.S. population. However, for some individual facilities, the young (0-4 years) appear to be over-represented in the affected population compared to the overall U.S. population. See section VIII of the preamble to the final rule and Chapters 2 and 5 of the RIA for a discussion on the air quality and monetized health benefits of this rule, including the benefits to children's health.

The emission reductions from the coordinated strategy will have large beneficial effects on communities in proximity to port, harbor, and waterway locations, including children, low-income, and minority communities.

1.1.6 Benefits Associated with Reducing Nickel

What Commenters Said:

Carter Strickland, Jr. commented on behalf of the City of New York that the proposed rule understated the adverse public health effects from the use of residual fuel in ships since residual oil contains more heavy metals then other fuels when adjusted for energy content. He noted that the application of low sulfur fuel should have the significant added benefit of reducing nickel and other heavy metals and EPA should continue to monitor fuel content and ambient air to ensure that heavy metals are reduced with sulfur and to undertake additional rulemakings if necessary.

Our Response:

We agree that the coordinated strategy will have additional health benefits beyond those that can currently be quantified and that heavy metals are important. As noted in Section 2.3.2 of the RIA, shipping emissions of $PM_{2.5}$ do contain small amounts of metals including nickel. The summary of the health effects evidence related to $PM_{2.5}$ exposures presented in the proposed rule is based on the 2004 PM Air Quality Criteria Document (AQCD, EPA document number: EPA/600/P-99/002aF). We are currently working to update the assessment and integrative synthesis of the scientific evidence for PM. EPA's National Center for Environmental Assessment (NCEA) issued a second external review of the *Integrated Science Assessment for Particulate Matter* in July 2009 for review by the Clean Air Scientific Advisory Committee (CASAC) and public comment (ISA, EPA document number: EPA/600/R-08/139B). This document includes consideration of the Bell et al. 2009 article titled "Hospital Admissions and Chemical Composition of Fine Particle Air Pollution" that Mr. Carter cites. The second draft PM ISA states that "Overall, the results indicated that many constituents of PM can be linked with differing health effects and the evidence is not yet sufficient to allow differentiation of those constituents or sources that are more closely related to specific health outcomes. These findings are consistent with the conclusions of the 2004 PM AQCD, that a number of source types, including motor vehicle emissions, coal combustion, oil burning, and vegetative burning, are associated with health effects" (ISA, section 2.4.4). The *Integrated Science Assessment for Particulate Matter* will be finalized in December 2009.

The measurement of ambient air pollution in the U.S. is provided through a number of ambient air monitoring networks operated almost exclusively by State, local, and Tribal air monitoring programs. This includes measurement of $PM_{2.5}$ components, including nickel and other metals at Chemical Speciation Network sites. In addition, the Agency is monitoring for nickel through the National Air Toxics Trends Stations and the Urban Air Toxics Monitoring Program. Data collected from this monitoring is assessed to detect trends and has been used in health studies.

For information on fuel quality please see Section 4.3.2 of this Summary and Analysis of Comments document.

1.2 Form of Emission Controls

What Commenters Said:

The American Lung Association, LBACA, NACAA, and CATF expressed support for EPA to adopt emission standards for Category 3 marine diesel engines even in the absence of international standards.

PMSA, the World Shipping Council, and Matson Navigation suggested that EPA should adopt the Annex VI regulator provisions with as little modification as possible, both to minimize the potential for disrupting global maritime activities and to acknowledge that EPA was part of the process for adopting the Annex VI standards originally.

The Chamber of Shipping of America emphasized that marine vessel regulation should be entirely governed by the International Maritime Organization. They expressed hope that finalization of this rule will ensure that its requirements are applied consistently throughout the

United States and represent the sole strong national program so badly needed to avoid multiple and potentially conflicting air emissions control programs that apply uniquely at the state or regional level.

EMA supported the proposed adoption of the Annex VI standards as an important step to control emissions in the context of an internationally harmonized requirement. EMA added several specific concerns, which we address elsewhere in this document.

Euromot supported adoption of the Annex VI requirements, but urged us to avoid making any substantial modifications, either in the technical content or the administrative proceedings.

Santa Barbara had positive response to EPA's proposed coordinated strategy for ocean-going vessels. While we generally support EPA's proposed standards, we believe that EPA is required under Section 213 of the Clean Air Act to consider both stricter standards and shorter implementation timelines. In addition, we recommend several principles that should be considered as part of this regulatory action.

NACAA commended EPA for the proposal and reiterated their strong support of decisive U.S. regulatory action. NACAA expressed strong support for both the U.S. rules and final implementation of an ECA for North America under the IMO process to comprehensively control both U.S. and foreign-flag vessels with C3 marine engines.

Ryan Boles objected to the proposed rule on the basis that it is ridiculous to threaten the American people with higher taxes and energy costs, driving up costs, and threatening jobs and the economy. In contrast, Samuel Chan expressed a desire to see the U.S. EPA lead the world in setting tough environmental protection rules by following what Hong Kong already requires regarding sulfur content of marine fuels.

Several additional commenters expressed a general support for EPA to adopt the Annex VI standards, many of which pointed to various aspects of our supporting rationale for pursuing these standards. The general expressions of support focused largely on the expected environmental benefit or the pursuit of harmonized international standards, or both.

Our Response:

EPA was pleased to participate in the MARPOL process that led to the adoption of new long-term emission standards for marine diesel engines. These standards are generally consistent with the requirements we have already adopted for Category 1 and Category 2 marine diesel engines, and with our interest in adopting standards for Category 3 marine diesel engines under the Clean Air Act. Our proposal took the approach of codifying the Annex VI standards and associated test procedures and certification protocol, with a number of adjustments that were needed to comply with various legal and procedural imperatives and constraints that apply in the United States. The Annex VI standards resulted from a process in which the International Maritime Organization responded favorably to the U.S. white paper proposing stringent and appropriate emission standards for the international community. We believe that these standards will give the greatest degree of emission control achievable considering compliance costs, lead time, and other relevant factors.

1.3 Issues Related to Rulemaking Process

What Commenters Said:

Several commenters objected to limiting the public comment period to 30 days and requested that we extend the comment period to at least 90 days. Some wanted EPA to extend the comment period so EPA will have a complete record it can consider before finalizing the standards. Some commenters in Alaska and the Great Lakes region expressed concern that they only very recently became aware that the proposed fuel standards would extend to their geographic region, and that this action was taken without meaningful consultation with affected parties.

The Lake Carriers Association
Canadian Shipowners' Association
Great Lakes Maritime Task Force
Bruce Botelho, Mayor, Juneau, AK (0298)
Mark Begich, U.S. Senator (AK) (0322)
State Senator Egan (0323)

Our Response:

EPA disagrees that additional time is needed for us to have a complete record for this rulemaking. First, although the proposed rule was not published in the Federal Register until August 2009, commenters in fact had three months to prepare comments on the proposal. The proposal became available electronically on July 1, 2009, at which time we also provided direct notification to interested parties to ensure that there was a broad awareness that the proposed rule was complete and that we would be taking comment on the proposed provisions. Taking this pre-publication period into account, prospective commenters had three full months to review the proposed rule before the end of the comment period, consistent with the commenters' request.

Second, EPA does not believe the scope of the proposal should have been a surprise to commenters. The proposed rule was first preceded by an Advance Notice of Proposed Rulemaking (ANPRM) announcing EPA's intent to adopt more stringent emission standards consistent with the U.S. position advocating more stringent global and geographic standards for these vessels under MARPOL Annex VI.

Given that the standards we are adopting under the Clean Air Act are largely consistent with the Annex VI requirements and our ANPRM, and given the opportunity for interested persons to view the proposal well before it was published, we believe commenters have had sufficient time to review the substance of the proposal and prepare their written comments. This is supported by the large number of comments we received on the proposal and the ANPRM from a wide range of interested parties.

To see other comments about application of the standards to Alaskan waters, please see section 2.2.2 of this document. To see other comments about application of the standards to the Great Lakes, please see Chapter 10 of this document.

1.4 Other General Comments

(A) Why isn't EPA Regulating Auxiliary Boilers to Control Emissions During Cargo Loading/unloading?

What Commenters Said:

The Coalition for Clean Air (CCA) commented that boilers used to power cranes and pumps to unload cargo such as crude oil and containers also emit air pollutants including volatile organic compounds and air toxics. CCA suggested that emissions from these boilers could be controlled using after-treatment technology, and evaporative emissions of volatile cargo could be captured with vapor recovery systems. (written copy of hearing testimony)

Our Response:

Today's rule primarily addresses the largest (Category 3) propulsion engines on marine vessels. The fuel used by most auxiliary boilers (those over 130 kw, the power equivalent of a small car engine) on large ships is subject to international air pollution standards, including globally-applicable fuel sulfur standards as well as the more stringent fuel sulfur standards applicable in Emission Control Areas under MARPOL Annex VI. MARPOL Annex VI also has a regulation specifically applicable to controlling volatile organic compounds when oil tankers load and unload their cargo. Further, auxiliary compression-ignition engines on ships may be classified by EPA as Category 1 or 2 marine diesel engines, which are covered by regulations under the Clean Air Act at 40 CFR part 1042 and/or part 94. States and port authorities also may have plans in place to reduce emissions from ships while engaged in loading and unloading cargo at port.

(B) Regulation of Marine Engines as Nonroad Engines

What Commenters Said:

Richard Hovan argued that Category 3 marine engines should be treated as stationary sources and required to meet all New Source Performance Standards monitoring rules.

Our Response:

Internal combustion engines on Category 3 marine vessels clearly fall within the definition of nonroad engine in §1068.30 since they are used on self-propelled vehicles. Nonroad internal combustion engines are excluded from the New Source Performance Standards (NSPS) for Stationary Compression-Ignition Internal Combustion Engines because the definition of stationary internal combustion at 40 CFR 60.4219, excludes nonroad engines, as defined in 40 CFR 1068.30, from that category of stationary sources. It is not clear on what basis the commenter believes that marine engines should meet monitoring rules. However, we believe the requirements we are establishing to certify engines, install diagnostic tools, require emission measurements following parameter adjustments, and require continuous monitoring related to on-off controls provides adequate assurance that in-use engines will control emissions in line with the original design and certification.

(C) Time and Location of Hearing

What Commenters Said:

Ricardo Pulido of the Coalition for a Safe Environment commented that the public hearing was held at a time and place that was very inconvenient for working people to attend, including logistics and cost of parking.

Our Response:

EPA is pleased that four members of the Coalition for a Safe Environment were able to attend the August 6 public hearing. We do understand that many others who care deeply about their air quality were unable to attend personally. In choosing to hold our hearing during normal business hours, we targeted attendees affiliated with organizations that could speak on behalf of the numerous affected individuals. Our attendee lists from both hearings do include several unaffiliated individuals, including a number of speakers who took time out of their work schedules to attend. With respect to the location of future hearings, we are open to suggestions for suitable venues that are accessible to public transit as well as regional airports.

We also note that anyone who was unable to attend the public hearings had an opportunity to submit written comments on the proposal. We have in fact received a great number of written comments, both from organizations and from individuals who have no apparent organizational affiliation.

CHAPTER 2: Scope and Applicability

What We Proposed:

The comments in this section generally correspond to Section V of the preamble to the proposed rule, where we describe the North American Emission Control Area as well as the applicability of our program to foreign flag vessels. The comments also correspond to Section III.B of the preamble where we describe how this program addresses emissions of greenhouse gases. See Chapter 5 of this document for a discussion of applicability of standards to other types of propulsion engines, and for a discussion of the geographic scope and applicability of MARPOL Annex VI through APPS.

2.1 Applicability to Foreign Flag Vessels

What Commenters Said:

(A) EPA Should Regulate Foreign-flagged Vessels under the Clean Air Act

At EPA's public hearing on this rule in Los Angeles, California, Concepcion Garcia of the Long Beach Alliance for Children with Asthma spoke and expressed her support for EPA's rule, "under the Clean Air Act to protect the public from the polluted air emitted by low-quality fuel used by ships arriving in our area."

South Coast Air Quality Management District, by incorporating by reference their previous arguments, reiterates their position that EPA has the legal authority to regulate foreign-flagged vessels under the Clean Air Act.

NESCAUM urges EPA to take action under the Clean Air Act to reduce pollution from all ships, regardless of flag, if the ECA designation is substantially delayed or not approved.

Natural Resources Defense Council points out that companies, including U.S. companies, have intentionally created off-shore companies in order to flag in other countries and circumvent application of U.S. emission standards to their ships, thus urges EPA to increase the scope of our rule to cover foreign-flagged as well as U.S. vessels.

The Texas Legislative Air Quality Caucus urges EPA to act quickly under domestic authority to limit OGV emissions if the ECA is not adopted in March 2010.

American Lung Association with Environmental Defense Fund commented EPA must regulate foreign-flagged vessels under the Clean Air Act and apply the same standards to those ships as it applies to domestic-flagged vessels. These commenters cite previous comments submitted by the Harvard Law School's Environmental Law and Policy clinic that read section 213 of the Clean Air Act to require the regulation of foreign-flagged vessels. They point to the pollution contribution from foreign-flagged vessels, which according to the U.S. Department of Transportation Maritime Administration (MARAD) account for 88% of ship emissions at U.S. ports, as impinging upon the ability of EPA to attain this rule's health benefits without a coordinated strategy to tackle foreign-flagged vessel emissions. Further, they call for the

Agency to be prepared to conduct an additional rulemaking to extend application of this rule to foreign-flagged vessels in the event that the amendments to Annex VI are not entered into force by July 1, 2010 or an ECA designation is not adopted by the parties to MARPOL Annex VI in March 2010.

Friends of the Earth, Center for Biological Diversity, and Earthjustice comment that EPA's proposed rule would be strengthened if its Tier 2 and 3 standards and low sulfur fuel requirements applied to foreign-flagged vessels as well as domestically-flagged vessels. These commenters note that EPA has not taken a position on whether section 213 of the Clean Air Act grants EPA authority to regulate foreign-flagged vessels in U.S. waters and recognizes EPA's commitment to revisit the issue if an ECA designation is not timely approved. However, these commenters find flaw in this approach, asserting that "uncertainty and additional delays inherent in this approach can and should be avoided," and that, "EPA must delineate the specific supplemental measures that will come into effect if the EA is not approved in March 2010 at IMO's MEPC 60." These commenters reassert their previous position as to EPA's section 213 authority to regulate foreign-flagged vessels by pointing to the large pollution contribution of these vessels, the text of section 213, case law regarding other U.S. regulation of foreign-flagged vessels, international law principles, and the United Nations Convention of the Laws of the Sea ("UNCLOS"). Because of their position on section 213 and the uncertainty they find with EPA's reliance on coordination with the IMO, these commenters urge EPA to apply Tier 2 and 3 standards to foreign-flagged vessels as part of this current rulemaking.

The Marine Engineers' Beneficial Association, Masters, Mates, and Pilots, American Maritime Congress, and the Maritime Institute for Research and Industrial Development (jointly as "Maritime Labor") submitted comments to generally support EPA's rule but express concerns stemming from unequal application of the rule to foreign- and domestically-flagged ships. Maritime Labor believes that "[i]n order to comply with congressional intent and effectuate the policies espoused in the Clean Air Act (CAA and APPS, the EPA must tie implementation of the regulations of the U.S. Flag Fleet to regulation of the foreign flag fleet docking in U.S. Ports." Maritime Labor further points to a U.S. Code section that expresses congressional intent for the United States to have a strong and independent merchant marine to argue that the Clean Air Act and APPS should be interpreted and implemented to further that intent. Maritime Labor specifically calls for EPA to "explicitly tie regulation of the U.S. flagged vessels to regulation of the foreign flag fleet, in time and substance." In order to attain uniform treatment of foreign- and domestically-flagged ships, Maritime Labor further believes that enforcement of EPA's current regulations should be delayed until the Annex VI standards become enforceable.

Ohio Environmental Council, along with Marsh Area Regional Council, Earth Day Coalition, and the Ohio League of Conservation Voters, call for equal application of marine engine standards to all ships operating on U.S. waters. With regard to EPA's Clean Air Act authority to regulate foreign-flagged vessels, these commenters continue to believe that EPA can interpret "'new nonroad engines' as including 'imported non-road engines' and to include foreign-flagged ships operating in U.S. waters as 'imported' for Clean Air Act purposes."

Santa Barbara County Air Pollution Control District ("Santa Barbara") expressed its "fundamental objection to EPA's approach on foreign flagged marine vessels," and reiterated its position that EPA has a "nondiscretionary duty" to include these vessels in it regulations issued pursuant to section 213 of the Clean Air Act. Based upon that legal position, Santa Barbara urges EPA to initiate a parallel rulemaking to subject vessels of all flags to the proposed

Category 3 emission standards, to fulfill its Clean Air Act duty and as a "backstop" to potential delays stemming from the IMO.

Clean Air Task Force, together with American Lung Association of New England, American Lung Association of New York, Citizen Action (Illinois), Clean Air Carolina, Clean Water Action, Clean Water Action (of Connecticut, Florida, Maryland, Massachusetts, Michigan, Minnesota, New Jersey, Pennsylvania, Rhode Island, Virginia, and Cleveland), Earth Day Coalition (Cleveland), East Michigan Environmental Action Council, Environment Illinois, Georgia Conservancy, Group Against Smog and Pollution, Marsh Area Regional Council (Lake County, Ohio), Michigan Environmental Council, Michigan League of Conservation Voters, Mothers and Others for Clean Air, New York Public Interest Research Group, Ohio Environmental Council, Ohio League of Conservation Voters, Progress Michigan, Public Citizen (Texas), Respiratory Health Association of Metropolitan Chicago, Save the River/Upper St. Lawrence Riverkeeper, Sierra Club (Great Lakes Program), Southern Alliance for Clean Energy, and Southern Environmental Law Center, expressed general support for EPA's rule but points out that it is "crucial" that EPA apply the standards to all ships visiting U.S. ports and operating in U.S. waters in order to attain the rule's public health and environmental benefits. Furthermore, Clean Air Task Force believes that EPA's approach with regard to foreign-flagged vessels is a "mistake" because IMO's adoption of the U.S. ECA is not guaranteed, and that without the ECA adoption EPA cannot apply IMO standards to foreign-flagged vessels through APPS. For these reasons, Clean Air Task Force incorporates by reference its previously stated position that there is no legal impediment to EPA's regulation of foreign-flagged vessels under the Clean Air Act as "imported non-road engines." Clean Air Task Force additionally points to the comments received in response to our ANPR from the Environmental Law & Policy Clinic at Harvard Law School and South Coast Air Quality Management District, which asserted that foreign-flagged vessels could also be included in EPA's regulation of oceangoing vessels as "new non-road engines."

(B) Standards for U.S. and Foreign-flagged Vessels Should Be the Same

American Petroleum Institute, among others, expressed its support for EPA's approach, to coordinate its Clean Air Act regulation with international emission standards. API believes that this coordination will result in uniform standards that will apply to all ships trading in U.S. waters.

Ricardo Pulido of Coalition for Safe Environment echoed this opinion: "I also ask that all foreign flag ships that enter U.S. ports be required to meet the same standards." (Ricardo Pulido of Coalition for Safe Environment, 0227).

Our Response:

We appreciate the comments we received and are committed to revisiting the issue if the U.S. ECA proposal is not timely adopted. However, we continue to believe we need not revisit this issue at this time given that foreign-flagged vessels will be subject to standards under APPS that are comparable to those for U.S.-flagged vessels under section 213 of the CAA. The issue of whether EPA is compelled to cover foreign-flagged vessels under section 213 of the CAA was raised in *Bluewater v. EPA*, 372 F.3d 404 (D.C.Cir. 2004), a challenge to EPA's decision in 2003 not to revisit the issue of whether foreign-flagged vessels may and should be covered by nonroad emissions standards issued under section 213 of the CAA. In finding Bluewater's claim to be

premature, the *Bluewater* court referred back to its determination in *Engine Mfrs. Ass'n v. EPA* that "new nonroad engine" as used in 213(a)(3) is ambiguous and reiterated EPA's undisputed finding that there would be no significant loss of emission reductions by not revisiting the issue.

We do not believe circumstances have changed to call into question the court's finding as applied to today's setting. In fact, the only changed circumstances further support EPA's decision not to revisit the issue. Since issuance of the 2003 final rule and the court's decision in *Bluewater*, Annex VI has entered into force, and the United States has become a Party to Annex VI and has successfully negotiated significant new emission and fuel standards. In addition, Congress has adopted amendments to the Act to Prevent Pollution from Ships to implement both the original and amended Annex VI requirements. Thus, given that foreign-flagged vessels are subject to the original and new Annex VI NO_X and fuel requirements under the operation of APPS, we do not believe it is necessary to address whether EPA may or should cover foreign-flagged vessels under section 213 of the CAA. *See South Coast v. EPA*, 554 F.3d 1076, 1081 (D.C.Cir. 2009)("Deferring resolution of the issue until it will have an effect remains reasonable and the petitioners' objection therefore remains premature.").

However, as noted above, we are committed to revisiting this issue if the proposed ECA, within which the most stringent NO_X and fuel requirements are applicable, is not timely adopted. Meetings to discuss adoption of the U.S.-proposed ECA are scheduled shortly after this rule is finalized, and thus, taking into consideration the lead times adopted, little time is lost in not revisiting this issue in this rulemaking. We also note that ships that are flagged in nations that are not a Party to Annex VI are subject to Annex VI requirements in U.S. waters under the Act to Prevent Pollution from Ships. Our regulations to implement the requirements of Annex VI with respect to such vessels make clear the applicability of those provisions to such vessels.

2.2 Emission Control Area

2.2.1 Support the North American ECA

What Commenters Said:

In March 2009, Canada was party to the joint submission with the U.S. to IMO to designate coastal waters of North America as an ECA. The Government of Canada expressed its commitment to improving the health, well-being, and safety of our shared ecosystem and its residents. As a next step, Canada is currently working towards ratifying MARPOL Annex VI and plans to make the appropriate changes to domestic regulations to implement the North American ECA.

A number of commenters expressed support of the proposed North American ECA. NRDC specifically encouraged EPA to continue to defend the proposed ECA to prevent it from being weakened or delayed at IMO. EDF and ALA expressed strong support of the in-depth and well-presented application EPA made to the IMO for a joint U.S./Canada Emission Control Area. They expressed the belief that the establishment of such an ECA is incredibly important to protect public health in the U.S. from international shipping emissions. In addition, they support EPA's coordinated strategy to reduce Category 3 emissions in the U.S., stating that it is important for EPA to establish timely federal emission and fuel standards that mirror the rigorous ECA application. Together, the coordinated strategy is capable of bringing necessary emissions

reductions and important public health and environmental benefits to the U.S. Maersk noted that, earlier in 2009, it publicly supported the U.S. EPA's Emissions Control Area ("ECA") proposal to the UN's International Maritime Organization "IMO."

Over the past two years, NACAA has directly participated in the International Maritime Organization's (IMO's) activities establishing international marine fuel and engine standards and providing for Emission Control Areas (ECAs). NACAA expressed wholehearted support of the outcomes of these efforts. NAACA stated that they are further encouraged by the progress made at the July 2009 meeting of the IMO Marine Environmental Protection Committee, at which the Committee gave its initial approval to a proposal by the U.S. and Canada for the creation of an ECA along the U.S. and Canadian coastlines. They look forward to the Committee's final adoption of the ECA in March 2010. Under a U.S./Canadian ECA, not only domestic vessels, but also foreign flagged vessels – which account for 90 percent of ships that call on U.S. ports – must comply with the IMO engine and fuel standards when they are within 200 miles of the coast. NACAA supports implementation of a comprehensive ECA for all eligible waters in the U.S. and Canada at the earliest possible date, which would ensure important benefits throughout both nations. Therefore, U.S. must to stay the course with the IMO and see the U.S./Canadian ECA through to approval. NAACA also expressed the importance of EPA working concurrently to finalize a regulation that will ensure that the U.S. has a plan in place and ready for implementation should action by the IMO not progress as hoped.

Canada (0252)
Maersk (0261)
Texas Legislative Air Quality Caucus (0367)
NRDC (0232)
Communities for Clean Ports (0232)
Coalition for a Safe Environment (0232)
AAPA (0232)
ALA+EDF (0366)
NAACA (0246)

Our Response:

We appreciate this show of support and will continue with our efforts as part of the U.S. Government's delegation to IMO to promote the adoption, and ultimately entry into force, of the North American ECA.

2.2.2 Inclusion of Alaska and Hawaii

What Commenters Said:

We received comment from a number of entities that waters of the coast of southeast Alaska should not be included as part of the North American ECA. These entities included the cruise line industry, other shipping interests in Alaska, cruise destination ports and several elected officials in Alaska. In addition, CLIA commented that Hawaii should also not be included in the North American ECA. These comments are described in more detail below.

CLIA commented that Alaska and Hawaii should be excluded from the petition until such time as EPA has adequately and scientifically evaluated the need for inclusion of Alaska and

Hawaii. EPA's proposal contains insufficient justification for including southeastern Alaska and eastern Hawaii regions in the proposed ECA while excluding western Hawaii and western Alaska regions. No dispersion modeling results are presented to justify these decisions and there is no information on the relative benefits of including (and disbenefits of excluding) these regions from the ECA.

CLIA, Governor Parnell, and others commented that neither Hawaii nor Alaska has air quality exceeding EPA's ambient air quality standards for ozone or $PM_{2.5}$. Measurements of ambient $PM_{2.5}$, NO_2 and SO_2 at three locations in Juneau, Alaska during 2000 and 2001 conducted by the Alaska Department of Environmental Conservation showed concentrations of all three pollutants were "appreciably below the State and national air quality standards" in both years.

TOTE commented that the proposed rule as it is written will require its vessels to use distillate fuel during the entire 1300 mile voyage from Tacoma to Anchorage. TOTE's vessels are never offshore more than 200 miles. TOTE stated that while the 200 mile limit may be appropriate in some geographic areas it is wholly inappropriate in the area they operate in because of the low population densities in western Canada and Alaska and because there are no nonattainment areas in this area, outside of Puget Sound. As such, the proposed rule should exclude the majority of this area. River Adventures commented that they are a small business in Southeast Alaska and work with all the major cruise lines. If this application were to be granted they would be hurt by a "double hit." Worksafe commented that it is a highly competitive, Alaska-based business that must make every penny count. To increase costs of doing business to address a non issue is nothing short of economic suicide. Several commenters argued that Alaska should not be included in the proposed ECA because no modeling was conducted in Alaska, the ECA boundaries only designate part of Alaska, and no economic analysis was conducted for the impact on Alaska.

Governor Parnell (AK) commented that EPA needs to collect additional information and conduct further analyses to support sound conclusions regarding an ECA proposal for Alaska and requested that EPA evaluate the basis for applying the new standards in Alaska as well as the economic impacts, especially on the cruise industry. Governor Parnell noted that the proposal states that EPA has not yet determined the extent to which Category 3 engines affect air quality in areas of Alaska west of Kodiak, and as a result, these areas are not included in the proposed ECA. He suggests that the extent to which Category 3 engines affect air quality in any area of Alaska has not been determined. In the absence of any air quality modeling for Alaska, he recommends that the proposed regulations and the ECA proposal be modified to exclude areas off Alaska. Similar comments were received from Congressman Young, Senator Murkowski, Senator Munroz, Ketchikan, Port of Anchorage, and Sitka. Some commenters stated that the IMO requires all ECA applications to consider the cost to implement the new standards and the economic impact. Senator Murkowski commented that while cruise ships do not travel to Southwest Alaska, freight and cargo vessels certainly do; therefore it seems inconsistent for EPA to treat southern/western Alaska waters differently since the state's coastal climate will provide for disbursal of pollutants in similar ways.

After the comment period, Governor Lingle (HI) sent a letter to Administrator Jackson expressing concern with the proposed rule. Governor Lingle expressed support for reductions in fuel emissions, but would like Hawaii's inclusion in the proposed ECA to be based on

quantitative air quality and economic impact data. Therefore, the Governor requested that we delay implementation of the proposed rule in the Southeastern Hawaiian Islands.

CLIA (0278)
TOTE (0289)
River Adventures (0244)
Governor Parnell (0287)
Congressman Young (0382)
Mayor of Ketchikan (0294)
Port of Anchorage (0299)
Sitka (0307)
Representative Munoz (0317)
Senator Begich (0322)
Senator Murkowski (0384)
RDC (0288)
Julies Fine Jewelry (0339)
WorkSafe (0369)
Governor Lingle

FOE and others commented that the ECA should include all of Alaska. They noted that the proposed rule relies on the IMO's approval of the U.S. ECA application as the sole mechanism for addressing emissions from foreign-flagged ships in U.S. waters. However, the ECA proposal does not include the Alaskan Arctic. The Aleutian chain and all Alaskan coastline north thereof has been excluded from the ECA proposal, despite the fact that the Alaska Department of Environmental Conservation (ADEC) encouraged EPA to consider including the State's Northwest, and that Western Alaska has consistently higher emissions of "criteria pollutants" such as NO_X, PM_{10}, $PM_{2.5}$, HC, CO and SO_2 than other parts of the state. Because only U.S.-flagged vessels will be required to meet the heightened emissions standards in the Alaskan Arctic, the proposed ECA and CAA rulemaking leave critical portions of the U.S. coastline less protected than the rest of the country. This lack of nation-wide uniformity in the applicable emissions standards for Category 3 vessels runs counter to the goals of the Clean Air Act. Title II of the Clean Air Act directs the federal government to assume primary responsibility for regulating emissions from mobile pollution sources. The proposed rule would leave large, environmentally sensitive parts of Alaska less protected than the rest of the country. This lack of uniformity runs counter the aims of the statute. Moreover, the application of Tier 3 NO_X standards for U.S.-flagged ships, but not foreign-flagged ships in Arctic Alaskan waters may place U.S. shippers at a competitive disadvantage, especially as the number of foreign-flagged vessels in the Alaskan Arctic increases dramatically with the opening of the Northwest passage to summertime commercial shipping. These issues should be remedied by including Arctic Alaskan waters within the ECA proposal, or by making the proposed emissions standards applicable to all Category 3 ships in U.S. waters, including Alaskan waters. (FOEI, 0320.1, pp. 10-11)

Our Response:

The above comments are specifically focused on the scope of North American ECA proposal that the U.S. and Canadian governments submitted to the International Maritime Organization (IMO) on March 27, 2009. While the NPRM discusses the North American ECA

and presents it as part of an overall coordinated strategy, this ECA was not proposed as part of this national rulemaking. As such, it is not within the scope of this final rulemaking to amend the North American ECA proposal.

Although the ECA proposal was not developed as a Clean Air Act rulemaking, it was developed by the U.S. Government through the processes associated with amending an international agreement. EPA worked with the U.S. Coast Guard, State Department, the National Oceanic and Atmospheric Administration and other agencies to develop the analysis supporting ECA designation for U.S. coasts contained in the U.S. and Canadian submittal to IMO. In addition, we collaborated with Environment Canada and the California Air Resources Board. In developing the ECA proposal, EPA consulted with stakeholders including representatives from the shipping industry, ports, master mariners, environmental interests and representatives from state and local governments.

It should be noted that the North American ECA proposal was specifically reviewed by a technical group of the MEPC and found to fully satisfy the criteria in MARPOL Annex VI, Appendix III.[2] Among other things, the criteria include an assessment that emissions from ships are contributing to ambient concentrations of air pollution or to adverse environmental impacts, analysis of relative costs of reducing emissions from ships, and evaluation of the economic impacts on shipping engaged in international trade. The U.S. Government's proposal to IMO included a complete analysis of how each portion of the North American ECA addressed these criteria. As a result, the proposal was approved at MEPC 59, and circulated for adoption. The earliest possible adoption date is at MEPC 60, which will take place in March 2010.

It should be noted that EPA reached out to the Alaska Department of Environmental Conservation and the Hawaii Department of Health when developing the ECA proposal. In October 2008, Alaska DEC submitted a letter to EPA, providing information on the adverse impacts of shipping in Alaska and requesting ECA designation for all of the waters along Alaskan coasts.[3] In January 2009, the Hawaii DOH submitted a similar letter requesting ECA designation for the entire Hawaiian Island chain.[4]

Commenters raised a number of issues regarding the modeling and analyses supporting the need for ECA standards in Alaska and Hawaii. The comments on costs and economic impacts are discussed in more detail in Chapter 6 and 7 of this document, respectively. Comments on air quality in Alaska and other environmental impacts of an ECA are addressed in Chapter 8 of this document.

At this time, the U.S. Government has not included northwestern Alaska or western Hawaii in the proposed ECA. While these areas also experience the environmental impacts of ship emissions, further information must be gathered to properly assess these areas and

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[2] International Maritime Organization, "Report of the Marine Environment Protection Committee on its Fifty-Ninth Session," MEPC 59/24, July 27, 2009.

[3] Letter from Clint Farr, Alaska Department of Environmental Conservation, to Mike Samulski, U.S. EPA, OTAQ, "Statement in Support of EPA Considering Alaska as Part of a Marine Emission Control Area," October 10, 2008.

[4] Letter from Wilfred Nagamine, Hawaii Department of Health to Kerry Drake, U.S. EPA, Region 9, "Emission Control Area Background Information for Hawaii," January 12, 2009.

determine how ECA controls will help. We will continue to gather information on these areas, as well as other U.S. territories not included in the ECA proposal, and take action as appropriate.

2.2.3 Other Areas

What Commenters Said:

Several commenters expressed support of Mexico joining the ECA. NAACA encouraged EPA to continue negotiations with Mexico to join the U.S. and Canada in petitioning for an ECA that would cover the coasts of all three countries. TOTE commented that the wellbeing of West Coast ports in general is at stake. With Mexico not signing on to the agreement it will give their ports a significant economic advantage. The new Panama Canal will further allow vessels to bypass U.S. West Coast ports. CLIA commented that if Mexico, Bahamas and the Caribbean nations do not join the ECA, the impact in these regions can be expected to be less dramatic than for the U.S.

NAACA (0246)
AAPA (0232)
CLIA (0278)
TOTE (0289)

Our Response:

At MEPC 59, Mexico indicated its interest in joining the North American ECA. We will continue to work with Mexico, and other neighboring countries to provide support as appropriate. We are currently performing analyses to support ECA designation, if appropriate, for Puerto Rico and the U.S. Virgin Islands and will be engaging stakeholders. That outreach will include neighboring countries, shipping companies, environmental organizations, and other stakeholders.

2.3 Greenhouse Gases

What Commenters Said:

The Clean Air Task Force and associated commenters encouraged EPA to take steps to reduce emissions of NO_X and black carbon from marine diesel engines to reduce the impact of these engines on global climate change.

The Carbon War Room insisted that EPA include substantial measures in this rulemaking to reduce greenhouse gas emissions. They pointed out that EPA has an obligation to set such standards under Clean Air Act section 213.

CLIA commented that viewing and analyzing air emissions from a holistic view (including factors for greenhouse gases) will be important. Thus far, all regulatory restrictions on pollutants have been done without consideration that reduction of one pollutant increases the production of another. The U.S. needs to join with the industry in developing solutions in a comprehensive rather than piecemeal approach. (CLIA, 0278)

Friends of the Earth, Center for Biological Diversity, and Earth Justice commented that EPA should exercise its authority under Clean Air Act section 213 to set emission standards to address climate change. They argued further that EPA should prohibit the use of residual fuel in marine vessels under Clean Air Act section 211. (Friends of the Earth and associated commenters, 0320)

South Coast AQMD urged EPA to consider whether fuel efficiency and other actions U.S. EPA is considering to control greenhouse gas emissions from vessels could produce nitrogen oxide emissions co-benefits earlier than IMO standards. (South Coast AQMD, 0309)

The American Lung Association urged EPA to look more closely at the additional benefits of reduced global warming effects by considering a direct PM emission standard.

Our Response:

EPA recognizes the contribution of all mobile sources, including marine vessels, to national greenhouse gas inventories. In our recently-published NPRM for light-duty vehicles, we note that we are currently evaluating controls for motor vehicles other than those covered by that proposal and are reviewing seven petitions submitted by various States and organizations requesting that we use our CAA authority to take action to reduce greenhouse gas emissions from ocean-going vessels (74 FR 49507, Septmber 28, 2009; see also http://www.epa.gov/otaq/climate/regulations.htm).

Our recently completed final rule will require engine manufacturers to report their emission levels of certain greenhouse gases (74 FR 56260, October 30, 2009). We are also working with ports, engine manufacturers and other stakeholders to encourage voluntary measures that would reduce emissions of GHG and criteria pollutants.

EPA is also a member of the U.S. delegation to the International Maritime Organization and is participating in discussions with respect to international standards for greenhouse gas emissions.

CHAPTER 3: Engine Standards

What We Proposed:

The comments in this section generally correspond to Section III of the preamble to the proposed rule, where we describe the engine standards for nitrogen oxides (NO_X), hydrocarbons (HC) and carbon monoxide (CO), as well as our approach to address particulate matter (PM) emissions. Note that some of the comments in this section also correspond to Section VI.A of the preamble, where we describe the PM testing requirements. The applicable regulatory provisions for these requirements are in 40 CFR part 1042.

The RIA describes the technical feasibility of engine standards in Chapter 4. Although issues related to feasibility are discussed here, that RIA chapter includes a much more thorough discussion of our basis for concluding the standards being finalized are appropriate under the Clean Air Act.

See Chapter 4 of this document for a discussion of comments related to the fuel standards. See Chapter 2 of this document for responses to comments on pollutants not directly regulated in this action.

3.1 Tier 2 Duty-Cycle NO_X Standards

What Commenters Said:

We received a number of comments on the feasibility of Tier 2 NO_X standards. These comments were focused on the technological aspects of our analysis and/or the whether the amount of lead time provided was appropriate. These comments are addressed together since the technological feasibility and lead time are so closely related.

Several commenters expressed general support for the Tier 2 NO_X standards. (ALA, ATS, CATF, CCP, NESCAUM). However, the Coalition for a Safe Environment asserted that the Tier 2 standard does not appear to go beyond current practice. They also stated that EPA should explain how the claimed reductions will be achieved and all the available technologies to achieve them. One commenter urged EPA to adopt earlier compliance deadlines for new engines, phase the standards in early for areas with the worst pollution.

Our Response:

As described in the RIA, we believe that the Tier 2 NO_X standards will give the greatest degree of emission control achievable considering compliance costs, lead time, and other relevant factors. We project that these standards will require manufacturers to incorporate in-cylinder emission control technologies such as electronically-controlled high-pressure common-rail fuel systems, turbocharger optimization, compression-ratio changes, and electronically-controlled exhaust valves. While these technologies are in use for many land-based engines and some marine engines, applying them to all new Category 3 engines cannot be required before 2011. It is important to emphasize that the Tier 2 NO_X requirements are a transitional aspect of

this program. Manufacturers will also be working to develop technologies to meet the longer term Tier 3 standards at the same time as they will be working towards the Tier 2 standards. Finalizing more stringent Tier 2 standards or applying them earlier would likely hinder efforts to meet the Tier 3 standards.

Given the very low sales volumes, an earlier phase-in of standards for Category 3 engines by sales fraction would not be practical. Similarly, the standards cannot be phased-in geographically because ships are generally not inherently limited to specific areas. In addition a phase-in would likely have disparate impacts on the manufacturers.

3.2 Tier 3 Duty-Cycle NO_X Standard

3.2.1 Feasibility and Lead Time of the Tier 3 NO_X Standard

What Commenters Said:

MECA provided extensive comments supporting the feasibility of the Tier 3 NO_X standard. Several other commenters supported the proposed Tier 3 standards as feasible without additional information. To support its belief that EPA should adopt more stringent Tier 3 standards, NESCAUM noted that SCR have been used on marine vessels for years. They also noted that in one case SCR was able to reduce NO_X emissions by 95 percent in cruise mode.

Manufacturers and operators generally supported the 2016 compliance date for the Tier 3 standards as challenging but feasible. They did not believe the standards could be met earlier. Others supported the proposal to some extent, but suggested EPA consider implementing the standards sooner. SCAQMD urged EPA to also consider phasing in the standards early for areas with the worst pollution.

The Ohio Environmental Council reminded us of the statutory provisions describing how EPA standards, with respect to both stringency and lead time, should be technology-forcing and not technology-following.

Our Response:

While the Tier 2 standards will achieve modest reductions quickly, the Tier 3 standards are projected to achieve reductions of about 80 percent from the current Tier 1 standards. As explained in our discussions of regulatory alternatives, we evaluated the possibility of requiring the Tier 3 limits on an earlier schedule than 2016. However, we found that a schedule requiring Tier 3 limits prior to 2016 had significant feasibility issues. Under the schedule being finalized, manufacturers of Category 3 engines will have about the same amount of lead time allowed manufacturers for smaller marine engines and locomotives. Commenters arguing for a more stringent NO_X standard did not address important issues related to in-use compliance throughout the useful life across the duty cycle. To comply with the Tier 3 standards manufacturers will need to design the SCR system to achieve greater than 80 percent reductions at higher power modes to offset lower efficiency at the 25 percent power mode. The will also need to include a compliance margin to address in-use deterioration and production variability. The final standards are consistent with the statutory direction to set standards requiring the greatest degree of emission reduction that is achievable in the given time frame.

As noted earlier, phasing in standards for Category 3 engines by sales fraction would not be practical. Similarly, the standards cannot be phased-in geographically because ships are generally not inherently limited to specific areas. In addition a phase-in would likely have disparate impacts on the manufacturers.

3.2.2 Alternative NO_X Controls

What Commenters Said:

Several commenters stated that the Tier 3 emission standards can be met with technologies other than SCR and that EPA should allow that. Seaworthy stated that they can be met using exhaust scrubbers and exhaust gas recirculation systems. EGCSA suggested that they could also be met using a combination of internal and external measures such as fuel emulsions and exhaust gas re-circulation and/or NO_X scrubbing. API emphasized that Regulation 4 would not force the allowance of any scrubber technology that does not provide an equal or better result than Annex VI demands; only those technologies that are at least as effective in terms of emissions reductions as that required by this Annex.

Our Response:

The NO_X program is a performance requirement. This is also true for our Clean Air Act program. Thus manufacturers are not precluded by our regulations from using these technologies.

3.3 Other Standards

3.3.1 HC and CO Standards

What Commenters Said:

(A) HC and CO Standards Are Achievable.

EMA stated that the proposed HC and CO standards should generally be achievable in combination with the ECA-based NO_X standards. However, they also expressed a preference for full alignment with MARPOL Annex VI requirements.

The Clean Air Task Force supported the proposed HC and CO standards as a way of preventing increased emissions in the future. They also anticipated an additional benefit of limiting CO_2 and PM emissions.

(B) HC and CO Standards Are Inconsistent with Annex VI.

The American Maritime Congress and associated organizations objected to adoption of HC and CO standards for engines on U.S.-flag vessels only, arguing that this represented an unfair burden that would not be applied to foreign-flag vessels. EMA and EGCSA also expressed a preference for full alignment with MARPOL Annex VI requirements. They stated that "in the absence of data to quantify typical current emissions and to quantify the likely benefits of the proposed targets it is likely that this requirement will drive away shipbuilding

from the USA (with the exception of vessels built to the Jones Act)." EGCSA also recommended that EPA work with EGCSA and its members to undertake trials to quantify typical emissions of CO & HC, their environmental and human health impacts, and the options for technological solutions to treat and remove these gases.

(C) HC Standard Should be Replaced by VOC Standards for LNG Engines.

EMA and Euromot expressed concern with respect to the metric for measuring and controlling HC emissions from gas-fueled (e.g., LNG -fueled) marine engines. They stated that EPA should designate volatile organic compounds ("VOC"), with the additional exclusion of formaldehyde from the measurement of VOC, as the relevant HC control parameter. EMA argued that using VOC would "properly exclude methane and ethane emissions from gas-fueled engines" based on their low photochemical reactivity. It would also be fully consistent with EPA's recently promulgated new source performance standards ("NSPS") for stationary SI engines. (See 40 CFR 60, Subpart JJJJ.)

Our Response:

We continue to believe that the HC and CO standards being adopted (2.0 g/kW-hr and 5.0 g/kW-hr, respectively) are appropriate under the Clean Air Act. Not finalizing these standards in order to achieve alignment with MARPOL Annex VI requirements would not be consistent with the requirements of the Act. Emission control technologies for C3 marine engines have been concentrated on reducing NO_X and PM emissions. These emission standards will prevent increases in emissions of HC and CO that might otherwise occur as a result of use of certain technologies for controlling NO_X, such as those that significantly degrade combustion efficiency. We believe the levels of the emission standards involve some burden to measure and report emissions, but these standards are not expected to involve engineering or development resources to redesign engines for improving control of HC and CO emissions. As such, we believe there should be no concern that the burden associated with complying with the HC and CO standards will pose a competitive disadvantage for U.S.-flag vessels. Also, given the level of these standards, we do not believe that extensive additional study of these emissions by EPA is necessary. Nevertheless, we would welcome such information if EGCSA members wish to share it.

We are applying emission standards to natural gas engines and we are adopting the HC and CO standards as proposed. We already regulate Category 3 marine engines fueled by natural gas under the Tier 1 standards (see 40 CFR part 94). While natural gas engines have relatively high emission rates of methane, methane has a very low reactivity with respect to ozone formation. For this reason, the final approach continues the practice of applying a nonmethane hydrocarbon standard to control HC emissions from natural gas-fueled engines. We do not agree that we should adopt special VOC standards for Category 3 engines that would allow manufacturers to also exclude ethane. (Note that since formaldehyde is not detected by our hydrocarbon measurement procedure, both NMHC and VOC standards effectively exclude it.) While we agree that ethane has a lower reactivity than most other hydrocarbon species, we do not believe it is present in large enough concentrations to justify the additional measurement complexity. Since the HC standard is in place largely to prevent emission increases, we believe manufacturers will be able to comply with the standard, including measurement of ethane, without the need for emission controls beyond that which is described in the Regulatory Impact Analysis. The only reason we can see that there would be a significant difference between

NMHC and VOC measurements would be for testing using fuel with high ethane content. However, §1065.715 specifies that natural gas test fuels may not contain more than 5.5 percent ethane. Levels below this limit should not cause problems for manufacturers.

We note for completeness that the HC and CO standards are not expected to reduce CO_2 or PM emissions. Manufacturers are not expected to incorporate engine controls to control HC or CO emissions in a way that would improve the engine's efficiency (for reducing CO_2 emissions) or substantially change the combustion characteristics (to reduce PM formation). Nevertheless, the HC and CO standards may prevent manufacturers from relying on certain NO_X emission controls that may have resulted in increased CO_2 or PM emissions.

3.3.2 Mode Caps

What Commenters Said:

Euromot requested the EPA clarify that the mode caps apply only for Tier 3.

Our Response:

Euromot is correct that the mode caps only apply for NO_X emissions.

3.3.3 Particulate Matter (PM) Standard

(A) EPA Must Promulgate a PM Standard

What Commenters Said:

Several commenters expressed support for the fuel sulfur standards and acknowledged that in addition to SO_X reductions, the use of lower sulfur fuel would result in PM reductions as well. However, commenters also noted that we did not propose PM emission standards for Category 3 marine engines. We received several comments requesting that we establish PM standards that go beyond those associated with switching to low sulfur fuel, either in this final rule or in a follow-up action.

While the proposed rule is expected to reduce 85 percent of PM emissions, NESCAUM and NAACA commented that the remaining 15 percent will represent a substantial amount of PM which is of significant concern to states and local areas. NESCAUM commented that, even with the fuel standards in place, the remaining PM emissions from ships will exacerbate health issues associated with PM, such as cardiovascular morbidity and mortality and an increased number and severity of asthma attacks. ALA and EDF commented that Category 3 engines are responsible for a significant amount of diesel PM emissions. The Port of Long Beach commented that vessels are the greatest driver to local health risks from port sources, and PM emissions from main engines are a significant contributor. The Port of Los Angeles commented that additional control of particulate matter is necessary to continue to reduce adverse health effects from this source. NRDC commented that technology forcing PM standards, beyond what would be gained from a 0.1 percent fuel sulfur standard, would be hugely beneficial for human health and would be a major step towards helping Southern California attain EPA's national air quality standards. SCAQMD commented that while significant particulate emission reductions

will result from IMO fuel sulfur limits, they will not be sufficient to implement the SIP which assumes 30 percent control in 2014 and 50 percent in 2023. Moreover, particulate emissions from ocean-going vessels are expected to be a significant contributor to local cancer risks near ports in coming years. Even with 1,000 ppm sulfur fuel, emissions from ocean-going vessels are expected to be the largest remaining contributor to local cancer risks near Southern California ports by 2020, and, given expected cargo growth, a key hurdle in achieving state and local polices to reduce cancer risks from DPM by 85% by that year. CATF commented that additional PM control is critically important in view of the increasingly strong evidence of the enormous human health, environmental and climate impact of emissions from these engines. Such emission reductions will also be critical in ensuring compliance with National Ambient Air Quality Standards in U.S. coastal areas and ports.

Several environmental organizations commented that while they support EPA's proposal of initial standards for SO_X emissions from Category 3 ships effective in 2015 as a good first step, the Agency must establish specific PM standards and tighter SO_X standards in the future. Specifically, they urged EPA to commit now to conducting an additional rulemaking within the next two years that would establish emissions standards for directly emitted $PM_{2.5}$ (including black carbon), as well "Tier 2" sulfur in fuel standards, that approach in stringency the levels set by EPA in its recent highway heavy-duty engine rule and its non-road diesel rule, for effect in the 2015—2020 time frame. They commented that while they support EPA's proposal to require measurement of PM emissions from ships, they do not believe that such a requirement should delay the promulgation of PM emissions standards.

MECA urged EPA to take a leadership position of setting a timetable for further reductions in the fuel sulfur level. MECA also expressed support for the Agency's plans to evaluate the impacts of its proposed rulemaking on PM emissions, and to assess the feasibility of further PM reductions from ocean-going vessels and propose a PM standard if appropriate.

NESCAUM commented that the Agency should strengthen its commitment by setting a date certain by which it will complete its evaluation of the need for further PM reductions. ALA and EDF commented that EPA should expeditiously examine and address direct PM emissions from Category 3 ships to protect human health and the environment and take action addressing direct PM emissions in this final rule or in an immediate rulemaking that follows this action. NAACA commented that the agency should pursue future efforts to ameliorate the remaining PM emissions.

The ports of Los Angeles and Long Beach commented that EPA should take further action by working with IMO to establish PM standards for category 3 engines or to otherwise develop strategies to control PM beyond lower sulfur fuel. The Port of Long Beach noted that while it important to include PM limits in this rule-making, the national rule will only apply to U.S. flagged vessels.

CATF and SCAQMD commented that technology forcing PM emissions reduction requirements for large new marine diesel engines are legally required under Section 213 of the CAA. SCAQMD commented that while achieving additional PM reductions beyond the benefits of low sulfur fuel may pose technical challenges, the courts have held that section 213 is a "technology-forcing" statute. Congress intended EPA to press for development and application of improved technology rather than be limited by what exists today. The proposed rule and IMO

standards, however, make no attempt to push PM control technology beyond the benefits of fuel sulfur limits . EPA has long justified its earlier failure to require any reductions of Category 3 engines by the promise, respected by the courts, that EPA would in the present rulemaking adopt requirements that fully satisfy the Clean Air Act's mandate. Unfortunately, the proposed rules do not achieve the "greatest degree of reduction achievable through the application of technology which the Administrator determines will be available . . ." as specified in section 213. Nor do the rules require such reductions "at the earliest possible date," as also required by Section 213.

NESCAUM (0356)
ALA+EDF (0366, 0227)
NAACA (0246)
NRDC (0227)
SCAQMD (0309)
CATF (0264)
Ohio Environmental Council et. al. (0314)
Port of Los Angeles (0232)
Port of Long Beach (0232)
MECA (0319)

(B) Technological Feasibility of Further PM Reductions

MECA commented that there are technologies to reduce PM emissions from new and in-use marine diesel engines, such as diesel particulate filters (DPFs) and diesel oxidation catalysts (DOCs), are commercially available today. These catalyst-based emission control technologies have already been installed on millions of new light-duty and heavy-duty vehicles and equipment and as retrofit technology on hundreds of thousands of existing on-road and off-road diesel engines worldwide to provide significant reductions in PM emissions, as well as reductions in hydrocarbon (including toxic HCs, like poly-aromatic HCs) and carbon monoxide (CO) emissions.

MECA commented that the successful application of these catalyst-based PM reduction technologies is dependent on the use of low or ultra-low sulfur diesel fuel since sulfur levels in the fuel can both deteriorate catalyst performance and contribute to PM emissions through the formation of sulfate emissions across the catalyst. This is why EPA’s recent final rulemakings covering new highway, off-road, locomotive, and smaller marine diesel engines include or take advantage of the mandated use of ultra-low sulfur diesel fuel (15 ppm S max.) to facilitate the use of sulfur-sensitive, catalyst-based emission control technologies like DPFs and DOCs, as well as NO_X adsorber catalysts. Similarly, for large ocean-going vessels, the application of catalyst-based DPFs and DOCs for PM reductions would not be practical until fuel sulfur levels are reduced to 500 ppm S, or in some cases even 50 ppm S, or lower. In this NPRM, EPA has only proposed reducing fuel sulfur levels to a minimum of 1,000 ppm for these large marine diesel engines. MECA supports this 1,000 ppm sulfur requirement, but urges EPA to take a leadership position of setting a timetable for further reductions in fuel sulfur to the ULSD level. This would extend catalyst durability (including SCR catalyst durability) and enable the use of DOC and DPF technologies for the reduction of PM.

CATF commented that the reduction of the sulfur content of diesel fuel is critical to utilization of exhaust control technology that will produce more substantial PM reductions. CATF commented that U.S. production and sale of ultra-low sulfur diesel fuel is presently or

will by 2012 be required for all land-based motor vehicles, as well as locomotives and inland and coastal marine diesel engines. Because USLD will be widely available in the U.S. within that time frame, we also expect that advanced technologies that require the use of such fuel will then be feasible for marine engines and thus will then represent the greatest degree of achievable emission reduction under Section 213(a) of the Act.

CATF also commented that available data on PM emissions from ships suggests emission rates of 0.25 to 0.3 g/kWh as an average, using low sulfur fuel, but significantly higher rates using residual fuel, primarily due to sulfate particulate. Current on-highway heavy-duty diesel engines have reduced PM levels to 0.01 g/kwh (combined with low NO_X levels), and nonroad engines will reduce PM levels to between 0.01 to 0.03 g/kwh by 2010. EPA's recent regulations for Category 1 and 2 marine engines would require PM emissions to be reduced to 0.03 to 0.19 g/bhp-hr. We believe that similar levels are feasible for Category 3 marine diesel engines, although special requirements may be appropriate for slow speed Category 3 diesels. We note that such standards would likely require the use of diesel particulate filters that would substantially reduce emissions of non-sulfate constituents of PM, such as black carbon, which as noted earlier, is not only harmful to human health and the environment, but is a potent climate forcing agent as well.

CATF noted that particulate filter controls for land-based diesels have typically required the use of a catalyst due to the low exhaust temperature in some applications; in order to achieve effective operation of these catalytic filters, ultra low sulfur diesel fuel is required. However, Category 3 marine engines typically operate at higher temperatures than land-based diesels, and thus particulate filters may be effective for use on such engines without the need of a catalyst. As a result, ULSD may not be required for effective particulate control, and particulate filter technology can be developed for large marine diesels operating on low sulfur distillate fuel.

The World Shipping Council commented that the use of 15 ppm sulfur fuel in large bore marine engines would exacerbate lubricity and other technical issues with operation of these engines. TOTE stated that the use of ultra-low sulfur fuel would require rebuilding its engines which is currently not recommended.

EGCSA stated that it does not agree with the claim that PM controls are not feasible for engines using residual fuels. EGCSA also contested the claim that "cleaner distillate" is the most effective means to achieve significant PM and NO_X reduction for all marine diesel engines, not just Category 3 engines. Test work indicates that in fact exhaust gas after treatment is capable of PM levels lower than can be achieved by an ultra low sulfur diesel fuel.

MECA (0319)
CATF, et.al., (0264)
EGCSA (0305)
WSC (0325)
TOTE (0289)

(C) Prevent Trade-offs Between NO_X and PM

Several commeters expressed concern that there is the potential for carbonaceous PM to increase due to a NO_X/PM tradeoff. NESCAUM commented that, because of the potential for

carbonaceous PM to increase due to a NO_X/PM tradeoff, and because of the lack of certainty that anticipated reductions in organic PM will actually occur, the Agency should strengthen its commitment by setting a date certain by which it will complete its evaluation.

NESCAUM (0356)
NAACA (0246)
NRDC (0227)
CATF (0264)

(D) Other PM comments

The Clean Air Task Force urged EPA to amend its requirement to measure PM emissions to also require speciation of the PM to determine the emission rate of black carbon and other constituents.

Our Response:

Even though the sulfur limit is much lower than current levels, it is not clear if this fuel sulfur level would be low enough to allow Category 3 engines to be equipped with the catalytic PM filters similar to those being used by trucks today. If we were to require technology that needs lower sulfur fuel, such as 15 ppm, ship operators would need to have access to this fuel around the world and at this time, it is not clear if 15 ppm sulfur fuel could be made available globally. Operating on higher sulfur fuel, such as for outside of our waters, could otherwise result in damage to the PM control equipment. Also, further evaluation is necessary to determine if any issues would arise from operating Category 3 marine engines on ultra-low sulfur fuel. In any case, the 1,000 ppm sulfur fuel requirement alone will eliminate 85 percent of PM emissions from ships operating in ECAs. The final standards are consistent with the statutory direction to set standards requiring the greatest degree of emission reduction that is achievable in the given time frame.

To further our understanding of PM emissions from ships, we are requiring engine manufacturers to measure and report PM emissions even though we are not finalizing a PM standard. The information gathered will help support our efforts as we continue to evaluate the feasibility of achieving further PM reductions. It will also help us to better characterize the PM emission rates associated with operating Category 3 engines on distillate fuel and will also allow further evaluation of the PM reduction potential of exhaust gas scrubbers. If we determine that further PM reductions are feasible or that a specific PM limit is necessary to ensure anticipated reductions in PM emissions from ships, we may propose PM standards for Category 3 engines in the future.

We are not establishing new engine standards for PM or SO_X emissions. We intend to rely instead on the use of cleaner fuels, or equivalent approaches. SO_X emissions and the majority of the direct PM emissions from Category 3 marine engines operated on residual fuels are a direct result of fuel quality, most notably the sulfur in the fuel. Other components of residual fuel, such as ash and heavy metals, also contribute directly to PM.

Using cleaner distillate fuel is an effective means to achieve significant PM and SO_X reductions for Category 3 engines. We are finalizing requirements to substantially reduce the

sulfur content of fuel purchased in the U.S. for use in an ECA. This complements Annex VI which requires that fuels used in ECAs around the world have sulfur levels no higher than 1,000 ppm. This sulfur limit is expected to necessitate the use of distillate fuel which will result not only in reductions in sulfate PM emissions, but also reductions in organic PM and metallic ash particles in the exhaust. In contrast, any potential increase in carbonaceous PM due to NO_X emission control technology is relatively small.

We are not setting a date by which we will complete an evaluation of PM emissions. We cannot accurately predict the rate at which we will gather information from our requirement to measure and report PM emissions. Sales of Category 3 engines for U.S.-flagged vessels are unpredictable, but always very low. Moreover, since PM emissions will be reported by family and we allow manufacturers to recertify using carryover data, the number of PM test results we receive each year will be often be less than the total number of Category 3 engines sold in that year. To the extent we revisit the issue of further PM emissions control, we will consider the impact of potential NO_X/PM tradeoffs in addition to other issues raised by commenters.

While we recognize that speciated measurements of PM emissions would be valuable, we are not finalizing such a requirement at this time. Requiring full speciation of PM emissions would add significantly to cost and complexity of the measurement. Moreover, EPA does not require speciated PM measurements for any other nonroad engine category.

CHAPTER 4: Fuel Standard and SO_2 Controls

What We Proposed:

The comments in this section generally correspond to Section IV of the preamble to the proposed rule, where we describe the changes to our diesel fuel program, and Section V.C where we discuss equivalent approaches to meeting the fuel sulfur limits. They also correspond to Sections III.B and VI.A, where we describe how our program addresses Particulate Matter (PM) emissions. The technical feasibility of our fuel program is described in Chapter 4 of the Regulatory Impact Analysis.

Please see Chapters 2 and 10 of this Summary and Analysis of Comments document for a discussion of fuel issues related to the North American Emission Control Area and the Great Lakes, respectively.

4.1 Amendments to the Diesel Fuel Sulfur Program

4.1.1 1,000 ppm Fuel Sulfur Standard

4.1.1.1 General

What Commenters Said:

Support

A number of commenters, in both written comments and hearing testimony, expressed support for our proposal to allow for the production, distribution, and sale of 1,000 ppm sulfur fuel for use in ECAs. Commenters stated that they generally supported the use of lower sulfur fuels in Category 3 (C3) engines, harmonization with MARPOL Annex VI, and/or the allowance for U.S. refiners to produce 1,000 ppm sulfur fuel.

The National Association of Clean Air Agencies (NACAA) and American Thoracic Society commented that they support the proposal to include the ECA fuel standard of 1,000 ppm fuel by 2016 for C3 vessels.

The Marsh Area Regional Council, Earth Day Coalition, Ohio Environmental Council, the Ohio League of Conservation Voters, Johnson Matthey, and the Manufacturers of Emission Controls Association (MECA) commented that they support the proposed 1,000 ppm sulfur standard; however, they also suggested several conditions to this support, including fuel quality and further reductions, as noted in section 4.3 below.

The World Shipping Council (WSC)and the Pacific Merchant Shipping Association (PMSA) commented that they fully support the proposal to codify and adopt the Annex VI sulfur standards, and expressed support for maintaining consistency with the requirements of Annex VI. The commenters further stated that they support the revision of the 40 CFR Part 80 fuel regulations to allow for the sale and use of 1,000 ppm fuels, as the commenters believe that failure to provide these fuels would effectively force the use of 15 ppm fuel in ocean-going vessels—potentially leading to technical issues (e.g., lubricity, viscosity, etc.) with operation of these engines with ultra-low sulfur limits.

The American Lung Association (ALA) and the Environmental Defense Fund (EDF) commented that they strongly support EPA's proposal to mirror the fuel standards required in ECAs, and noted that without this rulemaking, refiners would not be able to produce fuel with a sulfur level of 1,000 ppm.

The Engine Manufacturers Association (EMA) commented that it fully supports the strategy of pursuing harmonized international emission limits for C3 engines, and noted that otherwise, a distinct EPA program for C3 marine engines would result in ensuring that no C3 engines/vessels would be certified or registered under U.S. regulations which would disadvantage domestic engine manufacturers and shipbuilders. The commenter further stated that it supports the proposal requiring the use of fuel with a maximum sulfur content of 1,000 ppm or an IMO-certified scrubber system.

The Independent Fuel Terminal Operators Association (IFTOA) commented that it commends EPA for the proposal to amend the diesel program to allow for 1,000 ppm sulfur fuel and supports its adoption.

The Texas Commission on Environmental Quality (TCEQ) commented that it supports the 1,000 ppm standard.

Matson Navigation Company commented that it supports the revision of the diesel fuel program to allow for the sale and use of 1,000 ppm sulfur fuels in ocean-going vessels (OGVs).

The Pacific Merchant Shipping Association (PMSA) commented that it strongly supports the revision of the diesel fuel program to require the use of 1,000 ppm sulfur fuels for OGVs.

Clean Air Task Force (CATF), et al commented that they support the proposal to establish enforceable limits on the sulfur content of fuel burned by C3 engines in OGVs.

Maersk Inc. commented that it supports the proposal to ensure availability of fuels required for use inside the ECA.

Oppose

The Canadian Shipowners Association expressed the concern that no blended fuels currently meet a 1,000 ppm sulfur limit. The commenter also raised concerns about pricing of 1,000 ppm fuel. Murphy Oil USA commented that there is no cost-effective technology that would enable the commenter to produce a #6 fuel oil at 1,000 ppm sulfur after 2014. The commenter noted that at that time, it would need to supply vessels with straight diesel fuel, which would be a significant increase in costs for its customers.

Our Response:

As discussed in Section IV of the preamble to the proposed rule, we believe that because of the Annex VI limits on the sulfur content of fuel used in ECAs, the existing diesel fuel sulfur program should be revised to allow for the production, distribution, purchase, and use of 1,000 ppm sulfur fuel oil for use in C3 marine vessels. Therefore, we are finalizing the new 1,000 ppm sulfur category for fuel produced and purchased for use in C3 marine vessels (called "ECA marine fuel") to harmonize EPA's diesel sulfur program with the requirements of Annex VI.

Since the requirements for 1,000 ppm sulfur fuel will apply to any ECA established around the world, this fuel will likely be produced by refiners in other countries. Under our diesel fuel program prior to this final rule, fuel meeting a 1,000 ppm sulfur level would likely be distillate fuel, and thus subject to the 15 ppm NRLM sulfur limit in 2014 and later. If EPA were to require that fuel produced, distributed, and sold for use for Category 3 vessels in the U.S. meet the 15 ppm sulfur standard after 2014, we believe that Category 3 vessel owners would simply purchase 1,000 ppm sulfur fuel elsewhere to be used here in the North American ECA. This could be an extremely inefficient process for ship owners, and would mean a loss of sales for U.S. refiners of fuel that these Category 3 vessel owners purchase. These impacts would add to the costs and burdens of the program with no corresponding environmental benefit. Therefore, we believe that it is important to harmonize our standards with Annex VI by allowing U.S. refiners and importers to produce 1,000 ppm sulfur fuel for use by Category 3 vessels.

As discussed in the RIA and in section IV.C of the preamble to this final rule, we agree that the fuel sulfur limit of 1,000 will likely lead to the use of distillate fuel. The cost of switching from residual to distillate fuel is discussed in Chapter 6 of this document. While there may not currently be blended fuels available at the 1,000 ppm sulfur level, we do believe that this sulfur limit is achievable (whether by blending or refining). Please see Chapter 4 of the RIA for a detailed discussion on feasibility.

4.1.1.2 Proposed Prohibition on Use of Fuel Greater than 1,000 ppm

What Commenters Said:

Several commenters expressed concern that the proposed prohibition on U.S. production and sale of fuel greater than 1,000 ppm sulfur for use in ECAs would conflict with the flexibility offered under the ECA standards to use abatement technology in lieu of lower sulfur distillate fuels. These comments are discussed below in section 4.6 of this Summary and Analysis of Comments document. However, a few commenters did state that they support the proposal to prohibit the production and sale of marine fuel oil above 1,000 ppm sulfur for use in any marine diesel vessel operating within U.S. waters.

The Exhaust Gas Cleaning Systems Association (EGCSA) commented that the prohibition of the import, manufacture, and sale of marine fuels with sulfur content greater than 1,000 ppm will have a deleterious impact on a significant area of marine commerce in the U.S. The commenter stated that it believes that a prohibition on the sale of these fuels will result in the majority of internationally trading vessels purchasing bunkers outside the U.S. EGCSA further commented that such a prohibition will not provide any significant support to the enforcement of the ECA requirements. The commenter recommended that EPA fully align with MARPOL Annex VI and allow the import, manufacture, and sale of all types of marine diesel and residual fuels.

CLIA and Chamber of Shipping of America stated that they believe higher sulfur fuel should also be permitted for sale in the U.S. for use outside the ECA.

PMSA commented that it believes there needs to be some flexibility in the rule, and raised concern about the prohibition of production and sale of higher sulfur fuels. The commenter stated that we need to ensure that appropriate fuels remain available for steam propulsion vessels and boilers that are not capable of using distillate fuels. PMSA further

commented that the rigid fuel requirements could have the unintended consequence of forcing these vessels out of service or to use unsafe fuels if they cannot obtain the HFOs they require.

The Great Lakes Maritime Task Force (GLMTF) commented at length that the NPRM does not contain material, data, or findings necessary under Clean Air Act (CAA) section 211(c) to ban the use of residual fuels on vessels operating on the Great Lakes. The commenter also commented that EPA did not adequately explain the health basis or economic effects for choosing to ban fuels above 1,000 ppm sulfur.

The International Association of Drilling Contractors (IADC) commented that, with the proposed elimination of fuel above 1,000 ppm sulfur, all U.S. fuel for marine vessels in domestic service would then met or exceed the requirements established under MARPOL Annex VI. The commenter suggested that, with the timely approval of the [North American] ECA and changes to the diesel fuel program, EPA should prepare a notice for submission to IMO stating that the requirements of regulation 18 (relating to the bunker delivery note and representative fuel sample) will not be imposed on vessels in domestic service as the U.S. diesel fuel program ensures that fuel supplied to such vessels meets or exceeds the Annex VI requirements. (The commenter also noted that corresponding changes to 40 CFR 1043.60 and other affected sections would be required.)

Our Response:

This rulemaking does not affect the sale of high sulfur residual fuel for use outside of ECAs (or by a vessel using an equivalent approach, as discussed below in section 4.6). In addition, higher sulfur residual fuel may be sold for use in any steamships not subject to the fuel sulfur limits (see Chapter 10 of this Summary and Analysis of Comments document). Such fuel must be clearly designated on PTDs, and the use of this fuel in an ECA associated areas (on a vessel not equipped with a scrubber, or other equivalent technology) could result in an enforcement action.

With regard to the comment about EPA submitting a notice to IMO regarding bunker delivery notes and sampling, we note that vessels that operate only domestically (as specified in §1043.10(a)(2)) and comply fully with the fuel requirements of 40 CFR part 80 are deemed to comply fully with the requirements of the Annex (the operating and recordkeeping requirements of §§1043.60 and 1043.70).

EPA confirms that it is finalizing the revisions to the fuel sulfur program under 211(c)(1)(A). As explained in the proposed rule, EPA has previously examined the how emissions products of sulfur in nonroad, locomotive, and marine diesel fuel used in these engines contribute to PM and SO_X pollution. See 69 FR 38958. The proposed rule also provided detailed information demonstrating that emissions of these pollutants cause or contribute to ambient levels of air pollution that endanger public health and welfare. Control of sulfur to 1,000 ppm for fuel used in C3 vessels in the ECA and ECA associated areas will lead to significant, cost-effective reductions in emissions of these pollutants, with the benefits to public health and welfare significantly outweighing the costs.

EPA also considered "other technologically or economically feasible means of achieving emission standards under section [202 of the Act]" as required by 211(c)(2)(A). This provision has been interpreted as requiring consideration of establishing emission standards under section

202 prior to establishing controls or prohibitions on fuels or fuel additives under section 211(c)(1)(A). See *Ethyl Corp. v. EPA*, 541 F.2d. 1, 31-32 (D.C. Cir. 1976). In *Ethyl*, the court stated that section 211(c)(2)(A) calls for good faith consideration of the evidence and options, not for mandatory deference to regulation under section 202 compared to fuel controls. *Id*. at 32, n.66. As discussed in Chapter 3 of this document, we are not setting PM standards at this time and anticipate that the majority of direct PM emissions from C3 marine vessels can be reduced through lower fuel sulfur standards. Further, as discussed below, we also note that the rule provides for the sale of higher sulfur fuel if a vessel employs technology that achieves equivalent reductions in PM.

EPA disagrees with GLMTF's comment that it has not satisfied these requirements of the CAA. GLMTF argues that EPA's analysis fails to consider that Great Lakes' vessel account for a relatively small percentage of total emissions from C3 vessels. Section 211(c)(1)(A) of the CAA requires that before regulating a fuel or fuel additive the Administrator must determine that, "any emission product of such fuel or fuel additive causes, or contributes, to air pollution which may reasonably be anticipated to endanger public health or welfare." The focus of EPA's required analysis under 211(c) is the emission product of a fuel or fuel additive. Accordingly, as noted above, in this rule EPA provided information on the health effects resulting from emission products (PM and SO_X) from marine diesel fuel. EPA's analysis clearly shows that emissions of PM and SO_X cause or contribute to air pollution that endangers public health and welfare. Importantly, EPA's finding is based on the nationwide effects of emissions because the rule applies to C3 vessels nationwide. EPA's analysis is not limited to the Great Lakes because EPA's rule is not limited to the Great Lakes.

GLMTF does not dispute this finding but instead argues that EPA had to make a finding that vessels in the Great Lakes cause or contribute to the endangerment of public health. However, the CAA does not require that EPA parse its analysis to this level- that is, EPA is not required to make separate findings for every subsection of an industry or every specific region of the country. Instead, the CAA requires that EPA find the emission product of a "fuel or fuel additive causes, or contributes," to air pollution that may endanger public health or welfare. The focus in 211(c)(1)(A) is on the fuel or fuel additive, rather than on a particular industry that uses the fuel or fuel additive. EPA's obligation is to make a finding based on the scope of its rule rather than on a subset of the rule. Therefore, EPA has made the required finding under 211(c)(1)(A) based on its analysis of PM and SO_X emissions resulting from use of marine diesel fuel nationwide.

GLMTF also argues that significant "mode shifting" (i.e., transport of goods via modes of transportation other than rail) will actually result in an increase in emissions. EPA has provided a detailed response to this issue in Chapter 10 of this Summary and Analysis of Comments document. In sum, while our cost analysis shows that operating costs will increase for all vessels, including Great Lakes vessels, this increase will not be so high as to cause the removal of vessels from the U.S. Great Lakes fleet or the shift of significant amounts of cargo from ships to land-based transportation in the Great Lakes area.

Finally, GLMTF argues that EPA's regulation is not adequately tailored, pointing specifically in several places to steamships in the Great Lakes. As noted above, the CAA does not require EPA to determine that particular industries, or subsections of industry, emit pollutants in levels that cause or contribute to the endangerment of public health or welfare.

That said, EPA also notes that the final rule exempts steamships that operate in the Great Lakes from the fuel sulfur requirements. See 40 CFR 1043.95.

4.1.2 Compliance and Implementation

4.1.2.1 Elimination of 500 ppm Sulfur Fuel Standard After 2014

What Commenters Said:

Euromot commented that, due to environmental reasons, it does not see any need for actively phasing out the 500 ppm locomotive and marine (LM) diesel fuel standard. The commenter stated that C3 engines can operate on 500 ppm fuel as well as on 1,000 ppm fuel.

IFTOA commented that it strongly endorses the primary proposal to eliminate the 500 ppm LM diesel fuel category, as it is the easiest way to harmonize the C3 rule and the existing diesel program, and would help to simplify the diesel program's designate and track (D&T) provisions. The commenter stated that it believes that the elimination of the 500 ppm LM standard provides a much simpler solution for the regulatory regime.

Our Response:

As discussed in the preamble to the final rule, we are eliminating the 500 ppm LM diesel fuel standard once the 1,000 ppm standard becomes effective to simplify the diesel sulfur program. Under the diesel sulfur program prior to this final rule, 500 ppm LM diesel fuel could be produced by transmix processors indefinitely, and could be used by locomotives and marine vessels that do not require 15 ppm. The original intent of allowing for this fuel was to serve as an outlet for interface and downgraded diesel fuel post-2014 that would otherwise not meet the 15 ppm sulfur standard. However, we believe that the 1,000 ppm sulfur ECA marine fuel can now serve as this outlet. We believe that transmix generated near the coasts would have ready access to marine applications, and transmix generated in the mid-continent could be shipped via rail or fuel barge to markets on the coasts.

Elimination of the 500 ppm LM diesel fuel standard will simplify the diesel sulfur program such that sulfur can serve as the distinguishing factor for fuels available for use after 2014 (the designated products under the diesel fuel program will thus be: 15 ppm motor vehicle, nonroad, locomotive, and marine (MVNRLM) diesel fuel; heating oil; and 1,000 ppm ECA marine fuel). Further, this will help to streamline the D&T program as there will no longer be a need for a fuel marker to distinguish 500 ppm LM diesel fuel from heating oil and there will not be a need for the Northeast/Mid-Atlantic (NE/MA) area.

Regarding the comment from Euromot that the 500 ppm LM diesel fuel standard should remain for environmental reasons because C3 engines could operate on this fuel, we note that under the diesel sulfur program prior to this rule, the 500 ppm LM diesel fuel sulfur standard was for locomotives and Category 1 and 2 vessels and could be used indefinitely. Category 3 vessels could use distillate or residual fuel with much greater sulfur levels, as the diesel program did not regulate these heavier fuels (see discussion in section IV.B.1). Under today's program, with the elimination of the 500 ppm LM diesel fuel standard, locomotives and Category 1 and 2 vessels will now be required to use 15 ppm MVNRLM diesel fuel and Category 3 vessels will now use fuel with a controlled sulfur level of 1,000 ppm.

4.1.2.2 Labeling

What Commenters Said:

EGCSA commented that fuel pump labeling is unlikely to apply to the bunkering of merchant ships. The commenter noted that in such cases, the pump may be situated in a pump room below deck and any labeling would not be visible.

Our Response:

We appreciate the commenter's comments on labeling. As we understand that traditional pump labeling may not be feasible in many situations for 1,000 ppm sulfur ECA fuel, we are committed to working with industry to develop workable solutions to help encourage proper fuel usage and discourage misfueling.

4.2 Proposed Alternative Options

What Commenters Said:

While it supports the primary proposal to eliminate the 500 ppm LM category after 2014, IFTOA commented that if it is determined that some railroads require the 500 ppm sulfur fuel in the mid-continent and the elimination would be significantly detrimental, then the commenter would support the expanded Northeast/Mid-Atlantic (NE/MA) area.

Our Response:

We appreciate the comments on the proposed alternative options. We did not receive any comments stating that the elimination of the 500 ppm LM diesel fuel category would be detrimental to locomotives (or Category 1 and 2 vessels) that would have used this fuel; further, we believe that simplification of the designate and track program will greatly benefit the fuel production and distribution industry. Therefore, as noted above, we are finalizing the primary proposal to eliminate the 500 ppm LM diesel fuel standard when the 1,000 ppm sulfur ECA fuel standard takes effect in 2014.

4.3 Other

4.3.1 Category 1 and 2 Engines on C3 Vessels

What Commenters Said:

Euromot commented that it seeks clarification on fuel use in Category 1 and Category 2 engines onboard Category 3 Vessels. Specifically the commenter asked if: a) C1 and C2 engines be subject to the 15 ppm sulfur standard; b) it is envisioned that C2 engines and aftertreatment systems need to be compatible with 1,000 ppm fuel; c) C1 and C2 engines operating on 1,000 ppm fuel need to comply with C3 emission limits; and d) C1 and C2 engines operating outside U.S. waters on potentially unspecified fuel with sulfur limits much greater than 15 ppm be able to comply with the proposed exemption (i.e., EPA's Tier 3 marine standard).

NACAA and CATF commented that they are opposed to any relaxation of the 15 ppm fuel sulfur standard for C1 and/or C2 engines. CATF further stated that it believes that the higher sulfur would not only increase emissions from such engines, but would also compromise the effectiveness of controls for limiting directly emitted PM from those engines.

ALA and EDF commented that they do not support the use of 1,000 ppm fuel in C2 engines. The commenters further stated that they do not believe there is any reason to relax the fuel sulfur standards for C2 engines in this rulemaking.

EMA commented that it supports the use of 1,000 ppm fuel in C2 engines installed on C3-powered vessels (instead of 15 ppm sulfur fuel) when operating in ECAs. The commenter noted that these vessels could otherwise have to accommodate three separate fuel systems (1,000 ppm ECA marine fuel, bunker fuel for use outside ECAs, and 15 ppm diesel fuel for C2 engines), which it believes is unworkable and cost-prohibitive.

Our Response:

In general, we are not relaxing the sulfur standards for Category 1 and 2 engines. We are allowing the use of 1,000 ppm sulfur ECA marine fuel in certain Category 1 and 2 auxiliary engines installed on Category 3 vessels only. (See Chapter 5 of this Summary and Analysis document for additional discussion of this issue.) Category 1 and 2 vessels will still be required to use NRLM diesel fuel, consistent with the concerns expresses by CATF. Allowing the use of 1,000 ppm sulfur fuel in auxiliary engines on Category 3 vessels will still result in emissions benefits as most existing Category 3 vessels use residual fuel for their Category 2 auxiliary engines, and high sulfur distillate fuels for their Category 1 engines. Note also that this allowance also does not preclude the use of 15 ppm NRLM diesel fuel in these engines.

4.3.2 Fuel Quality

What Commenters Said:

The Marsh Area Regional Council, Earth Day Coalition, Ohio Environmental Council, and the Ohio League of Conservation Voters commented that they believe EPA should adopt a fuel quality standard specifying the sale of distillate fuel for marine use in U.S. waters. The commenters urged EPA to adopt minimum fuel quality requirements for all marine diesel fuel sold in the U.S. based on the characteristics of marine distillate fuel (MGO or DMA).

The City of New York commented that EPA should continue to monitor fuel content and ambient air to ensure that heavy metals are reduced with sulfur and to undertake additional rulemakings if necessary.

Our Response:

We appreciate the commenters' concerns. The regulations at 40 CFR Part 80 Subpart I currently control sulfur content, and cetane or aromatics. EPA's proposed action only proposed amendments to the fuel sulfur requirements, and we believe that this is appropriate given the environmental focus of and justification for this rulemaking. Expanding to other fuel properties would require a separate justification and action, as it is therefore beyond the scope of what EPA proposed. EPA notes that fuel quality standards, as recommended by the commenters, are

generally regulated by the American Society of Testing and Materials (ASTM, the recognized standard-setting body for fuels and additives in the United States) and the National Institute of Standards and Technology (NIST, the federal agency that develops and promotes measurement, standards, and technology). Fuel quality is often handled at the state level by State Weights and Measures departments.

Please see section 1.1.6 of this document for a discussion of the City of New York's comments on heavy metals.

4.3.3 Further Reductions in Fuel Sulfur

What Commenters Said:

The South Coast Air Quality Management District (SCAQMD) commented that it urges EPA to take additional actions that expedite and strengthen emission reductions; specifically, that EPA adopt technology-forcing particulate emission limits, and consider lower sulfur fuel than 1,000 ppm.

The Marsh Area Regional Council, Earth Day Coalition, Ohio Environmental Council, and the Ohio League of Conservation Voters commented that they believe additional control "tiers" containing more stringent sulfur limits in the future as lower sulfur fuel becomes more widely available, allowing land-based PM control technologies to be applied to large marine diesel engines.

CATF et. al. commented that they believe the proposal should have been expanded to set tighter sulfur standards over the next few years.

MECA and Johnson Matthey commented that they urge EPA to take a global leadership position of setting a timetable for further reductions in fuel sulfur to ULSD level, as they believe that this would extend catalyst durability and enable use of diesel oxidation catalyst (DOC) and diesel particulate filter (DPF) technologies for the reduction of PM.

Our Response:

We note that the lower fuel sulfur standards for C3 marine engines are intended to make fuel available in the U.S. that is harmonized with the international ECA fuel sulfur standards. If EPA were to take action to further reduce the sulfur of ECA marine fuel sold in the U.S., we believe that Category 3 vessel owners would simply purchase 1,000 ppm sulfur fuel elsewhere to be used here in the North American ECA. This could be an extremely inefficient process for ship owners and would not result in any environmental benefit. Further, it could put U.S. entities that are regulated by this rule at a competitive disadvantage because the U.S. regulations would then not be harmonized with the standards of the rest of the worldwide maritime industry. Please see Section 3.3.3 of this document for further discussion on the relationship between further reductions in fuel sulfur and PM emissions.

4.4 Technical Feasibility of Fuel Switching

What Commenters Said:

The Canadian Shipowners Association (CSA) raised a number of technical concerns associated with switching from high sulfur residual fuel to lower sulfur distillate fuel. CSA commented that vessel owners also have significant challenges with assuring the necessary modifications are made to vessels engaged in international trade which would call in the U.S. ECA. In this operating scenario, vessels would have to retrofit fuel storage and supply systems to enable the carriage and safe switch-over from a non-ECA to an ECA compliant fuel. In conjunction with this physical retrofit, new procedures and training protocols will need to be established to assure safe fuel switching occurs prior to the vessel's entry into the ECA. CSA also commented that there is a substantial loss in speed and therefore of vessel productivity and a significant increase in daily fuel consumption due to the loss of calorific values in conversion from residual to distillate fuels.

Chamber of Shipping of America commented that safety issues have arisen due to fuel switching. As an example, recently the San Francisco Harbor Safety Committee received input from U.S. Coast Guard and San Francisco Bar Pilots concerning propulsion problems while vessels are using low sulfur fuel as required by the California Air Resources Board (CARB). To date, at least seven propulsion losses have been documented in Los Angeles/Long Beach and San Francisco Bay and a number of other instances of reduced maneuverability relating to vessels' inabilities to go to dead slow ahead or astern at reduced RPMs/low speeds have also been documented. These issues must be fully identified and solutions found which will eliminate these situations which have the potential to negatively the impact in a far more adverse way than the air emissions they seek to reduce. Prior to imposing any new low sulfur fuel requirements at the federal level, EPA is urged to work closely with the USCG in assuring adequate and environmentally protective resolution of these issues.

Maersk commented that they have significant experience switching from residual to distillate fuel on their vessels, noting that they have been an industry leader in environmental improvements, in both vessel design and operations. Maersk stated that this is particularly evident in their ongoing environmental commitment on the U.S. west coast. Since March 2006, Maersk's ships have voluntarily switched to average 0.1 percent sulfur distillate fuel in both main and auxiliary engines, and operated auxiliary engines in "low-NO_X mode" on vessels so equipped when near or in California ports, and while at dock in other west coast ports. Reductions achieved have been 95 percent of SO_X, 86 percent of PM and at least 12 percent of NO_X. Maersk has now made over 1200 vessel calls with this lower sulfur fuel, reducing air emissions by over 2,400 tons, at a fuel differential cost of over $20 million. Maersk has openly shared its experiences with the agencies, the public and the industry, and continues to believe that fuel switching is the fastest and most cost effective way to reduce vessel emissions.

Chamber of Shipping of America (0256)
Maersk (0261)

Our Response:

In order to continuously operate on a distillate fuel, some vessels – such as the ships that operate almost exclusively on residual or intermediate fuel blends currently – will have to make

some modifications to their fuel distribution systems. Since distillate fuel is less viscous than residual or intermediate fuel oil, fuel system heaters are not required for operating on distillate fuel. With residual fuel, these heaters are needed to ensure that the fuel is injected into the engine at the proper temperature and viscosity. Additionally, since the distillate fuel does not contain the heavy metals or large hydrocarbon compounds typically found in the residual or intermediate fuels, the vessel will no longer require the extensive filtering / settling tanks within the fuel distribution lines for the distillate fuel system. In addition, some of these vessels may require an upgraded fuel injection system as the existing fuel nozzles may not be optimal for continual use of the lower viscosity fuel.

However, removal of the settling tanks / extensive filtering systems will allow more room on the vessel for fuel storage tanks or additional cargo, if the vessel owner chooses to modify the vessel to only operate on distillate fuel. As the majority of vessels today carry some form of distillate fuel for use in emergencies or for routine engine shut-down / start-up for before and after engine maintenance, almost all engine manufacturers publish standard operating procedures for ensuring safe fuel switching between residual or intermediate fuel oil and a distillate fuel. Provided these recommended operating procedures are followed correctly, onboard the vessel 'incidents' due to operation on or switching to a distillate fuel should be avoided, and as this procedure could be utilized in a shipboard emergency, all crew members should be properly trained in these procedures.

The marine distillate fuel has a lower energy content on a per volume basis when compared to the residual fuel; however, per ton, the distillate fuel's energy density is larger than the residual fuel. This means that when switching from residual fuel to distillate fuel, if the vessel's tanks are volumetrically limited (i.e., the tanks can only hold a set quantity of fuel gallons), the distance and possibly speed a vessel can travel on the distillate fuel may be slightly shorter and slower than the distance and speed the vessel could travel on the residual fuel due to the lower volumetric energy content of distillate fuel, which could require compensation. This distance reduction would be approximately 5%, and the vessel could increase the throttle slightly if the speed or if maneuverability / operation at the lower speeds was an issue. However, if the vessel is limited by weight, the higher energy content per ton of fuel would provide an operational advantage for the vessel.

Due to emission requirements for the state of California Air Resources Board and voluntary environmental measures, Maersk Lines have extensive experience with operating vessels on – and switching vessels to – distillate fuel. In their experience, Maersk operators have been able to successfully switch between residual fuel oil and distillate fuel oil without incident, such as propulsion losses, due to crew training and following proper switching procedures. As Maersk has been openly reporting their results and procedures with the public, industry, and federal agencies, their experiences are available to inform other vessel operators with potential fuel switching concerns.

The maritime industry has analyzed the differences between residual and distillate fuel compositions to address any potential issues that could arise from switching operation of a Category 3 engine from residual fuel to distillate fuel, such as propulsion losses. The results from this research has evolved into routine operational switching procedures that ensure a safe and efficient way for the Category 3 engines to switch operation between the residual and distillate fuels. Engine manufacturers, fuel suppliers, the American Bureau of Shipping, and the

U.S. Coast Guard have provided guidance on fuel switching procedures.[5,6,7,8,9] More detail on these fuel switching procedures and technical considerations is provided in the RIA.

4.5 Fuel Availability

What Commenters Said:

Several commenters raised concerns regarding fuel availability. CLIA stated that the proposed ECA will increase the demand for distillate fuel, particularly in the North American market. The recent Secretary General's expert group report estimates that the Baltic and North Sea SECA's (although very small in size) represent 8 percent of the global fuel demand. The EPA estimates that the North American ECA (despite its size) will place only a 4% demand for additional distillate in the world. Potentially other local regulations will increase demand at the same time. Additionally the European rules for operation in port while alongside requiring 0.1 percent sulfur content fuel will take effect in 2010. Conservatively, these requirements will require an additional 15 percent production of distillate fuels. These additional demands for distillate fuel call into question whether enough distillate fuel will be available in 2015 to meet the requirements identified.

CLIA also commented that the U.S. and Northern Europe are today net exporters of distillate fuels with excess refining capacity. Current economic conditions in the world have depressed the demand for fuels both refined and residual. It is not clear whether shipping will recover from the worldwide recession by 2015. If it does, how much additional demand for distillate will this create? Additionally, it is unclear as to whether low sulfur fuels will be readily available in select U.S. ports when the ECA comes into force. For example, low sulfur fuels are currently not available in Seattle or Vancouver where cruise ships bunker fuel for the Alaska cruise season. Those U.S. refineries that have not been required to comply with emission controls in the past will have to install new and updated emission controls for all existing and new capacity; a significant financial and logistical disincentive to increase output of distillate fuels domestically. This requirement calls into question whether U.S. and possibly Canadian refineries would be able or willing to invest in additional capacity for the marginally increased market expected as a result of this rule. If there is an under supply of distillate fuel in the North American market as a result, the required distillate fuels will have to be produced elsewhere and shipped to the U.S. Likewise, residual fuel will be produced here and shipped to other markets where it is still authorized for use. This increase in the transportation of fuels will result in an increase in greenhouse gas production.

CLIA raised the concern that if additional refining is conducted in developing nations where the retrofitting with additional and more modern emission control equipment and systems

[5] MAN B&W Diesel, "Operation on Low-Sulphur Fuels; Two-Stroke Engines," 2004.
[6] Wartsila, "Low Sulphur Guidelines," January 9, 2006.
[7] American Petroleum Institute, "Technical Considerations of Fuel Switching Practices," API Technical Issues Workgroup, June 3, 2009.
[8] American Bureau of Shipping, "ABS Notes: Use of Low-Sulphur Marine Fuel for Main and Auxiliary Diesel Engines," Fuel Oil Piping, EWZ-001-02-P04-W007, Attachment G – Revision 1.
[9] United States Coast Guard, "Avoiding Propulsion Loss from Fuel Switching: American Petroleum Institute, Technical Considerations," Marine Safety Alert 03-09, June 16, 2009.

are not required, more CO_2, SO_x, NO_x and particulate matter will be emitted in the production and transportation of the lower sulfur fuels.

CLIA commented that this requirement for distillate fuels in the marine industry will indeed have an impact on other industry segments. While the availability of crude stock may rise or fall with the world market, there is a limit to the amount of distillate that can be produced from a given barrel of oil – even with enhanced refining processes. With the marine industry now competing for this product, there undoubtedly will be significant upward pressure on the pricing structure for all industries (as well as the consumer) sharing the demand for distillate fuels. In this regard, we do not believe that the indirect economic impact of this regulation on other industries or communities has been adequately addressed. For example, there has been no evaluation of how the increased demand for distillate fuels resulting from the U.S. ECA will affect home heating oil prices in different regions of the country or other indirect impacts on others such as the Department of Defense and Department of Homeland Security.

Chamber of Shipping of America commented that, at current demand rates (low sulfur in certain regions including existing SECAs in the Baltic and North Seas), there have already been documented cases of short or non-existent supplies of low sulfur fuels. Adding demand as will be the case with the North American ECA adds great uncertainty to the supply and demand equation, most significantly on the supply side, a situation which will be further exacerbated should ECA's proliferate worldwide. While less of a concern for U.S. flag vessels that are engaged solely in domestic trade due to the expected availability from U.S. refineries, vessels of all flags trading internationally, must be able to procure the low sulfur fuels in other nations for voyages to the United States. Capacity within the U.S. refining complex does not equate to global availability for vessels inbound to U.S. ports.

Seaworthy commented that international marine shipping purchases a variety of fuels from all around the world. In fact, the United States supplies only a small percentage of the world's marine fuels. SFC commented that they appreciate that the EPA has included requirements for fuel production and sales in the Notice of Proposed Rulemaking, which will help ensure that the compliance burden is shared equally between shipowners/operators and refineries. However, SFC questioned the assumptions related to fuel availability for international vessels. Although the Proposed Rule will ensure that domestic vessels are able to find compliant fuel in the ports they call, it does not guarantee that such fuel will be available at all the ports a vessel may transit while en route to U.S. waters. In view of this, SFC recommended that clear mechanisms (based on Regulation 18 of Annex VI) be developed to cover situations in which a ship has unsuccessfully tried to obtain compliant fuel.

One commenter raised concerns that lower sulfur fuel may not be available in Alaska by 2010. Specifically, the commenter noted that EPA has acknowledged the difficulty for Alaska in-state refineries to convert to low sulfur and ultra low sulfur fuel by providing Alaska refineries have received a waiver to 2010 to meet ultra low-sulfur diesel. In addition, a December 2008 fire at Petrostar Valdez refinery means it is unlikely that the refinery can physically produce ultra low-sulfur in the volumes needed by the marine industry by March 2010. Petrostar has traditionally provided about 90 percent of the marine fuel supplies to coastal ports in Alaska. If that refinery can't meet sufficient production, it will require ultra-low sulfur diesel fuel (ULSD) to be shipped either to the state from West Coast facilities or to be shipped to coastal facilities from either Tesoro's Nikiski or Flint Hill's North Pole refineries – the only other fuel suppliers

in Alaska and only one of the two is producing ULSD. In either case, higher transportation costs for ULSD fuel deliveries were not included in the EPA modeling of transportation costs.

CLIA (0278)
Senator Murkowski (0384)
Seaworthy (0226)
Chamber of Shipping of America (0256)
Shipping Federation of Canada (0270)

Our Response:

The above comments primarily focus on the impact of the proposed North American ECA on marine fuel availability. As discussed in Chapter 2 of this document, the ECA proposal is not within the scope of this rulemaking. However, this rulemaking does apply ECA standards to U.S. internal waters. In addition, this rulemaking is making it possible for 0.1 percent sulfur, ECA-compliant distillate fuel to be sold in the U.S. Without these new provisions, marine distillate fuel sold in the U.S. would generally need to comply with a 15 ppm (0.0015 percent) fuel sulfur limit. Distillate fuel meeting the 15 ppm fuel sulfur limit is known as ULSD. Contrary to the comments regarding Alaskan refining, this rulemaking will not require ULSD to be used in ships in March 2010.

With respect to the MARPOL Annex VI requirements, Regulation 18 provides relief in the event that compliant fuel cannot be reasonably obtained by the ship operator. The ship operator would need to provide evidence that it attempted to purchase compliant fuel oil in accordance with its voyage plan and, if it was not made available where planned, that attempts were made to locate alternative sources for such fuel oil and that despite best efforts to obtain compliant fuel oil, no such fuel oil was made available for purchase. We would then take into account all relevant circumstances and the evidence presented to determine the appropriate action to take, including not taking control measures. As a party to Annex VI, we would provide this fuel availability relief provision, even for U.S. internal waters.

CLIA commented that EPA estimated that the North American ECA would represent 4 percent demand on world distillate fuel. It should be clarified that we estimate that the fuel consumed in the proposed ECA would represent less than 4 percent of marine bunker fuel demand, which is less than 1 percent of global distillate demand. In the modeling performed in support of the Secretary General experts' group study, a multiple ECA scenario was evaluated. In this scenario, it was considered that multiple ECAs encompassing Europe, Mediterranean Sea, Black Sea, North America, Tokyo Bay, and Singapore would total about 15 percent of global marine bunker fuel demand (not global distillate demand). Based on these, and other analyses, the recent amendments to Annex VI where approved which include the new ECA fuel sulfur standards and application criteria. One commenter argued that increased refinery operations and fuel distribution will result in increased emissions from the modeling. This factor was considered in the refinery modeling performed for the Secretary General experts' group study. In response to the comment that that refining is conducted in developing nations where modern emission control equipment and systems may not be required, these air pollution issues cannot be addressed through this rulemaking. Because the coordinated strategy is expected to have only minor impact on global distillate demand, any additional distillate demand coming from these refineries would be expected to have minor impact on emissions compared to the underlying

problem, and any emission increase would be expected to be far less than the emission reductions achieved from shipping.

In the U.S., Canada, and other parts of the world, distillate fuel is already available which would meet the long term 0.1 percent fuel sulfur limit that applies in ECAs beginning in 2015. Although the proposed ECA could result in additional demand for distillate fuel, we expect the amount of distillate used in the proposed ECA would be a small fraction of the global distillate usage. Global distillate fuel demand is projected to grow significantly over the timeframe of the long term ECA standards. The U.S. Energy Information Administration projects an annual growth in global demand for refined products of about 1.5 percent per year over the next five years.[10] In comparison to this growth in distillate supply and demand, any effect on demand from the North American ECA would be small as increased ECA distillate demand is estimated to be less than 1 percent of global distillate production. Further, as noted in the comments of CLIA, the recent economic downturn has allowed refining capacity to catch up and actually exceed current demand for distillate fuel.

Sophisticated refinery modeling was performed to evaluate the impact of the proposed ECA on global fuel production and costs. This work was done using the WORLD model, which is the same model that was used for the Secretary General's Expert Study. This modeling concluded that the additional distillate fuel for the proposed ECA could be produced through minor expansions in global coking and hydrotreating processes. This expansion would have a side benefit of generating additional gasoline, naptha, and liquid petroleum gas, thereby easing supply on those products. The refinery modeling considers not only refinery upgrades, but the location of these upgrades and product distribution costs. It is an economic model and considers that fuel used in the ECA may be produced outside the U.S. where that is the most economical solution. In addition, the model considers the impact of additional distillate demand for the marine sector on distillate prices in all sectors. As discussed in Chapter 6 of this document, the cost estimates from this modeling compare favorably with real-world bunker prices. Extensive detail on this modeling is included in the ECA proposal, the RIA, and the docket for this rule.

We think it is important, at this point, to provide the market with as much certainty as possible. The best thing we can do to ensure that the infrastructure exists for lower sulfur fuel production and supply is to establish a clear standard as early as possible so that companies can move forward on their business decisions. The sooner the proposed ECA is adopted under Annex VI, the sooner refiners can make clear plans to respond to the January 1, 2015 fuel sulfur requirements.

[10] Energy Information Administration, 2008b. "International Energy Outlook 2008" (DOE/EIA-0484(2008)); Washington, DC. (Available at: http://www.eia.doe.gov/oiaf/ieo/)

4.6 Fuel Equivalency Standard

4.6.1 Exhaust Gas Cleaning Systems

What Commenters Said:

A number of commenters expressed concern that the proposed fuel sulfur limit did not specifically include a provision allowing for the sale of high sulfur fuel, for use in an ECA, when an equivalent SO_X and PM control approach is used. API stated that the proposed rulemaking has completely thwarted the use of abatement technology through its simultaneously proposed fuel standards. Specifically, the EPA has proposed a prohibition on the sale of fuel above 1,000 ppm sulfur for use in all marine vessels operating in the U.S. ECA and U.S. internal waters. Such a prohibition functionally eliminates the possibility that vessels might choose to satisfy the MARPOL Annex VI emissions standard through the installation of abatement technology rather than through the burning of low-sulfur distillate.

We received several comments stating that not allowing for equivalent approaches would be inconsistent with MARPOL Annex VI. Specifically, commenters referenced Regulation 4 of MARPOL Annex VI which states: "The Administration of a Party may allow any fitting, material, appliance or apparatus to be fitted in a ship or other procedures, alternative fuel oils, or compliance methods used as an alternative to that required by this Annex if such fitting, material, appliance or apparatus or other procedures, alternative fuel oils, or compliance methods are at least as effective in terms of emissions reductions as that required by this Annex, including any of the standards set forth in regulations 13 and 14." Regulations 13 and 14 refer to the NO_X and SO_X/PM standards respectively.

Commenters noted that the United States has historically been supportive of performance based standards. EGCSA commented that the U.S. delegation at IMO MEPC 59 assured the meeting that the USA was committed to complete alignment with MARPOL Annex VI and its Regulations. The current EPA proposals are in direct contradiction to both Regulation 14 and Regulation 4. The American Petroleum Institutes specifically noted that the United States has already stated its intent to the international community that it will allow scrubber technology. In its application for an Emissions Control Area ("ECA"), the United States noted that "[a]s an alternative, an exhaust gas cleaning system (EGCS) may be used." API also noted that the proposal acknowledges that Annex VI allows for alternative compliance strategies in including the use of exhaust gas cleaning systems and goes on to describe the technological feasibility of scrubbers and how scrubbers may be used to achieve equivalent emission reductions as fuel switching.

Several other commenters promoted exhaust gas cleaning systems (e.g. SO_X scrubbers) as an equivalent alternative to switching to operation on lower sulfur fuel in an ECA. Several EGCS manufacturers recommended that EPA maintain the inclusion of a technology-based SO_X solution that would complement the low sulfur distillate solution and offer the international ship owner a business choice to be evaluated on a ship-by-ship basis. They argued that such an approach fully supports EPA's primary goals of reducing NO_X, SO_X and PM in engine exhaust emissions. Commenters stated that EPA should not eliminate of the production and sale of higher sulfur, residual fuels because these fuels have powered the world's commercial ships for many decades. Belco commented that having the option to either purchase the more expensive

low sulfur fuel or use a scrubbing system with the lower cost high sulfur fuel will provide great benefit not only to the shipping industry but also to the many air pollution controls companies in the United States and throughout the world. By applying the proven technologies of exhaust scrubbers and exhaust gas recirculation systems (used in many industries) to commercial ships, several commenters stated that SO_X, NO_X, and particulate matter can be brought into compliance with the proposed limits.

EGCSA commented that not only will limiting the sale of higher sulfur fuel prevent the United States from benefiting from the reduced emissions that can be achieved with exhaust gas cleaning technologies but it will almost certainly impact the wider adoption of the technology on a global basis. CLIA commented that further development of exhaust gas scrubbers or other similar technology and the use of such technology should be encouraged and the manufacture, offer for sale and sale of residual fuels should not be prohibited for use with such proven technology. CLIA went on to say that if technological solutions can only be utilized on engines that are required to utilize ECA fuel, then there is no benefit or incentive to either develop or utilize this promising technology.

Commenters recommended that we explicitly include the intent of Regulation 4 of MARPOL Annex VI enabling the use and operation of exhaust gas cleaning technologies on board vessels operating in or visiting the United States. More specifically, commenters stated that the final rule should make it clear that the sale of residual fuels is allowed in the United States for use in vessels equipped with appropriate exhaust gas cleaning systems as well as for use outside the ECA. CSA argued that the focus on fuels and alternative compliance technologies should be on use and not on whether the fuel is manufactured and distributed. EGCSA stated that the use of exhaust gas cleaning systems is entirely consistent with the U.S. Clean Air Act and its implementation in U.S. power utilities where such cleaning systems are frequently used for reducing PM and SO_X emissions.

Seaworthy (0226)
DuPont Belco (0362)
EGCSA (0305)
Canada (0252)
Chamber of Shipping of America (0256)
WSC (0325)
CLIA (0278)
API, (0354)
Shipping Federation of Canada (0270)
Euromot (0243)
Canadian Shipowners Association (0245)
EMA (0265)
Maersk (0261)
Lower Lakes (0230)

Our Response:

As a Party to Annex VI, we intend to implement the Emission Control Area in a way that is consistent with Annex VI. Under Annex VI, Regulation 4 provides for alternatives to the standards, including the NO_X and fuel sulfur limits in regulations 13 and 14, provided that these

alternatives "are at least as effective in terms of emission reductions." One of the prominent technologies that has been discussed as an equivalency for low sulfur fuel is the use of exhaust gas cleaning units (EGCS), also known as "scrubbers." We have had an active role in tracking the progress of this technology and in the development of ECGS guidelines through IMO. We recognize scrubbers as a promising technology for reducing exhaust emissions of SO_X from ships operating on high sulfur residual fuel. In fact, the proposed rulemaking includes a detailed discussion of SO_X scrubbers as a potential technical approach to comply with the ECA standards.

As proposed, ship operators would have been able to use SO_X scrubbers in the ECA, provided that an equivalency was granted under Regulation 4. In addition, these vessels would have been able to use high sulfur fuel in conjunction with the SO_X scrubber. However, the proposed rule did not include an allowance for the higher sulfur fuel to be purchased in the U.S., for use with equivalent technology. As this is inconsistent with Annex VI, we are correcting this oversight in the final rule. U.S. refiners will be able to sell fuel that does not meet the ECA fuel sulfur limit, for use in an ECA, in the event that the vessel uses a SO_X scrubber, or other equivalency, that achieves ECA compliance while operating on high sulfur fuel.

4.6.2 Other Approaches to Equivalency

What Commenters Said:

As discussed in 4.5.1 above, many commenters expressed support of equivalency approaches, as allowed under MARPOL Annex VI, regulation 4. While EGCS were discussed extensively, commenters raised a number of other approaches. Given the variety of trades, ships, fuels and ecosystems involved, industry stated that they should have access to a range of options, and the shipowner should have the final word on how air emission limits will be met.

Maersk encouraged EPA to keep standards focused on the environmental improvements while minimizing constraints which reduce operational flexibility or inadvertently inhibit innovation. For example, the rule should allow the use of a variety of fuels in conjunction with other exhaust gas cleaning technologies as long equivalent or better air quality is achieved and other environmental impacts can be appropriately addressed. Many new technologies are now in development, and this should be not be discouraged by regulatory impediments.

CLIA commented that EPA to broadly interpret the "equivalent" regulation to consider a wide number of strategies. These strategies are listed below. In addition, CLIA asked the EPA to support the development of these alternative compliance mechanisms through the use of pilot projects, and research and development efforts.

a. Acceptance of approved EGS technology;
b. Emission averaging based on the use of shore power while a ship is in port;
c. Fleet emission averaging if and when one or more of a company's ships utilize alternative technology such as gas turbine engines or alternative fuels which result in emissions that are much lower than that required for ECA compliance;
d. Allowing a ship that voluntarily utilizes lower sulfur fuels or technology outside of the designated ECA to average its own emissions;
e. Allowing credits/banking for early implementation of compliance measures;

f. Allowing ships to utilize markets available for purchase of SOx and NOx credits to offset emissions;
g. The use of fleet averaging, banking and trading (ABT) as an alternative compliance method has previously been accepted by EPA and we would encourage EPA to seek the cooperation of IMO, Canada, and other flag states in implementing ABT within the North American ECA. CLIA recognizes that tracking of fleet averaging and an acceptable method to prove equivalency will have to be developed and we would encourage EPA to support such developments in partnership with the maritime industry.

CSA commented that the final rule must provide the critical details of equivalency and alternative reduction strategies and create a system that provides the maximum flexibility for vessel owners to choose among a number of alternative equivalent reduction strategies. These alternative compliance programs should be fully detailed to promote the maximum in compliance flexibility and incentivize the development of even more efficient emissions reductions technologies which address multiple pollutants in a holistic manner. Examples of possible alternative programs include fleet averaging and the generation of emissions credits across a given fleet for cold ironing.

Maersk (0261)
Shipping Federation of Canada (0270)
CLIA (0278)
Chamber of Shipping of America (0256)

Our Response:

As discussed above, we are finalizing regulations that will allow for high sulfur fuel to be sold in the U.S. for use in vessels that have received an equivalency under Regulation 4 of Annex VI, provided that the equivalency allows for ECA compliance with high sulfur fuel. We do not believe that it is appropriate to determine the details of equivalency and alternative reduction strategies as part of this rulemaking. We would instead evaluate different technologies and approaches on a case-by-case basis under the provisions of Regulation 4. We agree with the comment that many new technologies are now in development, and should be not be discouraged by regulatory impediments.

4.7 Technical Feasibility of SO_X Exhaust Gas Cleaning Systems

4.7.1 SO_X Emission Reduction Capability

What Commenters Said:

Several commenters stated that exhaust gas cleaning systems may be used to achieve substantial reductions in SO_X emissions from ships. EGCSA stated that at least three exhaust gas cleaning systems are in operation on board merchant vessels and a further 4 to 6 projects are underway for installation on board vessels later this year or into 2010. EGCSA reported that all the exhaust gas cleaning systems currently in operation have achieved at least 98 percent reduction in SO_X emissions. Seaworthy commented that the use of exhaust gas scrubbers will result in compliance with the proposed low SO_X discharge limits irrespective of the original fuel type and its sulfur level. Such scrubbers offer a certified, proven technology solution which will

allow vessels to operate in ECAs using a wide range of marine fuels. Belco commented that scrubbing systems on ships are now well proven and some have even been certified by the various agencies. SFC commented that recent tests have shown that exhaust gas cleaning systems can attain SO_X reductions well above 90 percent.

Krystallon presented test data showing that its sea water scrubbing systems achieve more than a 98 percent SO_X removal efficiency. Krystallon stated that, for the target water flow rate of 45t/MW-hr of engine power, the performance is only slightly affected when operated in brackish waters such as the inner passage off the Pacific North West coast. They claimed to have only limited experience of operation of the scrubbing system in fresh water environments. However, chemical equilibrium models have indicated that the major issue is not removal of SO_X from the exhaust flow but in rebalancing the pH of the scrubber effluent before discharge. Under such circumstances Krystallon stated it would expect the addition on an alkaline buffer at the point of discharge would achieve a satisfactory discharge pH.

TOTE commented that SO_X scrubber technology is far from proven and is too large to be installed on its existing vessels. TOTE claimed that Holland America cruise line has tried one such system on one engine on one vessel with very poor results.

EGCSA (0305)
Seaworthy (0226)
DuPont Belco (0362)
Shipping Federation of Canada (0270)
Krystallon (0229)
TOTE (0289)

Our Response:

As discussed in RIA, there are a number of exhaust gas cleaning systems under development and prototype systems installed on marine vessels. We appreciate the additional data provided by commenters and encourage further development of EGCS technology as an equivalent approach to complying with ECA fuel sulfur standards.

4.7.2 Washwater

What Commenters Said:

CLIA offered the following comments on SCR by-product and EGCS waste water effluent (wash water) quality standards: With both the open loop and the closed loop EGCS and SCR, it will be imperative that EPA quickly develop national standards and capability for the shoreside discharge of waste and for open loop systems, the overboard discharge of cleaning/cooling water. EGCS is a promising technological solution that is proven to be able to significantly reduce both SO_X and PM. Holland America Line (a CLIA member cruise ship operator), with the participation of various government agencies in both the United States and Canada, has been involved in developing cruise ship application of the EGS. We also note that the Wärtsilä SO_X scrubber has been granted the Sulfur Emission Control Area (SECA) Compliance Certificate by the classification societies Det Norske Veritas and Germanisher Lloyd, thus advancing the technology from testing of proof of concept to commercial

availability. Others including Krystallon, Aalborg and ECOSPEC are in development. However, irrespective of how well these systems may perform, their use will be discouraged and in fact, be prevented if every state and local jurisdiction undertakes and publishes their own local requirements for EGS/SCR by-products. It is critical to this rulemaking that a national scheme be quickly developed and put into place so that adequate commercial opportunity is created for the significant investment required to develop these systems. In this regard, EPA should adopt or take account the standards for scrubber waste water recently adopted at IMO MEPC 59 in July of 2009.

TOTE commented that the use of SO_X scrubbers results in discharge in the water that that is believed to be problematic by the State of Alaska. CSA commented that for some of the technology based strategies which will be required to meet these requirements, it is essential to recognize that new waste streams will be created and thus shore reception facilities must be in place to receive these residual by-products. CSA stated that while IMO deliberations are addressing the nature of these new waste streams and their impact on the environment, it is critical that shore reception facilities be developed that can manage these wastes in an environmentally sound manner. CSA also noted that that even with the lengthy history of other MARPOL annexes, there still exist reception facility adequacy issues around the world, including here in the United States.

CLIA (0278)
TOTE (0289)
Chamber of Shipping of America (0256)

Our Response:

The IMO guidelines for the use of exhaust gas cleaning devices such as SO_X scrubbers include recommended monitoring and water discharge practices. The washwater should be continuously monitored for pH, PAHs and turbidity. Further, the IMO guidance include specifications for these same items, as well as nitrate content when washwater is discharged in ports, harbors or estuaries. Finally, the IMO guidance recommends that washwater residue (sludge) be delivered ashore to adequate reception facilities and not discharged to the sea or burned on board.

As the commenters recognize, any discharges directly into waters of the United States may be subject to Clean Water Act or other U.S. regulation. The Clean Water Act (CWA) requires that all point source discharges (which includes certain vessel discharges) must meet technology-based effluent limitations representing the applicable levels of technology-based control. Water quality-based effluent limitations (WQBELs) are required as necessary where the technology-based limitations are not sufficient to meet applicable water quality standards. To the extent that the air pollution control technology results in a wastewater discharge, such discharge is prohibited unless authorized by a Clean Water Act National Pollutant Discharge Elimination System (NPDES) permit. The 2008 NPDES Vessel General Permit (VGP) authorizes the discharge of Exhaust Gas Scrubber Washwater, and the discharge must, among other things, meet conditions found in Part 2.2.26 of that permit. Although the Agency notes that it is actively seeking to gather additional data on exhaust gas scrubber discharges for future permit issuances, including the metal concentrations and other constituents which may be found

in the discharge, issues pertaining to the development of CWA discharge standards are outside the scope of today's rulemaking.

4.8 Impact of Fuel/Equivalency Standards on PM

What Commenters Said:

EGCSA stated that test work indicates that exhaust gas after treatment is capable of PM levels lower than can be achieved by an ultra low sulfur diesel fuel. In two separate laboratory tests of exhaust gas cleaning systems currently in service, the reductions in PM that were recorded, indicate a removal efficiency that achieves an equivalent or a lower PM emission than could be expected if the test engine was using a 0.1% sulfur marine fuel.

Seaworthy commented that scrubbers greatly reduce exhaust particulate matter (80%) while reducing SO_X levels to the equivalent achieved by 0.1% sulfur fuel. Seaworthy went on to claim that using low sulfur distillates may achieve SO_X compliance but only reduces particulate matter by a nominal amount. In fact, the cleaner, low sulfur fuels may produce a greater amount of the smaller and more harmful particulates $PM_{2.5}$ in the exhaust gas

Krystallon commented that the design of its scrubbing systems is primarily for removal of SO_X and stated that this has been the principal target of the IMO regulations. Simple mixing of water and gas is unlikely to produce an efficient removal of particulate matter. This is especially true for smaller ($PM_{2.5}$) particles that are not easily wetted. Krystallon are however aware of the public and legislative interest in reduction of other particulate species and have undertaken work on both to improve removal efficiency and quantify the efficiency of our current design. Test data show PM reductions using Krystallon scrubbing system. Environment Canada is quoted as measuring approximately 70 percent reduction in exhaust particulates cross the scrubber when operated at full load with two of three stages of the scrubber in operation. The engine was operated on residual fuel of approximately 1.5 percent sulfur level. Mitsui Engineering and Shipbuilding indicated a maximum particulate reduction (dust) of 55-60 percent when operated on a 1.6 percent sulfur fuel. In addition, Krystallon has also investigated operation of sea water scrubber designs on distillate fuelled engines. Specific particulate measurements have not been taken at this point; however analysis of the wash water indicated around 0.1g/kW-hr of particulates were removed from the wash water stream, mainly as carbon. While not a specific analysis, this would indicate an overall removal efficiency on distillate fuelled engines of around 50 percent of the total particulate loading in the exhaust stream. It is Krystallon's belief, backed by test data, that operation of a scrubbing system designed for efficient removal of particulates will produce the same or better results than a simple switch from residual to distillate fuels.

EGCSA (0305)
Seaworthy (0226)
Krystallon (0229)

Our Response:

As discussed in the RIA, scrubbers are effective at reducing SO_2 emissions and sulfate PM emissions from the exhaust. However, we recognize that the effectiveness of the scrubber at

removing PM emissions other than sulfates is dependent on the scrubber design. In addition to sulfate PM reductions, switching from residual fuel to distillate fuel results in reductions in organic PM and metallic ash particles in the exhaust. As such, consideration should be given to non-sulfate PM when making the determination that using a given ECGS design is "at least as effective" as operating on lower sulfur fuel to control PM emissions.

We dispute Seaworthy's claim that low sulfur fuels may produce a greater amount of the smaller and more harmful particulates $PM_{2.5}$ in the exhaust gas. In addition to high sulfur levels, residual fuel contains relatively high concentrations of low volatility, high molecular weight organic compounds and metals. Organic compounds that contribute to PM can be present either as a nucleation aerosol or as a material adsorbed on the surfaces of agglomerated elemental carbon soot particles and metallic ash particles. The sulfuric acid aerosol in the exhaust provides a nucleus for agglomeration of organic compounds. Operation on higher volatility distillate fuel reduces both nucleation and adsorption of organic compounds into particulate matter. Therefore, in addition to direct sulfate PM reductions, switching from residual fuel to distillate fuel reduces organic PM and metallic ash particles in the exhaust.

4.9 Lead Time for Fuel Use Requirements

What Commenters Said:

A number of commenters representing shipping interests on the Great Lakes, stated that longer lead time is necessary for the fuel sulfur standards noting that this would give the ship fueling industry to develop an efficient supply chain. Some commenters stated that a longer lead time would be consistent with previous EPA rules for land-based engines.

GLMTF commented that the coordinated strategy will require major changes in fuel and emissions on the Great Lakes in less than three years. When the agency has addressed other sources of emissions, the impacted industries or modes of transportation were given much more time to comply with the new requirements. For example, when EPA launched its National Clean Diesel Campaign, the final rule for Tier 2 Light Duty vehicle engines was published in 1999, but not fully phased in until this year. Similarly, the new rules for Heavy Duty Highway were published in 2000, but full compliance will not be achieved until next year. The final rule for nonroad diesel engines was published in 2004, but the requirements will not be fully phased in until 2015. The control of emissions of air pollution from locomotive engines and marine compression-ignition engines less than 30 liters per cylinder rulemaking dated May 6, 2008 will not be fully effective until 2015.

GLMTF also claimed that, in the past, affected industries have been helped with the costs of switching to new technologies with grants and other incentives. The U.S.-Flag Great Lakes fleet has been left to face a bill of $286 million (the estimated cost to repower the 13 steamers) on its own.

GLMTF (0269)
Canadian Shipowners Association (0245)
Keystone Shipping (0349)
Midwest Energy Resources (0342)

Our Response:

The lead time requirements associated with the coordinated strategy are appropriate and consistent with past rulemakings. As discussed in Chapter 3, the exhaust emission standards are consistent with the statutory direction to set standards requiring the greatest degree of emission reduction that is achievable in the given time frame.

We also believe that the implementation dates for the fuel use requirements provide adequate lead time. Commenters appeared to be most concerned with modifications that would need to be made to existing steamships on the Great Lakes to burn lower sulfur fuel. In any case, as discussed in Chapter 10, these ships are excluded from the final rule. In addition, we believe most if not all marine diesel engines can operate on lower sulfur distillate fuel with only minor modifications, if any, to the fuel systems. As discussed in Chapter 10, the near term standards can be achieved with residual fuel, and we are finalizing provisions that ensure Great Lakes vessels will continue to be able to purchase residual fuel on the Great Lakes. The longer term fuel sulfur standards, which would likely require the use of distillate fuel, do not begin until 2015, providing five years of lead time.

GLMTF misrepresented the lead time of a number of EPA rules. For instance, the Tier 2 Light Duty final rule was published in 2000 and was phased-in from 2004 through 2007, giving 4 years of lead time. The Heavy-Duty Highway final rule was published in 2001, and the exhaust emission standards phased-in from 2007 through 2010. The final rule for nonroad diesel engines was published in 2004 and began phasing-in in 2008. The locomotive and marine rule was finalized in 2008 and set near term standards beginning in 2009 and long term standards beginning in 2014. It should be noted that, these past rules were for the application of advanced aftertreatment on engines and vehicles, not for fuel sulfur limits. The Heavy-Duty highway rule included standards for ultra-low sulfur (15 ppm) fuel that began in 2006, providing five years of lead time, which is consistent with the lead time between this final rule and 1,000 ppm sulfur fuel ECA requirements.

It is not clear what grants and incentives that GLMTF is referring to for switching to new technologies. To the extent that these opportunities exist, they were not included in the standards setting rulemakings. In any case, the 13 steamships referenced in the GLMTF comments are not included in this rulemaking.

CHAPTER 5: Certification and Compliance

What We Proposed:

The comments in this section generally correspond to Section VI of the preamble to the proposed rule, where we describe the provisions related to certification and compliance of Category 3 marine diesel engines with applicable standards, including and MARPOL Annex VI standards through the Act to Prevent Pollution from Ships (APPS). The applicable regulatory provisions for these proposed requirements are primarily in 40 CFR parts 1042 and 1043.

See Chapter 11 of this document for a discussion of certification and compliance issues that are related to the technical amendments to regulations applicable to other types of diesel engines. See Chapter 10 of this document for a discussion of comments received relating specifically to implementation of the international standards for vessels operating on the Great Lakes.

5.1 General Comments

5.1.1 Comments on Harmonization with IMO Compliance Requirements

What Commenters Said:

Several commenters stated that EPA's requirements should not go beyond what is required for compliance with Annex VI. Those that offer specific reasons for this position for certain issues are summarized in other sections. The Transportation Institute expressed this same general comment with respect to EPA's emission standards and controls for U.S.-flag vessel operators exceeding Annex VI of MARPOL. Based on their assertion that EPA should not go beyond what Annex VI requires, they stated that if the proposed ECA is not established, these requirements should be suspended or withdrawn until such time the requirements would apply equally to all vessel operators, whether foreign or domestic, transiting our coastal waterways.

Our Response:

As a general matter, the specific issues raised by commenters are addressed below. However, we note that where feasible and appropriate under the Clean Air Act, we provide flexible approaches for meeting both the Clean Air Act and Annex VI requirements.

We fully expect the ECA to be established, which would make the Transportation Institute's comment moot.

5.1.2 Clarity of the Regulations

What Commenters Said:

Several commenters stated that EPA's regulations were generally unclear. Those that mentioned specific regulations are addressed in other sections.

Our Response:

Our intent is to codify our regulations to be as clear as possible for the regulated community. We have revised our proposed regulatory in several areas to improve clarity. Where we determine in the future that we can further clarify our regulations we would expect to do so through technical amendment.

5.2 On-Off NO_X Controls

What Commenters Said:

EMA asserted that EPA assumes that Tier 3 engines will utilize SCR to comply with the Tier 3 NO_X standards when operating the ECA, and that those systems will not be active when the vessels are operating outside of the ECA. EMA also raised several issues relating to fuel-switching procedures and "on-off" or aftertreatment by-pass strategies. They argued that further study is need to determine whether exhaust flows should be diverted around the SCR catalyst to avoid sulfur build-up and contamination of the system when the SCR system is inactive and higher sulfur fuel is being used.

They also argued that the proposed requirements in §§1042.110(d) and 1042.115(g) for the design and monitoring of "on-off" systems are overly burdensome, costly, go well beyond what is required under MARPOL Annex VI and will impose inequitable burdens on manufacturers seeking to certify C3 marine engines in the United States. They stated that EPA has not demonstrated that NO_X sensors and other continuous NO_X emissions monitoring systems are robust or durable enough to be feasibly and cost-effectively utilized in conjunction with very large C3 engines or in the extreme conditions under which C3 vessels operate. (As part of their argument they assert that the objective of this rule is to ensure “harmonization with the MARPOL Annex VI requirements for the certification of C3 marine engines.” Finally, they suggest an alternative approach that would require measurement of exhaust temperatures and urea flow, stating that such indirect measurement and monitoring would be more practical and cost-effective.

Euromot suggested that EPA allow comparable systems in which the aftertreatment remained operational outside of ECAs, while the engine operates at a higher NO_X calibration, provided the emissions met the Tier 2 standard. As noted in the next section, they also supported following the IMO regulations for demonstrating NO_X compliance, instead of requiring NO_X monitoring.

Maersk expressed concern that the “on/off” requirements are written to include vessels that have the capability of fuel switching

Our Response:

We agree with EMA that manufacturers will need to do some development work to determine how to design engines and aftertreatment for fuel-switching and on-off emission controls. However, we believe that any build-up of sulfur on the SCR components will not permanently affect the performance of the SCR components, and that any deterioration in SCR performance is reversible (i.e. once a sufficiently high exhaust gas temperature is achieved, sulfur is removed from the SCR). In addition, we believe that any excessive build-up of sulfates

and/or sulfated compounds on the SCR components due to high fuel sulfur levels can be removed using existing technologies, such as dust blowers or sonic horns.[11] Finally, it is important to note that most of this work will be necessary to meet the newly adopted MARPOL Annex VI NO_X requirements.

We are revising our regulations in response to Euromot's suggestion to not limit this option to disabling aftertreatment. The final regulations will also allow manufacturers to run the engine with a different calibration. While we do not dispute that our requirement for NO_X monitoring requirement may go beyond the bare minimum necessary to meet MARPOL Annex VI requirements, the final rule requirements will allow manufacturers to show compliance with the CAA and Annex VI allowances for on-off controls using methods allowed by us and MARPOL Annex VI. This will address our stated goal of allowing manufacturers to "continue to use a single harmonized compliance strategy to certify under both systems." This statement was intended to communicate that we want manufacturers to be able to use a single design that complies with both the CAA requirements and MARPOL requirements, and be able to use much of their testing and analysis for both. The regulations being finalized will allow manufacturers and operators to meet our requirements for on-off controls using methods also allowed by MARPOL.

We are revising the regulations to clarify that the on-off requirements apply for NO_X.

5.3 NO_X Monitoring and Diagnostics

What Commenters Said:

Maersk commented that routine and normal maintenance and operational adjustments to engine parameters should not require retesting. They commented on the proposed requirement that engine manufacturers to exercise good engineering judgment in using measured NO_X concentrations to monitor the emission performance of the engine. They argued that emissions measurements on a new engine in a controlled setting predict relative performance, but should not be expected to define maximum values in a full range of actual uses. They noted that, since some variation is also to be expected with age regardless of preventive maintenance, it would not be reasonable to cap emissions at a particular level determined when an engine is new.

Euromot supported following the IMO regulations for demonstrating NO_X compliance, instead of requiring NO_X monitoring. They argued that the costs of the proposed monitoring requirements are not justified by the information that would be gained.

The World Shipping Council objected to the requirement to perform emission tests following parameter adjustments. They noted that this is impractical because Category 3 engines are subject to continual adjustment; operators would have no useful reference point for deciding when a test would be necessary. They also pointed out that anyone making an improper parameter adjustment would likely not record this adjustment or follow it with an emission test, which limits the effectiveness of the requirement.

[11] Holmström, Per, "Selective Catalytic Reduction," presentation by Munters at Clean Ships: Advanced Technology for Clean Air, February 7-9, 2007, Docket ID EPA-HQ-OAR-2007-0121-0013.

Matson Navigation, CSA, and the World Shipping Council asked that EPA clarify how EPA or the Coast Guard will treat emission spikes and other "exceedences" that would be reflected through use of a CEMS. CSA stated further that monitoring systems are not well developed.

EGCSA recommended that EPA consider supporting and encouraging the mandatory adoption of continuous emissions monitoring and reporting as a more effective and economic method of assuring protection of the environment and human health.

Our Response:

We are not requiring monitors or testing for routine and normal engine adjustments or repairs. The requirements apply only for engines equipped with on-off controls and when those controls are used. The allowance to turn emission controls off is unprecedented in EPA's nonroad engine program. We have generally not allowed such features partly because of concerns that the controls might not function properly when turned back on. Since we have this same concern for Category 3 marine engines, we are finalizing the requirement that engines equipped with on-off controls incorporate NO_X monitors. We note in response to Euromot's comment that we are not requiring monitoring for informational purposes, but rather as a means to ensure proper function of the aftertreatment.

We disagree that onboard monitoring technology is not sufficiently developed to meet the propose requirement. We discuss this further in the RIA for this rule. Moreover, since we will not allow on-off technology until the Tier 3 time frame, manufacturers will have several more years before they are required to install onboard monitors.

We believe the requirements being finalized will address EGCSA's recommendation that "EPA consider supporting and encouraging the mandatory adoption of continuous emissions monitoring and reporting".

We fundamentally disagree with the implication that engines should not be expected to meet the standards during actual use. It is not clear whether this was what Maersk was suggesting, or whether they mistakenly believed that we proposed that engines should be held to their certification or sea-trial levels in use. Rather, the requirement being adopted specifies that manufacturers should use good engineering judgment to determine concentrations and/or emission rates for operating modes that would indicate that a malfunction that would likely cause the engine to fail the standard if it was tested according to the official test procedure. Such malfunction or "exceedances" would be treated like all other malfunctions. The operator would be required to repair the malfunction as soon as practical.

5.4 Authority Issues Related to APPS

Several commenters supported EPA's proposal to apply emission limits to ships operating within the internal waters of the United States including the Great Lakes. They argued that this is necessary due to the impact that such emissions can have on the people and environment of U.S. coastal and even inland areas. (CATF, 0264 and Ohio Environmental Council et al. 0314)

We also received detailed comments challenging our authority under APPS. In particular, the Great Lakes Maritime Task Force provided the most extensive comments in this respect. This section 5.4 is structured to be consistent with the structure of their comments. Our subsections are generally identified by the section headings they used in their comments, which in most cases serve to summarize the comments. The reader should not infer any agreement by EPA with their rationale for this structure.

5.4.1 The APPS Does Not Give EPA Legal Authority to Implement ECAs or to Regulate Fuel Use in Internal Waters

What Commenters Said:

The Great Maritime Lakes Task Force made the general comment that that the NPRM was vague, confusing and unclear as to EPA's legal authority to designate the Great Lakes as an ECA and the omission of a meaningful discussion makes commenting very difficult. In addition, GLMTF comments that APPS does not give EPA the explicit authority to implement low-sulfur fuel ECAs in internal waters, and without explicit authority the rulemaking is contrary to law. GLMTF also states that EPA has no authority to create an ECA for internal waters and that APPS does not provide such authority.

Our Response:

The introduction and overview statement in the NPRM provides that "[t]he amendments to APPS to incorporate Annex VI provide the authority to ensure compliance with MARPOL Annex VI by U.S. and foreign vessels that enter U.S. ports or operate in U.S. waters." (74 FR 44444). The authority section of the NPRM provides that section 1903 of APPS "gives the Administrator the authority to prescribe any necessary or desired regulations to carry out the provisions of Regulations 12 through 19 of Annex VI". 74 Fed.Reg. at 44446-7. The substantive section on this issue reiterates that APPS applies Annex VI to all vessels in U.S. navigable waters, including internal waters, and further explains that because the U.S.-Canadian ECA does not expressly include reference to the internal boundaries of the U.S. or Canada, that clarification on what it means for APPS to apply Annex VI requirements to U.S. internal waters was both "necessary" and "desired". 74 Fed. Reg. at 44481. Clarification is necessary and desired to avoid both an under- and over-application of the ECA requirements. The under-application would involve an inexplicable turn-off of emission controls or diversion to higher sulfur fuels when entering internal waters from an ECA. The over-application could include compliance with ECA provisions in areas that are not shoreward of the ECA, such as those in northwestern Alaska. 74 Fed. Reg. at 44481. Neither approach is intended by Congress' direction that Annex VI requirements apply to all vessels in U.S. waters.

In sum, APPS applies Annex VI requirements to domestic vessels wherever located, including U.S. internal waters, and to foreign-flagged vessels in U.S. navigable waters (and beyond in some cases), defined by APPS to include U.S. internal waters. Contrary to GLMTF's comment, this is an explicit, comprehensive application by Congress of Annex VI requirements to all vessels in U.S. internal waters. Our regulation does not create "new" ECAs, but seeks to clarify how to apply the Annex VI ECA requirements, given the description of the ECA is by the outer-boundaries, to U.S. waters within those outer-boundaries. We are avoiding an under-application of this congressional direction for ECA purposes by specifying what we think is the obvious – that Congress intends all vessels covered by Annex VI to meet the most stringent of

the requirements of Annex VI even when within U.S. internal waters. A contrary reading of these provisions of APPS leads illogically to congressional allowances for domestic and foreign flagged vessels to emit greater quantities of dangerous pollutants closer to population centers than would be required of vessels out to sea. We are also avoiding an over-application of the most stringent requirements to U.S. internal waters that are not shoreward of an ECA. Although these waters are within the internal waters of the U.S., unless and until an ECA is established for the waters outside those internal water areas, we think it reasonable not to require vessels to meet the ECA requirements in those areas.

5.4.1.1 APPS Does Not Implement the 2008 Amendments to MARPOL Annex VI

What Commenters Said:

APPS does not implement the low-sulfur fuel requirements in the 2008 Amendments and nothing in APPS gives EPA the authority to create a low-sulfur fuel ECA in U.S. internal waters.

Our Response:

The 2008 amendments to Annex VI include two tiers of global NO_X and fuel sulfur standards. It also includes two tiers of ECA NO_X and fuel sulfur standards. APPS is clearly intended to require compliance with Annex VI and these 2008 amendments to Annex VI. Specifically, APPS provides: "It is unlawful to act in violation of the MARPOL Protocol …" (Sec. 1907(a)). APPS defines the MARPOL Protocol to include the Convention, which in turn is defined as " the International Convention for the Prevention of Pollution from Ships, 1973, including * * * *[Annex] VI thereto, including any modifications or amendments* to the Convention, Protocols or Annexes which have entered into force for the United States." The 2008 amendments are just such amendments to Annex VI and were contemplated at the time Congress considered amendments to APPS to implement Annex VI.

The comment regarding creation of an ECA for internal waters is addressed above.

5.4.1.1.1 The Senate Has Not Acceded to the 2008 Amendments to Annex VI

What Commenters Said:

The Senate acceded to the MARPOL Annex VI in April 2006. Since MARPOL is not a self-executing treaty, implementing legislation was required. Congress therefore enacted legislation implementing Annex VI in 2008 by amending APPS. Later that year, the IMO adopted certain amendments to Annex VI, after the Senate acceded to Annex VI and after Congress enacted legislation implementing Annex VI. Since the Senate has not acceded to the 2008 Amendments to Annex VI, those amendments, including the low-sulfur fuel requirements, are not law in the U.S. GLMTF refers to a recent U.S. Court of Appeals case in the District of Columbia they argue that concludes that a treaty cannot authorize future changes that would become binding on the U.S.

GLMTF also argues that because the U.S. was not permitted to vote on the 2008 Amendments to Annex VI, no branch of the federal government has formally accepted the treaty obligations which EPA now seeks to impose.

Our Response:

The Senate has given its advice and consent both to MARPOL itself and to Annex VI. Article 16 of MARPOL sets out a simplified amendment process, which was followed for the 2008 Amendments.

This kind of amendment procedure is a feature of many treaties to which the United States is a party and to which the Senate has provided its advice and consent. Indeed, the Senate Foreign Relations Committee has specifically noted and accepted the simplified amendment process. See, for example, the Committee's March 30, 2006 Report, document 109-13. The Senate and the Executive Branch have a longstanding, successful practice of working together in adopting and implementing amendment procedures such as this.

The D.C. Circuit case GLMTF cites addressed the impact of "decision" language agreed to under the Montreal Protocol following ratification of that treaty. The court termed such decisions "post-ratification side agreements." No party to that case claimed that the decisions were amendments to the treaty. Nor did the court reach a holding on any constitutional issue. Rather, the court held that the decisions in question were international political commitments. In reaching this holding, the court looked to the language of the treaty and the Parties' post-ratification actions. The court noted: "Nowhere does the Protocol suggest that the Parties' post-ratification consensus agreements about how to implement [the exemption at issue] are binding in domestic courts." 464 F.3d 1, 9. The court further noted: "The Parties' post-ratification actions suggest their common understanding that the decisions are international political commitments rather than judicially enforceable domestic law." Id. at 10. Thus, the court was not presented with a situation in which the Senate had ratified a procedure for reaching agreements intended to be binding in domestic courts. Here, the Senate has given its advice and consent to MARPOL and the Annex, which includes an amendment process. Thus, NRDC v. EPA is inapplicable. In enacting and amending APPS, Congress has made clear that Annex VI, including amendments that are binding on the United States, applies to ships as specified in APPS, and that EPA and Coast Guard have authority to issue any necessary or desirable implementing regulations.

Although the U.S. had no formal vote in the adoption of the 2008 Annex VI amendments, the U.S. took an active role in the negotiation of the amendments, which are very similar to a proposal submitted to IMO by the United States. Moreover, under MARPOL, any Party, including the U.S., has the opportunity to object to these amendments, in which case they would not apply to the objecting Party. The Senate gave its advice and consent on the procedures, and Congress approved the legislation authorizing this approach.

5.4.1.1.2 Setting aside Article 16(2), APPS itself is explicit that future amendments to Annex VI are subject to Senate advice and consent.

What Commenters Said:

Setting aside Article 16(2), APPS itself is explicit that future amendments to Annex VI are subject to Senate advice and consent:

> A proposed amendment to the MARPOL Protocol … may be accepted on behalf of the United States by the President following the advice and consent of the Senate, except as provided for in subsection (b) of this section.

The term "MARPOL Protocol" is defined to include "the Convention" which in turn is defined to include Annex VI. Therefore, any amendment to Annex VI is subject to Senate advice and consent. The reference to "subsection (b) of this section" denotes a procedure whereby the Secretary of State can lodge an objection to the proposed amendment following consultation with the Secretary of Homeland Security or the EPA Administrator. Subsection (b) does not address U.S. acceptance of an amendment to an Annex, and therefore does not displace the requirement for Senate consent before amendments can be accepted by the President. Article 16(2) does not trump the plain language of APPS, which requires Senate consent before amendment to Annex VI can be accepted by the U.S.

Our Response:

Contrary to the commenter's contention, APPS itself fully anticipates the prospect of simplified amendments that do not require Senate advice and consent. As an alternative to receiving the advice and consent of the Senate, Section 1909(b) explicitly provides that a proposed amendment to Annex VI, "may be the subject of appropriate action on behalf of the United States by the Secretary of State" (emphasis added) following consultation with EPA or the Secretary of Homeland Security. As provided for in Section 1909(c), the Secretary of State may also make a declaration of nonacceptance of an amendment, following consultations with the Secretary of Homeland Security. By contrast, Section 1909(a) states that amendments to the Protocol/Convention itself are subject to Senate advice and consent.

5.4.1.1.3 APPS Expressly Excludes the 2008 Amendments to Annex VI

What Commenters Said:

GLMTF stated:

> For purposes of APPS, Congress defined the MARPOL Convention in such a way to exclude future amendments. APPS defines the MARPOL Convention as follows: "Convention" means the International Convention for the Prevention of Pollution from Ships, 1973, including Protocols I and II and Annexes I, II, V, and VI thereto, including any modification or amendments to the Convention, Protocols, or Annexes which have entered into force for the United States.
>
> By contrast, a neighboring provision of APPS defines another treaty in a materially different manner: "Antarctic Protocol" means the Protocol on Environmental Protection to the Antarctic Treaty, signed October 4, 1991, in Madrid, and all annexes thereto, and includes any future amendments thereto which have entered into force.

Our Response:

Contrary to the commenters' claim, APPS does not exclude from its scope future amendments to the Convention, Protocols, or Annexes, either expressly or by implication. Indeed, APPS expressly includes within the scope of its definition of the MARPOL Convention

"any modification or amendments to the Convention, Protocols, or Annexes which have entered into force for the United States." 33 U.S.C. § 1901(a)(5). The United States did not ratify MARPOL until after enactment of APPS, so at the time that APPS was enacted, there could have been no amendments binding on the United States. Thus, Congress could only have had prospective amendments in mind. The same is true regarding Annex VI; Congress was aware that the U.S. was not yet a party to the Annex, and so could not be bound by any amendments at the time Congress acted. Finally, the existence of APPS Section 1909, which sets forth a process for future APPS amendments, demonstrates that Congress intended APPS to implement MARPOL with such amendments as may enter into force for the United States over time.

5.4.1.1.4 This Rulemaking, at Least as to the Great Lakes, Is Premature

What Commenters Said:

The EPA has based its rulemaking authority on the 2008 Amendments to Annex VI, but those amendments are not scheduled to enter into force until January 2010 and the U.S. could opt out at any time before then. Thus, even assuming the 2008 Amendments could enter into force for the U.S. in the future, the 2008 Amendments are not yet in force and EPA presently lacks any legal authority to promulgate regulations implementing those amendments. Accordingly, EPA's rulemaking is premature.

Our Response:

Section 1907 of APPS requires compliance with the Convention, which includes Annex VI and any amendments to it which have entered into force for the United States. The amendments in question will enter into force for the United States on July 1, 2010, unless the United States or the requisite number of Parties objects.[12] None of the Annex VI requirements that are specific to this final rule will be applicable to the regulated community prior to that time of entry into force for the United States. This final rule codifies those requirements so that the regulatory text will identify, for the ease of the regulated community, the Annex VI requirements subject to section 1907 enforcement. This final rule also addresses a number of other issues so the regulated community may ensure it is meeting the requirements of Annex VI and its amendments before the new global and the ECA standards go into effect. For example, the regulatory text identifies how and when an engine may be certified to NO_X standards, identifies how foreign nonparty vessels may demonstrate compliance with Annex VI NO_X requirements, and identifies specific exemptions and exclusions.

The final rule also specifies that the standards applicable in the North American ECA are intended to apply within U.S. internal waters once the ECA standards enter into force for the United States. The earliest date for entry into force of the U.S.-Canada proposed ECA would be August 2011, given MARPOL's entry into force provisions. In addition, because of the "grace period" provided in Reg. 14.7 of Annex VI, the ECA fuel standards for sulfur could not enter into force until August 2012. We are aware of no authority preventing EPA from anticipating the entry into force of the standards. Indeed, any interpretation suggesting otherwise—i.e., that

[12] In that case, EPA would need to take appropriate action to make clear that the regulatory requirements associated with those amendments would not become effective.

authority to promulgate regulations begins only at the point when the international legal obligations have taken effect—would effectively require some period of time in which the United States would be unable to comply with its international legal obligations.

5.4.1.1.5 The Grant of Authority to EPA under APPS Violates the Nondelegation Doctrine

What Commenters Said:

GLMTF commented that the grant of authority to EPA under APPS is to promulgate regulations "necessary or desired" to carry out Annex VI. The standard "desired" lacks an intelligible principle to which EPA is directed to conform, and thus violates the nondelgation doctrine. APPS's instructions that EPA promulgate "desired" regulations fall short of any objective criteria by which the agency's action can be measured. Who but the agency can determine what it subjectively 'desires"? Moreover, the EPA cannot "cure an unconstitutionally standardless delegation of power by declining to exercise some of that power." EPA can thus not fall back on its authority to promulgate regulations it deems "necessary" to carry out Anne VI because the overall delegation is unconstitutionally broad.

Our Response:

The APPS language raised by GLMTF is the standard language used in APPS to authorize issuance of regulations, by Coast Guard and by EPA, to implement MARPOL and its Annexes as well as other treaty requirements. EPA presumes that the law is constitutional.

Moreover, EPA believes that the regulations are necessary and desirable for the effective implementation and enforcement of Annex VI, insofar as they (inter alia): (1) implement the mandate in APPS to regulate foreign vessels; (2) clarify the geographic scope of application of ECA standards; (3) explain how Annex VI equivalence provisions will be implemented; (4) explain the process for issuance of EIAPPs, and (5) provide variances from the ECA fuel requirements for steamships on the Great Lakes and for certain vessels experiencing difficulties, as later discussed in Chapter 10.

5.4.1.2 APPS Does Not Authorize EPA to Regulate Use of Fuel in Internal Waters

What Commenters Said:

GLMTF state that even if the 2008 Annex VI amendments are binding on the U.S. and incorporated by APPS, nothing in APPS gives EPA the authority to declare that certain U.S. internal waters will henceforth be ECAs in which low-sulfur fuel must be used. APPS gives EPA the authority to prescribe regulations to carry out the provisions of Regulations 13 and 14; those Regulations define an ECA as an area "designated by the Organization;" and the Great Lakes are not referenced in the U.S.- Canada proposed ECA.

Our Response:

As explained above, APPS requires compliance with Annex VI requirements by domestic and foreign-flagged vessels in U.S. internal waters. As further explained above, the Annex VI ECA requirements, once adopted and in force, are Annex VI requirements and compliance with these amendments are compelled by Congress. Finally, we explain that his rule is intended to

clarify what we believe Congress intended in applying these ECA Annex VI requirements, to domestics vessels "wherever located," including in U.S. internal waters, and foreign-flagged vessels in U.S. internal waters.

However even if GLMTF's reading of APPS were correct, provisions such as §1902(a)(5)(B)(iii) clearly envision regulation of emissions from foreign-flagged vessels in areas outside of ECAs (which are addressed separately in §1902(a)(5)(B)(ii)) as "areas from which emissions from ships are of concern." Had Congress not intended to require foreign vessels to meet Annex VI ECA requirements in U.S. internal waters by virtue of the plain language applying Annex VI requirements to foreign-flagged vessels in U.S. internal waters, this provision provides alternative authority for requiring foreign-flagged vessels in U.S. internal waters to meet the same requirements as vessels operating in coastal areas of the United States. However, this authority would not apply to domestic vessels, since they are subject to the requirements of APPS "wherever located." We do not think Congress intended the incongruent result where foreign, but not domestic, vessels would be subject to ECA requirements in U.S. internal waters.

5.4.1.2.1 The U.S.-Canada Proposed ECA Excludes Internal Waters

What Commenters Said:

GLMTF stated that the U.S. and Canada jointly submitted an ECA for IMO consideration that "expressly excludes their internal waters," and that EPA's extension of the ECA boundaries into internal waters "contravenes the very source of authority it invokes for its regulations." They stated further that "even if Annex VI applies to U.S. internal waters through APPS, it would be the pre-2008 fuel standards of Annex VI that are applicable, not the more stringent standards implemented by the 2008 Amendments which are not effective with respect to the U.S. Finally, they argued that EPA ignored a "glaring omission of internal waters from the U.S.-Canada ECA," and that EPA's statement that "[v]essel emissions in these [internal] waters affect U.S. air quality to an equal, if not greater extent than emissions taking place in coastal waters" was conclusory. They also seemed to imply that EPA had no basis for describing the ECA as being sought to "protect air quality in U.S. ports and internal areas."

Our Response:

The proposed ECA does not "expressly exclude" internal waters. U.S. internal waters were not specified in ECA application boundaries because of the sensibility that it is not appropriate for an international organization to be designating control areas in U.S. internal waters. There was no counter-intuitive suggestion that marine emissions in such waters are any less harmful to U.S. air quality than emissions occurring from the baseline seaward to 200 nautical miles. Rather, EPA and other federal agencies believed that Congress' direction to apply APPS requirements to U.S. internal waters confers the authority – if not requires – application of the ECA standards to emissions in those waters, given that such emissions are even closer to U.S. population centers than are emissions from most parts of the designated ECA.

The commenter is incorrect when it suggested that EPA ignored the extent to which the ECA proposed to IMO included internal waters. Their suggestion is refuted by EPA's explicit statement that the regulatory text applying ECA requirements to internal areas was proposed under the authority of APPS (74 FR 44481).

While we continue to believe the statements GLMTF objects to are self-evident, we note the following in response to their concerns. First, if emissions in internal waters affect U.S. air quality to a lesser extent than emissions taking place in coastal waters (as suggested by GLMTF), it would necessarily mean that emissions become more harmful the further out to sea they occur. The logical extension of this would be that emissions in the port would be more harmful than emissions from land based service equipment and should be controlled more stringently than the land based equipment. GLMTF provided no basis for the illogical implication that emissions should be more aggressively controlled out at sea and on land than in internal waters. With respect to the second statement, we note that analysis of the impacts of ship emissions on internal areas was included as part of the supporting information for the ECA proposal.

5.5 Compliance Issues Related to Implementation of APPS

5.5.1 EIAPP Certification

What Commenters Said:

The World Shipping Council and Matson Navigation Co. stated that manufacturers should be able to submit a single application for both EIAPP and EPA certificates. They argued that this would be simpler for the regulated community as well as the EPA and Coast Guard.

EMA and Euromot argued that EPA should not require a manufacturer to obtain the EIAPP certificate before an engine is introduced into U.S. commerce. EMA also expressed confusion regarding how §1043.10(a)(2) and §1043.30(a) are related for vessels that operate only domestically.

Our Response:

While we do not think it would be practical to structure our certification program to enable a manufacturer to submit a single application for both EIAPP and EPA certificates, we plan to harmonize the two processes to the maximum extent possible. Coast Guard should not be affected by this certification process, since the same information will be provided in either case.

It is not clear how the requirement to have an EIAPP certificate would be enforced if we followed EMA's suggestion, since they did not suggest any other point at which the requirement would apply. Without a specific point by which the engine must have an EIAPP, engine and vessel manufacturers and operators of uncertified engines could always claim that they had merely not obtained the certificate *yet*.

We agree with EMA that §1043.10(a)(2) and §1043.30(a) of the proposed regulations are confusing. We have revised the regulations to clarify that vessels that operate only domestically do not need to obtain EIAPPs. However, to make this allowance fit better into our enforcement program, we are requiring that engines without EIAPPs that are intended for domestic use (or for use on public vessels) include a statement on the label to indicate that.

5.5.2 Applicability of International Emission Standards to Nonparty Vessels

What Commenters Said:

The Chamber of Shipping of America and WSC support the proposal to require vessels flying the flag of a State not party to MARPOL Annex VI to demonstrate equivalent compliance with the substantive standards found in Annex VI. They stated that demonstration of compliance by a non-party vessel should not be limited to documentation only, but should be subject to the same methods of verification, including physical inspection and testing, as used by U.S. enforcement personnel when inspecting a vessel flying the flag of a State party to MARPOL Annex VI.

Our Response:

As described in part 1043 of the regulations, we will treat non-Party vessels essentially the same as Party vessels, except for the requirement to have actual EIAPP certificates for the engines. More specifically, the final regulations state that non-Party vessels must comply with "operating requirements and restrictions specified in 2008 Annex VI (incorporated by reference in §1043.100) related to Regulations 13, 14, and 18" (in §1043.60) and "must keep all records required by Regulations 13, 14, and 18 of Annex VI and the NO_X Technical Code" (§1043.70).

5.5.3 In which U.S. waters are Annex VI and its ECA requirements being implemented through APPS?

WSC commented on the description in the NPRM preamble of how the ECA requirements apply to internal waters. Specifically they asked about use of the term "generally" and the phrase "internal waters that can be accessed by ocean-going vessels". WSC also asked that EPA clarify that the extension of the ECA requirements to internal waters would apply to both U.S. and foreign-flagged vessels operating in the internal waters of the United States. The Chamber of Shipping of America and Maersk ask EPA to clarify the term "U.S. waters"

Our Response:

We believe that most of WSC's confusion is related only the preamble language and the regulations use different wording that is clear. Since the preamble language is intended to be more readable for the general public, its wording is sometimes less precise.

We are finalizing regulations that specify that the requirements apply for any waters that fall within the scope of the navigable waters of the U.S. or the U.S. EEZ. We are also adding a definition of "ECA associated area" which means U.S. internal waters that are navigable from the ECA. We also clarify that this term does not include internal waters that are shoreward of ocean waters that are not part of an emission control area. It also does not include any waters not accessible to ocean vessels, such as land-locked internal lakes. The regulations specify that the requirements that apply under Annex VI to vessels in ECAs will apply in ECA associated areas.

In most respects, the regulations of 1043 apply equally to U.S.-flagged and foreign-flagged vessels of Party states. The only differences are that the following special provisions apply only for U.S.-flagged vessels:

1) As provided in APPS and Annex VI, section 1043.10 specifies that U.S.-flagged vessels must comply with AnnexVI in any waters, not just U.S. waters.
2) Section 1043.10 excludes U.S.-flagged domestic vessels from Regulation 13.
3) Section 1043.40 and 1043.41 specify how manufacturers obtain EIAPP certificates for U.S.-flagged vessels.

We believe that similar provisions will be applied to foreign-flagged vessels by their respective flag states – whether by statute, regulation, or other policy. Thus the ECA requirements in U.S. internal waters will apply equally to U.S.-flagged and foreign-flagged vessels.

In most respects, non-Party vessels will be treated the same under part 1043 as other foreign-flagged vessels. See section 5.5.2 for a discussion of the differences.

5.5.4 EPA's extension of an ECA to the Great Lakes violates bilateral treaties between the U.S. and Canada

What Commenters Said:

The Great Lakes Maritime Task Force (GLMTF) (0269) stated that the U.S. and Canada have a long tradition of cooperation on matters relating to the environment. Through treaties such as the Boundary Waters Act of 1909, the Great Lakes Water Quality Agreement of 1978, the Memorandum of Intent Concerning Transboundary Air Pollution of 1980, the ECE Convention on Long-Range Transboundary Air Pollution of 1979 and, most relevant here, the Agreement Between the Government of Canada and the Government of the United States of America on Air Quality ("Air Quality Agreement"), the U.S. and Canada have agreed to act as partners in protecting the environment and reducing transboundary air pollution.

GLMTF commented that a hallmark of these bilateral treaties between the U.S. and Canada, and in particular the Air Quality Agreement, is notice and consultation. Numerous provisions of the Air Quality Agreement require one country to notify and consult with the other when taking action to regulate air pollution. For example, Article V(6) requires one party to "notify and consult the other Party" where it "becomes aware of an air pollution problem that is of joint concern and requires an immediate response." Article V(3) requires each party to consult with the other upon request "concerning changes to its laws, regulation or policies that, if carried out, would be likely to affect significantly transboundary air pollution." Such consultations must also include "consideration of appropriate mitigation measures." Article V(1) requires each party to "assess those proposed actions" that "would be likely to cause significant transboundary air pollution, including consideration of appropriate mitigation measures."

GLMTF argued that EPA's unilateral decision to extend the boundaries of the ECA to include the Great Lakes repudiates the cooperative manner in which the U.S. and Canada have historically approached regulation of air pollution, and violates the spirit, if not the express requirements, of the Air Quality Agreement and related bilaterals. The lack of coordination is particularly ironic in light of the joint coastal ECA submission by the U.S. and Canada (and the highly cooperative manner in which the coastal ECA was developed) and the sweeping impact of this rulemaking on Canadian shipping and industry. The failure to consider these effects and

consult with our northern neighbor is not only disrespectful to one of our closest allies but a violation of U.S. treaty obligations.

Our Response:

EPA cooperates closely with the Canadian Government on a broad range of environmental matters. As the commenter notes, the U.S. and Canada jointly submitted the ECA proposal to the IMO. EPA has also consulted informally with the Canadian government with respect to this rulemaking. We do not agree that this rulemaking is governed by Article V of the U.S. – Canada Air Quality Agreement. To the contrary, Article V is intended to address potential increases in air pollution, not regulatory efforts to reduce it. For example, Article V.5 provides: "Each Party shall, as appropriate, take measures to avoid or mitigate the potential risk posed by actions, activities or projects that would be likely to cause or may be causing significant transboundary air pollution." Moreover, the "mitigation measures" cited by the commenter refer to measures to reduce transboundary air pollution, not measures to mitigate the economic impact of regulation.

Finally, we note that the Final Rule provides some relief for Canadian ships operating solely in the Great Lakes. This is discussed further in the preamble and Chapter 10 of this document.

5.6 Comments on Testing Requirements

5.6.1 1065 Test Procedures

What Commenters Said:

Manufacturers objected to the provisions specifying the use of the test procedures in 40 CFR part 1065. EMA objected because of the cost of modifying laboratories to test according to 1065. Euromot argued that 1065 procedures could not be readily applied to large volume 2- and 4-stroke engines. They also requested clarification of the liability for testing performed according to 1065.

Our Response:

We believe these two test methods provide similar emission results. However, we specified the test procedures in 1065 as the official test procedures for Category 3 engines because they are more up to date with current technology and result in more repeatable measurements. This is largely because the 1065 regulations are frequently updated to incorporate new measurement technologies and knowledge gained from testing.

While we do not agree with Euromot's comment that Category 3 engines cannot be tested according to 1065, we recognize EMA's concern that it could be expensive to upgrade a laboratory to test according to 1065. That is why we proposed §1042.501(g) which states:

> (g) For Category 3 engines, you may submit test data for NO_X, HC, and CO emissions that were collected as specified in the Annex VI Technical Code instead of test data collected as specified in 40 CFR part 1065. We may require you to include a brief engineering

analysis showing how these data demonstrate that your engines would meet the applicable emission standards if you had used the test procedures specified in 40 CFR part 1065.

However, this provision addresses both issues of cost and feasibility. Manufacturers that are already testing according to the Annex VI Technical Code could continue to do so. Under §1042.501(g), such data would be fully acceptable for certification. Nevertheless, we would expect such manufacturers to be familiar with the 1065 procedures.

While we believe the Annex VI Technical Code and 1065 procedures will provide very similar emission results, we recognize that it is theoretically possible for there to be a meaningful difference in some unusual set of circumstances. It would be inappropriate to allow a manufacturer to take advantage of any such differences. That is why we retain the right under §1042.501(g) to require manufacturers to perform a brief engineering analysis showing how that data collected according to the Technical Code are adequate to demonstrate that the engines would meet the applicable emission standards if they had had been tested according to the test procedures specified in 40 CFR part 1065.

5.6.2 Certification Fuel

What Commenters Said:

Euromot questioned the need for limits on sulfur in test fuels. They stated that such limits do not apply for IMO testing and would increase testing costs. EMA also opposed the revision to the test fuel requirements for C3 marine engines should not be finalized because it could require engine manufacturers to maintain a separate fuel supply at their testing facilities.

Our Response:

As we indicated in 5.6.1, we would accept test data collected according to the Technical Code, which does not include specifications for fuel sulfur.

5.6.3 Production-Line Testing

What Commenters Said:

Several commenters oppose the requirement to perform an emission test for each Category 3 engine after it is installed in the vessel. Their objections were based primarily on cost considerations. Euromot stated that such testing would extend the sea trial by at least one day. They estimated that extending the sea trial would cost $300,000 per day. EMA also argued that portable measurement systems have not been proven.

Our Response:

Sections 206 and 207 of the Clean Air Act direct EPA to establish test programs to ensure that engines are manufactured to conform to the applicable regulations in actual use. Thus, we do not believe that the Clean Air Act would allow us to have no program to verify emissions after certification.

We have used a variety of programs to fulfill this obligation for other engine sectors. We generally include some combination of regular testing of randomly selected engines as they are being produced (production-line testing), unscheduled testing audits by EPA of engines as they are being produced (selective enforcement audits), and testing of randomly selected engines in-use engines.

Under the existing regulations for Category 3 Tier 1 standards, this obligation was met by regulations specifying that we could require manufacturers to perform a selective enforcement audit. However, given the very small sales volumes for Category 3 engines, it is not appropriate for a long-term program to rely on any method based on testing only a subset of the engines produced. This is especially true for engines of this size, where a single engine can emit hundreds of times more pollution than smaller nonroad engines. The reliance on theoretical selective enforcement audits was only appropriate as a transition program implementing an initial tier of standards.

In addition, since Category 3 engines are generally not fully assembled in a testable configuration before being installed in the vessel, a program relying on onboard testing is the most workable approach. If the engine must be tested after installation in the vessel, we believe that testing during the sea trial will be the least burdensome approach.

We disagree with EMA's assertion that portable measurement systems have not been proven. They have been used extensively for a wide variety of application. Moreover, EPA recently completed a project to demonstrate the use of such systems onboard a marine vessel.

While we continue to believe this requirement to be essential for the long-term program, we accept that some manufacturers may need additional lead time to integrate the testing requirement into their sea trials. Therefore, we will not require such testing until the engines are subject to the Tier 3 standards.

5.6.4 PM Measurement

What Commenters Said:

Several manufacturers opposed the requirement to measure particulate emissions during certification testing of Category 3 engines. They generally argued that PM emissions from Category 3 engines cannot be accurately measured under 40 CFR part 1065 or that it would be prohibitively expensive. Commenters noted problems with measurement variability, fuel sulfur levels, and the exhaust flow rates/size of the exhaust stacks. Finally they questioned what benefits would be achieved with this requirement.

Our Response:

The PM measurement provisions in 40 CFR Part 1065 are more than adequate to accurately and repeatably measure PM from C3 marine engines. While there have problems

with measurement variability in past testing, these issues can be avoided by following the latest part 1065 requirements as discussed below.

One commenter appears to be basing the concern in part on data for PM measurement variability that was discussed by Hellen *et al.*, which advocates the use of ISO 9096 over ISO 8178-1, with a fuel sulfur upper limit of 0.8% for application of ISO 8178-1 and a CIMAC recommended upper limit (CIMAC Recommendation 23/2005) of 0.05%. [13,14,15] These recommendations were based on work by Bastenhof as published by CIMAC in 1995, where the precision in measurement of PM from an engine fueled by residual fuel with 3.66% sulfur was ±25 %.[16] It is important to note that the temperature and relative humidity of the filter conditioning room were not held to a tight tolerance during this testing: temperatures ranged from 22 to 26 °C and relative humidity from 36 to 58 %. This variability can greatly affect the amount of water bound to sulfuric acid trapped on the filter as discussed below. While this was not the only source of variability in this work, the lack of precision appears to be associated with increasing fuel sulfur level. The error in measurment of the particle phase sulfate can be directly attributed to the filter conditioning.

To minimize variability, consistent control of the sample zone temperature is also very important, especially for engines emitting high amounts of semi-volatile hydrocarbons, as the temperature controls the deposition of semi-volatile hydrocarbons onto the filter. Additional improvements to ISO 8178-1 and 40 CFR Part 1065 since the publication of the Bastenhof paper, with respect to sample zone temperature control (47 ±5 °C) and filter conditioning/weighing room environment (22 ±1 °C ambient temperature and 9.5 ±1 °C dewpoint) have worked to further lower the variability of these measurment methods, thus making them appropriate for measurement of PM from C3 marine engines. This has been further supported by work by Agrawal and Murphy, *et al.* which has shown very repeatable measurements using ISO-8178-1 to measure PM on-board ships.[17,18]

Further, with respect to measurement of C3 emissions as a whole, 40 CFR Part 1065 is very robust and more than adequate for measurement of emissions from C3 marine engines. Part 1065 is an improvement over existing test procedures with respect to accuracy and repeatability and its use would benefit C3 marine emission measurement.

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[13] "Particulate Emissions of Residual Fuel Operated Diesel Engines – Background, Particulate Size Distributions, Measurement Methods, and Potential Abatement Measures", Hellen, G., *et al*., International Council on Combustion Engines, Paper No. 56 (2007).

[14] ISO 9096, "Stationary Source Emissions – Manual Determination of Mass Concentration of Particulate Matter.

[15] CIMAC Recommendation Number 23/2005: Standards and Methods for Sampling and Analysing Emission Components in Non-automotive Diesel and Gas Engine Exhaust Gasses – Marine and Land Based Power Plant Sources.

[16] "Exhaust Gas Emission Measurements – A Contribution to a Realistic Approach", Bastenhof, D., International Council on Combustion Engines, 1995.

[17] "Emission Measurements from a Crude Oil Tanker at Sea", Agrawal, H., *et al*., *Environ. Sci. Technol.* **2008,** *42,* 7098–7103.

[18] "Comprehensive Simultaneous Shipboard and Airborne Characterization of Exhaust from a Modern Container Ship at Sea", Murphy, S., *et al*., Environ. Sci. Technol., 2009, 43 (13), pp 4626–4640.

With respect to test fuel, C3 marine engine manufacturers typically certify their engines on distillate fuel even if engines operate on HFO. By requiring a test fuel with a sulfur level of 800 to 2,500 ppm, we will be matching the in-use fuel S concentration for an engine complying with the Tier III fuel sulfur requirements and we expect this fuel sulfur concentration to be similar to that currently used by engine manufacturers for engine certification.

5.7 Exclusions and Exemptions

What Commenters Said:

Several commenters stated there EPA should continue to allow an exemption for replacement Category 3 engines. EMA emphasized that all of the exemptions provided in MARPOL Annex VI and under the APPS should be included in EPA's C3 Marine Engine Rule. In particular, they wanted additional exemptions for emergency and military engines and vessels, the Annex VI exemption for sea-bed mineral exploration and associated activities (see MARPOL Regulation 3.1).

The World Shipping Council stated that replacement of a failing Category 3 engine would be "extraordinarily rare," given the size and placement of these engines on a vessel. They stated further that it may be completely impractical to upgrade an engine from Tier II to Tier III if a larger physical infrastructure is required to install the new engine. They asked that EPA explain why there is no allowance for a replacement engine exemption for Category 3 engines.

AWO commented in support of the proposed exemption for vessels that operate only domestically.

Our Response:

We proposed to not allow a replacement engine exemption for Category 3 engines because we cannot envision a scenario in which it would be necessary to replace an engine with an uncertified engine or one certified to earlier standards. We still do not believe that such circumstances will occur. Nevertheless, we accept that we cannot imagine all possible circumstances. Therefore, the final regulations will allow a manufacturer to request a replacement engine, but only for very unusual circumstances.

With respect to the other exemptions, we are finalizing the APPS regulations to include the same exemptions and exclusions included under Annex VI. However, we are not applying them to our Clean Air Act regulations. Instead, we are continuing the same exemption provisions that already apply for marine engines. This includes national security and emergency exemptions, but does not include any exemption for engines used for sea-bed mineral exploration

5.8 Provisions for Category 1 and 2 Engines

What Commenters Said:

EMA also supports the Agency's proposal to adopt compliance flexibility for C1 and C2 vessels that operate primarily in foreign ports. Under that proposal, and beginning in 2016, vessel owners would be allowed the choice, with respect to C1 and C2 engines, between complying with EPA's Tier 4 NO_X and PM standards or the MARPOL Annex VI standards for

all CI engines over 130 kW installed on the vessel. EMA encourages the Agency to include such compliance flexibility in any final C3 rulemaking, and to amend the C1/C2 rule to delete the compliance requirements for 2016 and later model year engines installed on U.S. vessels traveling overseas.

EMA also endorses the additional compliance flexibility that the Agency has proposed with respect to the temporary exemption program for C1 and C2 vessels that may operate overseas under contract for extended periods in an area where 15 ppm sulfur fuel may not be available. That proposed auxiliary emission-control device (AECD) flexibility, however, should not be limited solely to auxiliary engines. In addition, it should be an option in addition to the current exemption program, and not a wholesale replacement of it. Including both flexibility options will provide better assurance of compliance for vessels that are properly engaged in international commerce.

Note that other Chapter 4 addresses other comments opposing allowing Category 1 or Category 2 engines to use higher sulfur fuel.

Our Response:

We are revising §1042.650 to add exemption provisions for Category 1 and Category 2 auxiliary engines on vessels with Category 3 propulsion engines. Previously, some such engines could have qualified for the migratory exemption we adopted in 2008 for vessels for Tier 4 standards. This exemption was intended primarily to address potential problems obtaining 15 ppm fuel overseas. We are finalizing a parallel exemption for auxiliary engines that would differ from the existing exemption by including engines on Category 3 vessels that operate domestically and apply for Tier 3 and earlier standards.

Under this option, manufacturers of Category 1 and Category 2 engines intended for use on Category 3 vessels that will not be limited to domestic waters may choose to certify only to Annex VI NO_X standards. We will not require CAA certification for such auxiliary engines if the conditions for this flexibility are met. As is specified in 1043, we will not require an EIAPP for engines certified under part 1042 if they will be limited to domestic waters. Thus , Category 1 and Category 2 engines intended for use on vessels that operate solely in domestic waters may be certified to either the CAA or the MARPOL Annex VI standard applicable to the model year engine.

We are including a provision to address potential an environmental disbenefit during the transition to the catalyst-based standards. In order to receive the flexibility described above for engines on vessels not limited to use in domestic waters, engines that would have been subject to the Tier 4 standards of part 1042 will be required to meet the Tier III NO_X requirements, irrespective of whether they would be required to comply under Annex VI. For example, this would affect 2015 Category 2 engines with a maximum engine power of 3000 kW installed on a 2015 vessel using this option. Since such an engines would have been be subject to the Tier 4 standards under §1042.101, they will be required as a condition of the exemption to meet the Tier III standards under Annex VI.

Given the MARPOL Annex VI and CAA NOX requirements are comparable, with slightly different phase-in dates and cut-offs, we believe this approach will be a less burdensome implementation approach over transitioning years, and will not have a meaningful impact on

emission reductions. In the absence of this exemption, manufacturers would have been required to certify special auxiliary engines that met both Annex VI and 1042 requirements for a U.S. market that could be as small as one engine per year. By allowing manufacturers to meet only the Annex VI requirements, they would be able to produce a single international engine and spread the administrative costs over many more engines. It is important to note that we are not extending this exemption to vessels with Category 1 or Category 2 propulsion engines because these factors cannot be presumed for such vessels.

5.9 Applicability to Gas Turbine Engines

What Commenters Said:

Several commenters objected to EPA's proposal to require marine gas turbine engines to meet the emission standards that currently apply for Category 1 and Category 2 diesel engines. Some of these commenters stated that turbines should not be included in the definition of "compression ignition" engines and that regulation of turbines does not fit within the scope of the rule. They argued that the goal of the proposed rule was "to align with MARPOL." They also asserted that the proposed requirements would not pass a cost/benefit analysis and that turbines cannot be tested under the procedures of 40 CFR part 1065. However, they did not provide any information about costs, benefits, or test procedures. Finally, the commenters stated that EPA was incorrect when we claimed that gas turbines operate at lower air/fuel ratios and have lower exhaust volumes.

Our Response:

We agree that it would be incorrect to define turbine engines as reciprocating or compression ignition. However, we did not propose to do so. The commenters are misreading §1042.1(f), which states:

> (f) The marine engines listed in this paragraph (f) are subject to all the requirements of this part even if they do not meet the definition of "compression-ignition" in §1042.901. The following engines *are deemed to be compression-ignition engines for the purposes of this subchapter*:
>
> (1) Marine engines powered by natural gas or other gaseous fuels with maximum engine power at or above 250 kW. Note that gaseous-fueled engines with maximum engine power below 250 kW may or may not meet the definition of "compression-ignition" in §1042.901.
>
> (2) Marine gas turbine engines.
>
> (3) Other marine internal combustion engines that do not meet the definition of "spark-ignition" in §1042.901.

This provision does subject marine gas turbine engines to the requirements of part 1042, but it explicitly recognizes that they do not meet the definition of "compression-ignition" in §1042.901. The confusion seems to arise from the statement that these engines "are deemed to be compression-ignition engines for the purposes of this subchapter." This statement is merely a regulatory convention that means the part applies to turbines as if they did meet the definition.

The commenters do not dispute the feasibility of these standards. They assert - without providing supporting information- that regulation of turbines will not be cost-effective. We recognize that the number of turbines that will be subject to these standards will likely be small. (Note that if there are no gas turbine engines manufactured, there would be no costs at all.) However, the main benefit of this requirement will likely be to prevent vessel manufacturers from circumventing our regulations by installing turbine engines rather than diesel engines. Nevertheless, our analysis shows that these requirements will be very cost effective, without regard to the number of turbines that are ultimately installed in marine vessels. The commenters questioning the cost-effectiveness of the requirements did not provide any cost or emission data to show otherwise, even though they likely had access to detailed cost and emission information. It is important to note that EPA requested such information years ago as part of its proposal to adopt new emission standards for Category 1 and Category 2 marine engines (72 FR 16004, April 3, 2007).

It is difficult to respond to the commenters' assertion that major revisions would be required to test turbines under 40 CFR part 1065 since they did not identify any specific problems. We continue to believe that only minor modifications would be needed and that they fall within the scope of special test procedures already allowed under §1065.10(c)(2). Manufacturers planning to certify gas turbine engines that believe they cannot test their engines according to part 1065, should contact EPA to request permission to use such special test procedures.

We do agree that it was incorrect to state that gas turbines operate at lower air/fuel ratios and have lower exhaust volumes. After further review, we recognize that this is not necessarily true. Both diesel engines and gas turbines can operate over wide ranges of air/fuel ratios, making categorical comparisons difficult. Nevertheless, we do not dispute the commenters' statement that modern gas turbine engines will have higher air/fuel ratios and exhaust flow rates than marine diesel engines.

Finally, irrespective of the actual cost for turbines to meet the standards, this requirement could be considered to be feasible based solely on the fact that vessel manufacturers do not need to use turbine engines. As we stated in the preamble for the proposal,

> (T)he only circumstance in which a vessel would actually need a gas turbine engine would be for military purposes where our national security exemption provisions would apply. For all other vessels, it is entirely feasible for the vessel to be powered by a diesel engine. In fact, that is what is being done today.

The commenters did not dispute this.

5.10 Applicability to Boilers

What Commenters Said:

Several operators on the Great Lakes expressed concern over forced retirement of steamships as a result of the proposed fuel sulfur requirements. They stated that the existing steamships on the Great Lakes cannot operate on distillate fuel for economic and safety reasons. These comments are discussed in more detail in Chapter 10.

In a letter to Senator Murkowski that was later forwarded to EPA, TOTE stated that they operate two steam propulsion vessels in domestic and international service off the Pacific coast. It is widely accepted that burning low sulfur fuel in the boilers of old steam vessels is not advised, and unsafe. Extensive and complex modifications would be required on these vessels to enable them to burn low sulfur fuels, and major modifications would not be economically justifiable as the life expectancy of vessels is 10 years or less. There is precedent for legislative relief in this bill already from congressional leaders from the states bordering on the Great Lakes. TOTE proposed that steam powered vessels in the U.S. fleet be exempted from the proposed regulations.

One commenter noted that the SS. Jeremiah O'Brien is the last working WWII Liberty ship and is designated as a National Historic Landmark. Obviously, the ship could not be modified to burn a low sulfur fuel without destroying its historically integrity. This vessel is equipped with a reciprocating steam engine and is not equipped to operate on distillate fuel. The commenter requested that we consider including an exemption for historic vessels in any new regulations applicable to existing ships.

Coalition for a Save Environment commented that boilers are used in tanker ships to pump out crude oil, fuels, and gas and to operate cranes in container ships. These boilers release tons of criteria pollutants and VOCs. Boilers can use high-efficiency aftertreatment technology to reduce emissions. They raised concern that no regulations are being proposed for these non-engine ship toxic emission sources.

Our Response:

A number of commenters raised issues regarding operating Great Lakes steamships on distillate fuel. As discussed in Chapter 10 of this document, existing Great Lakes steamships are excluded from this final rule.

Similar concerns were raised for the small number of steamships operating along the U.S. coasts. As these vessels do not operate exclusively within U.S. internal waters, they fall under the U.S. Government's (primarily EPA and Coast Guard's) implementation of the ECA provisions of the IMO MARPOL Annex VI treaty. The requirements of the MARPOL Annex VI ECA fuel sulfur limits apply to all vessels and have no exemptions for steamships. It is not within the scope of this rulemaking to amend the requirements of the MARPOL Annex VI treaty. However, through the comments and follow-up conversations with ship owners, we agree that special challenges exist for the use of lower sulfur fuel in steamships. Therefore, we will continue to work on this issue with the United States Coast Guard and other members of the U.S. Delegation to IMO as well as other interested stakeholders including the affected steamship operators. We are committed to resolving this issue before the end of 2011, well in advance of January 2015 when the 0.1 percent fuel sulfur standard will enter into force.

We have added a provision that would allow us to exempt historic steamships from the lower sulfur fuel requirements for operation in U.S. internal waters. The designated party for the historic steamship would need to request this exemption from EPA. We would make this decision on a case-by-case basis.

5.11 Coordination with Coast Guard

What Commenters Said:

CSA stated that the regulations should not be finalized and implemented without continuing the extensive consultation between Coast Guard and EPA to assure that any requirements related to emissions reductions from marine vessels do not run afoul of existing regulations which ensure operational safety and environmental protection.

We also received a request that EPA more clearly identify how both the proposed U.S. C3 regulations and IMO regulations will be enforced and what respective roles EPA and the Coast Guard will have in ensuring compliance with all of the fuel and emission control requirements.

Our Response:

We have consulted with Coast Guard throughout this rulemaking process and will continue to coordinate with Coast Guard as we move forward. The Act to Prevent Pollution from Ships authorizes the U.S. Coast Guard and EPA to enforce the provisions of Annex VI against domestic and foreign vessels and to develop implementing regulations, as necessary. In addition, APPS gives EPA sole authority to certify engines installed on U.S. vessels to the Annex VI requirements. This final rule contains regulations codifying the Annex VI requirements and regulations to implement several aspects of the Annex VI engine and fuel regulations, which we are finalizing under that APPS authority. We are currently working with the U.S. Coast Guard to better define the respective roles of the EPA and Coast Guard.

5.12 Other Marine Certification and Compliance Issues

(A) Defect Reporting.

What Commenters Said:

EMA objected to the proposal to apply the defect reporting requirements of §1068.501 to Category 3 engines, and reducing the threshold for filing a defect report to two claims. They argued that the proposed defect reporting threshold is too low and that engine manufacturers have no meaningful opportunity to monitor, investigate and report on emissions-related defect claims in a timely manner. They stated that manufacturers would generally be late in their submissions of defect reports to EPA if the Agency finalized a reporting threshold of two claims, and suggested that the actual air quality impacts from such a defect reporting requirement would be negligible. They recommended that the Agency apply the reporting thresholds already adopted in §1068.501(f)(2).

Our Response:

The threshold specified in §1068.501(f)(2) would be 10 defects. This is not appropriate for Category 3 engines because of their extremely low sales volumes. Under that approach a manufacturer that produced five Category 3 engines in a year, would never be required to file a defect report, even if all of the engines were found to be defective. We also do not accept the claim that defect reports will inevitably be late, since the regulations only require the

manufacturer to submit a report within 21 days once it becomes aware of the occurrence of the same defect in two or more engines within a family.

(B) How will standards be enforced?

What Commenters Said:

The Coalition for Safe Environment (LB hearing testimony 0232, p56) asked how the requirements will be enforced, and what the sanctions are for failure to meet these new standards. Maersk ask that the final rule be very clear as to which sections apply only to U.S.-flagged vessels vs. all vessels.

Our Response:

The CAA standards being adopted would be enforced as specified in 40 CFR part 1068, especially §§1068.101 and 1068.125. We believe the regulations are fairly clear that part 1043 applies for all vessels, while part 1042 applies only for U.S.-flagged vessels.

(C) Small Volume Manufacturers.

What Commenters Said:

EMA objected to the revised definition of "small-volume engine manufacturer," pointing out that it would apply a different threshold for companies making Category 2 engines if they happened to also make Category 3 engines.

Our Response:

We acknowledge that the definition as proposed would treat companies differently depending on whether or not they make Category 3 engines. However, we believe this highlights the need to revisit this definition more fundamentally. We continue to believe, as described in the proposed rule, that any manufacturer with the design and production capabilities to produce Category 3 engines does not warrant special treatment as a small business, regardless of the production volumes. Such an engine manufacturer would need very substantial capital and developmental resources and should not be treated differently than other manufacturers that do not qualify as "small."

Consideration of this comment made clear that, by establishing a threshold of 1000 engines, the definition is appropriate only for Category 1 engines, which are generally produced in relatively high volumes. Many manufacturers producing only Category 2 engines will never exceed production volumes 1000 engines per year. Much like Category 3 engines, these very expensive engines are produced by capital-intensive companies. We did not propose to change the definition for these companies, so we are not finalizing any further changes in this rule. However, we intend to change this definition in the future to more appropriately tailor rulemaking provisions for small manufacturers to those companies that have limited ability to do testing and meet other certification requirements.

(D) Re-flagging.

What Commenters Said:

Liberty Maritime expressed concern that the proposal would set a significant hurdle to the reflagging of vessels from foreign flag (built to MARPOL Annex VI standards) to U.S. flag. They argued that application of the EPA Standards would require ship owners to persuade the engine manufacturer to carry out extensive, U.S. EPA-unique, testing procedures to seek certification. Alternatively, the ship-owner would be required to change out or modify the engines. Maersk stated that since U.S. fleets often grow by acquiring vessels from outside the U.S., all requirements for "re-flagging" vessels into U.S. registration need to be clear, and the process must be timely and responsive to support U.S. companies in dealing with business changes. The Word Shipping Council requested that we clarify what certification and verification requirements apply for ship that becomes a U.S.-flag vessel after being placed into service under a different flag.

Our Response:

We recognize that reflagging vessels may be common in the coming years as the U.S. Department of Transportation Maritime Administration (MARAD) implements the Maritime Security Program (MSP). The requirements of the MSP may have created confusion for owners of non-U.S.-flagged vessels regarding their obligation to also comply with EPA's domestic marine diesel engine emission standards at the time they re-flag for inclusion in the MSF. We are revising the regulations to clarify these requirements and, as noted earlier, to provide exemptions for auxiliary engines on Category 3. First, we are revising §1042.1 to clarify that our regulations apply for all U.S.-flagged vessels. In conjunction with this, we are revising the definitions of "model year" and "new marine engine" to clarify that our marine engine program applies to all U.S.-flagged vessels regardless of where that vessels is built or operated, and how the regulations apply for vessels that are re-flagged to be U.S. vessels.

We are clarifying that engines on foreign vessels that vessels become "new marine engines" under part 1042 at the point at which they are reflagged. As new marine engines, we would expect them to be covered by valid certificates and/or exemptions prior to being placed into service. If engines on U.S.-flagged vessels are not covered by valid certificates and/or exemptions when they first enter U.S. waters, they would be subject to all of the prohibitions of part 1068.101. The operator would be in violation of the prohibition against introduction of an uncertified new engine into U.S. commerce.

Some of the revisions being finalized are intended to simplify the transition from part 94 to part 1042. Under the revised regulations, part 1042 becomes the default regulatory part for compression-ignition marine engines. Section 1043.1 specifies that such marine engines are subject to part 1042 unless they are certified under part 94. In addition, §1042.1(c) specifies that the definition of "new marine engine" in §1042.901 applies for engines certified under part 94. This is important because our standards and prohibitions apply for engines meeting the definition of "new marine engine". Thus, to determine whether an uncertified marine engine is subject to our standards and prohibitions, you must determine whether it meets any of the criteria of the definition of "new marine engine" in §1042.901.

Each "new marine engine", is subject to standards based on its model year. The revised definition of "model year" specifies that engines on re-flagged vessels would generally be subject to the standards that would have applied in the year they were originally manufactured. If the engine has a model year before the years the part 94 standards first applied, it would not be subject to any standards. If the engine has a later model year but one that is before the years the part 1042 standards apply, it would be subject to the standards of part 94. According to §1042.1(c), if the engine is certified to these part 94 standards, it is not required to comply with the requirements of part 1042.

To further smooth this transition, we are finalizing a new interim provision in §1042.145(i). This provision is intended to apply for vessel operators that were not aware that their vessels were required to comply with our regulations. Once this amendment takes effect, it will allow them to operate in U.S. waters until July 1, 2010 without certificates or exemptions for their engines. After that, it will be a violation of 40 CFR 1068.101 to operate in U.S. waters with uncertified engines if those engines are subject to our standards. Operation of such vessels in U.S. waters on or after July 1, 2010 is deemed to be introduction into U.S. commerce of a new marine engine.

(E) Penalties for noncompliant operation.

What Commenters Said:

The World Shipping Council objected to the regulatory provision identifying each two-hour period of operation in a noncompliant condition as a separate violation. This could lead to very high penalties in cases where the operator knows that an engine is in a noncompliant condition, but they are unable to correct the noncompliance until they arrive at a port where they can arrange for specialized service. It may be more appropriate to identify a violation as starting at the earliest practicable point of intervention, consistent with the problem and the required remediation. They also requested that we describe the role for manufacturers of aftertreatment systems in the certification process and clarify whether these companies are liable for in-use performance for their installed products.

Maersk also questioned the definition of two hours as a violation, and asked how this compares to international enforcement requirements for vessels and other mobile sources. They suggested an alternative of allowing a vessel which experiences such a malfunction at sea to make a reasonable attempt to solve the problem, and if not successful, document the attempts made and correct the equipment problem at the next port call where appropriate facilities, resources and expertise are available. This should not be considered as multiple violations.

Our Response:

We have added the following to §1042.660 in the regulations to address concerns about malfunctions that occur at sea:

> Note that where a repair (or other maintenance) cannot be completed while at sea, it is not a violation to continue operating the engine to reach your destination.

With respect to the role for aftertreatment manufacturers in the certification process and their liability for in-use performance, we note that our regulations apply for all persons meeting

the definition of “manufacturer” in the regulations. Nevertheless, we generally assign primary responsibility for in-use performance to the manufacturer that obtains the certificate of conformity for the engine (including the aftertreatment system).

5.13 Miscellaneous modifications to the proposed regulatory language

What Commenters Said:

One commenter expressed concern that it is confusing that the acronym PEMS is used in part 1065 for “portable emission measurement system” and in part 60 for “predictive emissions monitoring system”.

Our Response:

We do not believe that the different uses of this acronym are a problem that needs to be corrected. It is not uncommon for this situation to occur where a simple acronym has different meanings in different contexts. This acronym was established several years ago in part 1065. Within the regulated community of engine manufacturers it is widely understood to mean portable emission measurement system in the context of part 1065. We believe it would be more confusing to change this acronym or the acronym in part 60.

CHAPTER 6: Estimated Costs

What We Proposed:

The comments in this section generally correspond to Section VII of the preamble to the proposed rule, where we describe the expected costs of EPA's coordinated strategy for addressing ships' emissions. The Regulatory Impact Analysis describes costs in Chapter 5.

See Chapter 7 of this document for a discussion of comments on the economic impacts of this strategy. See Chapter 10 of this document for a discussion of costs and impacts specific to the Great Lakes region.

6.1 Cost of Engine Technology

What Commenters Said:

EMA commented that it has not been established whether or not diesel fuel with a sulfur content above 1,000 ppm will cause damage to Selective Catalytic Reduction (SCR)-based aftertreatment systems, even when the system is inactive. Regardless, to account for this possibility, the commenter stated that EPA should investigate the potential costs of a by-pass to the SCR system.

The U.S. Navy commented that their testing indicates that cost of catalyst-based aftertreatment systems for gas turbine engines would be expected to be considerably higher than those used on diesel engine exhaust systems, rather than lower. Others commented that applying these standards to marine turbine engines would not pass a cost/benefit ratio analysis.

EGCSA commented that EPA's cost estimates for retrofitting existing vessels with equipment to accommodate the use of lower sulfur fuel were too low. The commenter noted that recent discussions with a major tanker owner indicated that fuel line changes alone amounted to £100,000 per ship. The commenter also noted that many ships, including new builds, do not have sufficient tank capacity or segregated fuel tanks that hold both residual and distillate fuel; therefore, the options to divide residual fuel tanks or install new separate distillate fuel tanks will vary from ship to ship. Further, the commenter stated that 'distance from vessel hull regulations' may also limit options for new tanks. The commenter stated that the minimum cost of installation of new fuel tanks is unlikely to be less than $100,000 when accounting for all costs including opportunity cost, and could be in excess of $400,000 for some retrofit applications.

EMA (0265)
USN-DoD (0241)
Solar Turbines (0249)
GTA (0253)

Our Response:

Through our background work for this rulemaking and for the ECA application, we sought input from the regulated community regarding the expected future costs of applying the emission control technologies associated with the coordinated strategy. EPA contracted with ICF to research the fixed and variable costs associated with the technologies expected to be used to meet engine and fuel sulfur requirements, as applied to different engine types and sizes. After ICF developed their initial cost estimates, they provided surveys to several engine and emission control technology manufacturers, including at least one member from both EGCSA and EMA to determine the reasonableness of their approach and cost estimates. Input received from those surveyed was incorporated into the final cost estimates used in this analysis.

The costs of bypass systems associated with the use of SCR were investigated for a series of both slow-speed and medium-speed engine configurations and ranged from $4,700 -$7,500. Chapter 5 of the RIA presents this information in the discussion on variable costs associated with the use of SCR as a Tier III compliance strategy. These variable costs include: the urea tank, the reactor, dosage pump, urea injectors, piping, bypass valve, an acoustic horn, a cleaning probe and the control unit and wiring. The cost of applying SCR technology to gas turbine engines has been addressed in Section 5.8 of this document.

The cost estimates developed for the installation of equipment to accommodate the use of lower sulfur fuel on both new and existing vessels were developed separately. These estimates were based on the installation of distillate fuel tanks large enough to hold fuel sufficient for 250 hours of both main and auxiliary engine operation; however, the size of the tank actually installed on a particular vessel is dependent on the frequency with which the individual ship owner prefers to fill the lower sulfur fuel tank. The estimated costs were developed for new and existing vessels with engine configurations ranging from 4,500 kW medium speed engines to 48,000 kW slow speed engines. The estimated costs for new vessel installations ranged from nearly $34,000 to $73,000. Retrofitting a vessel is expected to require more effort than making upgrades during new vessel construction, to address this, additional labor costs were allocated for installing equipment to accommodate the use of lower sulfur fuel on existing ships resulting in cost estimates from $44,000 to $99,000.

The costs include additional distillate fuel storage tanks, a lower sulfur fuel oil separator, a residual/lower sulfur fuel oil blending unit, a 3-way valve, a lower sulfur fuel oil cooler, filters, a viscosity meter, and various pumps and piping. This cost analysis does not reflect opportunity costs, such as that of displaced cargo as there are other design options such as partitioning of a residual fuel tank to allow for lower sulfur fuel capacity which would reduce the amount of additional space required, nor does this analysis reflect the possibility that some ships may have already been designed to carry some amount of distillate fuel in separate tanks for purposes other than continuous propulsion. In fact, of the existing fleet of vessels, less than one-third would require modifications to carry enough distillate fuel to enable the vessel to travel 1,140 nm, and of these nearly 75 percent already carry some distillate fuel.

6.2 Cost of Lower Sulfur Fuel

What Commenters Said:

We received a number of comments on the economic modeling that was conducted to predict the difference in pricing between traditional residual marine fuel oils and distillate marine fuel oils as well as its expected impact on the various segments of the marine industry. The majority of these comments were that, based on historical experience, that the price premium for distillate is much higher than projected by EPA.

CLIA commented that the use of the global market fuel price differential is immaterial when the analysis concerns shipping that will trade almost exclusively within the ECA. Instead, the analysis should be conducted utilizing historical spot market bunker pricing within the various geographic areas of the ECA. CLIA's analysis, for example, indicates a historical 10 year average price differential between distillate and residual fuel in the U.S. Northwest of approximately $230 per ton. Note that the U.S. Pacific Northwest is the Alaska cruise market which operates exclusively within the ECA and thus, ECA compliant fuel must be used essentially 100% of the time. Thus, the expected fuel cost premium would be closer to $12-$16 per day instead of $7 per day adding approximately $86 to $112 to the price of a typical seven day cruise itinerary in this region, if historical averages hold true. CLIA also commented that there is a United States flag cruise ship operating in the State of Hawaii. Analysis provided by that operator indicates that the economic impact on Hawaii is consistent with that on Alaska. That is, an increase of almost $10 per person per day – a rise of 64%. This equates to an increase of $70 per person on a 7 day cruise or $280 for a family of four.

Both CLIA and Chamber of Shipping of America referenced a Final Report of ATEMIA – University of Antwerp (September 2009) which states: "*The price difference between IFO 380 and MGO (0.1% sulphur) fluctuates strongly in time (30% to 250% price difference) with a long term average of 93% (period 1990-2008). The price difference between LS 380 and MDO fluctuates between 40% and 190%, with a long term average of 87%. In other words, the specified MDO is historically on average 87% more expensive than LS 380. Overall the cost of marine distillate fuels is about twice what residual fuels costs due to increasing demand and the cost of the desulphurization process. These are long-term averages. Overall, the effect of the new Annex VI agreement may be quite costly for the participants in the shipping industry. Based on historical price differences, the use of MGO (0.1%) could well imply a cost increase per ton of bunker fuel of on average 80 to 100% (long-term) compared to IFO 380 and 70 to 90% compared to LS 380 grades (1.5%). This conclusion is in line with previous studies.*"

Chamber of Shipping of America believes that the increases in low sulfur fuel costs are significantly underestimated in EPA's cost/benefit analysis. EPA's fuel cost estimates found in Table VII-2 at page 44489 utilize the estimates found in the Martin Tallett/Ensys study which was one basis for the work of the IMO expert group which addressed this issue. The spread noted in this study between distillate and HFO was cited at 1.45. While this spread may be closer to reality in the current economic downturn which has resulted in the use of less volumes of heavy crude oils as well as excess refining capacity, historically we have seen the distillate/HFO spread closer to 2.0. Based on the expectation that economic downturns occur less than 25 percent of the time, a more appropriate spread would reflect "normal" economic

conditions as well as fully taking into account that distillate demand is expected to increase significantly with a corresponding decrease in demand for HFO.

Seaworthy commented that its decades of experience with marine fuels would indicate that a 70-80% price premium for 0.1 percent sulfur distillate. TOTE commented that the additional distillate fuel consumption from vessels forced to use this fuel will immediately increase the cost of all distillate fuel in the Puget Sound area. Small changes in consumption patterns in an already tight Puget Sound fuel market will have a disproportionate effect in this area.

SFC commented that by 2015, most (if not all) of the fuel production meeting the EPA's 1,000 ppm sulfur standard will have to be marine diesel. This means that refineries will have to make significant investments in conversion technologies, and that shipowners and operators will likely face increased fuel prices. A report undertaken for the IMO by the Informal Cross Government/Industry Scientific Group of Experts (published in December 2007) notes that the price difference between heavy fuel oil and distillate fuel has varied from 50 percent to 72 percent between 2000 and 2007 (a qualified estimate was impossible to provide). The report goes on to note that although forecasts of fuel prices are based on many variables, one certainty is that any increase in fuel costs will be incorporated into the ship's freight rates, which may result in competition between the marine mode and other transportation modes.

Governor Lingle of Hawaii commented that the EPA's analysis of estimated fuel costs, per footnote 130 in the proposed rule, "considers only the lower 48 contiguous states and southeastern Alaska."

CLIA (0278)
Chamber of Shipping of America (0256)
Seaworthy (0226)
TOTE (0289)
Shipping Federation of Canada (0270)
Governor Lingle (0400)

Our Response:

Studies were performed on the impact of a North American ECA on global fuel production and costs, to inform the application for such ECA.[19] These studies were performed prior to the ECA being defined; thus, we picked a maximum distance boundary to ensure the fuel volumes used for the cost analysis would be larger than required by the program. Specifically, we used the total fuel consumption in the U.S. and Canada exclusive economic zones.[20] The studies are relevant to this regulation as well, because they estimate the cost of 1,000 ppm sulfur fuel for Category 3 vessels operating in U.S. waterways.

[19] Research Triangle Institute, 2009. "Global Trade and Fuels Assessment— Future Trends and Effects of Designating Requiring Clean Fuels in the Marine Sector". Prepared for U.S. Environmental Protection Agency. Research Triangle Park, NC.
[20] In this analysis, the U.S. included the lower 48 contiguous states and southeastern Alaska.

To assess the effect on the refining industry of the imposition of a 1,000 ppm sulfur limit on fuels, we needed to first understand and characterize the fuels market. Research Triangle Institute (RTI) was contracted to conduct a fuels study using an activity-based economic approach. The study established baseline bunker fuel demand, projected a growth rate for bunker fuel demand, and established future bunker fuel demand volumes.[21] These volumes then became the input to the World Oil Refining Logistics and Demand (WORLD) model to evaluate the effect of the coordinated strategy on fuel cost.

The WORLD model was run by Ensys Energy & Systems, the owner and developer of the refinery model. The WORLD model is the only such model currently developed for this purpose and was developed by a team of international petroleum consultants. It has been widely used by industries, government agencies, and Organization of the Petroleum Exporting Countries (OPEC) over the past 13 years, including the Cross Government/Industry Scientific Group of Experts, established to evaluate the effects of the different fuel options proposed under the revision of MARPOL Annex VI. The model incorporates crude sources, global regions, refinery operations, and world economics. The results of the WORLD model have been comparable to other independent predictions of global fuel, air pollutant emissions and economic predictions.

The WORLD refinery model was used to evaluate the refinery cost impacts as well as the prices of supplying distillate and residual fuels in the Base (Business as usual case without an ECA) and ECA cases. In determining the prices for distillate and residual fuels, the WORLD model uses economic factors including refinery expansion projects, refinery operating costs, crude prices, return on assets, distribution costs, supply and demand of fuels, historical pricing patterns for fuels in world regions, etc. For the ECA cases, the WORLD model adds refinery residual coking capacity which converts residual stocks into distillates, increasing the supply of distillates while decreasing the supply of residual stocks. Additionally, the model incrementally increases crude throughput, which also increases the production of distillate stocks relative to the production of residual stocks.

The WORLD model was run for 2020, in which the control case included a fuel sulfur level of 1,000 ppm in the U.S. The baseline case was modeled as "business as usual" in which ships continue to use the same fuel as today. Because of the recent increases and fluctuations in oil prices, we had additional WORLD model runs conducted. For these runs, we used new reference case and high oil price estimates that were recently released by the U.S. Energy Information Administration (EIA). In addition to increased oil price estimates, the updated model accounts for increases in natural gas costs, capital costs for refinery upgrades, and product distribution costs.

There are two main components to projected increased marine fuel cost associated with the ECA. The first component results from shifting from operation on residual fuel to operation on higher cost distillate fuel. This is the dominant cost component. However, there is also a small cost associated with desulfurizing the distillate to meet the 1,000 ppm sulfur standard. Based on the WORLD modeling, the average increase in costs associated with switching from

[21] Research Triangle Institute, 2009. "Global Trade and Fuels Assessment— Future Trends and Effects of Designating Requiring Clean Fuels in the Marine Sector". Prepared for U.S. Environmental Protection Agency. Research Triangle Park, NC.

marine residual to distillate will be $145 per metric ton of fuel consumed. This represents a 45 percent increase per metric ton of fuel. Due to the differences in energy density between the two fuels, this translates to a cost increase of $123 for each metric ton of residual fuel replaced by distillate fuel.[22] This is the cost increase that will be borne by the shipping companies purchasing the fuel. Of this amount, $6 per metric ton is the increase in costs associated with distillate desulfurization.

A number of commenters stated that the results of the refinery modeling are inconsistent with the historical price differential between marine distillate oil and residual fuel oil. One commenter discussed the Secretary General's expert group report that presented average fuel oil prices, for Singapore and Fujairah, for the years 2000 through 2007. Over this time period the percent price premium on marine distillate fuel compared to marine residual fuel ranged from 39 to 98 percent. The cost premium based on the refinery modeling was in this range, at 45 percent. The price differential over these years, based on the study, ranged from $57/metric ton to $306/metric ton. The cost difference predicted by the refinery model was $145/metric ton which is near the center of this range. Note that the refinery model focuses on fuel cost impacts, where the historic fuel prices can be affected by external market impacts. An example of external market impacts that can drive pricing was during the tight distillate market of 2008. During this time period, diesel prices in the U.S. were higher than gasoline prices, even though further refining (more expensive processing) is necessary to produce gasoline than diesel fuel. This occurred because of high distillate demand in India and China outstripping existing distillate refining capacity.

For both the Base and ECA cases, the WORLD model grows the supply of all fuels until the demand of fuels are met, by adding refinery expansion projects. As a result of this, the WORLD model projects for the Base case and the ECA cases, that the pricing gap between distillate fuel and residual fuels will be lower than recent pricing patterns suggest. The prices projected for residual and distillate stocks in the Base Case and ECA cases are narrower than they were in recent years because the supply of distillate and residuals stocks are projected to be in balance with demand due to the WORLD model adding refinery expansion projects. In contrast, the price of distillate stocks in comparison to residual stocks was elevated much higher than historical norms from years 2003 until the start of the current financial crisis. The pricing abnormality during this time interval was due to overall shortages of refinery capacity needed to produce the volume of distillate stocks required to fulfill growth in demand for distillate stocks throughout the world. In response to this elevated pricing, which started in 2003, refineries around the world recently made substantial investments to add refinery capacity, with the projects coming on stream now and in the immediate future. Due to these expansions and the current economic crisis, the current pricing ratios for distillate and residual stocks have retuned to differentials that are similar to ECA projections, a time period when refining supply of distillates and other fuels were in balance with demand.

[22] Note that distillate fuel has a higher energy content, on a per ton basis, than residual fuel. As such, there is an offsetting cost savings, on a per metric ton basis, for switching to distillate fuel. Based on a 5 percent higher energy content for distillate, the net equivalent cost increase is estimated as $123 for each metric ton of residual fuel that is being replaced by distillate fuel.

Much of the inconsistency in individual estimates of the price differential between marine distillate and residual fuel is driven by the differences in the assumption of what the price of oil will be in the future. As oil prices increase, fuel prices increase correspondingly. In 2008, West Texas Intermediate (WTI) oil prices hit a maximum of nearly $150 per barrel and a minimum close to $40 per barrel. As such, marine bunker prices varied widely in that timeframe. In fact, these variations in price were greater than the average price difference between marine distillate and residual fuel. As discussed above, we used estimates from the EIA for oil prices in 2020. The reference case WTI oil price was projected to be $57/barrel and the high price estimate was $92/barrel (in 2006 dollars).

The estimate of $145/metric ton was based on the reference case oil price projection for 2020. As a check, we compared the projected price differential with actual spot prices on May 4, 2009. This date is interesting because WTI oil price was $54/barrel, making it close to the projected WTI oil price used in our refinery modeling. On that day, according to the same source referenced in the Secretary General experts' report, the differential between marine distillate oil and heavy fuel oil was $143 in Singapore and $146 in Houston. On a percentage basis, the distillate fuel was 46% more per metric ton than residual fuel in Singapore, and 48% more in Houston. These prices compare well with the results of our refinery modeling which was a price differential of $145, representing a 45% differential per metric ton.

The total fuel cost estimates included the impacts of an ECA surrounding the Southeastern Hawaiian Islands. Footnote 130 in the NPRM is simply referring to the initial analysis of fuel volumes used as an input to the refinery modeling. The original estimate actually resulted in a total affected fuel volume estimate for the proposed ECA which was higher than later estimated for the proposed ECA. When calculating total fuel costs, the per tonne increases were applied to fuel consumption in the entire ECA including the lower 48 states, Southeastern Alaska, and Southeastern Hawaii.

CHAPTER 7: Expected Economic Impacts

What We Proposed:

The comments in this section generally correspond to Section VII of the preamble to the proposed rule, where we describe the expected economic impacts of this action and our overall coordinated strategy. The Regulatory Impact Analysis describes our economic impact analyses in Chapter 7.

See Chapter 6 of this document for a discussion of comments on the program's estimated costs. See Chapter 10 of this document for a discussion of economic impacts specific to the Great Lakes region.

7.1 General Economic Impacts of Coordinated Strategy

What Commenters Said:

New York City commented that EPA has made the policy decision to focus on high production volume sectors ahead of large ships because R&D can be spread over larger number of engines. This commenter noted that this policy decision overlooks the fact that large oceangoing vessels are able to spread capital and operating costs over a great number of containers for cargo and thus over a wide customer base. Commenters noted that the impact of the proposed standards would have a minimal impact on price of goods, such as sneakers. [NY Testimony Comment 0227]

Our Response:

The cost and economic impact analyses presented in the RIA considers both operational and capital (including R&D) costs and the impact of these costs on the price of goods transported by ship.

7.2 Economic Impacts on Cruise Industry

What Commenters Said:

Several commenters stated that the cruise industry is vitally important to the economy of Southeast Alaska. Senator Begich stated that over a million visitors came to Alaska via cruise ship last summer, and nearly 14 percent of all employment in Alaska is directly tied to the tourism industry. Given this year's tourism season has demonstrated the price sensitivity of American and foreign consumers in the midst of the economic downturn, it is estimated Alaska will have approximately 140,000 less cruise ship passengers in 2010. Several commenters expressed concern that if the rule is finalized without consideration of economic impacts in Alaska, it may have the unintended consequence of a severe negative impact on the cruise industry and make Alaska less competitive as a cruise destination.

Senator Murkowski commented that in 2009, preliminary estimates are that cruise ship occupancy has fallen on Alaska cruises to 958,041, a drop of nearly 60,000 passengers from 2007 totals and a drop of about 50,000 passengers from 2008 totals. Senator Murkowski commented that, according to research by the McDowell Group Consultants in Juneau, 84 percent of tourists coming to Southeast Alaska traditionally arrive on cruise ships. That totaled more than 1 million tourists in 2007. Cruise ship passengers in that year spent $390 million while crew member spending totaled $15 million and cruise line spending on commodities and fuel reached $77 million. With related indirect spending, the cruise industry added $636 million to the Alaska economy.

CLIA commented that EPA has not adequately predicted the economic costs associated with this rulemaking. While the EPA's economic impact analysis evaluated the additional cost in fuel as well as equipment retrofits for ships to achieve compliance within the ECA, the analysis did not assume any loss in business to North American ports resulting from the additional costs associated with the ECA. This is particularly relevant to smaller ports of call for cruise ships as operators consider cost –saving options thus possibly jeopardizing the economic benefit of a full season of port calls. A more complete economic analysis would also consider these additional costs.

Representatives of the cruise industry commented that, unlike the other transportation services affected by the coordinated strategy, the demand for cruises is not nearly perfectly inelastic. These commenters noted that cruises are a recreational activity and consumers are more sensitive to price changes than consumers of transportations services for containers or bulk goods. They contend that if the price of a cruise increases, consumers will choose to spend their recreational budgets on other activities.

As an example, CLIA emphasized that the state of Alaska has enjoyed significant growth in the cruise tourism industry over the past decade or more. An in-depth analysis for 2008 shows for this state alone that:

- Alaska benefits from the cruise industry as the premiere cruise destination market in the United States. In 2008, Alaska accounted for $1.2 billion in direct cruise industry spending. The state ranks third in the nation in cruise industry expenditures.
- The cruise industry's spending generated 25,697 full- and part-time jobs and wages totaling $1 billion in income for Alaska workers in 2008.
- During peak season, the cruise lines directly employed more than 6,000 workers in Alaska.
- During 2008, Alaska ports received 3.9 million cruise passenger visits, 70 percent of all port-of-call passenger visits at U.S. ports.
- While primarily handling port-of-call visits, Alaska has homeporting operations as well, generating 184,500 passenger embarkations on turnaround cruises between Alaska and Vancouver.
- Major businesses in Alaska most impacted by the spending of the cruise industry generally include tourism-related industries such as airlines, hotels and tour operators.

The state of Alaska recently passed a $50 per person tax on all cruise guests visiting Alaska. CLIA argued that this tax has had a significant impact on the deployment of ships to Alaska. This surcharge in this economic environment has resulted in passenger's choosing alternative, less expensive vacation options. Indeed, several cruise industry operators have announced redeployment of vessels from the Alaska market in 2010 resulting in approximately 15 percent fewer cruise ship visitors anticipated in 2010. The consequential economic impact of a 15 percent decrease would represent approximately:

a. 585,000 fewer visitors to Alaskan ports;
b. A decrease of approximately $150 million in income for Alaska workers; and,
c. A decline of approximately $180 million in direct spending.

Based on these comments, CLIA expanded that while it is unclear as to the exact impact of the proposed rule on fuel cost increases, it likely will equate to two to three times the amount of this recently assessed head tax. As such, CLIA reasoned that there is clear evidence from the Alaska head tax that passing on a cost increase of this magnitude to prospective guests is not possible. It is unreasonable to expect that the market will bear such cost increases without there being significant impacts on cruise pricing and profitability of affected itineraries. The overall impact is expected to be significantly negative. The same holds true with regards to the U.S. flag cruise ship operations in Hawaii. If U.S. based cruise ship itineraries become uneconomical, decisions to redeploy ships out of the North America market may be required.

Commenters noted that Alaska cruises are different than other cruises because they remain within the ECA boundaries during their entire trip. In fact, the Alaska Cruise Association estimates that two thirds of all cruise costs within North America will be attributable to Alaska cruises. It is very uncertain whether the consumer would be willing to shoulder the burden of these additional costs, thereby seriously affecting the competitiveness of Alaska as a premier tourism destination. Commenters noted that EPA's cost analysis concluded that large passenger vessels would incur an additional $7 per passenger/day cost to pay for the new standards. Based on higher fuel cost estimates, CLIA estimated the expected fuel cost premium would be closer to $12-$16 per day adding approximately $86 to $112 to the price of a typical seven day cruise itinerary in this region, if historical averages hold true. Alaska Cruise Association analysis put the additional costs higher at $15 to $18 per passenger day. A $15 per passenger/day increase would add $100 million to the cost of operating in Alaska for ACA member lines.

Governor Lingle commented that, with limited refining capacity and capability in the State of Hawaii and great distances between the State of Hawaii and continental U.S. and foreign markets, the economic impact of the proposed fuel limits on Hawaii's shipping and cruise industry has not been quantified and is critical to a fair assessment of the proposed rule's impact on Hawaii's marine highway system and sea-based tourism.

(CLIA, 0278)
(Gov Parnell, 0287)
(Mayor of Juneau, 0298)
(Munoz, 0317)
(Egan, 0323)
(Sen. Begich, 0322)

(CLIA, 0278)
(Port of Anchorage, 0299)
(Mayor of Ketchican, 0294)
(Sitka, 0307)
(Murkowski, 0384)
(RDC, 0288)
(Governor Lingle, 0400)

Our Response:

Commenters noted that the cruise industry generates significant revenue for the Alaskan economy, due to both direct and indirect spending. As such they commented that any reduction in cruise passengers visiting Alaska, due to higher fuel prices, would have a negative impact on the economy in Alaska. Commenters said similar impacts may be seen for Hawaii, which is another cruise destination in the proposed ECA. The economic analysis performed for this rule holds all other aspects of the market constant except for the elements of the coordinated strategy. It does not attempt to predict future market equilibrium conditions, such as if the cruise market will recover from the current economic downturn. While the cruise sector may be in difficulty due to current economic conditions, independent of implementation of MARPOL Annex VI or the coordinated strategy, it is not possible to predict what the conditions will be when the coordinated strategy goes into effect in 2016 for Tier 3 engines and 2020 for 1,000 ppm sulfur fuel or whether the impact of the program will be more serious for these operators. This approach is appropriate because the goal of an economic impact analysis is to explore the impacts of a specific program; allowing changes in other market conditions would confuse the impacts due to the regulatory program.

We received comment that suggested that demand in the cruise industry should not be treated as nearly perfectly inelastic. In other words, demand may decrease due to higher fuel costs. Section 7.4.2 of the RIA provides a discussion of the impact of changing the assumption of nearly perfectly demand elasticity for marine transportation services in general, and for the cruise industry specifically. Relaxing this assumption is not expected to change the estimated total social costs of the program, which are limited by the engineering compliance costs. However, it would change the way those costs are shared among stakeholders.

We acknowledge that, as a recreational service, demand for cruises is expected to be more elastic than demand for other transportation services. However, an elastic demand for cruises means that the compliance costs associated with the coordinated strategy will be shared among the cruise providers and their customers, rather than being passed on completely to the passengers through higher prices. While this distribution of the compliance burden may offset at least partially a decline in demand for cruises through smaller price increases, it also means that cruise ship companies will bear at least part of the compliance costs of the program. Nevertheless, these compliance costs are still expected to be small compared to the daily costs of a cruise. As such, we would not expect the economic impacts on Alaska or Hawaii, associated with the coordinated strategy, to be significant. While the cruise sector may be in difficulty due to current economic conditions, it is not possible to predict what the conditions will be when the coordinated strategy goes into effecting 2016 for Tier 3 engines and 2020 for 1,000 ppm sulfur fuel.

Commenters did not provide information linking the $50 per passenger tax in Alaska to the decrease in cruise demand. This tax occurred simultaneously with an economic downturn that could also explain the decrease in demand. In addition, the State of Alaska, while noting that "the cruise ship industry and the 1 million passengers who come to Alaska every summer contribute significantly to Alaska's economy," has stated that it "will vigorously defend the state in this lawsuit," referring to the lawsuit brought by the Alaska Cruise Association which challenges the tax.[23] This suggests that the State of Alaska does not consider the tax to have a substantial negative impact on Alaska's economy.

Based on our analysis, the per passenger price of a seven-day Alaska cruise on a vessel operating entirely within waterways covered by the coordinated strategy is expected to increase about $7 per day, assuming that the total increase in operating costs is passed on to the passengers of the vessel. The price of a 7-day Alaska cruise varies from $100 to $400 per night or more. In that case, a price increase of about $7 per night would be a 1.5 percent to about 6 percent increase. Ships that spend less time in covered areas, such as a ships operating between Hawaii and a destination outside the proposed ECA, would experience relatively smaller increases in their operating costs. We would not expect the ECA to have a significant impact on Hawaii's marine highway system due to the relatively small increase in operating costs associated with the coordinated strategy, compared to the next cheapest mode of transportation between the islands. Commenters indicated that the price could be higher, due primarily to higher projected fuel prices in the future. As future fuel prices are uncertain, and as discussed in Chapter 4, we believe our fuel price estimates are appropriate for this analysis.

7.3 Other Economic Impacts in Alaska

What Commenters Said:

A number of commenters expressed concern that the proposed ECA will a have a negative economic impact on the State of Alaska. RDC stated that in addition to requiring scientific studies to justify an ECA, the IMO requires an economic analysis be done to consider the cost of implementing new standards, and the subsequent economic impacts to local communities. The Alaskan communities served by ocean-going ships, as well as the remainder of the state's residents, would certainly feel the effect of immense cost increases to vessel operations. This must be a factor that is taken into consideration before including Alaska in an ECA designation. RDC members across all resource sectors stand to be adversely affected: transportation companies that bring goods in and ship cargo out of the state will face significant cost increases in continued operations. Exportation of commodities, particularly Alaska's natural resources like oil and gas, minerals, and timber, will become increasingly more expensive if ships carrying them have to incur higher operating costs. TOTE commented that the cost of switching fuels will have a disproportionate economic impact on the residents of Alaska for no appreciable improvement in their lives, health or visual air quality. Switching to distillate fuel will immediately double the cost of fuel based freight charges for goods moving to Alaska by

[23] State of Alaska, Department of Law, "Press Release: Attorney General Will Vigorously Defend Alaska in Cruise Industry Lawsuit Against the State," September 18, 2009.

ocean going vessels. Their ability to pay this doubling of costs will affect the viability of TOTE going forward.

CLIA commented that although the EPA study addressed the added cost of producing distillate fuels and has indicated the expected additional cost per ton due to the manufacturing process, the analysis does not appear to take account of significant secondary impacts or "knock-on" effects in the distribution of these fuels such as:

a. The impact to the oil storage and distribution infrastructure in ports to account for these dramatic changes.
b. Whether or not suppliers will be able to remain in business as a result.
c. Access to credit facilities to fund the required changes in this tight credit market may be difficult.
d. Impact of product quality on the shipping and supply markets – for example, ships that are certified to transport heavy grade bunker oils may not be fit for the service of transporting distillate fuel. If this is not the case, expensive retrofits may need to be undertaken in the tanker industry.
e. Ship and shipyard capacity may not be available to undertake these ship alterations in a timely manner.
f. There may be a need for new ships and/or barges. If so, and credit, and construction capacity to support such an undertaking in a timely manner may be in short supply.
g. There may not be sufficient U.S. flag tonnage to haul U.S. produced products to U.S. markets.

The Port of Anchorage commented that ECA designation could adversely impact the critical function of maritime commerce and transportation in Alaska. As a non-contiguous state, Alaska is dependent on maritime transportation for the economic and efficient movement of freight and people. Additional regulations and strict environmental standards will only drive the cost of freight and transportation upwards, in a state where the cost of living already exceeds the national average. Without and independent study of these costs and an in-depth look at maritime transportation in Alaska, the economic impact on Alaskans is unknown.

Commenters noted that the proposed ECA boundaries will include the Port of Anchorage, which is of vital significance to most of the population of Alaska. According to the Port of Anchorage, it serves 85 percent of the state population as the entry point for 90 percent of the commodities entering Alaska. Consumer industrial goods, and petroleum products that move through this port, are dispersed to 237 communities lying north, south, east, and west of Anchorage. In a recently completed analysis of the Port of Anchorage, the port was found to contribute over $1.4 billion annually to the state and local economies. This port is a direct and indirect employment source for thousands of jobs in the maritime shipping, stevedoring, trucking, and rail communities. Commenters argued that implementing the proposed ECA would substantially drive up Alaska's already high cost of living and have a negative impact on employment.

Governor Parnell expressed concern that the proposals currently being considered by EPA could result in significant additional costs to operate the Alaska Marine Highway System. The Transportation Institute commented that while there may be nearly inelastic demand for ocean marine transportation services, this is not the case for domestic container freight to Alaska

which could also be shipped by truck over the Alaska-Canada (Al-Can) highway. Governor Parnell commented that Alaska is currently in the process of evaluating potential methods for dealing with these regulations on State-owned ferries and request that these impacts be considered in EPA's analysis of the proposed regulations.

(TOTE, 0289)
(RDC, 0288)
(CLIA, 0278)
(Port of Anchorage, 0299)
(Munoz, 0317)
(Mayor of Ketchican, 0294)
(Gov Parnell, 0287)
(Transportation Institute)

Our Response:

We recognize that an increase in fuel price would result in increases in shipping costs on goods and commodities to and from Alaska. This increase in fuel costs is included in the economic modeling for the coordinated strategy, including shipping in the ECA off of Alaska. However, we continue to believe that shipping in Alaska, even where the entire trip would be in the ECA, would be relatively inelastic. This assumption is reasonable because there are no reasonable alternatives to transportation by ship for most goods. Several commenters noted that marine vessels are much more efficient than trucks at moving cargo. GLMTF stated that for each gallon of fuel a ship moves more than 10 times as much cargo as a truck. The anticipated increase in fuel cost associated with the fuel sulfur standards is very small in comparison. Therefore, it is not expected that this increase in operation costs would be sufficient to make trucking more economically attractive than shipping. More discussion on mode shift is included in Chapter 10. In addition, many communities in Alaska are not connected to the Al-Can highway. For instance, Juneau is land-locked and can only receive goods by ship or by air. Air transport is significantly more expensive than even trucking. Therefore, we do not expect the coordinated strategy to have significant adverse economic impacts on ports in Alaska that import or export these goods.

In addition, as discussed in Chapter 7 of the RIA, virtually all of the compliance costs will be borne by the users of marine transportation services in the form of higher prices. The price increase on goods would be expected to be small as the transportation costs are only a small fraction of the final purchase price of the goods. As a result, it is not likely that the coordinated strategy would have a significant impact on the demand for goods to, or commodities from, Alaska.

CLIA raised a number of considerations that it believed should have been included in the economic impact analysis. Here, they are addressed one-by-one. The refinery modeling was based on an economic model that not only included refinery upgrade cost estimates, but the cost of fuel distribution as well. It was not considered which fuel suppliers would remain in business, only the costs of supplying the fuel. We recognize that any new standard can result in a shock to the market, but also recognize that, given proper lead time and incentive, the market will respond to the demand. Our analysis includes the cost of vessel modifications associated with switching from operation on residual fuel to distillate fuel. This is described in Chapter 5 of the RIA. We

believe that enough lead time is available to provide for these modifications, as necessary. In many cases, the ships are already capable of operating on lower sulfur fuel. As such, it is not clear why CLIA asserts that there will be a need for new ship and barge construction or why this rule would affect U.S. cargo carrying capacity. If the issue is that more barges are needed to transport the ECA compliant fuel, it should be noted that fuel transportation costs are included in the WORLD refinery model used to help develop our cost analyses.

CHAPTER 8: Environmental Impacts

What We Proposed:

The comments in this section generally correspond to Section II of the preamble to the proposed rule, where we describe the air quality, health and welfare effects, as well as the contribution of Category 3 vessels to national emission inventories. The Regulatory Impact Analysis describes the air quality, health and welfare effects in Chapter 2 and the emission inventory development in Chapter 3. Comments pertaining specifically to the Great Lakes are addressed separately in Chapter 10 of this document.

8.1 Emissions Inventory

8.1.1 Category 3 Vessel Inventory Contributions

What Commenters Said:

A number of commenters cited port inventory analyses that indicate that oceangoing vessels produce more pollutants than other elements of port operations and are a significant emissions source.

ALA stated that shipping is one of the major sources of nitrogen dioxide, and one that is expected to grow unless we take action. Based on EPA estimates, unless we require this cleanup, nitrogen dioxide emissions from ships would more than double by 2030, growing to 2.1 million tons per year. (hearing testimony ALA 0227)

NACCA commented that, unlike most other significant mobile sources of diesel air pollution, emissions from C3 marine vessels are virtually uncontrolled. Moreover, based on EPA estimates, if left uncontrolled the contribution of NO_X emissions from C3 vessels will grow from 10 percent of the mobile source inventory to 40 percent in 2030, $PM_{2.5}$ emissions from 24 percent to 48 percent and SO_X emissions from 80 percent to 95 percent. This will make C3 engines a dominant source of mobile source emissions unless controlled effectively. (NACAA, 0246)

A recent analysis by the New York Port Authority shows that oceangoing vessels produce far greater emissions of criteria pollutants than tugs and other harbor vessels, cargo handling equipment, drayage trucks, or other elements of port operations – including 65% of PM_{10} and 63% of $PM_{2.5}$. The City of New York also mentioned that more residual oil is used by the shipping sector than any other industry in the United States. (City of New York testimony, 0227)

NRDC commented that the Northeast region is home to many ports and emissions from category 3 engines are a significant source of NO_X, fine particulate, and SO_2. In 2000, approximately 230 tons of $PM_{2.5}$ was emitted by ocean going vessels in that year in the Port of New York and New Jersey – more than a third of all $PM_{2.5}$ emissions from port-related activity – excluding emissions associated with drayage. (NESCAUM, 0356) Ocean-going vessels in the

region emit 47 percent of the NO_X related to port activities in the region and 62 percent of the fine particulate matter related to the port activities in the region. (NRDC testimony, 0227)

In 2005, large ocean-going vessels produced over forty percent of all the oxide of nitrogen emissions in Santa Barbara County. SBAPCD stated that, due to increasing cargo volumes through the Santa Barbara Channel, these emissions are projected to make up close to three quarters of the County's NO_X emissions by 2020. (Santa Barbara County Air Pollution Control District, 0231)

Friends of the Earth and others stated that a recent industry report to the IMO on global emissions from ocean going vessels ("IMO Expert Report") estimates that for the year 2007, marine engines were responsible for 25.8 million metric tons of NO_X, 16.2 million metric tons of SO_X, 1.8 million metric tons of PM, and 1.12 billion metric tons of CO_2—more than is emitted by all of the world's oil refineries. (Earthjustice, Friends of the Earth, and Center for Biological Diversity joint submittal, 0320)

ALA and EDF commented that, based on current emission inventory analysis, EPA estimates that Category 3 engines contributed nearly 6 percent of mobile source NO_X, over 10 percent of mobile source $PM_{2.5}$, and about 40 percent of mobile source SO_2 in 2002. EPA has projected that emissions from these engines will increase significantly through 2030 as a result of an increase in the use of Category 3 marine engines used for international trade. EPA also projects that without further controls on these engines, their absolute magnitude will roughly triple and their relative contribution will increase to about 40 percent of mobile source NO_X, 48 percent of mobile source $PM_{2.5}$, and 95 percent of mobile source SO_2 by 2030. Much of the projected increase in baseline emissions is due to the projected growth in fuel use by Category 3 engines. As seen in Tables 3-57 and 3-91 from EPA's Draft RIA, EPA estimates that, without controls, total fuel use will increase from 8.5 million short tons in 2002 to more than 26 million short tons in 2030 – a 300% increase. (American Lung Association and Environmental Defense Fund, 0366)

ICCT commented that ship emissions are projected to grow dramatically in relation to other sources. They note that OGV contributed about 6% of transportation-related nitrogen oxide, 10% of PM and roughly 40% of SO_X in the U.S and without further controls pollution will increase to about 34% of NO_X, 45% of PM, and 94% of SO_X emissions by 2030.

Our Response:

We agree that emissions from Category 3 vessels are an important emissions source. On a nationwide basis, Category 3 vessels currently contribute 10 percent of mobile source NO_X emissions, 24 percent of mobile source diesel $PM_{2.5}$ emissions, and 80 percent of mobile source SO_2 emissions. In 2030, absent the controls in this rule, these vessels would become a larger portion of the total mobile source emissions inventory constituting 40 percent of mobile source NO_X emissions, 75 percent of mobile source diesel $PM_{2.5}$ emissions, and 95 percent of mobile source SO_2 emissions. See Chapter 3 of the RIA for more detail on our estimates of Category 3 vessel inventory contributions.

8.1.2 Contribution of U.S. vs. Foreign-Flag Ships

What Commenters Said:

SBCAPCD commented that ninety percent of the annual entrances to U.S. ports in 1999 were made by foreign flagged vessels and over 92 percent of the NO_X emissions from transits through the Santa Barbara channel in 2005 were made by foreign flagged vessels. (Santa Barbara County Air Pollution Control District, 0231)

According to ALA and EDF, the U.S. Department of Transportation Maritime Administration (MARAD) estimates that in 2007, foreign-flagged vessels made up 88% of Category 3 ship calls on U.S. ports. As a result, about 88% of ocean-going ship emissions at U.S. ports come from foreign ships. (American Lung Association and Environmental Defense Fund, 0366)

Liberty Maritime Corp. commented that MARAD indicates that only 89 U.S.-flag vessels were engaged in international registry trade for year end-2007. At that time MARAD reported 189 vessels in the U.S. ocean-going fleet (vessels over 10,000 DWT) of which 100 were engaged in the Jones Act trade and 89 in the foreign trade. Of the 89 foreign trade vessels, 59 vessels were enrolled in the Maritime Security Program (MSP) fleet as of April 2009. In terms of overall vessel calls, MARAD reports that, in 2007, U.S.-flag ocean-going vessels accounted for only 12 percent of U.S. port calls. Jones Act vessels accounted for 78 percent of U.S.-flag calls and 9 percent of overall calls. MSP vessels accounted for 2 percent of overall calls. "Other U.S.-flag" ocean going vessels represented 0.4% of U.S. port calls in 2007. (Liberty Maritime Corp, 0347)

Our Response:

We agree that the vast majority of port calls to the U.S. are made by foreign-flagged vessels and include these vessels in the inventory estimates presented in Chapter 2 of the RIA. The control reductions resulting from this rule are applied to both U.S. and foreign-flagged vessels, since the coordinated strategy targets both foreign and domestic ships operating off the U.S. coasts and within internal waterways.

8.1.3 Growth Rates

What Commenters Said:

TOTE commented that Ocean Going Vessel calls in all U.S. ports have declined by approximately 30 percent in the last year rendering the EPA calculations and future projections of this source of emissions completely inaccurate. (TOTE, 0289)

PMSA commented that graphics and tables from the Port of Los Angeles demonstrate that the previous cargo forecasts were overly optimistic. The bottom line is the throughput for 2009 is expected to be between 30 to 40 percent lower than 2008 and that equates to a throughput level roughly comparable to that of 2003. The graphic also shows that the peak levels seen in 2006 are not expected to be reached again until 2014 and that the rate of growth going forward is expected to be significantly slower than the previous forecast. (Pacific Merchant Shipping Association testimony, 0275)

PMSA also commented that there has been the perception that the rate of cargo growth is directly correlated with the increase in emissions. The 2007 emission inventories done by the Ports of Los Angeles and Long Beach clearly refute that assumption. Not only are 2007 ship emission below the 2006 emission for all pollutants, only hydrocarbon emissions show any increase above 2001 levels. These emission improvements occurred while container throughput increased 61 percent from the 2001 levels. (Pacific Merchant Shipping Association testimony, 0275)

SCAQMD stated that recent lower cargo projections for the Ports of Los Angeles and Long Beach do not justify adoption of delayed or relaxed controls. Cargo projections have been incorrect in the past (did not foresee extent of growth to 2006; then over-projected from 2007 through 2023). The Ports are still projecting enormous growth and the same ultimate level of cargo throughput, about 43 million containers, or TEUs, compared to 14 million in 2005 (the baseline year for the SIP). The growth will simply be delayed. The ports are expecting 25 million TEUs in 2023 (current ozone attainment year), 35 million TEUs in 2030 (potential attainment deadline for new ozone standard), and 43 million TEUs in 2035 (prior projection reached this level in 2023). (South Coast Air Quality Management District, 0309)

Graphs of cargo container volume in the Port of Los Angeles and Long Beach were provided by the Coalition for Clean Air. The commenter points out that the decline in the recent term still represents a significant increase of volume over the long term. (Coalition for Clean Air, supplemental comment following hearing testimony, 0220)

Just in their region, the Port Authority of New York and New Jersey expects container volumes to triple by 2020 from 2006 levels. (NRDC testimony, 0227)

Friends of the Earth and others commented that a recent industry report to the IMO on global emissions from ocean going vessels ("IMO Expert Report") predicts that these emissions will increase by as much as 40 percent by 2020 and that fuel consumption, the majority of which is residual fuel consumption, will grow by more than 30 percent. Already, the United States' emission inventory for Category 3 marine engines has far surpassed what EPA had previously predicted for the year 2030. See 72 Fed. Reg. at 69526; 68 Fed. Reg. at 9755. (Earthjustice, Friends of the Earth, and Center for Biological Diversity joint submittal, 0320)

Our Response:

Growth factors were developed for five geographic regions within the U.S. These factors are based on the expected demand for marine bunker fuels that is associated with shipping goods into and out of the U.S. This demand is driven by the demand for commodities that are produced in one location and consumed within another. The forecast for demand for shipping services and bunker fuel was determined for each area using information on commodity flows from Global Insight's (GI) World Trade Service. The flow of commodities is then matched with typical vessels for trade routes (characterized according to cargo capacity, engine horsepower, age, specific fuel consumption, and engine load factors). Typical voyage parameters are then assigned to the trade routes that include average ship speed, round trip mileage, tons of cargo shipped, and days in ports. Growth thus depends on commodity projections, ship characteristics, and voyage characteristics. The analysis also attempted to account for improvements in vessel fuel efficiency over time. The analysis does not simply extrapolate from past estimates of cargo tonnage and/or vessel calls.

Although vessel calls may have declined over the past year, it would not be prudent to project long-term growth based on these short-term changes. Ports are still projecting significant growth in the long-term.

As a means of comparison, the IMO Secretary General's Informal Cross Government/Industry Scientific Group of Experts presented a global growth rate that ranged from 3.3% to 3.7%. Our estimate of overall U.S. growth is 3.4%, which is consistent with that range.

8.1.4 Modeling Scenarios

What Commenters Said:

While the projected health and social benefits appear to be favorable in so far as the climatological modeling and health benefits models are correct, CLIA believes that a more accurate representation, at least for the long term model from 2020 to 2050, should be based on comparison to the expected 0.5% bunker oil sulfur content global cap expected effective in 2020. With this in mind, an analysis should be undertaken and the appropriate breadth of the ECA should be based on the correct analysis. (0278)

CLIA commented that EPA's analysis of the benefits of establishing an ECA is based on a comparison of air quality and health and environmental impacts under a 2020 base case (no ECA) scenario with a corresponding scenario assuming an ECA is in place. EPA's base case scenario included the assumption that residual oil fuel sulfur (S) levels in 2020 remained at current average levels (2.5% in the west and 2.7% elsewhere) whereas revisions to MARPOL Annex VI approved in October 2008 include a worldwide marine fuel sulfur level limit of 0.5% in 2020. Our analysis shows modifying EPA's 2020 base case to reflect the required use of 0.5% sulfur fuel reduces the benefits calculated by EPA by approximately 85%. Thus, 85% of the health benefit attributed by EPA to the ECA will be achieved by Annex VI global sulfur limit. This in turn leads to an 85% reduction in the monetary benefits calculated by EPA. (0278)

CLIA also argued that EPA's 2020 base case does not include the additional IMO Annex VI global NO_X control requirements which were approved in October 2008 and which go into effect prior to 2020 (retrofit of existing uncontrolled engines to meet Tier I control levels and Tier II NO_X control for new engines) whereas the 2020 ECA scenario includes both of these global controls. As a result, NO_X emissions are overstated in the 2020 base case and benefits from NO_X reductions (which include $PM_{2.5}$ and ozone reductions) ascribed to implementation of the ECA are overstated. (0278)

According to CLIA, EPA's 2020 base case overstates emissions from ships traveling in California coastal waters and cruise ship hotelling in California ports because EPA's emission inventory does not take into account recent California Air Resources Board regulations limiting fuel sulfur content to 0.1% by 2012 and requiring most ships visiting California ports to turn off their engines and plug into shore power while hotelling. Similarly, EPA's base case scenario overlooks the fact that numerous vessels in other ports are voluntarily plugging into shore power thereby substantially reducing their emissions in and around U.S. coastal cities. As more ships are equipped to do so, and ports are outfitted to provide this service, the effort will expand to other locations. (0278)

Chamber of Shipping of America stated that the appropriate points for the health benefits calculation are with the 0.5% global average required by 2020 compared to the 1.0 and 0.1% ECA requirements as contained in Annex VI. (0256)

Our Response:

In the rulemaking, our intent was to present the full costs and benefits of our entire coordinated strategy, both in the domestic and international arenas. This approach was consistent with the recommendations of the Office of Management and Budget.

If we were to model the reduction of fuel sulfur from 0.5% to 0.1%, as several commenters suggested and CLIA provided in Annex I of its comments, EPA agrees the scaling approach is generally sound as a "rough estimate" of benefits. The Agency believes the best approach would be to model the base case with the global controls and conduct the CMAQ/BENMap modeling with the actual emissions. However, as a first approximation, it seems reasonable to assume that the transition from 2.5% to 0.5% fuels would not result in large spatial differences in impacts, nor would we expect large non-linearities in the response of $PM_{2.5}$ levels to changes in direct PM or SO_2 emissions. While the scaling approach itself may not be inherently flawed, we believe the conclusion drawn by CLIA that this would lead to a similar reduction in monetary benefits is flawed. We would not only have lower benefits (15% of SO_X benefit of lowering from 2.7% sulfur fuel content), but much lower costs ($6 versus $145 or 4% of fuel cost) as well. As such, it would not be expected to change our decision with regard to the scope of the proposed ECA.

For the ECA application, the modelling focused on the effect of shipping emissions and ECA controls in 2020. This year was chosen for a number of reasons. First, air quality modelling is complex and time consuming, and, as a result, is typically only performed for selected years. In addition to running spatial allocation, air quality, and benefit models, a detailed emission inventory must be developed to perform this air quality modelling. This detailed emission inventory is not only needed for ship emissions, but for all other sources that contribute to ambient air pollution in the U.S. and Canada. By choosing 2020, we were able to make use of information and tools that had already been developed for wider scale air pollution modelling efforts.

With regard to the NO_X impacts of the ECA program, while 2020 will include five years of turnover to the Tier III standards, the long service lives of engines on ocean-going vessels mean that the fleet will not be fully turned over, with about one-third of the total fleet expected to be compliant with Tier III standards. Therefore the estimate benefits of the program would not be significantly different than if we had performed the analysis for 2016 when the Tier III NO_X standards begin. We did not include the global fuel sulfur standard in the 2020 ECA analysis to provide a better estimate of benefits in the early (pre-2020) years of the program.

8.1.5 Fleet Size and Turnover

What Commenters Said:

SCAQMD commented that the economy has resulted in idling of vessels thus creating uncertainty about whether the EPA projections based on historical new vessel construction and

routing to our ports will hold for the future. Lower new-vessel penetration rates are a distinct possibility. (0309)

Maersk testified that U.S. fleets often grow by acquiring vessels rather than building new vessels, and the acquired vessels are often purchased outside the U.S. (Maersk testimony, 0227)

Coalition for a Safe Environment asked, regarding the proposed near-term Tier 2 standards, how many new ships are being proposed to be built in the near term that would provide a significant near-term public and environmental benefit vs. more stringent standards, efficient engine designs and emission control add-ons? The commenter requested that EPA provide the ship builder information, engine manufacturer data and build schedule. (Coalition for a Safe Environment testimony, 0232)

Our Response:

Age distributions were developed based on vessel characteristic data associated with calls to U.S. ports. Age distributions for Great Lakes vessels were calculated separately, since vessels in the Great Lakes tend to last longer. While lower new vessel penetration rates are possible, these could not be estimated accurately. Issues related to re-flagging are discussed in section 5.12 (D).

8.2 Air Quality Modeling

8.2.1 Emissions Impacts by Distance from Shore

What Commenters Said:

Cruise Lines International Association commented that EPA's proposal considers only the establishment of an ECA within 200 nm of shore, irrespective of location along the coast, despite the fact that emission reductions at 200 nm can be expected to have less of a benefit on shore than emission reductions occurring much closer to the shore or within harbors. An ENVIRON photochemical grid modeling study of ocean going vessel (OGV) emission impacts on $PM_{2.5}$ and ozone air quality similar to that performed by EPA revealed that impacts drop off significantly as the distance from shore increases: 66% to 86% of the $PM_{2.5}$ impacts on Gulf and east coast cities (except for Miami) and 56 to 80% of the $PM_{2.5}$ impacts on west coast cities is accounted for by shipping activity within 39 nm of the coast. Calculations included in the ENVIRON study show that the cost effectiveness (expressed as OGV contributions to on-shore PM divided by OGV fuel consumption in tons) of emission controls within 39 nm of shore are over 1,000 times greater than controls applied beyond 39 nm out to 200 nm.

The Chamber of Shipping of America supported comments submitted by the American Petroleum Institute and their accompanying ENVIRON study which noted decreasing ozone and PM impacts as the distance offshore increases. The commenter stated that EPA's modeling indicates that more than 80% of the marine ozone and PM contributions are from vessels less than 100 nm offshore while the ENVIRON study shows the most cost effective control region is out to 19 nautical miles. The commenter strongly urged EPA to review the results of this study and rationalize the differences in the two very different conclusions.

In their comments, the American Petroleum Institute requested that EPA take the analyses commissioned by commenter into consideration when implementing MARPOL Annex VI and the North American ECA. In particular, the commenter suggests that the proposed 200 mile boundary on the East Coast may not be cost-effective, citing their finding that the most cost effective control region would be within 0-19 nautical miles offshore.

TOTE state that its vessels are never offshore more than 200 miles. While the 200 mile limit may be appropriate in some geographic areas it is wholly inappropriate in the area they operate in. This (pacific northwest/Alaska) area could be addressed by limiting the use of noncompliant fuels to the more reasonable 40 miles offshore ECA adopted by California.

Our Response:

The above comments primarily focus on the geographic boundaries of the proposed North American ECA. As discussed in Chapter 2 of this document, the ECA proposal is not within the scope of this rulemaking and the ECA proposal fully satisfied the criteria in MARPOL Annex VI, Appendix III.

With that said, there is a high level of shipping activity along each of the coasts included in the proposed ECA, out to 200 nm and beyond, as well as in and out of ports. As such, pollution from ships is emitted in all waters contained in the proposed ECA. This air pollution, even when emitted at 200 nm from shore reaches not only the coast, but well into the interior of the U.S. and Canada due to local meteorological conditions and the long atmospheric residence time of SO_X, PM, and NO_X emissions. Reductions in these ship emissions would lead to lower particulate matter concentrations and reductions in ground-level ozone. Reducing air pollution also reduces SO_X and NO_X deposition on land and in the water.

Conventional wisdom suggests that prevailing winds, over the U.S. and Canada, travel from west to east. On average, this is true, especially for the north Atlantic and the Pacific coasts. In the Gulf of Mexico, prevailing winds typically come from the southeast. While the frequency of maritime influences can vary by location, it is not uncommon for locations all across the United States to be affected by emissions that originate offshore. An EPA analysis of air parcel back trajectories over the 12-year period from 1995-2006 concluded that highly-populated coastal cities in the northeastern U.S. were impacted by marine air masses between 10-20 percent of the time. The intent of the EPA analyses was to demonstrate this impact of marine pollution on inland populations and ecosystems. As such, air pollution off the east coast, even 200 nm from shore, affects the air we breathe. Additional information on the impact of emissions off the east coast of the U.S. is included in Section 8.2.3 of this document.

Some of the most compelling evidence supporting the need for the proposed 200nm ECA designation is reflected in the U.S. and Canadian air quality and deposition maps shown in the North American ECA proposal, the technical support document for the ECA proposal, and the RIA. These maps are based on complex air quality modeling that considers a number of factors including where ship exhaust is emitted, weather and wind patterns, and atmospheric chemistry. This modeling shows that air pollution from ships travels great distances, over water and inland, on all coasts.

The Environ modeling uses a different air quality model than EPA. However, Environ states that "despite using different inventories and air quality models, results from both studies are generally consistent." This statement refers to emission concentrations in the U.S. due to pollution from ships and to the estimated impact of the proposed ECA on U.S. air quality. Environ discusses an approach where fuel consumption and emission impacts are presented for modeled ECAs that extend different distances from shore. Based on the Environ report, a 19nm ECA would impact about 40-70% of the Category 3 contribution whereas a 200nm ECA affects 90-95% percent of the emissions that eventually impact AQ concentrations over land. This is not inconsistent with our modeling. However, what the Environ report does not consider is the valuation of emission reductions by distance compared to costs. Although emissions 200 nm from shore generally have lower impacts on air quality over land than emissions nearer the coast, those emissions impacts are still significant compared to the cost of emission control.

The commenter noted that "the cost-effectiveness of applying fuel sulfur controls within 39 nm of shore are over 1,000 times greater than controls applied beyond 39 nm out to 200 nm." The cost-effectiveness numbers cited by CLIA were based on calculations done by Environ in their report titled *Modeling the Impacts of Marine Vessel Emissions to Ozone, Particulate Matter and Haze in the Eastern US*. EPA has not been able to identify any numbers in the Environ report that would correspond with controls being 1,000 times more cost-effective within 39 nm of shore. Using data contained in table 3-8 in the Environ report, controls are approximately 10 times more "cost effective" in the first 39 nm as compared to between 39 and 200 nm from shore. Note that this "cost effectiveness" metric uses fuel consumption as a surrogate for cost and does not quantify the cost. Also note that this analysis ignores capital costs which would be incurred regardless of the ECA boundary distance. In addition, air pollution concentrations are used as a surrogate for benefits and only receptors where marine vessel contributions exceeded 1 ug/m^3days were included. It is not clear why receptors where marine vessels contribute less than 1 ug/m^3 were excluded. Since scientists have not determined a "safe" PM exposure level, the best practice is to estimate benefits in all areas of the country (both in areas with poor air quality and those with acceptable air quality) to more accurately reflect the benefits of regulations for all of the areas within the U.S. While the most cost-effective emission controls are clearly closest to shore, at distances 200 nm from shore the benefits to controlling OGV emissions still substantially outweigh the costs.

It is important to note that the ECA scenario assumes ships meet ECA limits the entire time they are within the ECA, according to the empirically determined vessel traffic and routing in the base year. That is, analyses of benefits or costs throughout this application do not assume ships reroute in a manner perpendicular to the ECA boundary; they assume ships maintain existing routing. We believe this is a reasonable assumption because it is unlikely that ships currently operating near the coast would reroute beyond 200 nm from the coast, due to the time and expense associated with the additional distances that would need to be travelled. A smaller ECA could provide an incentive for ships to change their routing in such a way as to disrupt other operations. An example of this would be the Navy's Point Mugu Sea Range off the southern coast of California. By including this missile test range in the proposed ECA, there is no incentive for ships to divert, from other routes, through this range, to avoid the ECA fuel sulfur requirements.

8.2.2 Air Quality in Alaska and Hawaii

What Commenters Said:

A number of commenters expressed concern that EPA did not conduct any air quality modeling for Alaska and that due to the lack of air quality modeling, EPA did not meet the requirements to include Alaska in the proposed ECA. A number of commenters added that EPA should not proceed with adoption of the ECA until Alaska specific air quality, health, or environmental impact studies are performed. The commenters wrote that EPA needs to scientifically evaluate the need for the inclusion of Alaska and Hawaii and provide scientific evidence that Alaska's coastal communities have an ambient air problem as a result of marine vessels.

A number of commenters stated that neither Alaska nor Hawaii has air quality exceeding EPA's ambient air quality standards for ozone or $PM_{2.5}$. Many of these commenters go on to say that measurements of ambient $PM_{2.5}$, NO_2 and SO_2 at three locations in Juneau, Alaska during 2000 and 2001 conducted by the Alaska Department of Environmental Conservation (ADEC) showed concentrations of all three pollutants were "appreciably below the State and national air quality standards" in both years and that EPA should not ignore the ADEC's air quality measurements.

CLIA commented that EPA's proposal contains insufficient justification for including southeastern Alaska and eastern Hawaii regions in the proposed ECA while excluding western Hawaii and western Alaska regions. They add that no dispersion modeling results are presented to justify these decisions and that there is no information on the relative benefits of including (and disbenefits of excluding) these regions from the ECA.

Senator Murkowski of Alaska commented that "unlike in Los Angeles where cruise ship traffic occurs year-round, vessel traffic in Alaska waters is seasonal for only five months of the year, with the peak of traffic occurring during only a 14-week season from early June through the first week of September. That period also coincides, especially in later summer, with increased winds in coastal Alaska that serve to reduce the frequency of air inversions and disperse emissions. In Juneau, the town that has the most cruise ship visits in Alaska waters – about 99 percent of all of the 43 vessels coming to Alaska in 2009 docking in Juneau (Juneau having 581 port calls this year) – winds average 7 miles an hour year-round, but rise as the summer advances. Given the unique geographic and climatic conditions in Southeast and Southcentral Alaska, a single nationwide pollutant model is unlikely to accurately forecast air quality impacts in the State."

Governor Lingle of Hawaii commented, after the close of the comment period, that EPA does not have air quality data beyond the 48 contiguous states supporting ECA designation in Hawaii and the Hawaii Department of Health has not provided EPA with quantitative air quality data supporting Hawaii's inclusion in accordance with ECA criteria.

Senator Murkowski (0384)
Representative Munoz (0317)
RDC (0288)
River Adventures (0244)

CLIA (0278)
Mayor Williams – Ketchikan (0294)
Finkenbinder – Sitka (0307)
TOTE (0289)
Governor Parnell (0287)
Congressman Young (0382)

Our Response:

The above comments primarily focus on the geographic boundaries of the proposed North American ECA. As discussed in Chapter 2 of this document, the ECA proposal is not within the scope of this rulemaking and the ECA proposal fully satisfied the criteria in MARPOL Annex VI, Appendix III.

EPA performed detailed emission inventory modeling of pollution from ships operating off U.S. coasts, including the coasts of Alaska and Hawaii. This modeling not only quantified emissions from ships, but estimated where the emissions would occur off the coasts. Within the proposed ECA for Alaska, ships are expected to emit 32,000 tons of NO_X, 21,000 tons of SO_X, and 3,000 tons of $PM_{2.5}$ in 2020. Within the proposed ECA for Hawaii, ships are expected to emit 53,000 tons of NO_X, 34,000 tons of SO_X, and 4,000 tons of $PM_{2.5}$ in 2020.

Air pollution from ships impacts communities not just in ports and near coastlines, but also hundreds of miles inland. When people breathe this polluted air, their health is adversely affected, leading to lost productivity due to increased illnesses, hospitalizations, and even premature deaths. In our analysis, we assessed whether emissions from ships would reach populated areas in Alaska or Hawaii based on meteorological data. This analysis concludes that ships are contributing to ambient air concentrations of ozone and $PM_{2.5}$ in Southeastern and Southcentral Alaska, where most of the population resides. In setting the ECA boundary, EPA balanced considerations of protecting human health with impacts on the regulated community. Two of Alaska's three major population centers (Juneau and Anchorage) are on the coast in Southeastern Alaska and were included in the proposed ECA. The third major population center, Fairbanks, is inland of the proposed ECA. The Hawaiian Islands included in the proposed ECA are where the vast majority of the state's population resides.

Based on ambient air quality monitoring in Alaska, much of the state enjoys air quality that is generally cleaner than our National Ambient Air Quality Standards (NAAQS). However, Alaska does have some areas that have measured levels of ambient particulate matter near or above current NAAQS, particularly near Anchorage, Fairbanks and Juneau. On October 8, 2009, EPA issued final area designations for the 24-hour national air quality standards for fine particulate matter ($PM_{2.5}$). Portions of Fairbanks North Star County in Alaska were designated nonattainment for this new 24-hr $PM_{2.5}$ standard. The correspondence between EPA and ADEC in the years prior to this designation provided EPA with valuable information with which to assess the need for emission controls from ships.

Furthermore, scientists have not identified any ambient threshold for particulate matter below which no damage to health is observed. Thus, air pollution below the levels of the NAAQS for particulate matter is still harmful and the health of over a quarter million residents of Alaska can be enhanced by improving air quality further. It is highly beneficial, from a public

health perspective, to control PM because even short-term exposures (hours to days) to ambient PM can cause coughing, difficulty breathing, changes in lung and heart function and premature death.

It is also highly beneficial, from a public health perspective, to control ozone because exposure to ozone can cause throat irritation and make it more difficult to breathe deeply. Ozone can also aggravate asthma, leading to more asthma attacks. There are adverse human health effects caused by direct inhalation of SO_X or NO_X alone. However, due to the imprecise science of discerning those effects that are due solely to SO_X versus its PM derivatives (i.e. sulfate particles) or to NO_X versus its derivatives, ozone and PM, EPA's monetized benefits from the ECA do not separately quantify the human health impacts from exposure to direct SO_X and NO_X.

As stated is Chapter 2 of this document, at this time, the U.S. Government has not included northwestern Alaska or western Hawaii in the proposed ECA. While these areas also experience the environmental impacts of ship emissions, further information must be gathered to properly assess these areas and determine how ECA controls will help. We will continue to gather information on these areas, as well as other U.S. territories not included in the ECA proposal, and take action as appropriate.

We agree that cruise ship traffic in Alaska is seasonal and that seasonal fluctuations in wind speed can impact the dispersion of emissions. However daily meteorological conditions can vary from climatological averages so that there can still be days with slower winds and potential for inversions. In addition, increased wind speed can cause emissions to be transported further distances and impact additional areas.

The air quality modeling analyses focused on the 48-State contiguous portion of the United States, but the same meteorological conditions that result in potential impacts of ship emissions on air pollution over land in that region (e.g., prevailing winds, atmospheric stability, and precipitation patterns) can also result in potential impacts over Alaska and Hawaii. In fact, the oceanic influence is likely greater over the Hawaiian Islands and the coastal environs of Alaska (typically more populated than the interior portions of that State).

Because of its great expanse, the climatology of Alaska can differ widely depending upon latitude, altitude, and proximity to the ocean. Generally, the state's meteorology is classified in three zones: maritime, continental, and arctic. The weather in the maritime locations is strongly influenced by the relatively steady-state Pacific Ocean and as a result there are relatively small variations in prevailing winds, humidity levels and temperatures by season and location.[24] Without the stabilizing influence of the ocean waters, the continental and arctic regions can experience large seasonal extremes in temperature, humidity, precipitation, and wind direction. The local meteorology in these two zones is driven by the topography of the surrounding areas, the altitude, and the fraction of sea ice in the Arctic Ocean.

The proximity of the maritime regions to the shipping lanes lead to the conclusion that populations in these areas would be most likely to be adversely impacted by air pollution originating from ships. While wind directions at measuring sites in Alaska can be strongly

[24] Alaska Climate Research Center, 2009. Alaska Climatology,http://climate.gi.alaska.edu/Climate/index.html.

influenced by topography, the winds typically have an easterly component in populated locations like Anchorage, Juneau, Sitka, and Kenai.[25] The steering winds indicate the potential for the transport of shipping emissions in the North Pacific (shipping routes from Asia to North America). These winds are driven by common synoptic features that govern weather in this region, specifically the Aleutian low pressure cyclone in the winter and a northeastern Pacific anticyclone in the summer.

Not surprisingly, Hawaiian meteorology is also subject to strong maritime influences. Global circulations such as the Hadley cell establish east-northeasterly trade winds as the predominant flow pattern in Hawaii, especially in the warm season. These trade winds can comprise 50-90 per cent of the hourly wind directions over the region. Typically, the average height of the surface layer ranges from 1500-3000 m above ground level in all seasons in Hawaii. Any emissions input to this layer will remain in this layer unless ventilated by convection or removed by deposition. Ultimately, as there are shipping lanes on all sides of the main Hawaiian Islands; regardless of which way the wind blows, there is a high potential for ship emissions to affect air pollution over land.

8.2.3 Pollution Transport in the Air Quality Modeling

What Commenters Said:

The Canadian Shipowners Association commented on the air quality modeling which they say "suggests that marine pollution is carried uniformly inland from the east coasts". They reference a 2009 study of global marine emissions as evidence that emissions on the east coast are carried out to sea by prevailing winds.

The Chamber of Shipping of America commented that the basis for much of EPA's modeling data is questionable, including assumptions that weather and wind conditions are similar at all U.S. coastlines.

CLIA commented that with prevailing winds blowing from west to east over much of the country, the benefit of emission reductions in the outer waters can be expected to be significantly less along eastern shorelines.

ALA commented that "I am keenly aware of the impact that air pollution from these ships has on the health of millions of people across the nation. The pollution from these vessels jeopardizes the health and the lives of those who live and work along the nation's coastline, including the Great Lakes. But it does not stop there. The smog and soot forming exhaust from these ships travels hundreds of miles inland, threatening millions more who have no idea they breathe pollution that began in the boiler rooms in the harbors in far off Newark, Houston, LA and Chicago."

[25] Western Regional Climate Center, Alaska prevailing wind directions, http://www.wrcc.dri.edu/htmlfiles/westwinddir.html.

Our Response:

Conventional wisdom suggests that prevailing winds, over the U.S. and Canada, travel from west to east. On average, this is true, especially for the north Atlantic and the Pacific coasts. In the Gulf of Mexico, prevailing winds typically come from the southeast. However, winds fluctuate in speed and direction, and are less consistent on the north Atlantic coast than other coasts. As such, air pollution off the east coast, even 200 nm from shore, affects the air we breathe.

We agree that emissions on the northeast coast can be carried out to sea by prevailing winds. As seen in Figure 2-38 of the RIA, the largest predicted improvements in sulfur deposition from the proposed reduction in emissions along the eastern coasts of the U.S. and Canada occur over the Atlantic Ocean. It is reasonable to assume that if the EPA modeling domain extended further east, the simulation would have shown large improvements far out to sea. However, prevailing wind patterns can vary by season and by location; and daily meteorological conditions can certainly vary from climatological averages. While the frequency of maritime influences can vary by location, it is not uncommon for locations all across the United States to be affected by emissions that originate offshore. An EPA analysis of air parcel back trajectories over the 12-year period from 1995-2006 concluded that highly-populated coastal cities in the northeastern U.S. were impacted by marine airmasses between 10-20 percent of the time. The intent of the EPA analyses was to demonstrate this impact of marine pollution on inland populations and ecosystems.

One advantage of the annual (2002) MM5 meteorological modeling that was used to drive the air quality modeling simulations performed for the EPA analysis, is that it employed a fine horizontal grid resolution of 12 km. Unlike the coarse-resolution global modeling mentioned in the comment (where the grid resolution was 1.8 x 1.8 degrees latitude/longitude), the EPA MM5 modeling was able to capture important smaller scale phenomena like the sea breeze. These local circulations are well-known to result in the onshore transport of any air pollution trapped near the surface over large water bodies. In addition, EPA's evaluation of the meteorological modeling inputs closely matched observations for 2002. Therefore it was an appropriate dataset for assessing the frequency and magnitude of shipping emissions on inland locations.

8.3 Other Environmental Impacts

8.3.1 Ecosystem Impacts in Alaska

What Commenters Said:

Governor Parnell and Senator Murkowski noted that the proposal references a U.S. Forest Service study that attributes a reduction in lichen growth on Mt. Robers above downtown Juneau as potentially the result of sulfur and nitrogen emissions emitted by cruise ships. The proposal also notes that lichen is a food source for caribou, such as the Southern Alaska Peninsula Caribou herd. These commenters stated that while caribou do rely on lichen as a food source, no caribou live in the area of Southeast Alaska where the U.S. Forest Service study was conducted. In addition, the Southern Alaska Peninsula Caribou herd is located outside the emission control

area, on the other side of the Gulf of Alaska. This is given as an example that better Alaska-specific analysis is needed.

(Gov. Parnell, 0287)
(Sen Murkowski, 0384)

Our Response:

There are a number of important quantified relationships between nitrogen deposition levels and ecological effects. Certain lichen species are the most sensitive terrestrial taxa to nitrogen with species losses occurring at just 3 kg N/ha/yr in the Pacific Northwest, southern California and Alaska. A United States Forest Service study conducted in areas within the Tongass Forest in Southeast Alaska found evidence of sulfur emissions impacting lichen communities.[26] The authors concluded that the main source of nitrogen and sulfur found in lichens from Mt. Roberts (directly north of the City of Juneau in southeastern Alaska) is likely the burning of fossil fuels by cruise ships and other vehicles and equipment in Juneau. According to the Alaska DEC, damage to lichen populations has widespread effects in Alaskan ecosystems.[27]

We recognize that the discussion of the importance to lichen to caribou may have been misleading. The discussion of impacts on the Southern Alaska Peninsula caribou herd was based on information supplied by the Alaska DEC in promoting an ECA for all of Alaska. As such, it is not specifically relevant to the proposed rule. However, although caribou do not live in Juneau, there are caribou herds living inland of the proposed ECA for southeastern Alaska.

8.3.2 Reduction of Ozone and PM Pollution or Protection of Public Health and NAAQS Attainment

What Commenters Said:

NACAA commented that "C3 marine engines emit very large quantities of oxides of nitrogen (NO_X), sulfur oxides (SO_X) and fine particulate matter ($PM_{2.5}$), and myriad toxic air contaminants – all of which lead to degraded air quality and associated adverse health impacts. In many instances these engines contribute to nonattainment of the health-based National Ambient Air Quality Standards. In particular, these pollutants pose serious adverse air quality impacts on port cities across the nation, as well as areas downwind of these ports. Air pollution from ships is a significant component of the air quality problem in these communities."

The SCAQMD commented that "Deadlines to attain national ambient air quality standards in the South Coast Air Basin cannot be met unless emissions from ocean-going vessels are substantially and timely controlled. Nevertheless, the proposed rule and IMO standards will

[26] Dillman, K., Geiser, L., & Brenner, G. (2007). *Air Quality Bio-Monitoring with Lichens.* The Togass National Forest. USDA Forest Service. Retrieved March 18, 2009 from http://gis.nacse.org/lichenair/?page=reports.
[27] Alaska Department of Conservation, "Statement in Support of EPA Considering Alaska as Part of a Marine Emission Control Area," October 1, 2008.

likely fall significantly short of achieving the emission reductions needed in the South Coast Air Basin by federal attainment deadlines".

ALA/EDF commented that as of December 2008 there were 211 counties that either do not meet the 2006 $PM_{2.5}$ NAAQS or contribute to violations in other counties and there were 293 counties in violation of the 2008 eight-hour ozone standard. ALA/EDF also commented that climate change will exacerbate ozone and PM air pollution in the future, challenging compliance and public health protection.

The Ohio Environmental Council commented that reductions in NO_X and SO_2 are critical to ensure compliance with the NAAQS. They went on to detail that Ohio has four counties that are failing the particle pollution standard and in addition there will likely be counties that will fail the 2008 ozone standard.

The Santa Barbara County Air Pollution Control District commented that failing to reduce emissions from marine shipping may cause districts such as Santa Barbara to fall back into nonattainment for the federal ozone standard.

The Texas Commission of Environmental Quality commented that the adoption of the proposed emissions standards would contribute to the air quality goals of Texas and the U.S.

Chris Salmi on behalf of the Ozone Transport Commission (OTC) commented that many areas in the OTC region either currently do not meet the standards for ozone and $PM_{2.5}$ or are expected to be designated nonattainment and that attaining and maintaining these standards poses a significant challenge to the states.

Carter Strickland, on behalf of the City of New York, commented that the city is already nonattainment for $PM_{2.5}$ and ozone and that they will need help from this rule to meet their air quality goals.

Christopher Patton, an officer at the Port of Los Angeles, commented that federal partnership on engine and fuel control strategies for oceangoing vessels is essential to the regional attainment of NAAQS.

Texas Commission of Environmental Quality (0340)
NACAA (0246)
Port of LA (0232)
SCAQMD (0309)
ALA/EDF (0366)
Ohio Environmental Council et. al. (0314)
Santa Barbara County Air Pollution Control District (0231)
City of New York (0227)
Ozone Transport Commission (0227)

Our Response:

We appreciate the comments that these commenters provided. We agree with the commenters that emissions from ocean going vessels contribute to ozone and particulate pollution and that this rule is a crucial component of the effort to meet health based air quality

standards, such as the NAAQS. For the final rule we project that reductions of $PM_{2.5}$, NO_X, and SO_X emissions from marine diesel engines will produce nationwide air quality improvements. For instance, there are three counties whose projected design values go from being above the annual standard in the base case to being lower than the annual $PM_{2.5}$ standard with the coordinated strategy controls. Descriptions of the changes in design values for counties projected to be nonattainment in the future are provided below.

According to air quality modeling performed in conjunction with this rule, for the coordinated strategy, on a population-weighted basis, in 2030 the average modeled future-year annual $PM_{2.5}$ design values will decrease by 0.98 $\mu g/m^3$ and the average modeled future-year 24-hour $PM_{2.5}$ design values will decrease by 1.29 $\mu g/m^3$. Those counties that are projected to be above the $PM_{2.5}$ standard in 2030 will have even larger decreases from the emission controls associated with the coordinated strategy. On a population-weighted basis, the average modeled future-year annual $PM_{2.5}$ design values for counties whose design values were greater than 15 $\mu g/m^3$ will decrease by 2.03 $\mu g/m^3$ in 2030. In addition, on a population-weighted basis, the average modeled future-year 24-hour $PM_{2.5}$ design values for counties whose design values were greater than 35 $\mu g/m^3$ will decrease by 1.12 $\mu g/m^3$ in 2030.

The coordinated strategy will also result in nationwide ozone benefits. On a population-weighted basis, the average modeled future-year 8-hour ozone design values will decrease by 0.97 ppb in 2030. . In addition, those counties that are projected to be above the 2008 ozone standard in 2030 will have even larger decreases from the coordinated strategy. On a population-weighted basis, the average modeled future-year 8-hour ozone design values for counties whose design values were greater than 75 ppb will decrease by 1.60 ppb in 2030.

8.1.3 Air Quality Impacts from Ocean-going Vessels also Occur Away from Ports

ALA/EDF commented that emissions from OGV can have a tremendous negative impact on air quality outside of ports. They went on to cite studies that have looked at emissions from OGV and find that most shipping emissions occur away from port and conclude that the proximity of shipping lanes to coastlines has resulted in the movement of pollutants into coastal areas. They also note that the movement of ships through inland waterways can be expected to impact air quality in the communities they pass by. ALA/EDF also mention several studies that have looked at the impact of OGV emissions and find that emissions can impact well inland from the coastline.

The State of Texas commented that "These engines emit significant amounts of air pollution that contribute to ozone and particulate pollution in both coastal and inland areas in Texas and nationwide".

ICCT commented that pollution from ships not only impacts coastal regions but is also carried hundreds of kilometers inland.

ALA stated that beyond the pollution that is emitted here in the New York metropolitan area, the EPA estimates that pollution from these ships extends hundreds of miles inland, all the way to the Midwest. (ALA, 0227)

ALA stated that Texans, such as the commenter, are all too familiar with the blowing wind and with the air pollution that travels miles from its source, threatening people living and breathing down wind. The commenter was surprised to learn how far inland the pollution blows from these huge ships. EPA's analysis shows that the pollution from oceangoing vessels travels hundreds of miles inland. My neighbors and I certainly had no idea that these ships in Houston, over 160 miles away from Austin, are probably polluting the air that we breathe in our own backyard. (ALA, 0227)

Our Response:

We agree that the emissions from ocean-going vessels contribute to air pollution impacts far from the source. The maps presented in Chapter 2 of the RIA highlight the impact of the coordinated strategy inland as well as near the coasts. See Section 8.2 of this S&A for additional information on the meteorology used in the air quality modeling analysis and transport of pollutants.

8.1.4 Environmental Impacts Associated with Emissions from Ocean-going Vessels

What Commenters Said:

FOE and others commented that, in addition to health concerns, emissions from large marine diesel engines also harm the environment and public welfare by degrading visibility, contributing to haze, acid rain, eutrophication and nitrophication of watersheds, and reducing crop yields and productivity of forest ecosystems. *Id* at 69534-36. Particulate matter also causes soiling and erosion damage to materials, including culturally important objects, and promotes and accelerates the corrosion of metals, degrades paints, and deteriorates building materials. *Id.* at 69536. (Friends of the Earth, 0320)

Commenters stated that pollution from ocean-going vessels not only fouls our air, but impacts our water ways. The nitrogen oxides that are emitted are stripped from the air during precipitation events and washed into our waterways contributing to algal blooms and deadening of the waterway. It also causes acid deposition, watershed eutrophication and nitrification, adverse impacts on vegetation and ecosystems, materials damage and soiling and regional haze. EPA described these effects in its proposal. (Ohio Environmental Council et. al., 0314)

- Diesel air pollution impairs visibility. The same fine particles that have adverse health effects cause the haze that pollutes scenic vistas in national parks and wilderness areas, and creates brown clouds in our urban centers.
- Diesel air pollution threatens ecosystems across the country. The constituents of diesel exhaust contribute to the acid rain and nitrogen deposition that continues to harm sensitive ecosystems in the Adirondack Mountains, southern Appalachians and high elevation ecosystems in the western United States.

EDF and ALA support EPA’s application to IMO for a U.S. Emission Control Area and EPA’s Coordinated Strategy to reduce C3 emissions: “The emissions reductions from the coordinated strategy are also predicted to significantly reduce the annual total sulfur and nitrogen deposition occurring in sensitive U.S. ecosystems including forests, wetlands, lakes, streams, and estuaries. For sulfur deposition, adopting the coordinated strategy would result in reductions

ranging from 5% to 30% by 2020. Nitrogen deposition reductions would range from 3% to over 20%. 74 Fed Reg at 44,458." (0366)

CATF commented that diesel emissions also contribute to numerous adverse welfare and environmental effects. These include acid deposition, watershed eutrophication and nitrification, adverse impacts on vegetation and ecosystems, materials damage and soiling and regional haze. EPA described these effects in its proposal. (Clean Air Task Force, 0264)

ICCT stated that marine shipping is one of the major sources of NO_X, SO_X, and PM. Nitrogen oxides (NO_X), including nitrogen monoxide (NO) and nitrogen dioxide (NO_2) emissions are major contributors to acid rain, leading to the over-fertilization of lakes as well as the formation of smog. The working temperature and pressure of the engines have a very significant influence on the emission of NO_X. Sulfur oxides (SO_X), including sulfur dioxides (SO_2) and sulfur trioxide (SO_3), lead to acid rain and have detrimental effects on vegetation and human health. SO_X emissions are proportional to the sulfur content of the fuel and the total fuel consumption. Particulate matter is a generic term for a broad class of chemically and physically diverse substances. Of the precursor gases emitted by ships, SO_X and NO_X can directly lead to the formation of secondary PM. (The International Council on Clean Transportation, 0227)

Friends of the Earth (0320)
Ohio Environmental Council et. al. (0314)
American Lung Association and Environmental Defense Fund (0366)
Clean Air Task Force and many sign-ons (0264)
The International Council on Clean Transportation (0227)

Our Response:

We agree that emissions from C3 engines contribute to environmental effects. In the preamble EPA states "Emissions of NO_X and SO_X from ships contribute to atmospheric deposition of nitrogen and sulfur in the U.S. Atmospheric deposition of nitrogen and sulfur contributes to acidification, altering biogeochemistry and affecting animal and plant life in terrestrial and aquatic ecosystems across the U.S." The emissions reductions being finalized in this rule will help to reduce environmental effects associated with the emissions from C3 diesel engines. Air Quality modeling done for the coordinated strategy shows that adopting the coordinated strategy will result in sulfur deposition reductions ranging from 5% to 20% in 2020 along the entire Atlantic and Gulf coasts with higher levels of reduction, exceeding 25%, occurring in the near-land coastal waters of the U.S. Nitrogen deposition reductions will range from 3% to 7% along the entire Atlantic, Pacific and Gulf Coasts.

We also agree that C3 engines impact visibility. Air Quality modeling done for the coordinated strategy shows that improvements in visibility due to OGV emissions reductions will occur in all 133 mandatory class I federal areas in the future with the average visibility on the 20 percent worst days at these scenic locales is projected to improve by 0.22 deciviews, or 1.4 percent in 2020 and by 0.43 deciviews or 2.7% in 2030.

8.4 Benefits Analysis

8.4.1 Citation of Existing Health Impacts Literature and Data

What Commenters Said:

Alyssa Trujillo, testifying at the Long Beach hearing, stated that in a past letter to EPA, she implored the Agency to intervene in this matter because people were so sick and dying. She wondered how many people in the last 20 years might have died because of the environmental pollution that we experienced, either as a direct cause or as a secondary cause. She suggested that to find out, the Agency could utilize existing data such as regional claims for Social Security disability and SSI, while stating that she didn't think the correlation between the pollution that we are experiencing and health problems has really been made strong enough. She felt that the existing studies have not been done the way they should have, and that the Agency does not realize there is information out there that can be accessed.

Our Response:

While the Agency does not have an estimate of total premature deaths due to air pollution over the last 20 years, EPA agrees that ship emissions contribute to large numbers of adverse health impacts within the U.S. and internationally. For example, we estimated that in 2020, ships emitting at their current performance would be responsible for approximately 4,300 – 9,800 cases of premature mortality in adults in the U.S. (range based on the health impact function used – Pope et al., 2002 and Laden et al., 2006, respectively).[28]

We also estimated that ships are responsible for a large number of PM2.5-related morbidity impacts. For example, we estimate that in the U.S. in 2020, ships emitting at their current performance would be responsible for approximately 4,300 cases of chronic bronchitis, 8,900 non-fatal heart attacks, 5,600 hospital admissions and emergency room visits, 580,000 days of work lost, and 3,400,000 days of restricted physical activity.

Similarly, ship emissions contribute to adverse health impacts associated with ozone exposure. For example, we estimate that in the U.S. in 2020, ships emitting at their current performance would be responsible for approximately 370 – 1,700 cases of premature mortality, depending on the health impact function, 6,600 hospital admissions and emergency room visits, 810,000 days of school absence, and 2,300,000 day of restricted physical activity.

There are several types of data that can support the determination of types and magnitude of health effects associated with air pollution exposures. These sources of data include toxicological studies (including animal and cellular studies), human clinical trials, and observational epidemiology studies. All of these data sources provide important contributions to the weight of evidence surrounding a particular health impact, however, only epidemiology

[28] Refer to EPA's application for an Emission Control Area designation to the International Maritime Organization: http://www.epa.gov/otaq/regs/nonroad/marine/ci/mepc-59-eca-proposal.pdf Accessed Thursday, November 19, 2009.

studies provide direct concentration-response relationships that can be used to evaluate population-level impacts of reductions in ambient pollution levels.

For the data-derived estimates, EPA relies on the published scientific literature to ascertain the relationship between PM and ozone and adverse human health effects. We evaluate epidemiological studies using selection criteria that includes consideration of whether the study was peer-reviewed, the match between the pollutant studied and the pollutant of interest, the study design and location, and characteristics of the study population, among other considerations. The selection of concentration-response functions for the benefits analysis is guided by the goal of achieving a balance between comprehensiveness and scientific defensibility.

8.4.2 Related Estimates of Health Impacts

What Commenters Said:

In separate comments, the Clean Air Task Force, the International Council on Clean Transportation, a group of four Ohio-based organizations, and a joint submission by the Friends of the Earth, Earthjustice, and the Center for Biological Diversity, all referenced a study published in the December 15, 2007 issue of the American Chemical Society journal Environmental Science & Technology (hereinafter the "Corbett and Winebrake Study"). The study examined the link between international shipping emissions and human health impacts, including premature mortality, and demonstrated that these emissions have significant global impacts on human health.

As reported by the commenters, the Corbett and Winebrake Study estimated that the global cardiopulmonary and lung cancer mortality in 2002 from PM air pollution emitted by oceangoing ships would grow by 40% by 2012 along with a continued large increase in global trade and shipping traffic. Adverse morbidity and environmental impacts were also estimated to grow, though they were not quantified.

The Clean Air Task Force also stated that despite the considerable regional variability in the constituents of particulate matter, the epidemiological evidence that ambient exposures to particulate matter are associated with numerous adverse health effects is remarkably clear and consistent. The commenter noted that the consistency of the data makes it feasible to quantify the benefits for a suite of health indicators, including: premature mortality, bronchitis, hospital admissions for both respiratory and cardiovascular events, emergency room visits for asthma, nonfatal heart attacks, lower and upper respiratory illness, minor restricted-activity days, work loss days, asthma exacerbations, respiratory symptoms (asthmatic population), and infant mortality. The commenter also cited a study conducted by Abt Associates on behalf of the Clean Air Task Force that associated excess diesel exhaust particle exposure in the U.S. with an estimated 21,000 annual premature deaths, 27,000 heart attacks and 2.4 million work loss days, 12,000 cases of chronic bronchitis, 15,000 emergency room visits for asthma and 600,000 cases of respiratory symptoms.

A group of four Ohio-based organizations submitted a sign-on letter that also commented on the Abt study, noting that the health impact from diesel pollution in four PM nonattainment counties located within Ohio is measurable. For example, the study estimated 183 annual early deaths, 231 heart attacks and 17,450 work loss days in this four county region.

The South Coast Air Quality Management District commented that they had made significant progress in controlling emissions from sources within its regulatory authority, but that their region still has the worst air quality in the country with serious health impacts. They cited a number of statistics: 6,200 people die prematurely every year in this region due to fine particulate pollution; average cancer risks due to air pollution exceed 1,200 in a million with higher risks transportation near facilities like ports; and 52% of population-weighted exposure of all Americans to fine particulates is in the South Coast District.

Commenters from the Friends of the Earth, Earthjustice, and the Center for Biological Diversity noted that the public health impacts to citizens in California cities and towns from Category 3 marine vessel pollution are acute. The commenters cited a CARB report which indicated that mortality attributed to ocean going vessels will more than double from 210 (in 2005) to 540 by 2020, while most other inventory sources' contributions to mortality will decrease or increase only slightly.

Martin Schlageter, from the Coalition for Clear Air, testified at the Long Beach hearing that some 3,700 people die prematurely every year in California due to port and freight transportation pollution. He stated that they had established standards and set some targets. He also stated that should federal and international standards be set, the leadership of businesses and ports and regulatory agencies and the State of California will not be at a disadvantage; rather you will have the opportunity to level that playing field for business that is operating here in California and attempting to address the air pollution crisis.

The American Lung Association commented that air pollution is a threat to families, children, teenagers, elders and people who have chronic lung disease, heart disease and diabetes. The commenter also noted that air pollution sends people with lung disease to the hospital, shapes how children's lungs develop, causes heart attacks and can even kill. The commenter cited EPA's analysis estimates that the coordinated strategy will prevent between 13,000 and 33,000 premature deaths each year by 2030. The International Council on Clean Technology also referenced EPA's benefits analysis, citing the quantified and monetized health impacts and noting that the benefits of the coordinated strategy far outweigh the costs.

Our Response:

We agree with commenters that there are significant health concerns associated with PM- and ozone-related emissions. Scientific studies show ambient PM and ozone is associated with a series of adverse health effects. PM health effects are discussed in detail in the 2004 EPA Particulate Matter Air Quality Criteria Document (PM AQCD), and the 2005 PM Staff Paper.[29,30] Further discussion of health effects associated with PM can also be found in the RIA for this

[29] U.S. EPA (2004) Air Quality Criteria for Particulate Matter (Oct 2004), Volume I Document No. EPA600/P-99/002aF and Volume II Document No. EPA600/P-99/002bF. This document is available in Docket EPA-HQ-OAR-2003-0190.

[30] U.S. EPA (2005) Review of the National Ambient Air Quality Standard for Particulate Matter: Policy Assessment of Scientific and Technical Information, OAQPS Staff Paper. EPA-452/R-05-005. This document is available in Docket EPA-HQ-OAR-2003-0190.

rule. The health and welfare effects of ozone are well documented and are assessed in EPA's 2006 Air Quality Criteria Document (ozone AQCD) and 2007 Staff Paper.[31]

In the proposed RIA, we estimated that the coordinated strategy will result in between 5,300 and 14,000 cases of avoided $PM_{2.5}$-related premature deaths annually in 2020 and between 13,000 and 33,000 avoided premature deaths annually in 2030. For ozone-related premature mortality, we estimated a range of 61 to 280 fewer premature mortalities as a result of the coordinated strategy in 2020 and a range of 210 to 920 fewer premature mortalities in 2030. The increase in annual benefits from 2020 to 2030 reflects additional emission reductions from coordinated strategy, as well as increases in total population and the average age (and thus baseline mortality risk) of the population. The RIA presents a number of additional morbidity-related health impacts avoided as a result of the coordinated strategy and talks about those health and environmental impacts that we were unable to quantify, but will be reduced as a result of the coordinated strategy.

8.4.3 PM-related Premature Mortality

What Commenters Said:

The Chamber of Shipping of America noted that in its proposal, EPA estimated premature mortalities associated with a coordinated strategy to control shipping emissions of 5,300 in 2020 rising to13,000 in 2030. The commenter also stated that CSA members do not have expertise in toxicology, but that they knew from an examination of the record on the PM NAAQS and referenced material from CASAC that there is considerable discussion and disagreement over the methodologies for the estimation of premature mortality. The commenter noted specifically:

- The validity of the single concentration response function for PM based on the ACS and Six-Cities studies when there are other seemingly more appropriate studies available (e.g. Enstrom and Beelen),
- The apparent variability in health impact from the various forms of PM – e.g. scientific literature indicating soluble forms of PM such as nitrate, sulfate and ammonium PM exhibit lower toxicity potential than carbonaceous PM,
- The lack of inclusion of the effects of other confounders, e.g. smoking, and
- The use of a linear no threshold approach for sulfate PM when there are indications that a threshold may exist near the current NAAQS limit, which would

[31] U.S. EPA. (2006). Air Quality Criteria for Ozone and Related Photochemical Oxidants (Final). EPA/600/R-05/004aF-cF. Washington, DC: U.S. EPA. Retrieved on March 19, 2009 from Docket EPA-HQ-OAR-2003-0190 at http://www.regulations.gov/., U.S. EPA. (2007). Review of the National Ambient Air Quality Standards for Ozone: Policy Assessment of Scientific and Technical Information, OAQPS Staff Paper. EPA-452/R-07-003. Washington, DC, U.S. EPA. Retrieved on March 19, 2009 from Docket EPA-HQ-OAR-2003-0190 at http://www.regulations.gov/.

imply overestimation of premature mortality in areas with total concentrations below the NAAQS, i.e. in PM attainment zones – most of the U.S. coast line.

The commenter concluded by stating that as a small industry without experience in toxicology, the marine community relies on EPA to follow well-balanced scientific evidence. They noted that commentary from the broader U.S. industry on the PM NAAQS tends to indicate an overstatement of the health impacts from shipping emissions and that the EPA's Integrated Science Assessment for PM confirms that this is a complicated topic that should not be treated with the certainty implied in this rulemaking.

Our Response:

EPA relies on the published scientific literature to ascertain the relationship between PM and adverse human health effects. We evaluate the epidemiological studies using a well-established set of selection criteria. These criteria include consideration of whether the study was peer-reviewed, the match between the pollutant studies and the pollutant of interest, the study design and location, and characteristics of the study population, among other considerations. The selection of concentration-response functions for all of EPA's benefits analyses is guided by the goal of achieving comprehensiveness and scientific defensibility.

In addition to the above selection criteria, EPA relies on the guidance provided by internal and external review panels, comprised of distinguished scientists, engineers, and economists who are recognized, non-governmental experts in their respective fields. EPA consults with the Science Advisory Board's Health Effects Subcommittee (SAB-HES) and Clean Air Science Advisory Committee (CASAC) in the development and improvement of methods we use to estimate and value the potential reductions in health effects associated with air quality improvements. All of EPA's regulatory analyses also are reviewed extensively by the Office of Management and Budget (OMB). EPA also looks to recommendations provided by panels such as those convened by the National Academy of Sciences (NAS) to specifically address facets of our cost and benefits analyses.

EPA currently draws its effect coefficients from epidemiology studies examining two large population cohorts: the American Cancer Society cohort (Pope et al., 2002) and the Harvard Six Cities cohort (Laden et al., 2006). These are logical choices for anchor points in our analysis because, while both studies are well designed and peer reviewed, there are strengths and weaknesses inherent in each, which we believe argues for using both studies to generate benefits estimates. Previously, EPA had calculated benefits based on these two empirical studies, but derived the range of benefits, including the minimum and maximum results, from an expert elicitation of the relationship between exposure to $PM_{2.5}$ and premature mortality (Roman et al., 2008).[32] In the RIA that accompanied the proposal, we included the benefits estimates derived from the concentration-response function provided by each of the twelve experts to better characterize the uncertainty in the concentration-response function for mortality and the degree of variability in the expert responses. Because the experts used the two cohort studies mentioned above to inform their concentration-response functions, benefits estimates using these functions

[32] Please see the Section 5.2 of the Portland Cement RIA in Appendix 5A for more information regarding the change in the presentation of benefits estimates.

generally fall between results using these epidemiology studies. In general, the expert elicitation results support the conclusion that the benefits of $PM_{2.5}$ control are very likely to be substantial.

EPA strives to use the best available science to support our benefits analyses, and we recognize that interpretation of the science regarding air pollution and health is dynamic and evolving. Based on our review of the body of scientific literature, EPA applied the no-threshold model in its analysis of the coordinated strategy. EPA's draft Integrated Science Assessment,[33,34] which was recently reviewed by EPA's Clean Air Scientific Advisory Committee,[35,36] concluded that the scientific literature consistently finds that a no-threshold log-linear model most adequately portrays the PM-mortality concentration-response relationship while recognizing potential uncertainty about the exact shape of the concentration-response function.[37] Although this document does not represent final agency policy that has undergone the full agency scientific review process, it provides a basis for reconsidering the application of thresholds in $PM_{2.5}$ concentration-response functions used in EPA's RIAs.[38] It is important to note that while CASAC provides advice regarding the science associated with setting the National Ambient Air Quality Standards, typically other scientific advisory bodies provide specific advice regarding benefits analysis.[39] This approach reflects EPA's most current interpretation of the scientific

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[33] U.S. Environmental Protection Agency (U.S. EPA). Integrated Science Assessment for Particulate Matter (External Review Draft). National Center for Environmental Assessment, Research Triangle Park, NC. EPA/600/R-08/139. December. Available on the Internet at <http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=201805>.

[34] U.S. Environmental Protection Agency (U.S. EPA). Integrated Science Assessment for Particulate Matter (Second External Review Draft). National Center for Environmental Assessment, Research Triangle Park, NC. EPA/600/R-08/139B. July. Available on the Internet at <http://cfint.rtpnc.epa.gov/ncea/prod/recordisplay.cfm?deid=210586>.

[35] U.S. Environmental Protection Agency - Science Advisory Board (U.S. EPA-SAB). Review of EPA's Integrated Science Assessment for Particulate Matter (First External Review Draft, December 2008). EPA-COUNCIL-09-008. May. Available on the Internet at <http://yosemite.epa.gov/sab/SABPRODUCT.NSF/81e39f4c09954fcb85256ead006be86e/73ACCA834AB44A10852575BD0064346B/$File/EPA-CASAC-09-008-unsigned.pdf>.

[36] U.S. Environmental Protection Agency - Science Advisory Board (U.S. EPA-SAB). Consultation on EPA's Particulate Matter National Ambient Air Quality Standards: Scope and Methods Plan for Health Risk and Exposure Assessment. EPA-COUNCIL-09-009. May. Available on the Internet at <http://yosemite.epa.gov/sab/SABPRODUCT.NSF/81e39f4c09954fcb85256ead006be86e/723FE644C5D758DF852575BD00763A32/$File/EPA-CASAC-09-009-unsigned.pdf>.

[37] It is important to note that uncertainty regarding the shape of the concentration-response function is conceptually distinct from an assumed threshold. An assumed threshold (below which there are no health effects) is a discontinuity, which is a specific example of non-linearity.

[38] The final PM ISA, which will have undergone the full agency scientific review process, is scheduled to be completed in late December 2009.

[39] In the proposed Portland Cement RIA, EPA solicited comment on the use of the no-threshold model for benefits analysis within the preamble of that proposed rule. The comment period for the Portland Cement proposed NESHAP closed on September 4, 2009 (Docket ID No. EPA–HQ–OAR–2002–0051 available at http://www.regulations.gov). EPA is currently reviewing those comments. U.S. Environmental Protection Agency. (2009). Regulatory Impact Analysis: National Emission Standards for Hazardous Air Pollutants from the Portland Cement Manufacturing Industry. Office of Air and Radiation. Retrieved on May 4, 2009, from http://www.epa.gov/ttn/ecas/regdata/RIAs/portlandcementria_4-20-09.pdf

literature on $PM_{2.5}$ and mortality. Please refer to the proposed Portland Cement MACT RIA for a description of the history of the treatment of thresholds in our analyses.[40]

In regard to the comment that these studies lack the inclusion of effects of other confounders such as smoking, we respond that there is abundant evidence of significant associations between various measures of long-term exposure to PM and elevated rates of annual mortality. Most of the published studies have found positive (but not always statistically significant) associations with available PM indices such as total suspended particles (TSP). However, exploration of alternative model specifications sometimes raised questions about causal relationships. These early "ecological cross-sectional" studies were criticized for a number of methodological limitations, particularly for inadequate control at the individual level for variables that are potentially important in causing mortality, such as wealth, smoking, and diet. Over the last 15 years, several studies using "prospective cohort" designs have been published that appear to be consistent with the earlier body of literature. These new "prospective cohort" studies reflect a significant improvement over the earlier work because they include individual-level information with respect to health status and residence. The most extensive analyses have been based on data from two prospective cohort groups, often referred to as the Harvard "Six-Cities Study" (Dockery et al., 1993; Laden et al, 2006) and the "American Cancer Society or ACS study" (Pope et al., 1995; Pope et al, 2002; Pope et al, 2004); these studies have found consistent relationships between fine particle indicators and premature mortality across multiple locations in the United States. Please refer to the second draft PM ISA for a complete discussion of the available PM-related mortality literature.

The Agency also responds that current evidence is not sufficient to estimate benefits by PM component. The 2009 second draft PM ISA states: "[M]any constituents of PM can be linked with differing health effects and the evidence is not yet sufficient to allow differentiation of those constituents or sources that are more closely related to specific health outcomes."

The National Research Council (NRC)[41] highlighted the need for EPA to conduct rigorous quantitative analysis of uncertainty in its benefits estimates and to present these estimates to decision makers in ways that foster an appropriate appreciation of their inherent uncertainty. In response to these comments, EPA's Office of Air and Radiation (OAR) is developing a comprehensive strategy for characterizing the aggregate impact of uncertainty in key modeling elements on both health incidence and benefits estimates. Components of that process include emissions modeling, air quality modeling, health effects incidence estimation, and valuation.

In benefit analyses of air pollution regulations conducted to date, the estimated impact of reductions in premature mortality has accounted for 85% to 95% of total benefits. Therefore, it is particularly important to characterize the uncertainties associated with reductions in premature mortality. The health impact functions used to estimate avoided premature deaths associated

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[40] U.S. Environmental Protection Agency. (2009). *Regulatory Impact Analysis: National Emission Standards for Hazardous Air Pollutants from the Portland Cement Manufacturing Industry*. Office of Air and Radiation. Retrieved on May 4, 2009, from http://www.epa.gov/ttn/ecas/regdata/RIAs/portlandcementria_4-20-09.pdf

[41] National Research Council (NRC). (2002). *Estimating the Public Health Benefits of Proposed Air Pollution Regulations.* The National Academies Press: Washington, D.C.

with reductions in ozone have associated standard errors that represent the statistical errors around the effect estimates in the underlying epidemiological studies.[42] In our results, we report credible intervals based on these standard errors, reflecting the uncertainty in the estimated change in incidence of avoided premature deaths. We also provide multiple estimates, to reflect model uncertainty between alternative study designs.

For premature mortality associated with exposure to PM, we follow the same approach that has been used in several recent RIAs.[43,44,45] First, we use Monte Carlo methods for estimating random sampling error associated with the concentration response functions from epidemiological studies and economic valuation functions. Monte Carlo simulation uses random sampling from distributions of parameters to characterize the effects of uncertainty on output variables, such as incidence of premature mortality. Specifically, we used Monte Carlo methods to generate confidence intervals around the estimated health impact and dollar benefits. Distributions for individual effect estimates are based on the reported standard errors in the epidemiological studies.

Second, as a sensitivity analysis, we use the results of our expert elicitation of the concentration response function describing the relationship between premature mortality and ambient $PM_{2.5}$ concentration.[46, 47] Incorporating only the uncertainty from random sampling error omits important sources of uncertainty (e.g., in the functional form of the model; whether or not a threshold may exist). This second approach attempts to incorporate these other sources of uncertainty.

8.4.4 Value of a Statistical Life

What Commenters Said:

The Chamber of Shipping of America noted that the estimated benefits of the coordinated strategy rise from $45 billion in 2020 to $110 billion in 2030. They noted that the bulk of these benefits are related to the reduction in premature mortalities each year and that, assuming the

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[42] Health impact functions measure the change in a health endpoint of interest, such as hospital admissions, for a given change in ambient ozone or PM concentration.

[43] U.S. Environmental Protection Agency, (2004a). *Final Regulatory Analysis: Control of Emissions from Nonroad Diesel Engines.* EPA420-R-04-007. Prepared by Office of Air and Radiation. Retrieved on April 10, 2009, from http://www.epa.gov/nonroad-diesel/2004fr/420r04007.pdf

[44] U.S. Environmental Protection Agency, (2005). *Regulatory Impact Analysis for the Clean Air Interstate Rule.* EPA 452/-03-001. Prepared by Office of Air and Radiation. Retrieved on April 10, 2009, from http://www.epa.gov/interstateairquality/tsd0175.pdf

[45] U.S. Environmental Protection Agency, (2006). *Regulatory Impact Analysis for the PM NAAQS.* EPA Prepared by Office of Air and Radiation. Retrieved on April 10, 2009, from http://www.epa.gov/ttn/ecas/regdata/RIAs/Chapter%205--Benefits.pdf

[46] Expert elicitation is a formal, highly structured and well documented process whereby expert judgments, usually of multiple experts, are obtained (Ayyb, 2002).

[47] Industrial Economics, Inc. (2006). *Expanded Expert Judgment Assessment of the Concentration-Response Relationship Between PM2.5 Exposure and Mortality.* Prepared for EPA Office of Air Quality Planning and Standards, September. Retrieved on April 10, 2009, from http://www.epa.gov/ttn/ecas/regdata/Uncertainty/pm_ee_report.pdf

calculation of premature mortality was correct, the value associated with each premature mortality appears to the commenter to be high perhaps by as much as two orders of magnitude. In 2030, the EPA uses a value of statistical life (VSL) of $7.9 million. The commenter stated that while they are not experts in this field, this VSL, when applied to a number that is essentially the shortening of life by a matter of months at the end of life, appears to be excessive. The commenter contrasted the U.S. value with the EU's valuation of life year (VOLY) values that are on the order of €50,000. According to the commenter, applying a value of $100,000 to each mortality would lower benefits to $1.3 billion and total benefits to about $11.3 billion. This approach would substantially change the benefit/cost ratio and, according to the commenter, points out the need to be more accurate on the estimate of health impacts, both for mortality and morbidity.

Our Response:

EPA agrees that there is a large amount of uncertainty in the VSL for application to environmental policy analysis. However, as noted in the RIA, the SAB Environmental Economics Advisory Committee has advised that the EPA "continue to use a wage-risk-based VSL as its primary estimate, including appropriate sensitivity analyses to reflect the uncertainty of these estimates," and that "the only risk characteristic for which adjustments to the VSL can be made is the timing of the risk"(EPA-SAB-EEAC-00-013).[48] The Agency therefore applies the VSL that was vetted and endorsed by the Science Advisory Board in the Guidelines for Preparing Economic Analyses (U.S. EPA, 2000) while the Agency continues its efforts to update its guidance on this issue.[49] This approach calculates a mean value across VSL estimates derived from 26 labor market and contingent valuation studies published between 1974 and 1991. The mean VSL across these studies is $6.3 million (2000$). In developing our estimate of the benefits of premature mortality reductions, we also discount the VSL over a lag period between exposure and premature mortality, but we do not adjust the VSL to reflect any differences across age groups, consistent with SAB advice.

The Agency is committed to using scientifically sound, appropriately reviewed evidence in valuing mortality risk reductions and has made significant progress in responding to the SAB-EEAC's specific recommendations. The Agency anticipates presenting results from this effort to the SAB-EEAC in Spring 2010 and that draft guidance will be available shortly thereafter.

[48] U.S. Environmental Protection Agency (EPA). July 2000a. "An SAB Report on EPA's White Paper Valuing the Benefits of Fatal Cancer Risk Reduction." EPA-SAB-EEAC-00-013.

[49] In the (draft) update of the Economic Guidelines, EPA retained the VSL endorsed by the SAB with the understanding that further updates to the mortality risk valuation guidance would be forthcoming in the near future. Therefore, this report does not represent final agency policy. The 2000 guidelines can be downloaded here: http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html, and the draft updated version (2008) of the guidelines can be downloaded here: http://yosemite.epa.gov/ee/epa/eerm.nsf/vwRepNumLookup/EE-0516?OpenDocument

CHAPTER 9: Alternative Program Options

What We Proposed:

The comments in this section generally correspond to Section IX of the preamble to the proposed rule, where we describe the programmatic alternatives that were considered. The Regulatory Impact Analysis describes alternatives in Chapter 9.

See Chapter 3 of this document for a discussion of issues related to the technical feasibility and lead time of emissions controls.

9.1 Land-Side Controls

What Commenters Said:

Maersk agreed with EPA's decision not to act on mandatory cold ironing requirements at this time, as international standards for power delivery are not yet established, and funding for infrastructure and power availability may be problematic in many U.S. ports. Maersk believes that investments in solutions that travel with the vessels are the most effective in achieving wide-spread environmental benefits, because these can usually be implemented more quickly and provide greater flexibility for operations and route redeployments. (Maersk, 0261)

Earthjustice et al commented that the use of shore power or "cold ironing" can result in tremendous public health benefits, and encouraged EPA to consider voluntary and incentive-based measures to encourage use of shore power if EPA doesn't mandate its use. Examples given include working with state and local agencies and port authorities to develop programs to reduce electricity rates for participants, establishing federal grants for ship-side shore power installation, and instituting differentiated dockage fees and privileged docking. (FOE, 0320)

Our Response:

Some port authorities already require cold-ironing for frequent-calling vessels and are pursuing additional reductions from shoreside port equipment. EPA is working with East Coast ports to develop plans for shoreside power as part of port development plans. As discussed in the proposal and RIA, EPA believes the infrastructure to support shore power needs more time to develop before shore power could be adopted on a national basis. Thus, we are not adopting any provisions in this rule with respect to cold ironing or other land-side power emission reduction programs.

9.2 Program for Existing Engines

9.2.1 Voluntary Program

What Commenters Said:

(A) We support development of a Voluntary Program for In-Use Engines

In response to EPA's request for comment on the possibility of a Voluntary Marine Verification Program for in-use engines, many commenters supported this idea and encouraged

EPA to consider incentives and voluntary programs to reduce emissions from in-use Category 3 engines.

Commenters Supporting a Voluntary Verification Program:

Texas Legislative Air Quality Caucus. (0367)
MECA (0319)
NESCAUM (0356)
Canadian Shipowners' Association (0245)
American Lung Association (0227)
CATF (0335)

MECA commented that PM and NO_X emission control technology options have already been developed and demonstrated on existing large marine vessels, suggesting that a large-scale retrofit program could be technically feasible. "The program could provide incentives for demonstrations of advanced technologies that provide emission reductions in advance of the effective dates of the proposed Tier 2 and Tier 3 standards or that provide emission reductions beyond the proposed standards." (0319)

Maersk expressed interest in initiatives such as the Voluntary Marine Verification Programs described in this section, and requested additional information on how these programs might work. "We would also like to offer to assist in developing ideas for effective incentive programs which will further accelerate emissions reductions. In terms of existing vessels, the U.S. ECA proposal is on track and other IMO requirements are already in place to achieve reductions from these vessels. Since the U.S. is now a signatory to MARPOL, U.S. regulations should align fully with MARPOL requirements." (0261)

(B) We Encourage EPA to Develop other Incentive Programs

SCAQMD urges EPA to fund demonstration of early implementation of needed technologies, and develop incentive or other programs for early development and deployment of retrofit kits and for routing of the cleanest vessels to areas with the worst air pollution. (0309)

The Ozone Transport Commission members encourage the EPA to evaluate additional methods including faster turnover of the existing fleet so that air quality benefits may accrue in a more expeditious manner. (0227)

Earthjustice et al suggested that EPA carefully structure any incentive programs or grants to encourage broader participation in voluntary programs, and provided examples of European programs.(0320)

SBAPCD offered to work with EPA and other stakeholders to evaluate potential incentive based approaches to cleaning up the existing fleet. SBAPCD noted that EPA should evaluate California's successful Carl Moyer program for reducing mobile source emissions while creating partnerships with operators, in terms of its applicability to ships. SBAPCD also suggested the approach of differential port fees as an incentive for ships to use cleaner engines and conduct retrofits. (0231)

(C) Voluntary Measures should supplement, not obviate regulation

Earthjustice et al commented that "the voluntary measures that EPA outlines in its proposed rule, while in some respects commendable, are not sufficient to achieve the levels of air emission reductions needed to protect public health and the environment. Insufficient attention is paid to the potential degree of industry participation and actual reductions that may or may not be realized under such programs. EPA's proposal lacks a detailed description of specific voluntary programs; fails to establish safeguards, incentives, monitoring, and goals; and summarily rejects some promising voluntary measures. In light of this, voluntary measures should be enhanced, but they should be considered supplemental to, and not in lieu of, regulatory mandates to attain air pollution objectives from existing U.S.-flagged vessels." (0320)

Our Response:

While we are not adopting any provisions in this rule to establish voluntary programs or other incentives to reduce emissions from existing vessels, we will continue to work with interested stakeholders to further these goals.

9.2.2 Regulatory Program

(A) Mandatory Retrofits are Needed

Several commenters encouraged EPA to regulate existing Category 3 engines, particularly in the form of a mandatory retrofit program, similar to the current program for Category 1 and 2 marine engines.

We encourage EPA to extend this rule to in-use as well as to new engines. (NRDC 0232)

SBAPCD offered to work with EPA and other stakeholders to evaluate potential regulatory approaches to cleaning up the existing fleet (0231).

The Ozone Transport Commission commented that EPA should examine the availability of NO_X reducing technologies such as engine timing, engine cooling and advanced computer controls and similar technologies as retrofits to the existing fleet (0227).

As EPA itself acknowledges, ocean-going vessels have a very long life. While the standards EPA has proposed for new engines will ultimately lead to a much cleaner fleet of ocean-going vessels, it will be decades before the full suite of emission reductions are achieved. Moreover, securing emissions reductions from existing engines is often a very cost-effective means of lowering pollution on a much faster time frame. Our comments on NO_X standards for existing C3 ships apply to *all* existing C3 ships in U.S. waters regardless of nationality. (ALA/EDF, 0366)

SCAQMD stated that the MARPOL retrofit program is inadequate and compliance deadlines for new engines are too late to meet local air quality planning needs. Also, EPA should treat major maintenance as making the engine new. Further, other technical approaches such as water injection and humid air motor used in combination may provide sufficient benefits to achieve the Tier 3 standard and may be easier to retrofit than SCR. (0309).

Earthjustice et al also commented that, “while some may contend that existing vessels are subject to MARPOL Annex VI standards pursuant to the Act to Prevent Pollution from Ships, only ships built from 1990 to 1999 *with* an available certified remanufacture system fall under that Act’s standards. Furthermore, ships older than 1990 are omitted from any regulation.” (FOE 0320)

We also strongly request EPA to set NO_X limits for existing engines that mirror the MARPOL Annex VI amendments. In this NPRM, EPA is proposing not to establish NO_X standards for existing engines, but instead to rely on the Act to Prevent Pollution from Ships and Annex VI. We believe EPA should also ensure the implementation of these standards under the Clean Air Act. (ALA/EDF, 0366)

Earthjustice et al commented that EPA’s decision to not acknowledge a remanufacturing process for Category 3 ship engines or “like new” engines effectively rejects regulation of existing vessels. Since EPA has found that the engines used in such ships tend to be integral to the vessel, and because they are very difficult to remove, owners and operators of commercial vessels regularly rebuild existing engines to extend their service lives rather than install a completely new engine. Thus, a remanufactured engine criteria or threshold should be established for Category 3 engines. (FOE, 0320) “Technologies and approaches, such as humid air motors, emulsified fuel, selective catalytic reduction retrofits, and vessel design improvements, could be applied now to existing vessels which would, in combination, produce NO_X reductions of 85 to 90 percent or more.”(FOE, 0320)

In-use requirements to be applied at the time of major engine servicing are necessary to address the NO_X emissions from the legacy fleet of vessels which will continue to call at our ports for many years to come. Based upon our forecasting, controlling NO_X emissions from vessels in the future will be one of our most significant challenges. The new [built] standards will help, however in-use requirements will also be necessary. [Port of Long Beach, 0232, 0365] Port of Los Angeles echoed the port of Long Beach's comments regarding extension of this rule to address in-use vessel operations. (0232)

The Clean Air Task Force and the Ohio Environmental Council et al both requested that EPA require marine vessels to meet emission standards when engines are rebuilt. They believe EPA’s proposal can be strengthened by promulgating measures to reduce non-sulfur related (ie NO_X) emissions from existing C3 ships. They both also commented that EPA should explore additional approaches to reduce emissions of NO_X and PM from the existing fleet of ships travelling in U.S. waters. (0264, 0314)

SCAQMD suggested that EPA make use of a policy to define engines undergoing major maintenance as "new," similar to U.S. EPA policy for locomotives. (0309)

Substantial reduction of NO_X emissions from existing ships is critical. In addition, a failure to reduce existing emissions from ships will provide unregulated ships with a competitive advantage over cleaner ships. (CATF 0264)

The Ohio Environmental Council et al., and CATF both urge EPA to use all means at its disposal to reduce NO_X emissions from existing ships, including engine rebuild standards, low sulfur *distillate* fuel requirements, operational restrictions and economic incentives. “We specifically support EPA’s proposed Voluntary Marine Verification Program, which we believe

will complement EPA's NCDC. EPA should establish emission standards for NO_X, CO, HC and PM from remanufactured marine engines. EPA includes substantially modified vessels within its definition of "new vessel." We urge EPA to do the same with respect to its definition of "new marine engine." EPA states in the C3 Marine Engine NPR that it is not practical to adopt a remanufacturing program for C3 engines because such engines are not "remanufactured" all at one time, but rather engine components may be replaced as needed at different times. We do not believe that this is a bar to a requirement that a ship's engine meet tightened emission levels when a certain aggregate portion of its major components have been replaced (e.g., 50%), even if those replacements do not all occur at the same time; we urge EPA to adopt such a requirement." (0264, 0314)

The Ohio Environmental Council et al., and CATF both urge EPA to adopt requirements that simply require available control technology to be used on existing engines. "Specifically, we urge EPA to require all C3 engines built prior to 2000 to comply with EPA's Tier 1 NO_X limits, and for engines built after 2000 to comply with EPA's Tier 2 standards, provided that there is an approved remanufacture kit available for that engine meeting the applicable standard." (0264, 0314)

(B) Retrofits Might Not Be Beneficial

The Chamber of Shipping of America supported EPA's decision to not pursue standards for existing engines at this time. They agreed with EPA's determination that remanufacturing programs for Category 3 engines are inappropriate. "Cat 3 engines are not in a practical sense subject to rebuilding as are smaller diesel engines used in locomotive and other heavy duty engines. Further, these Cat 3 engines have long life spans due to the rigid daily maintenance programs which limit major work to relining of cylinders and valve replacements. Further, the cylinder liner replacements should not be considered a "remanufacture" as is the case with smaller diesel engines." They also expressed concerns about costs and safety. (0256)

The Pacific Merchant Shipping Association and the World Shipping Council commented that development of a remanufacturing requirement for Category 3 marine diesel engines is unlikely to produce significant emission benefits in light of the longevity of these slow-speed, 2-stroke engines. (0275, 0325)

(C) U.S. Regulations for Existing Vessels Should Align with MARPOL

Maersk commented that the U.S. ECA proposal is on track and other IMO requirements are already in place to achieve reductions from existing vessels. Since the U.S. is now a signatory to MARPOL, Maersk commented that U.S. regulations should align fully with MARPOL requirements (0261).

(D) EPA Should Require PM Reporting from Existing Vessels

Earthjustice et al commented that EPA possesses the authority to require PM reporting on existing U.S. ships with remanufactured engines that are functionally equivalent to freshly manufactured engines. EPA's goals in establishing the PM reporting requirement are furthered by the inclusion of existing vessels, especially because existing ships represent the largest ship demographic (FOE, 0320)

(E) Comments on EPA's Authority to Regulate In-use Vessels

NRDC commented that EPA has the legal authority to regulate in-use vessels, and pointed to the passage of the enabling legislation for MARPOL Annex VI as evidence of such authority. (0232)

SCAQMD noted that the level of maintenance triggering "new" designation is not specified in the Clean Air Act and EPA thus has discretion to broadly define this. They also expressed concern that further delays could occur if IMO action is denied or delayed, while EPA determines whether it has authority to regulate in-use vessels, and adopts such regulations. (0309)

Our Response:

We agree that it would be desirable to achieve emission reductions from existing Category 3 marine engines. However, although Category 3 engines may remain in the fleet for several decades, they are not maintained in the same way as Category 1 or Category 2 engines. Because there is no specific maintenance action common to all Category 3 engines that (1) would return an engine to as-new condition and (2) could be used to identify engines as being remanufactured and therefore "new," we conclude it is not possible to extend the marine remanufacture program to Category 3 engines at this time.

CHAPTER 10: Application of ECA Requirements in the Great Lakes

What We Proposed:

The comments in this section relate to Sections IV and VI.B.5 of the preamble, with respect to applying the CAA marine fuel sulfur program and the ECA requirements within the Great Lakes. These include comments related to the applicable regulations, the emissions inventory, and the air quality and human health benefits on the Great Lakes. See Chapter 2 of this Summary and Analysis document for a discussion of general ECA-related comments, and Chapter 5 for a discussion of comments related to implementation of Annex VI through APPS in U.S. internal waters. See Chapter 8 for a discussion of other comments related to environmental impacts and benefits.

In Section IV of the preamble, we proposed fuel sulfur limits under section 211(c) of the Clean Air Act that match the limits that apply under Annex VI in ECAs. The adoption of such standards would: (1) forbid the production and sale of fuel oil above 1,000 ppm sulfur for use in the waters within the proposed ECA (as well as internal U.S. waters); and (2) allow for the production and sale of up to 1,000 ppm sulfur fuel for use in C3 marine vessels.

In Section VI.B.5 of the preamble, we proposed regulatory text under APPS that clarifies that the NO_X and fuel sulfur requirements set out in MARPOL Annex VI Regulations 13, 14, and 18 generally, and the requirements that apply in designated ECAs specifically, would apply to internal waters such as the Mississippi River and the Great Lakes that can be accessed by ocean-going vessels. We noted that vessel emissions in these waters affect U.S. air quality to an equal, if not greater extent that emissions taking place in coastal waters. This provision would apply only to those internal waters that are shoreward of an ECA designated under Annex VI; internal waters that are adjacent to northwestern Alaska and western Hawaii would therefore not be affected. This provision is necessary because the recent USG proposal for ECA designation that was submitted to IMO, although intended to protect air quality in U.S. ports and internal areas, does not explicitly state that it applies to internal waters.

We received a large number of written comments with respect to these provisions and their application to vessels that operate on the Great Lakes. These written comments were submitted by about 50 entities representing a wide spectrum of entities that would be affected by the application of the ECA requirements within the Great Lakes. These include companies than own vessels, and their employees; companies that use the products transported by ship on the lakes, including steel and utility companies; regional associations; port authorities; fuel providers; and environmental and governmental groups. Many of these commenters also provided testimony at the public hearings for this rule.

10.1 General Comments Supporting or Opposing Application of ECA requirements within the Great Lakes

We received comments on our proposal to apply the ECA requirements within the Great Lakes from the following: Agri-Fine, OAR-2007-0121-0315; American Great Lakes Ports Association,OAR-2007-0121-0262; American Iron and Steel Institute, OAR-2007-0121-0295; American Maritime Officer Services, OAR-2007-0121-0364; American Maritime Officers of the

Great Lakes, OAR-2007-0121-0318; ArcelorMittel USA, OAR-2007-0121-0280; Calumet Area Industrial Commission, OAR-2007-0121-0332; Canadian Shipowners' Association, OAR-2007-0121-0227, 0245 and 0297; Canadian Steel Producers Association, OAR-2007-0121-0359; Central Marine Logistics, Capt. Tom Wiater, OAR-2007-0121-0276 and 0304; Employees of Central Marine Logistics, OAR-2007-0121-0234, 0236, 0237, 0238, 0239, 0240, 0260, 0293, and 0371; Chamber of Marine Commerce, OAR-2007-0121-0353; Chamber of Shipping of America, OAR-2007-0121-0256 and -0227; City of Sarnia, ON, CAN, OAR-2007-0121-0306; City of Superior, WI, OAR-2007-0121-0352; Clean Air Task Force, OAR-2007-0121-0264, 0227 and 0335; Cleveland Port Authority, OAR-2007-0121-0310; Cliffs Natural Resources Inc., ArcelorMittel USA, US Steel Corp., OAR-2007-0121-0376; Council of Great Lakes Industries; OAR-2007-0121-0296, 0312 and 0363; CSX Transportation, OAR-2007-0121-0300; Detroit Regional Chamber, OAR-2007-0121-0248 and 0274; The Development Association, OAR-2007-0121-0279 and 0290; DTE Energy, OAR-2007-0121-0328; Duluth Chamber of Commerce, OAR-2007-0121-0282; Duluth Propeller Club, OAR-2007-0121-0292, 0313 and 0399; Duluth Seaway Port Authority, OAR-2007-0121-0283; Great Lakes Maritime Task Force, OAR-2007-0121-0269 and -0329; Great Lakes Metro Chambers Coalition, OAR-2007-0121-0258; Greater Cleveland Partnership, OAR-2007-0121-0330; Interlake Steamship, OAR-2007-0121-0268 and 0357; Keystone Shipping Company, OAR-2007-0121-0273, 0311, and 0349; Kinder Morgan, OAR-2007-0121-0326; Kindra Lake Towing, OAR-2007-0121-0291; Lafarge North America, OAR-2007-0121-0383; Lake Carriers' Association, OAR-2007-0121-0233 and 0345; Lower Lakes Towing, OAR-2007-0121-0230; Maritime AFL-CIO, OAR-2007-0121-0321; Midwest Energy Resources Co., OAR-2007-0121-0342; Minnesota Chamber of Commerce, OAR-2007-0121-0350; Murphy Oil, OAR-2007-0121-0301; Ohio Environmental Council, Earth Day Coalition, Marsh Area Regional Council, Ohio League of Conservation Voters, OAR-2007-0121-0314; Ozinga Materials, OAR-2007-0121-0343; Raffin Construction Co., OAR-2007-0121-0344; Robertson, Paul, Economic Minister, Government of Canada, OAR-2007-0121-0252; Shipping Federation of Canada, OAR-2007-0121-0270; Soo Marine Supply Inc., OAR-2007-0121-0351; Stupak, Bart, Representative, US Congress (MI), OAR-2007-0121-0338; Transportation Institute, OAR-2007-0121-0302 and 0355; Two Harbors Area Chamber of Commerce, OAR-2007-0121-0324; Warner Petroleum Corporation, OAR-2007-0121-0251; Wisconsin Commercial Ports Association, OAR-2007-0121-0368

10.1.1 General Support for Application of ECA to the Great Lakes

What Commenters Said:

The environmental groups (e.g., Clean Air Task Force, 0265; Marsh Area Regional Council et al, 0314) and the Shipping Federation of Canada (0270) are supportive of the application of ECA requirements within the Great Lakes. For example, Marsh Area Regional Council, et al., notes that "emissions from Great Lakes Shipping can travel into the heart of the Midwest, and must be controlled (Marsh Area Regional Council et al, 0314). The Shipping Federation of Canada cites the benefits of harmonized standards, and offers three recommendations to improve the program: to clarify the standards are performance based and would allow the use of scrubbers; specify procedures that would apply when ships cannot purchase compliant fuels; and create an incentive program to reduce the overall carbon footprint of the supply chain that would acknowledge the potential of intermodal shifts (Shipping Federation of Canada, 0270). Similarly, the Canadian Shipowners Association indicated they support the objective of reducing air emissions, but that such reductions must be achieved in a

manner than minimizes the risks of modal shift and industrial diversions to mitigate the adverse unintended consequences of modal shift, fuel supply disruption and lost economic activities (CSA, 0245).

Our Response:

We agree that application of the ECA requirements within the Great Lakes will provide environmental benefits.

With regard to the recommendations of the Shipping Federation of Canada, our final rule clarifies that the use of equivalent technology will be permitted, and we provide procedures that would apply when ships cannot purchase compliant fuels generally, including in internal waters (see Chapter 4 of this document).

We also provide a separate provision that will allow operators on the Great Lakes to purchase marine residual fuel through 2014 if even if compliant 10,000 ppm S fuel is unavailable. Under this provision, if marine residual fuel meeting the 10,000 ppm S standard is not available, it will not be a violation of our standards for owners of vessels operating on the Great Lakes to purchase and use marine residual fuel with sulfur content above 10,000 ppm S provided the fuel they purchase is the lowest sulfur marine residual fuel available at that port.

With regard to an incentive program to reduce the overall carbon footprint of the supply chain, we will consider this suggestion as part of any future consideration of GHG emissions from vessels.

10.1.2 General Opposition of Application of ECA to the Great Lakes

What Commenters Said:

A wide spectrum of commenters voiced opposition to the application of the ECA to the Great Lakes. Many of these commenters cited a lack of environmental and economic analysis to support application of these requirements. Some of these commenters were concerned about EPA's authority to set standards for fuels sold on the Great Lakes. Others said that EPA did not do appropriate analysis to justify applying the ECA requirements within the Lakes. Many said the economic impacts to the Lakes will be severe, with at least one commenter saying that this proposed rule would cause the greatest disruption of commerce in the history of the Great Lakes (Great Lakes Maritime Task Force, 0269). Many of these commenters asserted that the provisions will result in transportation modal and industrial source shifts that will result in increased emissions. Other commenters said that 30 days was not enough time to review the proposal for the Lakes, with some urging EPA to exempt the Lakes or to postpone such a decision until more analysis can be carried out. Several commenters noted that the impacts on Canada and on small businesses were not addressed

Our Response:

Our responses to each of these sets of comments are set out below.

10.2 EPA does not have legal authority to extend the ECA requirements within the Great Lakes

What Commenters Said:

The Great Lakes Maritime Task Force commented that EPA made this proposal without the legal authority to do so, either under the Act to Prevent Pollution from Ships or the Clean Air Act (GLMTF, 0269). They argue that APPS does not implement the 2008 Amendment to Annex VI and that APPS does not authorize EPA to regulate the use of fuel in internal waters, let alone the Great Lakes. They also argue that prior to enacting a ban on residual fuel, including such a ban on the Great Lakes, EPA must make certain findings under CAA §211(c)(2)(A). Several other commenters also questioned whether EPA met its legal obligation in proposing applying the ECA requirements within the Great Lakes. Similar comments were made by other stakeholders, with Canadian Shipowners Association noting their concern that EPA is taking liberties with the ambiguities of APPS and that there is no real authority to include the internal waters of the U.S. when implementing ocean-going IMO standards. They recommended that the rule be postponed until EPA has a clear legal basis (CSA, 0245)

Our Response:

See Chapter 5 of this document for a discussion of our authority to extend the ECA requirements within U.S. internal waters generally.

See Chapter 4 of this document for a discussion of the requirements to restrict the production and sale of residual fuel in the United States generally.

10.3 EPA has not justified extending the ECA requirements within the Great Lakes

We performed an extensive economic analysis to examine the inventory contribution, air quality impacts, benefits, and costs for all vessels covered by this rule, including Great Lakes vessels. In response to the comments in this section we also prepared a Note to the Docket that organizes the Great Lakes-specific analyses in a single place.[50] That Note explains how the Great Lakes were taken into account in our inventory, air quality, benefit, and cost analyses. It also provides a brief analysis of the potential for modal and source shifts as a result of this rule. It also provides additional information regarding impacts on the Great Lakes marine transportation market.

[50] Memorandum to Docket EPA-HQ-OAR-2007-0121 from Michael J. Samulski. Control of Emissions from New Marine Compression-Ignition Engines at or above 30 Liters per Cylinder – Information in Support of Applying Emission Control Area (ECA) Requirements to the Great Lakes Region.

10.3.1 Extending the ECA requirements within the Great Lakes is not supported by EPA's analysis

What Commenters Said:

Many of the commenters who oppose application of the ECA requirements within the Great Lakes insisted that EPA is doing so without adequate analysis, and that the proposed rule would expand, without explanation or justification, the scope of the regulation to vessels in the Great Lakes (Agri-Fine, 0315; Duluth Seaway, 0283; Kindra Lake Towing, 0291; Minnesota Chamber of Commerce, 0350; Duluth Area Chamber of Commerce, 0282; Calumet Area Industrial Commission, 0332 Superior WI, 0352). Others said that EPA appears to have casually and carelessly included "internal waters" (i.e.: Great Lakes) within the scope of this regulatory action, with little understanding of the unique impacts of the proposal on the region's economy and environment. (American Great Lakes Ports Association, 0262; Wisconsin Commercial Ports Association, 0368). Warner Petroleum Corporation stated that the inclusion of the Great Lakes as in ECA in the proposed rule is an afterthought and that potential environmental, economic, and hardship assessments have not been conducted for these navigation waterways. Great Lakes Maritime Task Force said that EPA does not provide the factual basis for applying the ECA requirements within the Great Lakes and that the analysis that was performed focuses on the coasts. Therefore, the public cannot comment on the need for these controls on the Lakes (GLMTF, 0269). The Canadian Shipowners Association also argued that EPA did not conduct proper analysis of air emissions or adequately identify negative environmental and commercial effects of the proposal (CSA, 0245).

Other commenters said EPA never gave any clear indication it was considering ECA designation for the Great Lakes before the proposed rule. ArcelorMittal noted that there was only limited discussion of this provision in the ANPRM, and that the ECA submission was ambiguous about the Great Lakes. However, the proposed rule provides almost no support for EPA's current position to designate the Great Lakes as an ECA (ArcelorMittal, 0280). Transportation Institute stated that they were "blindsided by the sudden turn of the EPA's regulatory fevor to determine ... 'coasts' and 'coastal waters' somehow now mystically encompasses the American vessels plying the freshwaters of the Great Lakes" and noted that while EPA proudly denotes its efforts to provide incentives and publicize emissions issues among maritime interests along the East and West Coasts, no similar demonstrable effort is noted or apparent for the Great Lakes region (Transportation Institute, 0302). GLMTF also notes that the coastal ECA has been in the works for many years through a transparent, meticulous and science-based process, but it appears that the Great Lakes were just tacked onto the ECA with a simple justification that vessel emissions in internal waters affect U.S. air quality to an equal if not greater extent" with no clarification of that statement, and with no consideration of key differences between OGV and vessels that operate on the Great Lakes (GLMTF, 0269). Marine Trade Department commented that EPA's perfunctory approach to the Great Lakes ECA is particularly shocking in that this region would negatively impact the Great Lakes shipping business and shoreside industries more than any other region in the country. (Maritime Trades Department, 0321). Canadian Shipowners Association noted that EPA did not include the Pacific U.S. territories, smaller Hawaiian Islands the U.S. territories of Puerto Rico, the U.S. Virgin Islands, or Western Alaska and the Aleutian Islands in the ECA submitted to IMO because further information is required, and suggested that the Great Lakes not be included into an ECA for the same reason (Canadian Shipowners Association, 0245).

Warner Petroleum Corporation also commented that the proposal does not present data to demonstrate the lakes meet the ECA criteria and so inclusion of the great lakes in the ECA is not justified by the standards and criteria established by EPA (Warner Petroleum Corporation, 0251).

See also comments from Calumet Area Industrial Commission (0332); (Canadian Shipowners' Association, 0245); Interlake Steamship (0268); CSX Transportation, 0300); Greater Cleveland Partnership (0330); Congressman Stupak (0338); Chamber of Marine Commerce (0353); ArcelorMittel USA (0280); Canadian Shipowners' Association (0245); Keystone Shipping (0349);

Our Response:

The main emphasis of these comments is that our analyses do not take into account the peculiarities of the Great Lakes region, with regard to operating profiles, average sulfur content of fuel sold on the Lakes, attainment status of coastal areas, and the existence of transportation alternatives for Great Lakes marine transportation service consumers.

The Great Lakes were included in all aspects of the analysis supporting this rule. The national inventory estimates were broken out by regions in our NPRM, including the Great Lakes, Gulf Coast, and other areas (see Chapter 3 of the Draft RIA). However, the air quality impacts and benefits modeling which relies on those regional inputs are reported out for the nation as a whole. The justifications for regions such as the Gulf of Mexico and the Great Lakes were presented with equal weight in the NPRM. Nevertheless, in response to this comment, we prepared a Note to the Docket that organizes the Great Lakes-specific analyses in a single place. This Note explains how the Great Lakes were taken into account in our inventory, air quality, benefit, and cost analyses. It also provides a brief analysis of the potential for modal and source shifts as a result of this rule.[51]

In addition, in response to these comments and as suggested by Congress, we will perform an additional analysis of the economic impacts of the application of the ECA requirements on ships operating on the Great Lakes. This study, which we expect to complete by summer 2010, will be developed cooperatively with stakeholders and will examine the economic impacts of the rule on Great Lakes shipping including whether these standards may lead to a modal shift away from marine transportation and toward transportation by rail or truck. We will take into account data and studies submitted by participants as well as other information.

Based on our analysis in the NPRM and subsequently in our docket note, we are finalizing this rule as proposed, including the Great Lakes in the internal waterways to be covered by the ECA requirements through our authority granted in the Act to Prevent Pollution from Ships (see Sections 5.4 and 5.5 of this document for more information about APPS).

[51] Memorandum to Docket EPA-HQ-OAR-2007-0121 from Michael J. Samulski. Control of Emissions from New Marine Compression-Ignition Engines at or above 30 Liters per Cylinder – Information in Support of Applying Emission Control Area (ECA) Requirements to the Great Lakes Region.

10.3.2 Specific comments on inventory inputs and assumptions for the Great Lakes

What Commenters Said:

Several commenters are critical of the assumptions we used in our air emission inventory modeling for the Great Lakes, alleging that the analysis does not accurately and fully reflect the unique characteristics and contribution of the vessels that ply the Great Lakes. (Keystone Shipping Co., 0349)

The Lake Carriers' Association (LCA) indicated that their analysis of EPA's 1999 National Emission Inventory found it to vastly overstate vessel emissions in the Port of Cleveland, Ohio. Those flawed Cleveland findings were then extrapolated to other Great Lakes port states, cities, and counties based on port tonnages. LCA fears the RIA analysis may be a repeat of this overestimate for the Great Lakes. (Lake Carriers' Association, 0345, p. 12-13) Although LCA has previously provided the EPA with data on laker vessel efficiency and demonstrated that the EPA data on emissions at Great Lakes ports was in error by a factor of more than 300 percent, the EPA neither recognized the laker vessel efficiencies nor corrected their erroneous data. (Canadian Shipowners Association, 0245, p. 4 and p. 37) In comments provided by Keystone Shipping Co., they acknowledge that it appears the more recent analysis of Great Lakes port air emissions was referenced and used in some of the studies referenced in the RIA; however, it is not certain nor could it be determined how that data was incorporated into the final Regional analysis conclusions. (Keystone Shipping Co., 0349, Appendix 1, p. 4)

Other comments concerning the inputs to our inventory modeling include the following:

- Great Lakes bulkers stay in port in populated areas for much shorter periods of time that ocean going ships do. Nearly all Great Lakes Bulk Carriers are equipped with self-unloading equipment that allows them to unload in a matter of hours, versus the days that ocean going vessels often spend in port. (Interlake Steamship, 0268, p. 3)

- Two or three ports were used to extrapolate emission contributions for all ports on the Great Lakes and for in-transit times. Although certainly more appropriate than extrapolating from the port of Long Beach, we question the validity of using those ports to determine emissions for the entire Great Lakes Region. One cannot calculate emissions from laker vessels through mathematical formula from one or two ports because of the vast differences in port facilities and traffic activity. (Great Lakes Maritime Task Force, 0269, p. 24 and p. 37)

- The analysis for "in transit" time as applied to the Great Lakes fleet is flawed and incomplete. (Great Lakes Maritime Task Force, 0269, p. 24) While the global model used may be suitable for ports that are geographically separated and may have accuracy for coastal ports with foreign voyages, there are over 70 ports in the relatively small geographic area of the Great Lakes and it is not clear how the modeling accounted for such a large number of ports in the confined geographical location. (Keystone Shipping Co., 0349, Appendix 1, p. 3)

- Even EPA's use of a predictive emissions model, such as the STEEM analysis presented in the Regulatory Impact Analysis, does not clearly take steamers into account. (Great Lakes Maritime Task Force, 0269, p. 28)

- Vessels like Interlake's, that operate exclusively within the Great Lakes, typically last decades longer than those that operate on the oceans. (Interlake Steamship, 0268, p. 4)

- The environmental benefits of the ECA are based on very large growth estimates for ocean shipping, with high horse-powered engines, and these estimates are not at all representative of the Great Lakes region. (Canadian Shipowners Association, 0245, p. 4)

- The baseline inventory is established in 2002 and there has been substantial refinement in the Great Lakes vessel port and vessel information since that time particularly on the Great Lakes. (Keystone Shipping Co., 0349, Appendix 1, p 3 and p. 4)

We also received comments on the fuel sulfur content level used in our inventory modeling. While an ocean-going vessel can currently purchase and burn up to 4.5 percent sulphur in fuel, the reality for the Canadian fleet in the Great Lakes is a fleet average sulphur content of only 1.7 percent. (Canadian Shipowners Association, 0245, p. 15) Based on "business confidential" fuel analysis previously provided to EPA, a Great Lakes Maritime Task Force member calculated that the weighted average sulfur position of more than 130 million gallons of fuel (Heavy and Intermediate Fuel Oil) burned over the post 4.5 years in the Great Lakes is 1.5 percent. (Great Lakes Maritime Task Force, 0269, p. 5) The average sulfur content for all residual fuel consumed by the eight Key Lakes vessels from 2006 through August 2009 was 1.62 percent. By assuming a higher sulfur content of 2.7 percent, EPA inflates the current environmental impact of the Great Lakes ships and overstates the benefits of reducing the sulfur content in fuels. (Keystone Shipping Co., 0349, p. 2) The sulphur content of residual fuel sold for use on the Great Lakes has a dramatically lower sulphur content (approximately 1.7 percent) than similar fuels on a global basis (approximately 3.5 percent - 4.5 percent). (Lower Lakes Towing LTD, 0230, p. 1) The average sulfur content for all residual fuel consumed by Interlake's vessels from 2006 through August 2009 was 1.8969 percent. However, because Interlake's vessels consume MDO during maneuvering and while in port, the weighted average sulfur content for all fuels used by Interlake's vessels impacted by the proposed rule is 1.6818 percent. (Interlake Steamship, 0268, p. 3)

Our Response:

Since the development of the 1999 National Emission Inventory, the Category 3 vessel inventory for the U.S., including the Great Lakes, has been updated. We agree that earlier analyses overestimated the emissions of Category 3 vessels in the Great Lakes, by including some Category 2 vessels. For this rule, the Category 2 vessels were carefully removed from the call data for the Great Lakes ports.

We agree that marine transportation on the Great Lakes has unique characteristics that need to be taken into consideration. While the overall methodology for inventory development

outlined in the RIA applies to all areas of the U.S., this methodology allows for and uses a number of inputs specific to the Great Lakes. The LCA port data for Cleveland and Duluth-Superior were used to develop the port time-in-mode data for the Category 3 vessels operating on the Great Lakes. In addition, U.S. Army Corp of Engineers (USACE) call data and vessel characteristics specific to each Great Lakes port was used; call data for Cleveland and Duluth-Superior were not simply applied to the other Great Lakes ports. Although it would have been preferable to use port-specific information for every port, this approach uses all Great Lakes port data available at the time of the analysis.

The Great Lakes do include a large number of ports in a rather small geographical location. Ports were each treated separately for the purposes of inventory estimation. There are four modes of port operation included in the port inventories: hotelling, maneuvering, reduced speed zone (RSZ), and cruise. The hotelling and maneuvering emissions are assigned to a single latitude/longitude coordinate point using the port center as defined by the Army Corp of Engineers in the Principal Ports of the United States dataset. The RSZ and cruise routes were modeled as lines. The RSZ distance for each Great Lake port was fixed at three nautical miles. The cruise mode emissions assume a 7 nautical mile distance beyond the RSZ. Because some ports are confined to a rather small location, the RSZ and cruise mode links overlap. In these cases, the emissions for those ports, once calculated, were allocated to the same links, such that the total emissions allocated to the links are the sum of emissions from all of the ports sharing that link.

The interport emissions were estimated using the Waterway Network Ship Traffic, Energy, and Environmental Model (STEEM). STEEM uses a spatially-defined waterway network based on empirical shipping information. Emissions along the waterway network are calculated using entrances and clearances data in conjunction with vessel characteristics such as vessel speed and engine power. In the Great Lakes, the waterway network, call data, and vessel characteristic data used to develop interport emissions are specific to the Great Lakes. Although the STEEM inventory is not segregated by ship type, steamers are included in the STEEM inventory.

Other inputs specific to Great Lakes include age distributions and growth. Age distributions by engine type were developed specifically for the Great Lakes. Age distributions were determined using USACE entrances and clearances data for 2005 linked with Lloyds data to determine ship engine characteristics and build date. The age distributions for Great Lakes vessels reflect more aged vessels than those for ocean-going vessels, as some commenters have suggested. Similarly, an average annualized growth rate was developed specifically for the Great Lakes. The growth rate for the Great Lakes (1.7 percent) is the lowest regional growth rate used in the analysis; the range of regional growth rates used is 1.7 to 5.0 percent.

Inventories are one of the first products required at the start of the rulemaking process. The inventories for this rule were developed several years ago. Calendar year 2002 was used as the base year, since it was the latest year for which information was available at the time the analysis was done. These emission inventories are then used as the basis for air quality modeling, which feeds into the benefit and deposition modeling. Unfortunately, it would be a considerable effort to update both the port and interport (STEEM) portions of the inventory to incorporate more recent data and carry these updates through all of the subsequent modeling and analysis.

Our analysis uses a baseline residual fuel sulfur level of 2.7 percent in the Great Lakes, which is based on the global average. To the extent that Great Lakes vessels would use lower sulfur fuel than currently modeled, even without an ECA, the realized benefits (and to some extent the incremental costs) would be lower. However, due to the high benefit to cost ratio of this program, we can still conclude that the benefits would still greatly outweigh the costs.

10.3.3 Specific comments on the inventory contributions of Great Lakes vessels

What Commenters Said:

Several commenters asserted that the contribution of Great Lakes shipping to national inventories is not significant. These include comments that EPA's own analysis demonstrates that vessels operated on the Great Lakes are not a major contributor to the U.S. C3 vessel emissions inventory. (Great Lakes Maritime Task Force, 0269, p. 32; Keystone Shipping Co., 0349, p. 3) The 1998 Emission Inventory shows that the Great Lakes shipping accounts for 3 percent of the NO_X and PM emissions from commercial marine vessels. (Greater Cleveland Partnership, 0330, p. 3) A comparison of the contribution of Great Lakes steamer fleet emissions to the total national U.S. C3 vessel emissions confirms that the Great Lakes steamers' contribution is extremely small, far less than one percent. (Great Lakes Maritime Task Force, 0269, p. 24 and p. 27) The actual Great Lakes steam vessel contribution relative to the EPA provided numbers for the Great Lakes in the RIA is quite small and nearly insignificant particularly for NO_X, HC, and CO. (Keystone Shipping Co., 0349, Appendix 1, p. 6) The EPA models used to support the proposal for a North American Emission Control Area show that the marine industry's contribution to total sulphur deposition is generally less than 2 percent and rarely more than 5 percent of the total throughout the Great Lakes region. This is in marked contrast to the IMO SECA targeted West coast, for example, where in many areas marine sulphur emissions account for more than 60 percent of the total. (Canadian Shipowners Association, written hearing testimony, 0227, p. 3)

Finally, one commenter noted that the contribution of steamers to this inventory is also quite small. When comparing EPA recommended emission factors for various marine vessels, steamers' emissions are a small fraction of diesels' emissions for HC, NO_X, and CO; [i]t's really only in Particulate Matter that diesels are superior. (Lake Carriers' Association, 0345, p. 14)

Our Response:

The analysis for this rule agrees with earlier estimates that the Great Lakes contribution to national NO_X and PM emissions from Category 3 vessels is 2-3 percent. However, this does not reduce the need for emission control for vessels that operate on the Great Lakes. Their relative contribution to localized inventories, such as the air inventories for Duluth, Chicago, Detroit, Cleveland, and other areas along the lakes, can be substantial.

The impacts of these inventories on the Lakes region can be seen more clearly on the air quality maps developed for this rule, shown in Chapter 2 of the RIA. Many of the port and coastal areas of the Lakes are in nonattainment for ozone, PM, or both, in part due to emissions from vessels that are the subject of this action. Reductions in the sulfur content of fuel used in lake vessels and in their engine emissions will assist these areas in their attainment plans. Emissions from lake vessels are also transported inland, affecting air quality in areas far from the lakes.

Similarly, we agree that the Great Lakes steamers' contribution to the national total would be less than one percent. Our marine diesel engine inventory takes into account the different emission rates for steamships operating on the Great Lakes (further evidence we considered the Great Lakes with some specificity). The emission factors for steamships are estimated to be lower than slow-speed or medium-speed diesel engines for HC, CO, and NO_X and comparable for PM but much higher for CO_2. Generally, the low relative emission contribution from a subcategory of engines does not lead us to exempt engines and their fuels from regulation. This is because all broad categories of mobile sources can be broken into small enough categories as to make only a small contribution. However, as discussed below in section 10.4.3, we are excluding Great Lakes steamships from the ECA fuel sulfur requirements. For the purpose of this exclusion, Great Lakes steamships means vessels, operating exclusively on the Great Lakes and Saint Lawrence Seaway, whose primary propulsion is a steam turbine or steam reciprocating engine. In addition, these steamships must have been in service on the Great Lakes prior to October 30, 2009. This does not include diesel propulsion Category 3 vessels with auxiliary boilers.

10.3.4 Specific comments on air quality modeling inputs and assumptions for the Great Lakes

What Commenters Said:

The Canadian Shipowners Association commented that the analysis of the benefits of the coastal ECA is not directly transferable to inland waters such as the Great Lakes. This is because the amount of marine sulfur emissions from ships is smaller and because the prevailing winds are different. In addition, they question the air quality modeling which they say "suggests that marine pollution is carried uniformly inland from the east coasts". They reference a 2009 study of global marine emissions as evidence that emissions on the east coast are carried out to sea by prevailing winds. (Canadian Shipowners Association, 0245, page 15)

The Chamber of Shipping of America commented that the basis for much of EPA's modeling data is questionable, including assumptions that weather and wind conditions are similar at all U.S. coastlines.

Our Response:

The commenters are incorrect in assuming EPA's analysis only considered coastal emissions. The air quality modeling analysis performed for the coordinated strategy takes into account the location and amount of marine sulfur emissions in the Great Lakes region as well as elsewhere. In addition the meteorological inputs to the air quality model closely match observed meteorology for 2002 including within the Great Lakes region.

Conventional wisdom suggests that prevailing winds, over the U.S. and Canada, travel from west to east. On average, this is true, especially for the north Atlantic and the Pacific coasts. In the Gulf of Mexico, prevailing winds typically come from the southeast. However, these winds fluctuate in speed and direction, and are less consistent on the north Atlantic coast than other coasts. As such, air pollution off the east coast, even 200 nm from shore, affects the air we breathe.

We agree that emissions on the northeast coast can be carried out to sea by prevailing winds. As seen in Figure 2-38 of the RIA, the largest predicted improvements in sulfur deposition from the proposed reduction in emissions along the eastern coasts of the U.S. and Canada occur over the Atlantic Ocean. It is reasonable to assume that if the EPA modeling domain extended further east, the simulation would have shown large improvements far out to sea. However, prevailing wind patterns can vary by season and by location; and daily meteorological conditions can certainly vary from climatological averages. While the frequency of maritime influences can vary by location, it is not uncommon for locations all across the United States to be affected by emissions that originate offshore. An EPA analysis of air parcel back trajectories over the 12-year period from 1995-2006 concluded that highly-populated coastal cities in the northeastern U.S. were impacted by marine airmasses between 10-20 percent of the time. The intent of the EPA analyses was to demonstrate this impact of marine pollution on inland populations and ecosystems.

One advantage of the annual (2002) MM5 meteorological modeling that was used to drive the air quality modeling simulations performed for the EPA analysis, is that it employed a fine horizontal grid resolution of 12 km. Unlike the coarse-resolution global modeling mentioned in the comment (where the grid resolution was 1.8 x 1.8 degrees latitude/longitude), the EPA MM5 modeling was able to capture important smaller scale phenomena like the sea breeze. These local circulations are well-known to result in the onshore transport of any air pollution trapped near the surface over large water bodies. In addition, EPA's evaluation of the meteorological modeling inputs closely matched observations for 2002 and therefore were an appropriate dataset for assessing the frequency and impact magnitude of shipping emissions on inland locations.

Note that there were additional comments on this topic which were not specific to the Great Lakes. See Section 8.2.4 of this document for additional information on transport of emissions and prevailing winds.

10.3.5 Specific comments on benefits for the Great Lakes

What Commenters Said:

The Canadian Shipowners Association commented that The rule poses a higher economic burden on Great Lakes shipping while achieving only 1/5 of the benefit – this is not an equitable outcome of the proposed rule.

Our Response:

We disagree with the commenter's assertion that the coordinated strategy will place a higher economic burden on shipping activity within the Great Lakes region while achieving only 1/5 of the benefit. In a memo published to the docket ("Regulatory Impacts of Proposed Category 3 Vessel Emission Standards on Great Lakes Shipping," Docket EPA-HQ-OAR-2007-0121), we found that emissions from shipping on the Great Lakes affects air quality in the mid-western U.S. and that the benefits associated with the coordinated strategy that will accrue to the six U.S. states that border the Great Lakes will greatly outweigh the costs

The report estimated that for the Great Lakes fleet, in 2030, the costs of control will be $49 million compared to national costs of $3.1 billion. Approximately 1.6 percent of the total

costs of the program are therefore incurred by vessels operating on the Great Lakes. In terms of cost-effectiveness (a ratio of engineering costs incurred per ton of emissions reduced), the NO_X, SO_X and PM emissions reductions from the proposal compare favorably to other land-based control programs that have been implemented. For the national program, we estimated a cost effectiveness of $510/ton NO_X, $930/ton SO_X, and $7,950/ton PM. The cost effectiveness of PM and SO_X emission control is not significantly different for the Great Lakes vessels versus ocean-going vessels. The reason for this is that costs associated with PM and SO_X emission reductions are primarily driven by fuel costs, which are a function of how much the ship operates in the ECA. To determine the cost effectiveness of NO_X emission reductions in an ECA, the analysis considered both hardware costs (SCR unit) and operational costs (urea consumption) to determine the cost effectiveness of NO_X emission reductions in an ECA. As the amount of operation in the ECA increases, urea consumption increases proportionately with emission reductions. However, hardware costs remain constant. Therefore, increasing the amount of ship operation included in an ECA increases the estimated emission reductions per dollar spent on hardware. This results in a directionally improved NO_X cost effectiveness for Great Lake vessels.

The report also estimated the health-related benefits associated with the coordinated strategy in the 6 western states that border the Great Lakes (IL, IN, MI, MN, OH, and WI). In the analysis, we disaggregated the PM2.5-related benefits that accrue to these states from the nationally aggregated PM2.5 benefits totals presented in the rulemaking support documentation that accompanied the NPRM. The monetized PM-related benefits in the 6 states accounts for between 1.4 and 1.7 percent of the nationally-aggregated monetized benefits (and saving between 180 and 450 lives in 2030). Note that improvements in air quality that occur in Canada as a result of ships operating in the U.S. portion of the ECA are not accounted for in these benefits.

For both the national program as a whole, and the Great Lakes specifically, the monetized health benefits of the Category 3 marine vessel program greatly outweigh the associated costs. Nationally, in 2030, the estimated monetized PM2.5 benefit of the proposed standards would be between $110 and $270 billion. The annual costs would be significantly less, at approximately $3.1 billion. For the six western states bordering the Great Lakes, the estimated monetized PM2.5 benefits in 2030 would be between $1.6 and $3.8 billion. In comparison, the total projected costs for Great Lakes vessels, in 2030 would be $0.05 billion.

The benefits considered here are the focused on the monetized human health benefits associated with reductions in PM2.5 emissions. Additional benefits that would be expected were not considered in these calculations. These additional benefits would include human health benefits associated with improvements in ozone concentrations, and benefits to ecological systems associated with improvement in air quality and acid deposition. At the same time, all costs of emission control are considered.

10.4 The economic impacts of applying the ECA requirements on the Lakes will be severe

The majority of the comments we received with respect to our proposal to apply the ECA requirements within the Great Lakes expressed concern about the continued viability of marine transportation in that region. These commenters note that marine transportation is an efficient mode of transportation in the Great Lakes. Many commenters describe the adverse impacts that are expected if the provisions for the Great Lakes are finalized. These adverse impacts are expected to occur because the provisions will force the retirement of steamer vessels and will raises operating costs for vessels that use intermediate fuel, making them less competitive compared to rail and truck alternatives. The result of these adverse impacts is expected to be modal shifts away from marine transportation as well as source shifts as manufacturers relocate in response to increased transportation costs. This section summarizes comments from: American Great Lakes Port Association, 0262; Wisconsin Commercial Ports Association, 0368; American Maritime Officers Service, 0364; American Maritime Officers, 0318; ArcelorMittel USA, 0280; Canadian Shipowners' Association, 0245; Mr. Grzesiek, 0234; Lower Lakes Towing Ltd., 0230; Keystone Shipping Co (0349); Warner Petroleum Transportation, 0251; Government of Canada, 0252; Chamber of Shipping of America, 0256; (Great Lakes Metro Chambers Coalition, 0258; American Great Lakes Ports Association, 0262; Interlake Steamship, 0268; Shipping Federation of Canada, 0270; Capt. Wiater, 0276, 0304; Duluth Seaway, 0283; Duluth-Superior Propeller Club; AISI, 0295; CGLI, 0296; Murphy, 0301; Transportation Institute, 0302; Port of Cleveland, 0310; Marine Trades Department, 0321; Congressman Stupak, 0338; Midwest Energy Resources, 0342; Soo Marine Supply, 0351; CSPA, 0359; USS, 0376; Larfarge, 0383; Keystone Shipping, 0349, Lake Carriers' Association, 3045; Great Lakes Maritime Task Force; 0269; Canadian Shipowners Association (0245).

After summarizing this set of comments by issue area, we respond to the ensemble of these concerns in Section 10.4.4. See also our note to the docket explains how the Great Lakes were taken into account in our inventory, air quality, benefit, and cost analyses and provides an analysis of the potential for modal and source shifts as a result of this rule.[52]

10.4.1 The Great Lakes are an efficient transportation mode

What Commenters Said:

One theme that was repeated throughout many of the comments we receive with respect to the Great Lakes is their importance as a transportation corridor for a variety of manufacturing activities including steel, cement, electricity, and agricultural goods particularly grain. Manufacturers receive inputs (e.g., iron ore, limestone, coal) from the upper Lake region, and transport finished goods (steel, cement, grain) throughout the region. Many commenters note that the Great Lakes fleet is small, with 55 U.S. vessels (13 steamships, 13 vessels that burn intermediate fuel, and 29 other vessels). These vessels moved about 101 million tons of dry-bulk cargo in 2008. The 26 most effected vessels represent about 50 percent of the capacity needed to

[52] Memorandum to Docket EPA-HQ-OAR-2007-0121 from Michael J. Samulski. Control of Emissions from New Marine Compression-Ignition Engines at or above 30 Liters per Cylinder – Information in Support of Applying Emission Control Area (ECA) Requirements to the Great Lakes Region.

meet the demand for moving iron ore, coal, limestone, and cement. Several commenters noted that the Great Lakes and St. Lawrence Seaway are over 2,000 miles long, although the largest vessels are captive on the lakes since they are too large for the locks on the St. Lawrence and Welland Canal are limited to 740 ft. This is important because vessels would have to comply with the ECA fuel requirements virtually all of the time and would not be able to save costs by fuel switching, an option available to ocean-going vessels that operate on the coasts and spend most of their time outside the ECA.

Citing various studies, including a recent study by the U.S. Army Corps of Engineers, commenters noted that marine transportation is the most efficient transportation in the region. Because there is less friction as a vessel moves through water, less power is needed. As a result, a laker can move one ton of goods 607 miles on one gallon of fuel. The same ton of goods could be moved only 202 miles on a gallon of fuel by rail, ad only 59 miles by truck. Another comparison notes that it would take 700 rail cars (with 14 to 21 engines) to transport the same quantity of bulk good that can be moved in one 1,000 foot laker, or 2,800 trucks. This would result in the additional consumption of tens of millions more gallons of fuel – up to 85 million more in the case of trucks. In addition to fuel costs, there are the costs of manufacturing and maintaining these extra rail cars, tires, and transportation congestion issues. For all of these reasons, marine transportation is very economical, with commenters noting the USACE study conclusion that the next least costly mode of transportation would result in an addition $3.6 billion of transportation costs per year for Great Lakes industries. The USACE study estimates there are 44,000 U.S. jobs directly dependent on Great Lakes shipping, with tens of thousands of additional jobs in shipping-dependent Industries. Finally, the Transportation Institute, the Government of Canada and Canadian Shipowners' Association, among others, noted that this rule will undercut the current U.S./Canada joint effort to promote short sea shipping to reduce greenhouse gas emissions, improve the environment, relieve land-side infrastructure congestion, limiting harmful surface runoff, and avoid highway fatalities.

10.4.2 The economic impacts of applying the ECA requirements within the Great Lakes will be substantial

What Commenters Said:

Several commenters expressed concern that the application of the ECA requirements within the Great Lakes would be detrimental to the local economy. As expressed by one commenter, the rule will cause irreparable damage to Great Lakes Shipping industry, industries which rely on it, the economic health of the Great Lakes region and the environment due to the dramatic increase in cost and resultant modal shift to less efficient modes of transportation (Lower Lakes Towing Ltd., 0230). This section summarizes comments describing these adverse impacts; comments discussing the causes of these impacts are summarized in later sections.

Several commenters noted that the primary industries serviced by Lakers were built around the Great Lakes to take advantage of the proximity to natural resources and the economics of scale provided by waterborne transportation – a dramatic increase in operating costs passed onto these companies would limit their ability to compete in the global economy (Lower Lakes Towing Ltd., 0230). Including the Great Lakes in the ECA and enacting an almost immediate ban on the use of residual and heavy blended fuels will dramatically impact every port and port community along this bi-national waterway (Duluth-Superior Propeller

Club). SOO Marine Supply stated they are starting to see a glimmer of hope in 2010 that business may return with some normality… half of their customer base will be eliminated overnight (Soo Marine Supply, 0351). Banning the use of residual fuel will significantly challenge our ability to get economical raw materials required in the manufacturing process. The proposed regulations will also jeopardize our ability to move our products to their end markets. (Lafarge, 0383)

One commenter stated that EPA has no grounds to extend the ECA approach to the Great Lakes, and doing so would effectively bring the majority of the fleet currently in operation in the Great Lakes to a halt. The implications of such a move would be disastrous to the national economy, as well as to our members in the Detroit region (Detroit Regional Chamber, 0248)

Warner Petroleum commented that imposing more restrictive regulations at a faster pace than currently called for in international agreements poses a serious threat to jobs, the economy and the very survival of the Great Lakes shipping industry. … The increased fuel costs alone will create a major disincentive for steel companies, limestone, cement and other major freight customers to continue operating within the Great Lakes region … The region will also become far less attractive for the newly emerging alternative energy industry … ability to move large turbine components cost-effectively will negatively impact our competitiveness with other regions and countries… Warner Petroleum has invested more than $7.9 million in the past 3 years; many of the jobs we've created would be lost (Warner Petroleum Corporation, 0251)

Great Lakes Metro Chambers Coalition stated that the application of an ECA to the Great Lakes appears to have been a last-minute idea, and we fear that it will be counter-productive to interconnected goals of clean air, energy efficiency, and economic sustainability… The rule would have a devastating job impact on the Great Lakes shipping industry, raw material shippers, fuel suppliers, and end users, including the steel, automobile, power, and manufacturing industries. The new rule comes at a time when the states in the highly-integrated Great Lakes/Midwest manufacturing belt have been among the hardest hit by the recession. (Great Lakes Metro Chambers Coalition, 2058)

ArcelorMittal noted that their 25 million tons of annual North American steelmaking capacity … are located on the Great Lakes [because it] requires approximately 40 million tons of iron or and stone … 100 percent of which is delivered by Lake freighters. Efficient lake bulk transportation is why these plants are cited where they are, and also explains why many facilities without lake access have been shut down. … Although the Great Lakes received sparse attention in the Proposed Rule and underlying record, the rule nonetheless threatens severe harm to the future of Great Lakes Shipping, would impair the viability of the industries which depend on that shipping capacity and risks causing significant harm to the environment. … Nor does the Proposed Rule contain any distinct analysis of the economic impact that imposing an ECA would have on the Great Lakes shipping and the industry it supports. (ArcelorMittal, 0280) Kindra Lake Towing was also concerned that the provisions would put the American steel industry at risk (Kindra Lake Towing, 0291). AISI noted that well over half of the U.S. production of steel takes place at facilities located in the Great Lakes states, and as such those facilities rely heavily on Great Lakes shipping of raw materials that feed those operations. … Much of the inputs are moved by vessels on the Great Lakes. In addition, finished products also are transported within the region. For this reason, the proposed rule's applicability to Great Lakes vessels is of vital concern to the North American steel industry. … Steel production levels have begun to climb. Hundreds of thousands of jobs are at stake if transport of materials cannot be accomplished

efficiently, economically, and safely. … Added costs for steelmaking will have cascading effect … and provide a competitive advantage to foreign steel importers (AISI, 0295) US Steel noted that American steel industry is heavily depending on Great Lakes shipping and would see its costs increase significantly without concomitant environmental benefits. It takes 2.2 tons of raw materials to make a single ton of steel, so cost effective, environmentally sound and efficient bulk transportation is critical to the steel industry … all of those raw materials as well as the finished product would move within the ECA at a higher transportation cost under the proposed EPA rule (USS, 0376)

DTE noted that their largest coal fired power plant in Monroe, MI, uses a flue gas desulfurization system that requires limestone. Escalated fuel costs may significantly impact the quarry if it can't transport product via vessels because lakers have been taken out of service. Plant can't accommodate trucks or rail. Construction of those facilities would be expensive and those costs would be passed on to electrical customers. Also, the air use permit for the facility requires delivery of limestone by freighter and the permit does not have a provision for additional potential truck or rail traffic. There is a similar issue for coal, especially at the Monroe power plant since the rail lines to that plant are already congested. (DTE, 0328)

10.4.2.1 EPA's rule will upset the advantages of marine transportation in the Great Lakes region

What Commenters Said:

Commenters expect that the above-described economic impacts will occur because the proposal will result in the early retirement of the steamer fleet and increased fuel prices that will make it harder for vessels that use intermediate fuel to compete. The resulting loss of capacity and increased operating costs will make lakers less able to compete with land-based transportation, leading to modal shifts, source shifts, and adverse economic impacts for the region. Each of these is described below.

10.4.2.2 Steamships on the Great Lakes Cannot Comply with ECA Fuel Sulfur Levels

What Commenters Said:

There are 13 steam vessels in the U.S. Great Lakes fleet. The Great Lakes Maritime Task Force and Lake Carriers' Association, among others, commented extensively on the safety concerns associated with using distillate fuel in steamers. These safety reasons stem from the design and operation of these vessels. Their engines designed with heavy, high BTU fuel in mind. While boilers can be safety lighted with distillate fuel, this can be done only during cold start-up and only for as long as necessary for atomization and heating of the primary fuel. Even if engines could be modified for fuel switching, the constant mode shifting that is necessary for lake operations would create a safety hazard. Specifically, according to the GLMTF, as boilers are added or turned off, it creates the possibility that unburned fuel will be present in the firebox for a short period of time. This could lead to an explosion as the fuel ignites. They note that boiler explosions can result in loss of life. Many commenters cited a statement from the American Bureau of Shipping, the U.S. classification society for marine vessels with regard to the use of distillate in these boilers advising that: "…a) unburnt fuel may be admitted to a hot furnace, following flame failure. This could result in an explosion in the furnace…"

In addition, there are issues with the flame pattern and burning of fuel, having to do with the possibility of issues with the distribution of the flame inside the boiler that would cause uneven heating of the tubes that surround the firebox, which could crack and expose engine room personnel to boiling hot water and steam. Finally, there are issues with the flash point of the fuel, since lakers are required by Coast Guard to use products with a minimum flash point of 60 degrees C.

Consequently, a requirement for steamships to comply with the ECA fuel requirements would result in the immediate and permanent retirement of the 13 steam vessels in the United States fleet, which are about 25 percent of the U.S. vessel fleet on the Lakes and a significant portion of total shipping capacity. This loss of capacity would adversely affect the steel and utility industries that rely on bulk shipment of raw inputs to their plants by ship, as well as for the transportation of their production. An alternative method would need to be found to move those inputs and outputs, which would have to be rail or truck. This would be especially unfortunate because shipping is so much more efficient than rail or truck transportation. One commenter explained that the Great Lakes fleet has an extraordinarily low horsepower/cargo tonnage ratio: 0.2 to 0.3, compared to 1:1 for rail and 15:1 for trucks. One steamer carries about 2.7 million net tons of cargo, equivalent to 135,000 truckloads. Therefore, the modal shift from marine to rail or truck will result in increased emissions and increased safety hazards from more congestion on the railways and highways.

Lake Carriers' Association, GLMTF, Keystone Shipping, and others commented that the option of converting steamships to motor vessels is not feasible given the cost ($22 million per ship), the lack of shipyard capacity to convert all steamships, the time required, and the loss of capacity while the ships are being retrofit. For similar reasons it is not possible to build new vessels to replace these older steamships.

10.4.2.3 Operating cost for vessels that use intermediate fuel will be significantly higher

What Commenters Said:

In addition to the steamships that cannot use distillate fuel, a significant number of the remaining Great Lakes vessels will also have difficulties complying with the ECA fuel requirements. These are the 13 U.S. vessels that have Category 3 marine diesel propulsion engines and currently use residual or intermediate fuels in their engines. Several commenters wrote that while these vessels can switch to distillate, the additional cost would threaten their long-term viability and result in their losing business to rail and truck transportation.

Another commenter noted that vessels previously burning intermediate fuel would face increased costs of $1/gallon. These costs would apply all the time; these vessels cannot engage in fuel switching to reduce costs because they would operate 100 percent of the time in the ECA. Others noted that the operating cost increase will be even higher when the distillate requirement begins in 2015; commenters said that currently distillate fuel on the lakes is priced 3 times more than residual fuel. Some commenters questioned whether these ships could switch to 1.0 percent S fuel by 2012 because the fuel won't be available (see 10.4.2.4, below), forcing them to switch to distillate fuel earlier.

Some commenters noted that mandating these intermediate-fuel vessels to burn low sulfur distillate fuel could require retrofitting or replacing some vessel engines at significant

expense to accommodate the cleaner but far more expensive, and its not clear if these retrofits could be made given cost and shipyard constraints (American Maritime Officers, 0318; Midwest Energy Resources, 0342),

Some of these commenters pointed out that there is already fierce competition between lake and rail transportation for some services, and an increase in lake transportation operating costs would result in the loss of business to rail or even truck. According to this commenter, marine freight rates are low because ships don't need to be replaced. If owners incur large capital costs to enable fuel switching or to employ an alternative technology to comply with the rule, the higher freight rates could mean loss of business to rail or truck since haulage or freight contracts can be lost to shipping and railroad competitors for just pennies a ton. Some commenters argued that these increased operating costs cannot be easily passed on to customers. Some commenters also noted that the ECA fuel requirements could come on top of requirements for ballast water and future energy efficiency standards, and that the combination of all of these requirements will make land-based transportation more attractive.

Interlake Steamship noted that they recently repowered 2 steam vessels with Tier 2 engines, and is planning to repower another. They said the $60M investment was based on the ability to use intermediate fuel; these projects would have very low or possibly negative return if the proposed rule is implemented (Interlake Steamship, 0268). Similarly, CSPA noted that for vessels costing on average $50 million and having decades-long lifespan, it is unrealistic to implement wholesale changes over only a two to five-year period. They said emission reductions can necessarily only take place within the investment profile of the current fleet and the difficult economic climate in both the U.S. and Canada. The Seaway is operating at approximately 50 percent capacity due to the economic crisis, and the proposed program would result in further reductions in traffic and economic activity, affecting their revenues and profitability (CSPA, 0359).

10.4.2.4 Fuel meeting the 1.0 percent fuel sulfur standard for 2012 will not be available on the Great Lakes

What Commenters Said:

Several commenters, expressed concern that a 1.0 percent fuel sulfur standard would drive the use of distillate fuel. Canadian Shipowners Association commented that, based on a recent survey of fuel refiners in Canada conducted by their members, there is little likelihood of residual fuels with a sulfur content of less than 1.0 percent being available to support the Great Lakes market in 2012. Canadian Shipowners Association claimed that, due to fuel stability issues, it is not technically feasible to blend intermediate fuel oils with MDO beyond a certain proportion; usually, 30 or 40 centistokes is the lower threshold of viscosity below which the fuel becomes unstable and therefore unusable. At this level of blending, it may be possible to meet the 1.0 percent limit, but this is highly unlikely. As a result, the 1.0 percent sulfur limit for 2012 effectively means that vessels will be forced to burn distillate fuel while in waters covered by the proposed rule (including all of the Great Lakes) in order to be certain that the 1.0 percent limit has been met. Effectively, this imposes the 0.1 percent sulfur limit in 2012, not in 2015, as it should be under MARPOL Annex VI. Effectively, according to Canadian Shipowners Association, the marine industry will have no alternative but to switch to distillate fuels once the fuel standard is reduced to 1.0 percent sulfur content.

Matson Navigation Company expressed concern whether the fuels that would be required for a North American ECA would be available in 2012 and 2015. They stated there are indications that fuel suppliers will not provide such fuels in California and some other states which would effectively force Matson to use ultra low sulfur fuel in boilers, propulsion and auxiliary engines onboard vessels for an extended period of time.

The American Petroleum Institute commented that removal of sulfur from heavy fuel oil is technically more difficult and much more costly than is the case for gasoline or diesel fuel, which are core refinery products. They stated that large volumes of low-sulfur residual marine fuel cannot reliably be produced at sulfur contents below 1.0 percent due to technical, quality, and economic constraints. In contrast, Murphy Oil, which supplies marine fuel to the Great Lakes, commented that they intend to meet the 1.0 percent fuel sulfur standard in 2012 with a residual fuel that will be created by blending with ultra low sulfur diesel fuel.

The Canadian shipowners also noted that U.S. refineries are designed to produce gasoline, and that the Montreal refinery may close, further affecting the availability of fuel on the Lakes.

10.4.2.5 The ECA requirements will lead to a transportation modal shift on the Great Lakes

What Commenters Said:

The above comments raise two sets of issues: those associated with the use of lower sulfur fuel in steamships, and those associated with the increase price of fuel for other vessels that use residual or intermediate fuels. As a result of these effects, commenters predict there will be a serious transportation modal shift on the Great Lakes, away from marine shipping and toward rail and truck transportation. Many of these commenters criticize EPA for not considering the potential of modal shift with respect to the environmental impacts and increased congestion stemming from a significant increase in rail and truck traffic. Some of these commenters suggest that, unlike the demand for ocean marine transportation services, the demand for marine transportation on the Lakes is not inelastic and that increases in marine freight rates due to compliance with the fuel requirements could lead marine transportation consumers to use other modes of transportation. The Chamber of Marine Shipping cites a Canadian study that says shifting to distillate could induce a shift of 10-20 percent of existing market share to other modes of transportation (Chamber of Marine Shipping, 0353). More specifically, the Canadian Shipowners Association estimates that fuel costs will increase up to about 63 percent, resulting in operating costs increasing about 32 percent. This translates to a 15 to 20 percent increase in commodity freight rates which will lead at least some commodities (aggregates, possibly some Canadian agricultural movements) to switch to other transportation modes. (Canadian Shipowners Association, 0245)

The Canadian Shipowners Association also noted that in addition to increased fuel prices, the use of lower sulfur fuel will lead to increased transportation time making ship transportation less attractive. MDO has a higher calorific value by weight but a lower calorific value by volume. As a result, engine rack settings will have to be increased by about 10 percent to obtain the same power output, and it is unknown if fuel racks will be able to adjust to these changes due to the age of the ships. This could lead to a speed loss of 2.5 to 5 percent, although this has not been quantified.

One commenter noted that freshwater shipping has been a major factor in controlling rail costs and absent that control railroads would raise their rates – potentially to the rates charged by trucks. Thus the higher operating costs will result in modal shift to rail and trucks, whose rates will also increase. One commenter noted that the increased fuel prices will affect more than just the vessels that operate exclusively on the Lakes. This commenter noted that foreign vessels will not want to incur the additional cost of ECA-compliant fuel for the 2,340 mile voyage up the seaway system to discharge or pick up cargo on the Lakes. Instead, they will call on coastal ports, leading to more traffic by rail or truck to move bulk materials to those ports. The net result is that the costs for everything using these materials, from electricity to steel, will increase.

10.4.2.6 The ECA requirements will lead to source shifts on the Great Lakes

What Commenters Said:

Several commenters raised the possibility of source shifts as a result of the application of the ECA requirements within the Great Lakes. According to these commenters, centers of production will move from the Great Lakes to other areas of the country, or even to other countries where the environmental laws are less stringent.

10.4.2.7 The ECA requirements will lead to Refinery Product Shifts

What Commenters Said:

Murphy Oil commented that they can blend fuel to meet the 1.0 percent standard. However, the product that they currently sell to ships on the Great Lakes (#6 fuel oil), will need to find a different market beginning in 2015, since it cannot meet the 0.1 percent fuel sulfur limit. This fuel oil will need to be transported to other locations by rail and/or truck, which will result in additional emissions.

10.4.3 Our Response

The stakeholders who submitted the comments summarized above voiced the concern that the program will have significant adverse effects on Great Lakes transportation. With regard to steamers, the concern is that these vessels cannot safely use compliant fuel and will therefore be removed from the fleet. This removal of marine transportation capacity will necessarily result in a modal shift to rail and truck since new cargo vessels cannot be built in time to replace this ship capacity and, even if they could, the cost would be prohibitive. With regard to vessels that use intermediate fuel, there are two concerns. The first concern is that 1.0 percent sulfur residual fuel will not be available in 2012, forcing vessels to use distillate fuel. The second concern is that the additional operating costs associated with lower sulfur fuel are so high as to render marine transportation noncompetitive with rail and truck. If vessels owners lose freight, there is a risk their operations will become financially unsound and these ships will also be withdrawn from the fleet, adding to a transportation modal shift. The loss of capacity and increased operating costs will also lead to source shifts for the steel, cement, and oil industries. These modal and source shifts will lead to more, not less, air pollution, and will put the local economy at risk.

With regard to the steamship concerns, these comments and follow-up conversations with ship owners have clarified the special challenges posed by the use of lower sulfur fuel distillate

fuel in steam engines. While we continue to believe this is a technical problem that can be solved, we acknowledge that this safety concern must be addressed for existing steamships. These technical concerns led us to consider a number of options to address the safety issue. Since our proposal was published, however, Congress acted to address this concern by placing a prohibition on EPA's use of funds, in this fiscal year, to finalize application of the ECA fuel sulfur requirements to internal waters for existing steamships that operate exclusively within the Great Lakes. Therefore, we are excluding Great Lakes steamships from the ECA fuel sulfur requirements. For the purpose of this exclusion, Great Lakes steamships means vessels, operating exclusively on the Great Lakes and Saint Lawrence Seaway, whose primary propulsion is a steam turbine or steam reciprocating engine. In addition, these steamships must have been in service on the Great Lakes prior to October 30, 2009. The exclusion does not extend to diesel propulsion Category 3 vessels with auxiliary boilers. The immediate impact of this revision to our program is that the existing 13 U.S.-flag steamships may continue to operate on the Great Lakes with no change to their operation, and thus this pressure for a modal shift from marine to land-based transportation is removed.

With regard to the availability of 1 percent sulfur intermediate fuel on the Lakes, studies performed in support of the 2008 Amendment to Annex VI and the North American ECA application conclude that 1.0 percent sulfur fuel will generally be available in the marine fuels market. The International Maritime Organization established a Cross Government/Industry Scientific Group of Experts to evaluate the effects of the various fuel standard options under consideration at that time. This expert group engaged the services of EnSys to assess the impact of these fuel options using the WORLD model. The final report from the Experts Study presents contains details on the capabilities of the WORLD model and explains why the WORLD model was chosen as the appropriate tool for modeling the economic impacts of the different fuel options. Two of the scenarios modeled in support of this effort were consideration of a 1.0 percent sulfur global requirement and evaluation of a 1.0 percent sulfur requirement for multiple ECAs (North America, Europe/Mediterranean Sea/Black Sea, and Asia) totaling 15 percent of global bunker fuel consumption. The supporting work performed by EnSys for API, considered a global 1.0 percent fuel sulfur requirement to drive the use of distillate fuel, but the multiple ECA scenario to be met through the use of lower sulfur residual fuel. In its final report, EnSys stated that it would require a sulfur standard below 0.5 percent to force a conversion to distillate fuel. They did note that refiners may choose to blend residual fuel with distillate blendstocks to comply with a 1.0 percent sulfur requirement rather than investing in residual fuel processing equipment. This modeling suggests that 1.0 percent sulfur residual fuels can be supplied in quantities large enough to support the proposed North American ECA in addition to existing ECAs in the Baltic and North Sea. In response to the comments from the Canadian Shipowners Association, the characteristics of U.S. refineries (designed to produce gasoline) were reflected in this analysis. While the WORLD model may not have taken into account the situation at the Montreal refinery, it is not clear from these comments why the Montreal refinery is expected to close or whether it is likely to be a direct result of this program.

API's comments are consistent with the EnSys study. API suggested that removing sulfur from residual fuel is difficult and costly. The EnSys study noted that refiners would choose to blend distillate into bunker fuels rather than remove sulfur through residual fuel processing. API expressed concern over whether large volumes of lower sulfur residual fuel can be produced, not whether it can be produced at all. The EnSys study shows that lower sulfur residual fuel could be produced in sufficient quantities for multiple ECAs in quantities greater

than needed to supply the U.S./Canada ECA and all other known ECAs, but not for a global requirement. In addition, to the extent that equivalent technology, such as SO_X scrubbers, is used to comply with this requirement, the demand for 1.0 percent sulfur fuel would be reduced.

Canadian Shipowners' Association commented that blending current residual fuel with enough distillate to reduce the sulfur content below 1.0 percent could result in very low viscosity fuel. However, this argument focuses on blending distillate fuel into current residual fuel rather than producing a lower sulfur residual fuel. In other words, CSA did not consider the amount, or fuel sulfur content, of the distillate that must be blended into the refinery bottoms to create the marine residual oil in the first place. By blending a low sulfur distillate into the refinery bottoms, a lower sulfur residual fuel oil can be produced. This lower sulfur residual fuel could then be blended with marine distillate oil, under current practices, to make the various IFO grades. Finally, Murphy Oil, which supplies bunker fuel to the Great Lakes carriers, stated that it can produce the 1.0 percent sulfur residual fuel.

We acknowledge that just because 1.0 percent sulfur fuel is available, either through refining or blending, this does not necessarily mean it will be available on the Great Lakes. As noted above, Great Lakes shippers raised concerns that it would not be available and they would be required to purchase distillate fuel to comply with the 1.0 percent sulfur requirement. However, we note that they also commented that residual fuels used on the Great Lakes have much lower baseline sulfur levels than residual fuels used in vessels operating in the oceans. This is important because it means that less processing or blending of the fuel would be necessary to meet the 1.0 percent sulfur limit. Based on this observation, and the comments from Murphy Oil, we continue to expect that bunkering terminals on the Great Lakes will be able to supply 1.0 percent residual fuel.

Nevertheless, this final rule contains a provision that would allow ships on the Great Lakes to purchase fuel with fuel sulfur content in excess of 1.0 percent to comply with the ECA requirements. Specifically, in lieu of a study of the availability of 1.0 percent sulfur fuel on the Great Lakes recommended by Congress, we are including a provision that would allow the use of 1.0 percent fuel sulfur (10,000 ppm) standard if residual fuel meeting that standard is not available on the Great Lakes. This provision will ensure that operators on the Great Lakes will be able to buy marine residual fuels when the 10,000 ppm S standard applies even if compliant 10,000 ppm S fuel is not available. Under this provision, if marine residual fuel meeting the 10,000 ppm S standard is not available, it will not be a violation of our standards for vessel operators to bunker and use marine residual fuel with sulfur content above 10,000 ppm S provided the fuel they purchase is the lowest sulfur marine residual fuel available at the port. We believe this market based approach will provide a significant incentive to fuel suppliers to provide 10,000 ppm S fuel, while giving Great Lakes shippers confidence that marine residual fuel will be available for their use during the 10,000 ppm S fuel program.

With regard to the cost of 0.1 percent sulfur fuel on the Great Lakes, many commenters are concerned about price differential between residual and distillate fuel. Some commenters said distillate costs three times more than residual; others said that distillate costs $1.00 per gallon more. The Canadian Shipowners Association study of potential mode shifts on the Lakes as a result of applying the ECA fuel requirements estimated fuel cost increases in 2012 and 2015. Using publicly posted prices at Sarnia for various marine fuels for 2008, and spot prices for June 7, 2008 and July 10, 2009, they estimate that fuel costs will increase up to 63 percent in 2012 (based on the June 7, 2008 price differential between Bunker C and MDO) and up to 76

percent in 2016 (based on the differential between Bunker C and MGO plus a $100 premium reflecting a "likely" cost increase by refiners). Their study estimates price differential to be between $86 and $116 per tonne for MDO, and $106 to $130 per tonne for MGO+$100, compared to Bunker C. However, it should be noted that these price differentials for Bunker C, MDO, and MGO+$100 (fuel prices for 2008 on average and June 7, 2008 specifically) occurred during a period of extreme prices for distillate. The world fuel market was experiencing very strong demand for distillate in the mid-2008 period which pushed up the price for distillate to near-historic highs. This market condition persisted until it peaked in August, 2008; by December 2008 prices dropped significantly and prices in 2009 have more closely tracked historic rates. Therefore, a more appropriate comparison is the July 10, 2009 baseline. When the data reported in the Canadian study for these prices is used, they estimates fuel cost increases of 28 percent for 2012 (based on the differential between Bunker C and MGO) and 47 percent for 2015 (based on the differential between Bunker C and MDO+$100), which are estimated to increase operating costs by about 6 and 9 percent, respectively.

A price differential of $1.00 per gallon is about the same as a differential of about $500 per tonne of fuel. While such a differential is possible, having occurred in rather unique circumstances in the past, and is unlikely to recur if the supply and demand fuel markets remain roughly in equilibrium (i.e., there are no unexpected shocks in the market that would lead the price of residual or distillate fuel to be abnormally high) and the oil prices are close to those being projected by EIA. On December 6, the WTI oil price was $75.47 per barrel. This is significantly higher than the $57/barrel WTI used on our refinery modeling, yet the price difference between residual and distillate fuel is close to our estimate of $145/tonne, or $0.30/gallon (see Table 10-2). Because residual and distillate fuel are commodities, there is no reason to believe that the price differential between residual and distillate fuel on the Great Lakes will be vastly different from the differential on the world market.

Table 10-1 Fuel Price Differential, Residual and Distillate Fuels

	Houston	**Singapore**	**Rotterdam**	**Fujairah**
$/tonne				
Distillate	$642.5	$627.0	$619.5	$634.5
IFO 380	$459.5	$472.5	$454.0	$472.0
Difference	$183.0	$154.5	$165.5	$162.5
$/gallon				
Distillate	$2.03	$1.99	$1.96	$2.01
IFO 380	$1.69	$1.74	$1.67	$1.74
Difference	$0.34	$0.25	$0.29	$0.27
WTI	$75.47			
distillate	$315.80 gallon/tonne			
IFO 380	271.56 gallon/tonne			
Source: www.bunkerworld.com, 12/7/2009				

Table 10-2 Estimated Marine Fuel Costs (Source: RIA, Chap 5)

FUEL	UNITS	REFERENCE CASE		HIGH PRICE CASE	
		Baseline	ECA	Baseline	ECA
MGO	$/bbl	$ 61.75	$ 62.23	$ 102.70	$ 103.03
	$/tonne	$ 464	$ 468	$ 772	$ 775
MDO	$/bbl	$ 61.89	$ 62.95	$ 102.38	$ 103.70
	$/tonne	$ 458	$ 466	$ 757	$ 767
IFO	$/bbl	$ 49.87	$ 49.63	$ 83.14	$ 82.52
	$/tonne	$ 322	$ 321	$ 538	$ 534

With regard to transportation modal shift, the analysis for this program relies on the assumption of nearly perfectly inelastic demand for marine transportation services. For ocean-going vessels, this effect is fairly clear: to ship a container from Asia to the United States there are only two options: ship or air, and air is several times more expensive than ship and therefore is not a feasible option for all but the lightest or most perishable goods.

We acknowledge that there are alternative, land-based modes of transportation available for goods that are moved on the Great Lakes (truck and rail). However, as noted by many of the commenters, the USACE study shows that the next least costly mode of transportation would result in an addition $3.6 billion of transportation costs per year for Great Lakes industries. The study also reports that a Great Lakes bulk carrier can move one ton of cargo 607 miles on one gallon of fuel; a train can move a ton of cargo only 202 miles on one gallon of fuel, and a truck only 59 miles. The Great Lakes St. Lawrence Seaway Study performed by Transport Canada et al. (2007) provides an estimate of the cost savings offered by the Great Lakes St. Lawrence Seaway by commodity (Table 3.1, reproduced below). This information shows that the next least expensive form of transportation would cost an addition $9.35/ton transported , for metallic minerals and ores, and the average cost savings for shipping by the Lakes is about $14.80 per ton. In comparison, the fuel requirements will impose an addition cost of about $0.40 per ton. Given all of this information, it is hard to imagine that the additional fuel costs associated with using ECA-compliant fuel will result in a large transportation modal shift, especially since rail and truck transportation will be required to use ULSD in the same time frame.

Table 10-3 Transportation Savings Offered by the GLSLS by commodity
(in descending order of total shipper savings, numbers rounded to nearest 1,000)

COMMIDITY GROUP	SAMPLE SIZE TONS	SAVINGS/TON	TOTAL SAVINGS
Aggregates and Slag	37,813.000	$16.03	$605,988,000
Metallic Minerals and Ores	62,395,300	$19.35	$583,464,000
Coal, Coke, Pet Code	40,783,600	$13.36	$544,961,000
Iron, Steel and Other Metals	12,872,200	$32.49	$418,219,000
Non-metallic Minerals	8,883,600	$19,50	$173,224,000
Wheat	8,046,500	$17.37	$139,776,000
Petroleum Products	3,932,500	$18.60	$73,137,000
Other Grains and Feed Ingredients	1,819,400	$28.20	$51,330,000
Soybeans	1,691,800	$22.26	$37,667,000
Corn	1,169,300	$23.61	$27,614,000
Total	179,407,200	$14.80	$2,665,360,000

Source: Great Lakes St. Lawrence Seaway Study, Final Report, Fall 2007, available at http://www.glsls-study.com/Supporting%20documents/GLSLS%20finalreport%20Fall%202007.pdf

The price differentials provided in the study performed for the Canadian Shipowners Association suggests that the rate increases associated with fuel cost increases along the order expected to result from this program are small: 6 percent rate increase in 2012 and 9 percent increase in 2015 as a result of switching to MDO (2012) and MGO+$100 (2015). These rate increase are not likely to be high enough to provoke shippers to switch to higher cost rail or truck transportation. It should be noted that even at the higher price differentials cited by the Canadian Shipowners Association, their study suggests that while such high fuel prices would lead to a 20 percent shift in the aggregate/construction market, the main impacts on the salt and Canadian petroleum industries would be an inability to re-capture market share already lost to rail. Also, while they note agricultural freight could decrease by 12.3 percent, this would be constrained by the carrying capacity of the rail system.

In addition, it is common practice in the marine industry to include a fuel cost differential in transportation contracts, passing those costs on to the industrial transportation purchaser. As long as the capacity is there, and as noted above the provision for steam ships and the special provisions for 1.0 percent sulfur fuel are designed to retain the shipping capacity on the Great Lakes, the fuel differential for ships will be much less than shifting to rail or truck. This is particularly true given the limited capacity for the rail and truck industries, and the infeasibility of a construction program to provide sufficient rail cars, locomotives, and trucks to replace the Great Lakes vessels. As noted by several commenters, there currently aren't enough rail cars and truck to take over the transportation of aggregates, iron ore, coal, and other bulk goods to facilities along the lakes, and such a building campaign would cost many times the increased costs associated with the program. This will also limit any possible modal shift caused by increased operating costs on the Great Lakes. Also would need to be considered are the additional costs in road congestion, both on the rails and on the interstates, the additional costs in time, for loading and unloading individual railcars and trucks, as well as movement over these different distances. Finally, operating costs for rail and truck transportation will be changing, due to the requirements for ultra-low sulfur diesel fuel, and personnel costs may be different.

In sum, while our costs analysis shows that operating costs will increase for all vessels, including Great Lakes vessels, this increase will not be so high as to cause the removal of vessels from the U.S. Great Lakes fleet or the shift of significant amounts of cargo from ships to land-based transportation in the Great Lakes area. It should be noted that about half of the large U.S. Great Lakes cargo vessels already operate on distillate fuel and have for some time. These U.S. vessels are subject to our domestic federal engine standards and are already unable to purchase distillate fuel in the United States that is not compliant with the ECA requirements. Also, at least some of the Great Lakes vessels currently operating on residual fuel are ocean-going vessels that will be required to comply with the relevant engine and fuel requirements as they pass through the North American ECA on their way to the Lakes.

With regard to the potential speed reductions that may result from using MDO, the Canadian comments were unsure about the actual impacts. However, a speed reduction of 2.5 to 5 percent may be within the existing speed variations on the Lakes due to weather, congestion at the locks, port scheduling, etc. Also, shipowners have indicated to EPA that they are constantly changing their scheduling based on market needs, and therefore it may be difficult to estimate

with any precision the "typical" time of a ship voyage on the lakes and timing changes that may be associated with fuel changes.

We acknowledge that investing in upgrades and retrofits in an uncertain regulatory climate is difficult. At the same time, however, we cannot delay implementation of standards due to private investment decisions. We expect that most companies that operate on the Lakes will be able to accommodate the new requirements. To address those cases of extreme hardship, we have developed an economic hardship provision that may help companies in these situations adjust to the new regulatory regime. This is discussed in more detail in Section VI of the preamble. Specifically, at the suggestion of Congress, we are finalizing a provision that provides for relief in the event of serious economic hardship that allows Great Lakes shippers to petition EPA for a temporary exemption from the 2015 fuel sulfur standards (0.1 percent sulfur). The shipper must show that despite taking all possible business, technical, and economic steps to comply with the fuel sulfur requirements, the burden of compliance costs would create a serious economic hardship for the company. Once again, this provision will help reduce the likelihood of a reduction in carrying capacity on the Lakes.

The combination of these three provisions (steamers, 1.0 percent fuel requirement, economic hardship) is expected to reduce or eliminate any pressure for transportation modal shift on the Great Lakes.

For similar reasons, we do not expect there to be a source shift as a result of the provision extending the ECA requirements within the Great Lakes. We do not expect there to be a reduction in shipping capacity on the Great Lakes, and therefore bulk carriers will continue to be able to provide transportation for the steel, cement, utility, and refining industries. While the fuel price differential will increase operating costs, this increase will not be large enough to warrant taking steel or other production offshore, or to the interior of the country, since the costs of moving a plant are not likely to exceed the additional operating costs associated with the program. For example, if steelmakers shut Great Lakes furnaces and take steel production offshore, they will incur not only the costs of ramping up production elsewhere but also the costs associated with transporting the finished product back into the United States, including the additional costs associated with operating in the coastal ECA and the additional costs associated with moving the goods by rail or truck to the plants where they will eventually be used as inputs to make other goods.

With respect to a refinery shift, it is not clear that transporting #6 fuel to other facilities for their use will necessarily result in increased emissions. This will depend on how much fuel is transferred, the final use of the fuel (e.g., in a power plant subject to emission controls) and how the fuel is transferred (by low-emission heavy-duty trucks or locomotives equipped with Tier 3 or Tier 4 engines). Any resulting emission impacts should be compared to the emissions from Category 3 engines that currently operate on the Lakes and that use higher sulfur residual fuel emissions, making them the equivalent of an uncontrolled power plant operating on the lakes. In any case, it is not clear that moving large amounts of #6 fuel away from the Lakes will be necessary as it may be used offered for sale for use outside the ECA or for use on vessels with SO_X scrubbers or vessels that operate outside of the ECA.

Finally, in response to these comments and at the suggestion of Congress[53], we will perform an additional analysis of the economic impacts of the application of the ECA requirements on ships operating on the Great Lakes. This study, which we expect to complete by summer 2010, will be developed cooperatively with stakeholders and will examine the economic impacts of the rule on great lakes shipping including whether these standards may lead to a modal shift away from marine transportation and toward transportation by rail or truck. We will take into account data and studies submitted by participants as well as other information.

In the meantime, we are finalizing this rule as proposed, including the Great Lakes in the internal waterways to be covered by the ECA requirements through our authority granted in the Act to Prevent Pollution from Ships (see Sections 5.4 and 5.5 of this document for more information about APPS).

10.5 Comments on EPA's Economic Impact Analysis regarding the Great Lakes

We performed an Economic Impact Assessment to estimate the social costs associated with the proposed program and how those costs will be shared across stakeholders. This analysis was performed at the national level, for the program as a whole. The total estimated social costs of the coordinated strategy in 2030 are equivalent to the estimated engineering compliance costs of the program, at approximately $3.1 billion. We estimate that compliance with the coordinated strategy would increase the price of a new vessel by 0.5 to 2 percent, depending on the vessel type. The price impact of the coordinated strategy on the marine transportation services sector would vary, depending on the route and the amount of time spent in waterways covered by the engine and fuel controls (the U.S. ECA and U.S. internal waters covered by the coordinated strategy). For example, we estimate that the cost of operating a ship in liner service between Singapore, Seattle, and Los Angeles/Long Beach, which includes about 1,700 nm of operation in waterways covered by the coordinated strategy, would increase by about 3 percent. On the Lakes, operating costs would increase by the full amount of the fuel price increase (see response in Section 10.4.3, above).

What Commenters Said:

Several commenters suggested that EPA is incorrect in assuming nearly perfectly inelastic demand for marine transportation services on the Lakes. Unlike ocean-going marine transportation, Great Lakes marine transportation market is elastic because there are alternative modes of transportation available in this geographic market, namely rail and truck. (ArcelorMittal, 2080). The Transportation Institute notes considerable attention and effort has been given to encourage shippers to consider waterborne transportation for coastwise movement of cargo that otherwise would be carried on truck or rail, with the goal of relieving traffic congestion, saving infrastructure dollars, reducing greenhouse gases, limiting harmful surface runoff, and avoiding highway fatalities. This suggests that demand for this transportation is more elastic. (Transportation Institute, 0302).

[53] 111th Congress, "Department of the Interior, Environment, and Related Agencies Appropriations Act, 2010" and associated legislative report.

Our Response:

As explained in the RIA for this rule and in the discussion in Section 10.4.4, our assumption that the demand for marine transportation services is nearly perfectly inelastic relies on the observation that most cargoes shipped by vessel over the Great Lakes could be shipped by rail or truck only at great expense: by using hundreds of rail cars or thousands of trucks per load. This makes demand for marine transportation inelastic since, as noted above, the next most favorable mode is expensive and difficult. The price differential between shipping by vessel and shipping by rail favors shipping in most cases, and the small increase in operating costs associated with this rule is not likely to change that dynamic, especially given the upcoming stringent standards for rail engines and fuels.

Nevertheless, in response to these comments and as suggested by Congress, we will perform an additional analysis of the economic impacts of the application of the ECA requirements on ships operating on the Great Lakes. This study, which we expect to complete by Summer, 2010, will be developed cooperatively with stakeholders and will examine whether these standards may lead to a modal shift away from marine transportation and toward transportation by rail or truck. We may reconsider the assumption of nearly perfectly inelastic demand for marine transportation services on the Great Lakes, depending on the outcome of this study.

In the meantime, we are finalizing this rule as proposed, including the Great Lakes in the internal waterways to be covered by the ECA requirements through our authority granted in the Act to Prevent Pollution from Ships (see Sections 5.4 and 5.5 of this document for more information about APPS). If the study referred to above suggests a different approach is more appropriate, it will be addressed in a separate future rulemaking.

10.6 Comments Requesting Extended Comment Period, Separate Rule

10.6.1 EPA Should Extend the Comment Period for this Rule

What Commenters Said:

Several commenters requested that EPA extend comment period to raise issues so EPA will have a complete record it can consider before finalizing the standards. Several of these commenters expressed concern that EPA only recently extended the proposed regulations to include vessels that operate solely on the Great Lakes, and that this action was taken without any meaningful consultation with affected parties and with only 30 days to provide comment on the rule. See Calumet Area Industrial Commission (0332); Calumet Area Industrial Commission (0332); Duluth Area Chamber of Commerce (0282); Keystone Shipping (0349); ArcelorMittel USA, 0280; Greater Cleveland Area Partnership; Great Lakes Metro Chambers Coalition. Others requested 90 additional days for comment (Agri-Fine, 0315; Development Association, 0279; Kindra Lake Towing, 0291; CSX, 0300; Superior Mayor (0352); City of Sarnia, ON (0306). The Canadian Shipowners Association stated that while the proposal was made available 7/1/09, it was not published until 8/29/09; published rule set out comment period deadline of 9/28/09. They noted that normal practice is to allow 30-90 days after publication, and stated that more time is needed to give this issue the consideration it requires and therefore EPA should allowed the maximum permitted time for comment on the official, published version of the proposed rule if it intends on proceeding to the final rulemaking with this flawed regulation

(Canadian Shipowners Association, 0245). Kinder Morgan, Raffin Construction Co., Two Harbors Area Chamber of Commerce, and Ozinga Materials also requested a 90-day extension of the comment period (Kinder Morgan, 0326; Raffin Construction Co., 0344; Two Harbors Area Chamber of Commerce, 0324; Ozinga Materials, 0343)

Some commenters noted that the 30-days comment period of the proposed rules and the short planned implementation scheduled remove any feasible option for the development and implementation of survival business options (Warner Petroleum Corporation, 0251; Keystone Shipping, 0349)

Our Response:

EPA began this action with an Advance Notice of Proposed Rulemaking, published on December 7, 2007 (72 FR 69522). We received specific comments on the application of a fuel standard on the Great Lakes from the Lake Carriers' Association (see EPA-HQ-OAR-2007-0121-0101).

Given that the standards we are adopting under the Clean Air Act are largely consistent with the Annex VI requirements and our ANPRM, and given the opportunity for interested persons to view the proposal well before it was published, we believe commenters have had sufficient time to review the substance of the proposal and prepare their written comments. This is supported by the large number of comments we received on the proposal and the ANPRM from a wide range of interested parties. See response in Section 1.3 for additional discussion.

Our proposal was a direct outgrowth of the ANRPM and our March 2009 proposal. The NPRM was signed June 26, 2009 and was made available on our website on July 1, 2009 (www.epa.gov/otaq/oceanvessels.htm). An e-mail note informing all parties that commented on our ANRPM notifying them that the NPRM was available was sent by EPA on July 1, 2009. The comment period was extended to September 28, 2009. We have accepted and responded to comments received as late as November 30, 2009.

The implementation schedule for the ECA fuel requirements will not begin earlier than August 2012 and this final rule contains various provisions that will help owners of Great Lakes vessels as they develop their compliance plans.

10.6.2 EPA Should Establish a Separate Action for the Great Lakes

What Commenters Said:

Several commenters were concerned that EPA did not adequately study the effects of applying the ECA requirements on the Great Lakes, with once commenter stating that EPA must simply concede that it lacks the scientific data … to justify extending the coastal ECAs to the Great Lakes; this commenter recommended EPA postpone implementation until the need has been substantiated (Lake Carriers' Association, 0345). Other commenters requested that EPA suspend application of ECA rules to the Great Lakes region and establish a separate regulatory action to focus on appropriate and workable emission regulations for Great Lakes vessel operators. As a part of a separate regulatory action, they asked that EPA conduct a thorough analysis of the impact of emissions from Great Lakes vessels on regional air quality, an analysis of the technical challenges unique to Great Lakes vessels, an analysis of potential modal shift

impacts, and an analysis of employment impacts in the Great Lakes region. EPA should develop and disclose sound scientific data to show whether and to what extent fuel from these vessels presents risks to public health; give the public adequate time to consider the data; and disclose alternatives that will both reduce pollution and preserve the economic activity that relies on movement of cargo across the Great Lakes. Finally, they urged EPA to work cooperatively with Great Lakes vessel operators to determine if there are alternative options available, such as exhaust emission control technologies. Several of these commenters also requested that EPA suspend application of the ECA to the Great Lakes until such an action is completed. Keystone Shipping enclosed a copy of their report, *Great Lakes Steam Vessels Regional Contribution* for consideration. (American Great Lakes Ports Association, 0262; Wisconsin Commercial Ports Association, 0368; American Maritime Officers, 0318; ArcelorMittel USA, 0280; Great Lakes Metro Chambers Coalition, 0258; Wisconsin Commercial Ports Association, 0368; Duluth Seaway, 0283; Duluth-Superior Propeller Club, 0292; AISI, 0295; CGLI, 0296; Transportation Institute, 0302; Port of Cleveland, 0310; DTE, 0328; Greater Cleveland Partnership, 0330; Midwest Energy Resources, 0342; Minnesota Chamber of Commerce, 0350; Chamber of Marine Commerce, 0353; CSPA, 0359; USS, 0376; Lafarge, 0383; Duluth Area Chamber of Commerce, 0282; Calumet Area Industrial Commission, 0332); Government of Canada, 0252; Great Lakes Metro Chambers Coalition, 0258; Keystone Shipping, 0349; Lake Carriers' Association, 0345; Great Lakes Maritime Task Force, 0269;

Our Response:

For all of the reasons explained elsewhere in the RIA for this rule and in this S&A document concerning the inventory and air quality impacts of ships that operate on the Great Lakes, we are not excluding the Great Lakes from this final rule.

Nevertheless, in response to these comments and as suggested by Congress, we will perform an additional analysis of the economic impacts of the application of the ECA requirements on ships operating on the Great Lakes. This study, which we expect to complete by Summer, 2010, will be developed cooperatively with stakeholders and will examine the economic impacts of the rule on great lakes shipping including whether these standards may lead to a modal shift away from marine transportation and toward transportation by rail or truck. We will take into account data and studies submitted by participants as well as other information.

In the meantime, we are finalizing this rule as proposed, including the Great Lakes in the internal waterways to be covered by the ECA requirements through our authority granted in the Act to Prevent Pollution from Ships (see Sections 5.4 and 5.5 of this document for more information about APPS).

10.7 Other Comments on EPA's Analysis for the Great Lakes Region

10.7.1 EPA must consider National Security impacts and energy impacts

What Commenters Said:

One commenter noted that 50 percent of lakers have been laid up for past 2 years. The industry expected recovery by 2012 but with ECA that is not likely. This means that more mariners will lose their jobs to injudicious regulation and the result will be fewer merchant marines available for national security functions (American Maritime Officers, 0318)

Another commenter expressed concern that modal transportation shift from marine to rail and truck transportation would also compromise efforts to reduce dependence on foreign supplies of petroleum products (AISI, 0295)

Our Response:

We understand the importance of the merchant marine to the national security of the United States. However, we do not think that our rule, in and of itself, will result in a change in the amount of goods transported on the lakes by vessels or the number of merchant mariners employed in this sector. Nevertheless, we can consider this aspect of the fuel requirements in the study which we plan to complete by Summer 2010 to look at the economic impacts of the application of the ECA requirements within the Great Lakes.

For the reasons discussed in 10.4.3, above, we do not expect there to be a transportation modal shift from marine to rail or truck. Therefore, we do not expect increases in fuel consumption from that shift and greater dependence on foreign energy than would otherwise be the case.

10.7.2 EPA must consider the Impacts on the Canadian Economy

What Commenters Said:

The Maritime Trades Department and The Great Lakes Maritime Task Force commented that EPA did not take into consideration the impact of this rule on Canada, its maritime industry, or the related industries there and in the U.S. (Maritime Trades Department, 0321; Great Lakes Maritime Task Force, 0269). Canadian Shipowners Association recommended that EPA should develop a binational, cooperative approach for the Lakes with Canada (Canadian Shipowners Association, 0245)

Our Response:

We are not legally required to take into account the economic impacts of regulatory action on the Canadian economy. However, Canadian vessels were included in the analysis performed for this rule in the foreign vessel category for our inventory and cost analyses.

10.7.3 EPA must consider the impacts on small businesses that operate on the Great Lakes

What Commenters Said:

The Great Lakes Maritime Task Force (0269), among others, noted that EPA is required by the Regulatory Flexibility Act to consider the impacts of the proposed program on small businesses. The Proposal completely ignores the impact on shippers who are small businesses.

Our Response:

We have examined the impacts of this requirement on small businesses operating regulated vessels on the Great Lakes for the final rule. It can be found in Chapter 8 of the RIA for this rule. Based on this analysis, we find that this provision will not have a significant impact

on a substantial number of small businesses. In addition, as noted above, we are including provisions with respect to steamships, fuels, and economic hardship that may help any small businesses who have difficulty complying with the requirements.

10.7.4 EPA Must Consider Alternative Approaches for the Great Lakes

We received comments urging us to consider alternatives. One set of comments recommended a different fuel sulfur limit. Another recommended an averaging program.

10.7.4.1 EPA should consider an alternative fuel sulfur limit

What Commenters Said:

Some commenters suggested EPA consider alternative programs for ships that operate on the Great Lakes.

A number of commenters stated that the residual fuel used by Great Lakes vessels has a lower sulfur content than residual fuel used by ships operating in the ocean. Several commenters said that the sulfur content in residual fuel sold in the Great Lakes is less than 2.5 percent but not as low as 1.0 percent. The Canadian Shipowners Association (CSA) commented that he current bunker fuel range is 1.6-2.7 percent sulfur and this is blended with various proportions of marine diesel oil (MDO). CSA and Lower Lakes Towing commented that the current sulfur content of residual fuels sold on the Great Lakes is 1.7 percent. Keystone stated that the average sulfur content for all residual fuel consumed by their eight vessels, from 2006 through August 2009, was 1.62 percent and that the weighted average for all heavy fuel burning Jones Act vessels is estimated at about 1.55 percent sulfur. Great Lakes Marine Task Force commented that one of their members calculated an average fuel sulfur level of the heavy and intermediate fuel they consumed over the past 4.5 years was 1.5 percent. Murphy Oil commented that its refinery terminal is the only fuel supply location for vessels operating in the upper Great Lakes and that its residual fuel averages about 1.5 percent sulfur.

CSA and Lower Lake Towing recommended that the 1.0 percent fuel sulfur standard be replaced with a 1.5 percent fuel sulfur standard that applies until 2020, with further reductions as technology and fuel supplies will allow for. They commented that fuel suppliers would be able to make 1.5 percent fuel residual fuel available on the Great Lakes. Keystone recommended a 2.5 percent fuel sulfur standard for domestic Great Lake shipping beginning in 2012, followed by a 0.1 percent sulfur standard in 2020.

One commenter suggested a solution that would preserve net environmental benefits would be to reduce the fuel sulfur limit from 4.5 percent to 1.5 percent in the Great Lakes until 2020. This would allow these inland vessels to continue to burn residual fuels at or below 1.5 percent, the current ECA limit, and would allow time for those vessels to be phased out and new, more efficient vessels be built to replace them (Canadian Shipowners, hearing testimony).

Keystone Shipping (0349) provided a range of options for EPA to consider for the Great Lakes, including:

a. Remove the designation of the Great Lakes as an ECA
b. Exempt Jones Act trade from the Great Lakes ECA

c. Exempt steam ships from the ECA
d. Extend the phase-in period for vessels physically confined to the Great Lakes, i.e., cannot ever and will not ever trade outside the ECA
e. Apply global PM and SO_X controls to the Great Lakes (2012: 3.5 percent sulfur; 2020: 0.5 percent sulfur)
f. Apply PM and SO_X controls – more stringent than global, but less imminently devastating to the U.S. domestic Great Lakes shipping (2012: 2.5 percent sulfur: 2020: 0.1 percent sulfur)

Our Response:

The approach described by the Canadian Shipowners would be difficult because of the complications it would create for foreign vessels that operate on the Lakes. Foreign vessels account for about one-third of the vessels on the Lakes. This alternative would allow them to also use the higher sulfur fuels. But because they would be required to comply with the ECA outside the Great Lakes system, this means they would either have to use 1.0 percent sulfur fuel while operating in the Lakes or install yet another fuel tank for the 1.5 percent fuel that they would use in a "relaxed" ECA on the Great Lakes. This would add greater complication to the compliance program for the ECA. Further, these foreign ships could be held in noncompliance at their period surveys if they use a higher sulfur fuel in an ECA. Finally, it's not clear how these vessels would refuel on the Lakes.

We do not agree with comments that the near term fuel sulfur limit for the Great Lakes should be raised to a higher limit of 1.5 percent or 2.5 percent as suggested by some commenters. As discussed above, we believe that 1.0 percent fuel will be available in the Great Lakes when the ECA standards go into place. In addition, we are finalizing near-term relief provisions with respect to the availability of compliant residual fuel on the Great Lakes. We also do not agree that the long term standard of 0.1 percent sulfur should be delayed or relaxed for the Great Lakes. As discussed above, we expect this fuel to be widely available in 2015.

Finally, and perhaps most importantly, allowing the use of 1.5 percent sulfur fuel on the Lakes until 2020 will not achieve the same environmental goals as requiring the use of 1.0 percent fuel sulfur as required by Annex VI and APPS, which reduces the fuels sulfur content level to 0.1 percent by 2015. The net result of such an alternative would be additional emissions from ships until 2020.

10.7.4.2 EPA should consider a fleet averaging approach

What Commenters Said:

In their supplemental comments, Canadian Shipowners Association requested that EPA consider a fleet averaging approach. This program would extend the 0.1 percent sulfur fuel requirement to 2020, but require the fuel sulfur content of fuel used in a fleet to meet a declining average, beginning in 2011. This approach would allow owners time to investigate alternative technologies and implement investment options. It also avoids any issues associated with fuel blending. Specifically, shipowners could meet the declining average through using any one or more of several options:

- Retire older less fuel efficient vessels (steamships)

- Invest in new more fuel efficient vessels
- Use alternate abatement technology (freshwater scrubbers)
- Change existing vessels over to MDO
- Retrofit marine engines to improve fuel efficiency and fleet average
- Consider alternative fuels such as biodiesel and natural gas

Our Response:

While we are not generally opposed to averaging provisions in our mobile source programs, the programs that we do have (e.g., manufacturer fleet averaging programs) are feasible because these program will not, on average, have a detrimental impact on human health and the environment. Most of these programs are designed to provide flexibilities to manufacturers as they phase in production of new emission technology. In this case, we are not revising our program to adopt an averaging approach in this final rule. We received no detailed analysis that estimates the benefits of such a program. In addition, we are not persuaded a fleet-wide averaging approach would yield the same air quality and environmental benefits as the proposed program, due to variability in where ships operate, the amount of time they operate, and the variability in the actual operations between ships.

10.7.5 Vessels that Operate on the Great Lakes Already Participate in a Program to Reduce Emissions.

What Commenters Said:

The Canadian Shipowners' Association noted that ships on Lakes already participate in Green Marine program to reduce their emissions (Canadian Shipowners' Association, 0245). This program, described in more detail at http://www.green-marine.org/action.html, was created for the St. Lawrence and Great Lakes regions. It is a voluntary industry-led environmental program whose focus is environmental protection and sustainability. It provides three tools to help member businesses achieve even more effective environmental management: training, research and development, and adoption of an environmental management system. Participants that have fulfilled the requirements of the program receive the Green Marine seal of certification. Many ships also have Environmental Management systems, and shipowners are constantly optimizing vessel schedules and routes to transport the maximum amount of goods in the most efficient way possible. See also comments from Chamber of Marine Shipping, 0353, Canadian Steel Producers Association, 0359.

Our Response:

We applaud the creation of the Green Marine program, and acknowledge that these voluntary industry programs can have a significant positive impact on the environment in the Lakes. However, EPA is legally required by the Clean Air Act to address air emissions from Category 3 marine diesel engines that operate in the Great Lakes region through mandatory emission standards. In addition, we believe it is most equitable to extend the international program to the Great Lakes through an enforceable program. However, we are optimistic that the results of this program can be augmented by the Green Marine program which takes into account all aspects of ship emissions, not just air emissions.

10.7.6 Low-Speed 2-stroke engines are designed to operate on heavy fuel

What Commenters Said:

Canadian Shipowners Association commented that low-speed 2-stroke engines are designed to operate on heavy fuel, and that Wartsila warned in a 2002 paper that a switch from high-sulfur heavy fuel oil to low-sulfur fuels can lead to engine issues. They noted that a permanent switch to MDO will require consultation with engine manufacturers to determine proper modifications (Canadian Shipowners Association, 0245).

Our Response:

Both Wartsila and MAN B&W, the main Category 3 marine diesel engine manufacturers, have issued guidance about fuel switching. For Wärtsilä, see LOW SULPHUR GUIDELINES (Made: 23rd March, 2005; Updated: 9th January, 2006; available at http://www.wartsila.com/Wartsila/global//docs/en/ship_power/media_publications/technical_papers/low_sulphur_guidelines.pdf). For MAN B&W, see Operation on Low-Sulphur Fuels - Two-Stroke Engines (available at http://www.manbw.com/files/news/filesof5271/Operation%20on%20Low-Sulphur%20Fuels.pdf

More discussion of this issue can be found in Chapter 4 of the RIA for this rule.

CHAPTER 11: Technical Amendments

What We Proposed:

The comments in this section generally correspond to Section IV.E of the preamble to the proposed rule, where we described several amendments to the regulations that apply for various highway and nonroad engine programs. The applicable regulatory provisions for these requirements are in 40 CFR parts 86, 89, 92, 94, 1027, 1033, 1039, 1045, 1048, 1051, 1054, 1060, 1065, and 1068. These regulations apply to a variety of sizes and classes of diesel and gasoline engines, both land-based and marine.

We received some comments regarding minor typographical errors. We are finalizing these changes, but are not summarizing them in this chapter. We also received comments related to the testing provisions in part 1065 that are summarized in a separate memorandum to the docket.

The following sections summarize and respond to the remaining comments. We start with issues of general interest, followed by a separate discussion of issues for each category of engines.

11.1 General Compliance Provisions (40 Part 1068) and Other Broadly Applicable Comments

Comment: EMA objected to the proposed amendment at §1039.240 and §1048.240 requiring that all test points over the durability demonstration meet the emission standard, especially on account of the variability associated with measuring very low emission levels. They also pointed out that the proposed language would be problematic for carry-across deterioration factors where it would be unclear how to evaluate an engine's compliance at mid-life measurement points.

Response: Our interpretation of this longstanding requirement is that engines must meet emission standards "throughout the useful life." It would not be appropriate to certify an engine family if we can expect from the durability demonstration that the engine will be exceeding emission standards for some portion of the engine's useful life. This is a concern especially as we consider the potentially opposing trends for changing HC and NO_X emission levels relative to an NO_X+HC emission standard. An engine might have higher emission levels at some mid-life point than at the end of the useful life.

We have modified the regulatory language to more carefully specify that the durability demonstration applies within the engine family. In other words, for a given engine family, all measured results are expected to be below the applicable standard. This applies for individual test points and the full-life value after applying the deterioration factor. When applying a carry-across deterioration factor to a different engine family, the compliance demonstration for the second engine family would be based solely on the official emission result (from the low-hour test) and the deteriorated emission result, which results fro m applying the deterioration factor to the official emission result.

Issue	Response
§1027.105: EMD requested that we update the fee values in the regulations since they have changed substantially from the published values that applied in 2005.	The regulations provide a means of calculating the applicable fees for each new calendar year. It is true that the tabulated numbers are outdated, but this would occur again in another year. We plan to revise this approach in the future, likely to replace the table of values (for illustration) with a link to an EPA website that is updated regularly to include the current figures. In the meantime, this information is available in guidance letters we post on the Internet at: http://www.epa.gov/otaq/guidance.htm
§1068.1: EMA requested that we add text to clarify that land-based turbines are not subject to part 1068, and that marine turbines are not subject to part 1068 before they are subject to emission standards under part 1042.	We have revised §1042.670 to explicitly exclude marine gas turbine engines from part 1068 until those engines are subject to standards. For land-based engines, we are relying on the language of §1068.1 and §1068.260 to make this clear. Section 1068.1 states that the part applies to engines that are regulated by one of the applicable standard-setting parts. Land-based gas turbine engines are not subject to emission standards. Also, §1068.260 specifies that the presumption that engines are subject to part 1068 does not apply for gas turbine engines.
§1068.25, §1068.105, §1068.261, §1068.501: Impco supports the proposed changes.	We are adopting the changes as proposed.
EMA expressed a concern about the wide range of regulatory provisions requiring manufacturers to get EPA approval. With no deadline for EPA decisions on those requests for approval, manufacturers are concerned that they may be forced into a need to make decisions regarding their products before the EPA decision is made and communicated. EMA recommends that EPA implement formal response deadline and develop a process for manufacturers to presume EPA approval under certain circumstances.	We agree that waiting for EPA approval can be difficult for manufacturers. That is why some provisions allow manufacturers to presume approval or automatically grant approval when a certificate is issued. However, in certain cases these approaches are not appropriate. We commit to evaluate our review practices to eliminate any unnecessary delays for approvals.
§1033.801: EMD objected to the proposed change to the definition of "total hydrocarbon" and "total hydrocarbon equivalent," pointing out that the specified hydrogen-to-carbon ratio should be characterized as an atomic ratio, not a mass ratio.	We agree with the comment and have revised the regulation accordingly. This change applies for several engine categories.

Issue	Response
EMA recommended clarifying the regulations where we define engine families to give examples of "cylinder arrangements", such as in-line or v-block construction. This applies across engine categories.	We agree with the comment and have revised the regulation accordingly. This applies for everything except locomotives.
EMA noted that the provisions in §1039.235 related to EPA testing were misplaced, given that the section heading describes only manufacturers' testing responsibilities. They also objected to the specific provision allowing EPA to adjust engines differently than the manufacturers' settings/adjustments for their own testing. It was also unclear whether this provision applied only for certification, or also for selective enforcement audits.	We agree that the section heading should be revised to reflect the fact that EPA may also perform tests related to certification. These provisions do not apply for selective enforcement audits, though we may consider adding comparable language to §1068.410 in the future. We have revised the regulation to clarify that the adjustments in question are those that the manufacturer applies during production. If the engine might be calibrated or assembled with a certain degree of variability, we specifically should not be constrained to test engines only in the configuration selected by the manufacturer. This is the primary purpose for manufacturers to identify the production variability in their application for certification. We are making these changes in §1039.235 and §1042.235. We intend to make these same changes for nonroad spark-ignition engines in a later rulemaking to ensure that affected companies will have the opportunity to comment on the changes.
§1039.715(b): EMA recommended that we the term "reserved credits" in paragraph (b) to define the term..	We agree with the comment and have revised the regulation accordingly. This also applies for §1033.715 and §1042.715. We intend to make these same changes for nonroad spark-ignition engines in a later rulemaking.
§1039.735: EMA suggested that we revise the regulation to accommodate the fact that engine manufacturers do not always know the ultimate purchaser for their engines, which is already reflected in current EPA implementation of the emission-credit provisions.	We agree with the comment and have revised the regulation accordingly. This also applies for §1042.735. We intend to make these same changes for nonroad spark-ignition engines in a later rulemaking.
EMA, Impco, and the Industrial Truck Association objected to the proposed definition of "carryover," pointing out that the language seemed to prevent manufacturers from making any changes if they wanted to use carryover emission data to certify an engine family for a subsequent model year. They recommended removing the second sentence of the proposed definition.	We did not intend for the proposed language to be limiting as understood by the commenters, since it referred "generally" to the fact that things don't change from year to year. However, we acknowledge that the proposed language could continue to cause confusion. We agree that a shorter definition referring to the actual carryover provisions in the regulations is sufficient. This change applies for §1033.901, §1042.901, §1039.801, and §1048.801.

Issue	Response
EMA recommended revising the ABT reporting requirements to refer to "U.S.-directed production volumes" rather than "engines with a point of first retail sale in the United States." This would allow for manufacturers to make a good-faith effort to determine whether engines are destined for customers in the United States or not.	We agree with the comment and making this change in §1033.730, §1039.730, §1042.730, and §1054.730. We intend to make these same changes for Marine SI engines and recreational vehicles in a later rulemaking to ensure that affected companies will have the opportunity to comment on the changes.
§1068.103(a): EMA shared a concern that limiting engine families to a certain set of engine configurations without a proper definition could cause confusion. In particular, they noted that the engine configuration should not be defined by parts that are not emission-related.	We have adopted a definition of "engine configuration" in most of the standard-setting parts that would address EMA's concern. We have revised part 1068 to include this definition.
§1068.105(a): EMA and NMMA recommended adding a provision specifically allowing equipment manufacturers (or boat builders) to install engines built before new standards started to apply if they were held in the engine manufacturer's inventory.	We agree with the comment and have revised the regulation accordingly.
§1068.240: EMA recommended making several minor changes to the section as proposed: (1) correcting cross references to the revised paragraphs, (2) revising the labeling requirements to avoid differentiating the different kinds of replacement engines, (3) revising the description of "installation instructions" to refer instead to assembling complete engines.	We agree with the corrected references and have revised the regulation accordingly. We also agree that it is not necessary for labels to differentiate among the different kinds of replacement engines (this is already the case for replacement engines under §1068.240(b). Finally, we specifically intend for the manufacturers installation instructions to be something they can provide by, for example, posting on a publicly accessible website.
§1068.240: EMA suggested that we clarify that replacement engines meeting the tracking requirements of §1068.240(b) not count toward the sales limit for untracked replacement engines even if it was not clear at the point of initial shipment to a distributor that the engine would meet all these requirements.	We agree with the comment and have revised the regulation accordingly.

Issue	Response
§1068.240: EMA requested that we accommodate shipment of engines over 7 liters per cylinder to distributors before they made the demonstrations required under §1068.240(b). This would allow them to respond more quickly if an operator would have an urgent need for a replacement engine.	We understand that manufacturers want to be responsive to demand for replacement engines, but we are aware that there is a risk to selling noncompliant engines to a distributor and trusting the distributor to follow regulatory requirements in spite of the potential to sell the engine as if it were certified. We are therefore adopting a provision to allow this practice, but are including a requirement for the manufacturer to report to EPA annually regarding the disposition of the engine. The manufacturer would also need to send a final report after the engine is sold as a replacement engine, describing how all the requirements and conditions associated with the exemption were met. If an engine is installed in a vessel in a way that does not meet the requirements of the replacement engine exemption (or Annex VI, as applicable), the manufacturer would be found in violation of §1068.101.
§1068.40: EMA suggested a general change to allow for lead time to implement technical amendments, providing an automatic period of 90 days after publication of a final rule in the Federal Register, or until the start of the next model year.	Most of the changes we make under part 1068 do not require lead time because they deal with compliance provisions describing what to do if something goes wrong, or the changes add in flexibility. We are revising §1068.40 in two ways to address EMA's concern. First, we are adding a provision that specifically allows lead time for the changes we are making to §1068.240. If we are aware of any similar changes that call for lead time, we can include those with a date for applying the new requirements. Second, we are including an automatic 60-day grace period for any changes that require a change in production procedures (including labels), a redesign of the product, or a change in the information required for an application for certification. We believe that any other changes to the regulation should apply immediately when the rule change goes into effect.
§1068.225: EMA pointed out the need for a correction to a reference in paragraph (b).	We agree with the comment and have revised the regulation accordingly.
§1068.260(a) and (b): EMA requested that we clarify how these two paragraphs apply for emission-related components that are not covered by the delegated-assembly provisions of §1068.261.	We have modified these paragraphs to more clearly state how we allow manufacturers to ship partially assembled engines, whether the emission-related components are shipped along with the engine, or whether they are shipped separately. In particular, for parts that are not covered by §1068.261, we would generally allow for separate shipment, but we may specify certain conditions to ensure that engines will eventually be assembled in a certified configuration.

Issue	Response
§1068.261: EMA recommended that we clarify which parts of aftertreatment systems and air intake systems are subject to the delegated-assembly provisions, including several specific recommendations about which parts to include and which parts to exclude.	We are not prepared to make final determinations in this regard in the current rulemaking. We look forward to working with engine manufacturers in the future to further clarify these provisions.
§1068.260(c): EMA recommended that we revise this provision to mirror §1068.261(b), where manufacturers keep records instead of asking for approval for an exemption related to intra-company shipments.	We agree with the comment and have revised the regulation accordingly.

In addition, we are making minor changes to the regulations describing how to amend an application for certification. In particular, we specify that the application must be amended based on new information that should be included in the application, rather than referring only to information that is included in the application. We are also cleaning up the characterization of what information must be included in the amendment. We are making these changes to §§1033.225, 1039.225, and 1042.225. We intend to make these changes to other parts in a later rulemaking.

11.2 Land-based Nonroad Spark-ignition Engines above 19 kW (40 Part 1048)

Issue	Response
§1048.240(e): Impco and the Industrial Truck Association were concerned that the proposed language would prevent manufacturers from demonstrating compliance with the field-testing standards using engines that no longer qualified as low-hour engines.	We agree that there was no intent to limit testing to low-hour engines. We have revised the regulatory text to require manufacturers to demonstrate that engines comply with field-testing standards "throughout the useful life." Depending on the circumstances, manufacturers might apply deterioration factors to emission results from low-hour engines, but other approaches may also be acceptable.
§1048.405: Impco and the Industrial Truck Association objected to the proposed change to allow 24 months to complete testing after EPA received an in-use test plan (rather than starting the clock after approving the plan), recommending that the language remain unchanged to avoid penalizing manufacturers if EPA takes a long time to review the plan, or revise the regulation to specify that plans are presumed to be approved within 30 days. EMA suggested that we omit the 24-month specification and replace it with a 36-month requirement from the point of selecting a family for in-use testing. EMA also suggested adding a provision to allow EPA to approve an extension of the deadline for circumstances beyond the manufacturer's control.	We believe EMA's suggested approach of specifying a 36-month deadline for the overall testing program is the most effective way to address the various concerns for EPA and manufacturers. We are also including in the final rule a requirement that manufacturers respond to an EPA request for additional information within 30 days. This would address the problem we have experienced recently by multiple manufacturers that submitted incomplete or inadequate testing plans and were not very responsive to requests for complete and correct information. The regulation currently allows us to cancel the test plan for circumstances beyond the manufacturers' control. We agree that it would be appropriate to allow us instead to extend the deadlines.
§1048.30: EMA objected to the proposed provision requiring manufacturers to keep records for one year if the records are not related to certification.	The regulations specify several recordkeeping requirements that are unrelated to certification, such as records related to exempt engines. Unless we state how long these records must be kept, any such recordkeeping requirement will not be meaningful or enforceable. It is therefore not appropriate to make the suggested change.

11.3 Locomotives (40 Parts 92 and 1033)

Locomotives Operating in Mexico

Comment: Under current regulations, EPA does not allow locomotive manufacturers to introduce engine designs that increase NO_X emissions when the locomotive is operating in Mexico, even if the engine design would reverse the adjustment to allow the locomotive to conform to NO_X emissions standards when it returns to the United States. EPA noted its concerns over the potential adverse impacts on U.S. air quality, recognizing that emissions that occur outside the territorial boundaries of the U.S. can impact air quality within the U.S. Locomotive manufacturers had objected to these regulations, claiming EPA had no authority to prevent such designs. We did not propose to change these provisions, but we requested comment on what conditions we should set if we allow such designs, including whether to approve the design only if it was calibrated to remain in the low NO_X mode until it was at least 200 miles away from the U.S. border.

Two locomotive manufacturers commented that EPA does not have authority to prevent these engine designs because they affect emissions performance outside the United States. They also provided additional comments with respect to how EPA should apply and enforce an allowance to include such features. EMA commented that EPA should not allow such features for Tier 4 locomotives because of concerns about catalyst damage.

Response: The two commenters who support these engine designs continue to argue that EPA does not have authority to prevent these engine designs because they affect emissions performance outside the United States. The commenters did not support EPA allowing such an engine design only if it operates beyond 200 miles beyond U.S. territory, saying any limitation of operation outside of the United States is inappropriate. As we stated previously, we disagree with the commenters' claim that EPA does not have the authority to restrict the types of AECDs in question for locomotives introduced into U.S. commerce. Section 203(a)(3) of the CAA gives EPA broad authority to prohibit the installation of components that render emission controls inoperative. As we have stated, emissions that occur in Mexico can and do affect U.S. air quality, and EPA is authorized to deny introduction of locomotives and locomotive engines into American commerce that adversely effect air quality in the United States. Neither commenter disputes that emissions outside the U.S. can affect U.S. air quality. Neither the Clean Air Act nor the existing regulations require any exceptions for AECDs that only operate outside the U.S.

In addition, the comment from EMA indicates that, at least with regard to one type of emission control (SCR), extended disabling of the emission control could lead to deterioration or malfunction of the emission control that would prevent the controls from performing as intended when they would be reactivated. This is further reason not to allow such AECDs in these engines that go back and forth over the United States border. We reject the commenters' argument regarding EPA authority, and for the reasons discussed above, EPA will not change its regulations to allow such AECDs.

Energy Saving Design Features

Comment: GE opposed the proposed change to §1033.530(h) to limit this provision to new features that were not commonly incorporated into locomotives in 2008. In particular they were concerned about distributed power technology that uses radio controls to optimize operation of locomotives throughout a train. Such technology was being incorporated into some but not all newly manufactured locomotives in 2008, but not incorporated into most older locomotives.

Response: We agree with GE that the case of distributed power technology is not clear. Therefore, we are adding a special provision to §1033.530(h) to address it. This provision specifies that the adjustment for incorporating distributed power in freshly manufactured locomotives will be prorated by 50 percent. This proration reflects that fact that the fraction of a manufacturer's new sales that included distributed power has varied over the last few years and varied by manufacturer. In some cases, it has been as low as zero percent, while in others it has been essentially all locomotives.

Issue	Response
GE asked that hotel power for passenger locomotives be excluded from the definition of AECD.	We continue to believe that hotel power falls within the proper scope of what is an AECD. However, GE's concern is being addressed by clarifying that hotel power is not a defeat device, provided the same emission controls are applied in hotel and non-hotel modes (as was already specified in the existing regulations) or we approve necessary modification of the emission controls.
EMD requested that we modify the interim test fuel allowances of §92.12 and §1033.150.	This issue was addressed in a previous rulemaking (73 FR 3797).

11.4 Land-based Nonroad Diesel Engines (40 Parts 89 and 1039)

Issue	Response
§1039.125: EMA recommended changing the maintenance specifications for particulate traps and trap oxidizers to allow for replacement of these components, not just cleaning and repair.	In practice, the filters on such parts may be cleaned in place on the equipment but may also be removed from the equipment and cleaned in a separate location (making it impractical to install the original filter). If the filter is cleaned in a separate location, then a previously cleaned alternate filter could be installed in its place. We believe the existing regulatory language that allows for the cleaning of such parts allows for the installation of an alternate cleaned filter. Under such practice the replacement filter should be comparable to the original filter since the filter must enable the engine to meet the same emission standard and subsequent maintenance intervals as the originally certified configuration.
§1039.125 EMA also requested that we allow manufacturers to schedule maintenance more frequently, and that we allow them to replace old trap-related components with new components.	We agree with EMA's suggestion that we allow scheduling shorter intervals and replacement with new components, provided that manufacturers pay for the maintenance and they demonstrate to our satisfaction that such maintenance will be performed according to the specified schedule. We are also finalizing the proposed revisions to §1039.125(a)(5), which allows the manufacturer to request shorter maintenance intervals under limited conditions. Any shorter maintenance intervals approved by EPA under §1039.125(a)(5) do not require the manufacturer to pay for such maintenance unless the manufacturer chooses to do so to fulfill the requirements of §1039.125(a)(1).
§1039.135: EMA pointed out that they will need lead time to implement the revised labeling requirements. They also requested that we clarify that a flexible approach to identifying dates of manufacture is acceptable to avoid potentially conflicting requirements. Dates may be expressed for example as 06/2009 or 2009/06.	We agree that manufacturers may need several months to modify their labeling practices. We have included a provision in §1039.104 to specify that the new requirement does not start until the 2011 model year. As we noted in an earlier rule, "We intend to further standardize labeling with further specification related to the format of the build date. For example, we believe it is not appropriate to identify the date with coded alphanumeric characters intended to disguise the information from anyone who is not privy to the coded meaning. Spelling out the full date is clearly acceptable. We would also consider acceptable certain standard abbreviations, such as Sep 10 or 09/10 to indicate September 2010. We plan to propose detailed specifications in a future rulemaking to describe a range of acceptable ways to identify an engine's build date." We would also agree that reversing the month and year is acceptable.

Issue	Response
§1039.201(h): EMA questioned whether the proposed provision allowing for alternate certification processes was necessary considering that §1039.605 seems to address a similar concern. EMA requested that we at least clarify that manufacturers modifying certified engines and recertifying them in a different configuration are responsible for their work. EMA recommended the following language: "The alternate certification provisions identified are the responsibility of the party responsible for the conversion of the engine from its original certified motor vehicle configuration to its nonroad configuration."	The provisions of §1039.605 describe how a company can avoid re-certifying an engine that is adapted for use in an application that differs from the original certification. There are circumstances where a different kind of conversion or modification would occur that would require recertification. It may be difficult to follow all the normal certification procedures under these circumstances (such as doing a low-hour test and applying a deterioration factor to an engine that has already undergone substantial operation in the field). We need to be able to adjust the certification protocol for these unusual circumstances. It should be clear that the manufacturer that modifies and recertifies the engine is responsible for their work, both to certify the engines and to modify them in a way that is consistent with their certification. Note also that the prohibitions identified in §1068.101 apply to the company that introduces engines into commerce.
§1039.225(f): EMA objected to the regulatory language specifying that manufacturers raising their FEL for a family mid-year must use the higher FEL for the whole model year (unless they raise the FEL to reflect a new engine configuration in the family).	The proposed approach is something we have already adopted in most of our nonroad programs. Manufacturers establish an FEL for the emission family based on certification testing with the worst-case engine configuration. If manufacturers add a new configuration that has higher emissions than the original certification engine, they should be able to raise the FEL starting with the introduction of the new engine configuration. Absent such a change, it is not clear that there would be any technical basis for changing the FEL only after some point in time. If the engine family needs a higher FEL to ensure compliance, then this conclusion should apply for the whole engine family. We note further that the provision in question specifies only that the higher FEL applies for calculating emission credits at the end of the model year; it does not address in-use compliance.
§1039.245: EMA suggested revising the regulatory text to refer to "steady-state and transient test cycles" instead of "duty-cycle emission standards".	EMA properly interpreted the regulatory provision as proposed. We refer to "duty-cycle emission standards" and "duty-cycle testing" in various places in the regulations to contrast these with not-to-exceed testing and standards, which do not involve operation over a specific duty cycle. We believe this change is not necessary.

Issue	Response
§1039.715: EMA recommended that we revise the description of banked emission credits. (1) Paragraph (a) should continue to limit credit banking. (2) Use the term "reserved credits" in paragraph (b) to define the term..	Part of the rationale for making the changes to §1039.715 was to clarify the relationship between banking and averaging. Banking refers simply to carrying over a balance of emission credits; this involves no transaction or use of the credits. Manufacturers "spend" these credits by trading them or using averaging to demonstrate compliance in a given model year. It is not necessary to limit banking to an averaging set because there is no transaction. We limit credit exchanges to an averaging set for trading and averaging, where there is a transaction to use up the credits. We agree that paragraph (b) should identify reserved credits and have revised the regulation accordingly.
§1039.801: EMA pointed out that the definition of "new nonroad engine" mistakenly omitted the table describing when emission standards started to apply.	We agree with the comment and have revised the regulation accordingly.
§89.109(c)(4): EMA suggested adding in a specific allowance to schedule maintenance involving replacement of certain components.	The provisions of §89.101(b) already allow for manufacturers to include part replacements in their scheduled maintenance, since this is consistent with the approach specified in §1039.125 starting with Tier 4 standards. We will approve any request to apply this Tier 4 provision early.
§1039.627(a)(3): EMA pointed out that the references to §1039.102 should point to paragraph (e), not (d).	We agree with the comment and have revised the regulation accordingly.

11.5 Evaporative Emission Standards for Nonroad Spark-ignition Engines and Equipment (40 Part 1060)

Issue	Response
§1060.520: MTD pointed out that our sample calculation for determining a mass emission rate did not match the lead-in description and appeared to include an error in the final value.	We agree with the comment and have revised the regulation accordingly.
§1060.137: EMA suggested making a broader accommodation to omit labeling of very small components.	We agree with the comment and have revised the regulation accordingly.

11.6 Heavy-Duty Highway Engines

Issue	Response
§86.1001-84: EMA suggested allowing manufacturers of heavy-duty vehicles certified using chassis-based test procedures to use the SEA provision in part 86, subpart G, or in part 1068, subpart E.	We agree with the comment and have revised the regulation accordingly. This provision is stated in §86.601-84.
§1068.410: EMA suggested that we specify that the idle-speed adjustments not apply for heavy-duty highway engines.	We believe it is appropriate to omit the specified idle-speed adjustment for all manufacturers. This is most likely to apply for Small SI engines and we concluded that this provision should not be part of production-line testing for those engines.
§1068.415(a): EMA recommended that we add regulatory text to preserve the current policy describing which test procedures apply for selective enforcement audits with heavy-duty engines.	We agree with the comment. We have included the paragraph in question in the revised §86.1001, and not in part 1068, since part 86 is the standard-setting part for heavy-duty highway engines.
§1068.415(c): EMA expressed a concern that an expectation for testing two engines per day was unreasonable in many cases. Paying for outside testing would be very costly, would add complexity with respect to quality control, and would be difficult to justify. EMA requested that we clarify that limited testing capability in existing certification test cells should be a valid bases for approving a reduced testing rate.	We are aware that selective enforcement audit testing would pose a challenge for manufacturers that likely have a full schedule of testing for their test labs. We will take this into account as best we can in the effort to complete the audit in a timely way. We expect to revisit this provision in a future rule to more carefully specify minimum testing rates for engines tested under selective enforcement auditing.
§1068.440: EMA recommended revising the text to avoid using the term “production-line testing,” since this may be understood to imply a requirement for manufacturers to perform routine testing with production engines. This would not be appropriate for heavy-duty highway engines.	We agree with the comment and have revised the regulation accordingly.

11.7 Marine Spark-ignition Engines (40 Part 1045)

Issue	Response
§1045.405: Impco and the Industrial Truck Association objected to the proposed change to allow 24 months to complete testing after EPA received an in-use test plan (rather than starting the clock after approving the plan), recommending that the language remain unchanged to avoid penalizing manufacturers if EPA takes a long time to review the plan, or revise the regulation to specify that plans are presumed to be approved within 30 days. EMA suggested that we omit the 24-month specification and replace it with a 36-month requirement from the point of selecting a family for in-use testing. EMA also suggested adding a provision to allow EPA to approve an extension of the deadline for circumstances beyond the manufacturer's control.	We believe EMA's suggested approach of specifying a 36-month deadline for the overall testing program is the most effective way to address the various concerns for EPA and manufacturers. We are also including in the final rule a requirement that manufacturers respond to an EPA request for additional information within 30 days. This would address the problem we have experienced recently by multiple manufacturers that submitted incomplete or inadequate testing plans and were not very responsive to requests for complete and correct information. The regulation currently allows us to cancel the test plan for circumstances beyond the manufacturers' control. We agree that it would be appropriate to allow us instead to extend the deadlines.