United States
Environmental Protection
Agency

Air and Radiation

EPA420-R-00-027
December 2000

EPA

Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements:

Response to Comments

EPA420-R-00-027
December 2000

Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements:

Response to Comments

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

December 21, 2000

RESPONSE TO COMMENTS DOCUMENT

Heavy Duty Engine and Vehicle Standards and
Highway Diesel Fuel Sulfur Control Requirements

Table of Contents

Page

RESPONSE TO COMMENTS DOCUMENT

Heavy Duty Engine and Vehicle Standards and
Highway Diesel Fuel Sulfur Control Requirements

Table of Contents (cont.)

Page

RESPONSE TO COMMENTS DOCUMENT

Heavy Duty Engine and Vehicle Standards and
Highway Diesel Fuel Sulfur Control Requirements

Table of Contents (cont.)

Page

RESPONSE TO COMMENTS DOCUMENT

Heavy Duty Engine and Vehicle Standards and
Highway Diesel Fuel Sulfur Control Requirements

Table of Contents (cont.)

Page

ISSUE 1: GENERAL POSITION STATEMENTS

Issue 1.1: Supports Rule

(A) Expressed general support for EPA's fuels standards and engine and vehicle standards as proposed since the implementation of this program will lead to significant health benefits and/or environmental benefits.

(1) Most of the commenters to the NPRM supported the rule without providing any supporting information or detailed analysis. Commenters expressed their support by citing a variety of issues and studies related to environmental, health and visibility impacts. Specific comments on these issues are addressed in Issue 2. This comment was made by approximately 14,400 private citizens.

Letters:

10th District PTA (IV-F-166, 190) **p. 262**
20/20 Vision (IV-F-58, 117) **p. 272**
Air Pollution Control District (IV-D-55) **p. 1**
ALA, ED, and Clean Air Trust (IV-D-282) **p. (all)**
Alliance of Automobile Manufacturers (IV-F-9), (IV-G-50)
American Lung Association (IV-D-270) **p. 2**, (IV-F-60, 161, 164, 181, 192) **p. 8** (IV-F- 72, 191) **p. 146**
American Lung Association of CT (IV-D-63) **p. 1**
American Lung Association of NH (IV-D-116) **p. 1**
American Lung Association of WI (IV-D-32) **p. 1**
American Lung Association of GA (IV-F- 117) **p. 258**
American Lung Association of Metropolitan Chicago (IV-F-13)
American Lung Association of TN (IV-D-19) **p. 1**, (IV-F-117) **p. 62**
Atlanta Bicycle Campaign (IV-F- 117) **p. 231**
Bay Area Air Quality Management District (IV-D-139) **p. 1**
Bagnarol-Reyes, Carolina, et. al. (IV-G-24)
Beaumont High School Environmental Club (IV-F- 190) **p. 141**)
Beeman, Nora, et. al. (IV-G-09)
Bellomo, A. (IV-F-190) **p. 89**
Berger, Paul (IV-F- 191) **p. 66**
Bishop, Mark (IV-F-12)
Bottino, Maria (IV-F-116) **p. 326**
Boulder County Clean Air Consortium (IV-D-35) **p. 1**
Bramble Berry, Inc. (IV-G-35) **p. 1**
Bressler, Daniel J. (IV-D-104) **p. 1**
Burns, Troy (IV-F- 117) **p. 260**
CA Air Resources Board (IV-F-190) **p. 13**
CA PIRG (IV-F- 190) **p. 175** (IV-F-190) **p. 280**
CA Transit Association (IV-G-14) **p. 1**
CA Trucking Association (IV-F-190) **p. 38** (IV-F- 116) **p. 150** (IV-F-192) **p. 34**
CO Allergy & Asthma Centers (IV-F- 191) **p. 76**
CO Environmental Coalition (IV-F- 191) **p. 237**
CO People's Environmental and Economic Network (IV-F-191) **p. 222**
CT DEP (IV-F-49)

Caesar, M. (IV-D-339)
Carson Forest Watch (IV-D-106)
Cardona, Marina (IV-F-116) **p. 291**
Carruthers, Hilary (IV-F- 117) **p. 60**
Cassara, Bob (IV-F-65)
Center for Neighborhood Technology (IV-F-11)
Chameides, Michael (IV-F- 117) **p. 262**
Chicago Asthma Consortium (IV-F-22)
Chicagoland Bicycle Federation (IV-F-19)
Chicagoland Transportation and Air Quality Commission (IV-F-10)
Chin, Rocky (IV-F-39)
Chuang, Henry (IV-F- 117) **p. 265**
Chung, Payton, et. al. (IV-D-133)
Cimino, James (IV-F-116) **p. 343**
Citizens for a Better Environment (IV-F-3)
City of Arcata (IV-D-200) **p. 1**
City of Los Angeles Environmental Quality and Waste Man (IV-F-190) **p. 95**
City of NY, Borough of Manhattan (IV-F-51)
City of NY, Manhattan Community Board (IV-F-68)
City of Portland (IV-D-198) **p. 1**
City of Seattle, Seattle Public Utilities (IV-D-66) **p. 1**
Clean Air Council (IV-F-116) **p. 333**
Clean Air Network (IV-F-191) **p. 84**
Clean Air Now Campaign (State PIRGs & citizens) (IV-D-357, 358)
Clean Fuels Development Coalition (IV-F- 191) **p. 225**
Coalition for Clean Air (IV-F-190) **p. 177**
Coalition on the Environment and Jewish Life (IV-F-184)
Commissioner of Clear Creek County (IV-F- 191) **p. 14**
Communities for a Better Environment (IV-F-190) **p. 129**
Community Coalition for Change (IV-F-190) **p. 74**
Congress of the United States (IV-D-294) **p. 1**
Congressman Mark Udall (IV-F-191) **p. 206**
Congresswoman Diana DeGette (IV-F-191) **p. 208**
Connor, Thomas, et. al. (IV-D-132)
Consumer Policy Institute (IV-D-186) **p. 3**
Consumer Policy Institute, NY (IV-F-116) **p. 305**)
Corning, Inc. (IV-F-77)
Countrymark Cooperative (IV-F-191) **p. 184**
Damitz, Kyle and Colleen (IV-F-20)
Davidson, Karin, et. al. (IV-D-79)
Delsener, Ron (IV-D-152)
Dickson, Victoria, et. al. (IV-D-77)
Diesel Technology Forum (IV-F- 190) **p. 190**
Dolman, Suzanne, et. al. (IV-D-341)
Domac, Jacquiline (IV-F-190) **p. 249**)
Economic & Social Justice (IV-F- 117) **p. 236**
Engine Manufacturers Association (IV-F-174)
Ens and Outs, UUCA (IV-D-107)
Environmental Advocates (IV-F-35)
Environmental Defense (IV-D-346) **p. 14**, (IV-F-169, 56), (IV-F-117) **p. 81** (IV-F-191) **p. 18**
Environmental Law & Policy Center of the Midwest (IV-F-6)

Environmental Law and Policy Center (IV-D-331) **p. 2**
Estler, Danielle (IV-F-21)
Evans, Alexander J. (IV-F- 116) **p. 186**
Evans, David (IV-F-116)
Feeley, Dr. Jeryl and Zachariah (IV-F- 191) **p. 50**
Firestone, Ross (IV-F-4)
Fisher, Alexandra (IV-F- 116) **p. 231**
Fleming, Scott, et. al. (IV-D-13)
Fletcher, Robert E. (IV-F-117) **p. 175**)
Flowers, Bobbie (IV-D-67)
Fogel, Judy (IV-F-190) **p. 68**
Foley, Deborah (IV-G-56)
Ford, O.T. (IV-F-117) **p. 126**
Franceshini, Charles (IV-F- 116)
Franczyk, Catherine A., et. al. (IV-D-233)
Freechild, Aquene, et. al. (IV-G-60)
Friedman, Jane (IV-F-2)
Friends of the Children (IV-F-158)
GA Coalition for Peoples' Agenda (IV-F- 117) **p. 241**
GA Department of Natural Resources (IV-D-268) **p. 1**
GA House of Representatives (IV-F- 117) **p. 56**
GA Legislator (IV-F-117) **p. 136**
GA Public Interest Research Group (IV-F-117) **p. 43, 268**
GA State Senator (IV-F-117) **p. 179**
Gibbs, Nancy (IV-F-116) **p. 360**
Gill, Matthew (IV-F-191) **p. 82**
Golland, Laurie, et. al. (IV-G-33)
Gordon, Ken (IV-F- 191) **p. 204**
Greene, Richard (IV-G-57)
Grider, Susan (IV-F-117) **p. 143**
Hacienda Heights Improvement Association (IV-F-172)
Hackel, Barbara, et al. (IV-D-14) **p. 1**
Hart/IRI Fuels Information Services (IV-D-154) **p. 2**, (IV-F-190) **p. 254** (IV-F-117) **p. 206**
Health Committee of Metro Seniors in Action (IV-F-81)
Health Educator, Tenth District PTA (IV-F- 190) **p. 171**
Higginson, Norman, et. al. (IV-D-196)
Hinds, William (IV-F- 190) **p. 202**
Holy Spirit Church (IV-D-83)
Hopkins, Steve, et. al. (IV-G-07)
Hyatt, Robert E. (IV-D-94)
IL House of Representatives (IV-F-24)
IL Public Interest Research Group (IV-F-18)
INFORM, Inc. (IV-F-47)
Ihara, Karyn (IV-F- 190) **p. 278**
Institute for Global Solutions (IV-F-175)
International Center for Technology Assessment (IV-D-313) **p. 1-2, +all**
International Truck & Engine Corp. (IV-F-34), (IV-F-117) **p. 109**
Interstate Claims (IV-F-190) **p. 66**
Jack Jones Trucking, Inc. (IV-F-190) **p. 58**
Khalsa, Mha Atma S. (IV-D-71)
Kinyon, John, et. al. (IV-G-13)

Response to Comment 1.1 (A)(1):

A large number of commenters expressed general support for our proposed program. After considering all of the comments, we are finalizing a comprehensive program that in most respects matches the proposed program. We believe that the resulting overall program will achieve the necessary emissions reductions resulting in significant health and environmental benefits.

(2) Some commenters noted that the implementation of EPA's proposed rule is crucial in order to ensure that the NAAQS for ozone and/or particulates in their areas are met. One commenter added that attainment would have an important impact on conformity issues, and thereby an area's ability to proceed with new construction and road building.

Letters:

CA Air Pollution Control Officers' Association (IV-D-109) **p. 1**
CA Trucking Association (IV-D-309) **p. 3-4**, (IV-F-190) **p. 38**
CO Public Interest Research Group (IV-F-191) **p. 219**
CT DEP (IV-D-142, 320) **p. 1 (both)**, (IV-F-49)
City of Chicago (IV-D-240) **p. 3**
City of Los Angeles Environmental Quality and Waste Man (IV-F-190) **p. 95**
Consumer Policy Institute (IV-D-186) **p. 2**
DaimlerChrysler (IV-F-167, 186)
GA State Senator (IV-F- 117) **p. 179**
Greater Houston Partnership (IV-D-172) **p. 1-2**
Mayor and citizens of Fort Collins, CO (IV-F-191) **p. 211**
NY DEC (IV-D-138, 239) **p. 1 (both)**
NY State Attorney General's Office (IV-D-238) **p. 6**
NY State Senator (IV-F-83)
Nolan, Catherine (IV-D-169) **p. 1**
OR DEQ (IV-F- 191) **p. 164**
OR Environmental Council (IV-D-68) **p. 1**
Ozone Transport Commission (IV-D-249) **p. 1**
PA DEP (IV-D-100) **p. 1**
Public Advocate for the City of New York (IV-D-222) **p. 1**
South Coast Air Quality Management District (IV-D-147) **p. 1**
TX Natural Resource Conservation Commission (IV-G-3) **p. 1**
WI DNR (IV-D-291) **p. 1**

Response to Comment 1.1 (A)(2):

Several commenters stated that the emission reductions of the program are needed to ensure attainment of the ozone and/or PM NAAQS standards. We agree with this view, as described in the preamble to this final rule. Also, to the extent that this regulation promotes local area attainment, it will also assist the area of conformity demonstration.

(B) Expressed support for EPA's systems approach to controlling emissions by imposing both fuel sulfur standards along with engine and vehicle emission standards, without necessarily expressing a position on the specific proposed standards.

(1) Many commenters expressed support for EPA's approach to fuel and/or engine/vehicle standards. Several expressed no further reasons for their support. Other commenters gave specific reasons for supporting the rule such as the cost-effectiveness of a systems approach and the need for low-sulfur fuel to enable new technologies that reduce emissions. Specific comments regarding engine standards and the need for low sulfur fuel are listed in Issue 3, below. Fuel standard comments are discussed specifically in Issue 4, below.

Letters:

AL State Office of the Governor (IV-D-158) **p. 1**
Alliance of Automobile Manufacturers (IV-F-9,190) **p. 114** (IV-F- 191) **p. 89**
American Lung Association of CO (IV-D-98) **p. 1**
Chicago DEP/Chicago Metropolitan Mayors Caucus Clean Ai (IV-D-335) **p. 3**
City of Chicago (IV-D-240) **p. 3**
Citizen, physician (IV-F-190) **p. 76**
Citizens for a Better Environment (IV-F-3)
Clean Fuels Development Coalition (IV-F-191) **p. 225**
Congressman Mark Udall (IV-F-191) **p. 206**
DaimlerChrysler (IV-F-15, 167, 186, 191) **p. 173**
Detroit Diesel Corporation (IV-F-7, 168)
Diesel Technology Forum (IV-F-14, 54, 190) **p. 190** (IV-F- 117) **p. 148** (IV-F-191) **p. 179**
Engine Manufacturers Association (IV-F-33, 174)
Fox, John (IV-F- 191) **p. 75**
Hart/IRI Fuels Information Services (IV-F-117) **p. 206**
Hinds, William (IV-F-190) **p. 202**)
IL Environmental Protection Agency (IV-D-308) **p. 2**
International Truck & Engine Corp. (IV-F-27, 180, 191) **p. 99**
Kern Oil & Refining Co. (IV-F-173)
Lake Snell Perry & Associates (IV-D-321) **p. 1**
MD DOE (IV-D-163) **p. 1**
Manufacturers of Emission Controls Association (IV-F-26, 187, 190) **p. 108** (IV-F- 191) **p. 120**, (IV-G-53)
NJ Transit (IV-G-4) **p. 1**
NYC DEP (IV-D-159) **p. 1**
National Petrochemical & Refiners Association (IV-D-218) **p. 13**
Ozone Transport Commission (IV-D-249) **p. 2**
PennFuture (IV-D-225) **p. 1**
Permanent Citizens Advisory Committee (IV-D-318) **p. 1**
Regional Air Pollution Control Agency (IV-D-103) **p. 1**
STAPPA/ALAPCO (IV-D-295) **p. 1**, (IV-F-32, 190) **p. 21**
Swift Transportation Company (IV-D-263) **p. 1**
Tri-Met (IV-D-96) **p. 1**
UAW (IV-D-215) **p. 2**
WI DNR (IV-D-144, 291) **p. 1 (both)**

Response to Comment 1.1 (B)(1):

We agree that the systems approach will enable promising new technologies for cleaner highway diesel engines and maximize the emission benefits. The fuel change, in addition to enabling new technologies that will achieve lower emissions, will produce emissions and maintenance benefits in the existing fleet of highway vehicles.

Issue 1.2: Opposes Rule (Engine/Vehicle, Fuel or Both)

(A) Opposed generally the proposed regulations and suggested that EPA re-analyze the scientific data prior to making any significant environmental policy decision.

(1) Sulfur dioxide is a gas known for its cooling qualities, and therefore removing it from gasoline and diesel could contribute significantly to global warming. This commenter suggests that EPA investigate unspecified fuel additives which eliminate noxious particles, decrease refining costs, and increase fuel economy while allowing sulfur to remain in the fuel.

Letters:

Orr, David (IV-F- 191) **p. 258**

Response to Comment 1.2(A)(1):

Of all U.S. sources of oxides of sulfur (SO_x) emissions, the heavy duty trucks and engines addressed by our proposal represent only about 1 percent. While our proposed program would reduce this fraction substantially, the absolute reduction in overall SO_x will be small relative to all sources. It appears that such a small change in overall U.S. SO_x emissions would not be likely to make a significant difference in projected global warming trends.

Further, the Intergovernmental Panel on Climate Change has stated that sulfate cooling is not a straightforward offset to CO_2 warming. This is because CO_2 concentrations are globally very uniform (due to the long lifetime of CO_2 in the atmosphere) while sulfate concentrations differ considerably from region to region because sulfates are relatively short-lived in the atmosphere. Even if the direct radiative forcings of CO_2 warming and sulfate cooling were to cancel one another out over a certain region, it does not mean that the region would be protected from climate changes caused by the net warming of the global atmosphere.

For further discussion of SO_x and global warming, see the response to comment 2.4(O).

On the other hand, as discussed elsewhere, reductions in highway diesel fuel sulfur will result in considerable quantifiable health benefit, which would be sacrificed under the commenter's plan. Sulfur control in diesel fuel is a necessary component of any new standards for control of emissions from heavy-duty engines/vehicles and trucks, given the effects that fuel sulfur has on emission control equipment. The commenter provides no data to show that such effects can be prevented, and there is considerable evidence to the contrary.

We also do not believe that fuel additives would get the same emissions benefits as highway diesel fuel sulfur control because it would still allow the performance of emissions control technology to be degraded by exposure to unreasonably high sulfur levels. We will evaluate any data regarding fuel additives as it becomes available, but we continue to believe that aftertreatment will be necessary to meet the standards in this rule and we do not expect that any changes to the diesel sulfur program would result from information provided about diesel fuel additives.

(2) Commenters state that EPA should delay or withdraw and reconsider the proposed rule for a variety of reasons which include uncertainty in emissions control and measurement technology and its sensitivity to sulfur, refinery desulfurization technology and costs for engine/vehicle manufacturers, fuel refiners, distributers and the buying and operating public. EPA needs to accurately assess costs and benefits of the rule as well as the impact of the rule on stakeholders including agribusinesses and farmer co-ops. Commenters also stated that the program should be delayed until after the implementation of the gasoline rule or until EPA concludes its rulemaking for nonroad diesel and home heating oil.

Letters:

AL Farmers Federation (IV-D-206) **p. 1-2**
Agricultural Retailers Association (IV-D-178) **p. 1-4**
Agricultural Retailers Association, et. al. (IV-D-148) **p. 1**
Agricultural organizations as a group (IV-D-265) **p. 1-2,** (IV-G-26) **p. 1**
American Petroleum Institute (IV-F- 117) **p. 161** (IV-D-343) **p. 24, 68**
American Public Transportation Association (IV-D-275) **p. 2**
Capellan, Claudia, et. al. (IV-D-338) **p. 2**
Cenex Harvest States Cooperatives (IV-D-232) **p. all**
Countrymark Cooperative (IV-F-30), (IV-D-333) **p. 14**
Cummins Engine Company, Inc. (IV-D-352) **p. 2,** (IV-D-231) **p. 4-5**
ExxonMobil (IV-D-228) **p. 2, 5, 17**
Food Marketing Institute (IV-D-283) **p. 3**
Higginson, Norman, et al (IV-D-196)
ID Barley Commission (IV-D-312) **p. 1**
IN Builders Association (IV-D-208) **p. 1-2**
IN Retail Council (IV-D-211) **p. 2**
KS Cooperative Council (IV-D-187) **p. 1-2**
MD Farm Bureau (IV-D-192) **p. 1-2**
MFA Oil Company (IV-G-16) **p. 2**
MI Petroleum Assoc./MI Assoc. of Convenience Stores (IV-D-202) **p. 1-2**
MN Association of Cooperatives (IV-D-188) **p. 1-2**
Marathon Ashland Petroleum (IV-D-261) **p. *3-*4, 4, 10, 17-18**
Mercatus Center at GMU (IV-D-219) **p. 31-33**
Mid-Atlantic Petroleum Distributors' Association (IV-D-124) **p. 1-2**
National Council of Farmer Cooperatives (IV-D-351) **p. 1**
National Ready Mixed Concrete Association (IV-D-271) **p. 2**
North American Equipment Dealers Association (IV-D-194) **p. 1-4**
NE Farm Bureau Federation (IV-D-153) **p. 1**
National Federation of Independent Business (IV-D-243) **p. 1-2**
OH Trucking Association (IV-D-190) **p. 1**
Service Station Dealers of America (IV-D-253) **p. 2**
Society of Independent Gasoline Marketers of America (IV-D-328) **p. 2**
Thomas, Bill; U.S. House of Representatives (IV-G-39) **p. 1**
Tseng, Joyce, et al (IV-D-03)

U.S. Chamber of Commerce (IV-D-329) **p. 3**
VA Aggregates Association (IV-D-177) **p. 1-2**
VA Agribusiness Council (IV-G-1) **p. 1**
VA Trucking Association (IV-D-191) **p. 1-2**
Village of Brookfield (IV-D-29) **p. 1**
Western Governors' Association (IV-G-41) **p. 3**
WI Motor Carriers Association (IV-D-189) **p. 1**

Response to Comment 1.2(A)(2):

EPA considered all of the above comments and provides responses to all of these issues later in this document. At this time, however, there are ozone areas in the United States that need reductions as soon as possible to meet their Clean Air Act deadlines for nonattainment. Diesel exhaust contributes to pollution which continues to cause considerable damage. It will be several years before heavy-duty engines that meet today's standards will displace older, dirtier engines. The sooner the provisions are completed and implemented, the sooner the health and welfare affects of pollution from diesel engines and fuel can be reduced. Refineries and engine manufacturers need leadtime to meet the standards by the implementation date. We received comments from EMA indicating that manufacturers should receive more than the statutorily-required leadtime when EPA promulgates standards (IV-D-251, at 85). As discussed further in the RIA and preamble, the technology necessary to meet the requirements of this rule are known and well defined, and postponing this rule will not appreciably change the analysis of feasibility for this rule. Therefore, we believe that this rule is necessary and appropriate at this time.

(B) Opposes the fuel and/or engine/vehicle standards as too stringent and/or unnecessary to enable technology or to protect public health and welfare.

(1) See detailed supporting information under other applicable issues (especially in Issues 2, 3, 4, 5, 7, and 8) on why commenters oppose the fuel and/or engine/vehicle standards.

Letters:

Agricultural Retailers Association, et. al. (IV-D-148) **p. 1**
Agricultural organizations as a group (IV-D-265) **p. 2**
AL Farmers Federation (IV-D-206)
American Bus Association (IV-D-330) **p. 1-7**
American Farm Bureau Federation (IV-F-5)
American Petroleum Institute (IV-D-343)
American Trucking Association (IV-D-269)
CA Trucking Association (IV-F-190) **p. 38**
CO Petroleum Association (IV-D-323) **p. 1, 4**
Cenex Harvest States Cooperatives (IV-D-232) **p. 1**
Chevron (IV-D-247)
Citgo Corporation (IV-D-314) **p. 7**
Coal Operators & Associates, Inc. (IV-D-64) **p. 1**
Cooperative Refining, LLC (IV-D-300) **p. 1-2**
Conoco (IV-F-191) **p. 154**
Countrymark Cooperative (IV-D-333) **p. 2-6**, (IV-F-30), (IV-F-117) **p. 74** (IV-F-191) **p. 184**
Cummins, Inc. (IV-D-231)

DaimlerChrysler (IV-D-284, 344)
Detroit Diesel Corporation (IV-D-276)
Equiva Services (IV-D-226) **p. 3**
Engine Manufacturers Association (IV-D-251)
Ergon & Lion Oil Co. (IV-F-117) **p. 183**
ExxonMobil (IV-D-228) **p. 2, 5**, (IV-F-800)
Farmland Industries (IV-F-29)
Food Marketing Institute (IV-D-283) **p. 2**
Ford Motor Company (IV-D-293)
Gary-Williams Energy Corporation (IV-F-43)
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256)
Gorton, Slade (IV-D-171) **p. 2**
ID Barley Commission (IV-D-312) **p. 1-2**
IN Retail Council (IV-D-211)
IN Builders Association (IV-D-208)
Independent Fuel Terminal Operators Association (IV-D-217) **p. 3-4**
International Truck & Engine Corp. (IV-D-257)
Johnson Petroleum, Inc. (IV-D-17) **p. 1**
Kentuckians for Better Transportation (IV-D-16) **p. 1**
Kern Oil & Refining (IV-D-310), (IV-F-173)
Koch Industries (IV-D-307) **p. 7-9**
KS Cooperative Council (IV-D-187)
MD Farm Bureau (IV-D-192)
MFA Oil (IV-G-16)
MI Petroleum Association (IV-D-202)
MN Chamber of Commerce (IV-D-28) **p. 1**
Mack Trucks (IV-D-324)
Marathon Ashland Petroleum (IV-D-57), (IV-D-261) **p. 7, 19, 55**, (IV-F-74)
Mercatus Center at GMU (IV-D-219)
Mid-Atlantic Petroleum Distributors Association (IV-D-124)
Murphy Oil (IV-D-274)
NATSO (IV-D-246) **p. 8**, (IV-F-17)
National Alternative Fuels Foundation (IV-D-214) **p. 2**
National Ready Mixed Concrete Association (IV-D-271) **p. 1**
National Association of Convenience Stores (IV-F- 191) **p. 168**
National Council of Farmer Cooperatives (IV-D-351) **p. 3**
National Grain and Feed Association (IV-D-301) **p. 1**
National Petrochemical & Refiners Assoc./CITGO (IV-F-117) **p. 101**
National Petrochemical & Refiners Association (IV-D-218), (IV-F-31, 44)
NE Farm Bureau Federation (IV-D-153) **p. 1**
New England Fuel Institute (IV-D-296)
NY Assoc. of Service Stations & Repair Shops (IV-F-45)
North American Equipment Dealers Association (IV-D-194)
OH Trucking Association (IV-D-190)
Paramount Petroleum Corporation (IV-F-190) **p. 168**
PA Association of Milk Dealers (IV-D-23) **p. 1**
Perfection Oil Company (IV-D-41) **p. 1**
Petro-Star Inc. (IV-D-216)
Petroleum Marketers Association of America (IV-F-67)
Phillips Petroleum Company (IV-D-250) **p. 3**
Placid Refining Company, LLC (IV-D-230) **p. 1**
Ports Petroleum Co., Inc., (IV-F- 117) **p. 190**

Remster, John (IV-F-28)
Reusable Industrial Packaging Association (IV-D-129)
Service Station Dealers of America (IV-D-253)
Sinclair Oil Corporation (IV-D-255) **p. 2**
Society of Independent Gasoline Marketers of America (IV-D-328) **p. 1**
Stevens, Ted (IV-D-170) **p. 2**
Ultramar Diamond Shamrock Corporation (IV-F- 191) **p. 136**
U.S. Chamber of Commerce (IV-D-329) **p. 1**
U.S. Oil & Refining (IV-F-190) **p. 159**
VA Aggregates Association (IV-D-177)
VA Agribusiness Council (IV-G-1)
VA Trucking Association (IV-D-191)
Western Governors' Association (IV-G-41) **p. 1**
Welsh, Inc. (IV-D-22) **p. 1**
Western Independent Refineries Association (IV-F-190) **p. 144**)
WI Motor Carriers Association (IV-D-189)
WY Refining Company (IV-F-191) **p. 58**

Response to Comment 1.2 (B)(1):

As discussed in the preamble to this rule and further supported in the Regulatory Impact Assessment document, the engine and vehicle standards set forth will improve air quality in the United States. The fuel standards are necessary to enable emission control equipment and will, themselves, reduce harmful emissions especially of sulfates. Specific comments regarding public health and welfare impacts and the feasibility of the vehicle/engine standards and fuel standards are responded to in corresponding sections later in this document.

Issue 1.3: Timing of Rule

(A) EPA should finalize the proposed rule in 2000 or as soon as possible.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Clean Air Council (IV-F-116) **p. 333**
IL Environmental Council (IV-D-115) **p. 1**
Ozone Transport Commission (IV-F-55)
U.S. Department of Energy (IV-G-28) **p. 1**

(2) There should be no delay in the decision to finalize EPA's proposal, since to do so would also delay the reduction in health impacts due to diesel exhaust emissions. Such a delay is unnecessary and would substantially jeopardize the prospects of reaching the goal of truly clean diesel engines. If the rule is delayed, the commitment and financial investment that have been made by emission control manufacturers and other members of industry will most likely be scaled back and it is uncertain whether the same level of commitment will be resumed at a later date. No investment in technology development will occur based on the vague prospect that if technology is developed, regulations may be adopted and in the context of EPA's proposed rule, clear technology pathways are defined for meeting the future standards proposed

by EPA.

Letters:

California Air Resources Board (IV-G-52)
Corning, Inc. (IV-G-59)
Manufacturers of Emission Controls Association (IV-D-267) **p. 1-2** (IV-G-53)

Response to Comment 1.3(A)(1) and (2):

In order for the benefits of this rule to be realized soon, it should be finalized as early as possible. EPA has reviewed all aspects of this program and carefully considered the timing required to implement these regulations. Therefore, we decided to finalize these standards in today's action so that the resulting overall program will achieve the necessary emissions reductions on a schedule that achieves them when they are needed while at the same time appropriately considering the legal time necessary, for example, to allow full developmental implementation of necessary engine redesign and of emission control system/design and fuel changes. These considerations are all reflected in the implementation schedules for this rule.

(B) EPA should delay the finalization of the proposed rule.

(1) Commenters state that EPA should delay or withdraw and reconsider the proposed rule for a variety of reasons. See Issue 1.2 (A)(2) for further discussion.

Letters:

AL Farmers Federation (IV-D-206) **p. 1-2**
Agricultural Retailers Association (IV-D-178) **p. 1-4**
Agricultural Retailers Association, et. al. (IV-D-148) **p. 1**
Agricultural organizations as a group (IV-D-265) **p. 1-2,** (IV-G-26) **p. 1**
American Petroleum Institute (IV-F-117) **p. 161**, (IV-D-343) **p. 24, 68**
American Public Transportation Association (IV-D-275) **p. 2**
Capellan, Claudia, et. al. (IV-D-338) **p. 2**
Cenex Harvest States Cooperatives (IV-D-232) **p. all**
Countrymark Cooperative (IV-F-30), (IV-D-333) **p. 14**
Cummins Engine Company, Inc. (IV-D-352) **p. 2,** (IV-D-231) **p. 4-5**
ExxonMobil (IV-D-228) **p. 2, 5, 17**
Food Marketing Institute (IV-D-283) **p. 3**
Higginson, Norman, et al (IV-D-196)
ID Barley Commission (IV-D-312) **p. 1**
IN Builders Association (IV-D-208) **p. 1-2**
IN Retail Council (IV-D-211) **p. 2**
KS Cooperative Council (IV-D-187) **p. 1-2**
MD Farm Bureau (IV-D-192) **p. 1-2**
MFA Oil Company (IV-G-16) **p. 2**
MI Petroleum Assoc./MI Assoc. of Convenience Stores (IV-D-202) **p. 1-2**
MN Association of Cooperatives (IV-D-188) **p. 1-2**
Marathon Ashland Petroleum (IV-D-261) **p. *3-*4, 4, 10, 17-18**
Mercatus Center at GMU (IV-D-219) **p. 31-33**
Mid-Atlantic Petroleum Distributors' Association (IV-D-124) **p. 1-2**

National Council of Farmer Cooperatives (IV-D-351) **p. 1**
National Ready Mixed Concrete Association (IV-D-271) **p. 2**
North American Equipment Dealers Association (IV-D-194) **p. 1-4**
NE Farm Bureau Federation (IV-D-153) **p. 1**
National Federation of Independent Business (IV-D-243) **p. 1-2**
OH Trucking Association (IV-D-190) **p. 1**
Service Station Dealers of America (IV-D-253) **p. 2**
Society of Independent Gasoline Marketers of America (IV-D-328) **p. 2**
Thomas, Bill; U.S. House of Representatives (IV-G-39) **p. 1**
Tseng, Joyce, et al (IV-D-03)
U.S. Chamber of Commerce (IV-D-329) **p. 3**
VA Aggregates Association (IV-D-177) **p. 1-2**
VA Agribusiness Council (IV-G-1) **p. 1**
VA Trucking Association (IV-D-191) **p. 1-2**
Village of Brookfield (IV-D-29) **p. 1**
Western Governors' Association (IV-G-41) **p. 3**
WI Motor Carriers Association (IV-D-189) **p. 1**

Response to Comment 1.3(B):

See response to Comment 1.2(A)(2).

ISSUE 2: ENVIRONMENTAL AND AIR QUALITY ISSUES

Issue 2.1: Public Health & Welfare Concerns

(A) The rule will help alleviate adverse ozone problems, and ozone has significant adverse health and environmental effects.

(1) A large body of evidence shows that ozone can cause harmful respiratory effects including chest pain, coughing, and shortness of breath, which affect people with compromised respiratory systems most severely and seriously aggravates asthma. [See also Issue 1.1, Point (A).]

<u>Letters:</u>

American Lung Association (IV-D-270) **p. 3-4**
Children's Environmental Health Network (IV-D-244) **p. 1**
Environmental Defense (IV-D-748) **p. 7-8**
MI Environmental Council (IV-D-290) **p. 1**
NESCAUM (IV-D-315) **p. 2-3**
Natural Resources Defense Council (IV-D-168) **p. 2**
Ozone Transport Commission (IV-D-249) **p. 2**
STAPPA/ALAPCO (IV-D-295) **p. 7**

<u>Response to Comment 2.1(A)(1):</u>

We agree with the comment.

(2) Private citizen commenters argued generally that the rule is necessary because of the health problems caused by smog, soot, and air toxics. Approximately 13,800 commenters made this statement.

<u>Letters:</u>

20/20 Vision (IV-D-74)
Acoff, Jeffrey, et. al. (IV-G-11)
American Lung Association of Colorado (IV-D-54)
American Lung Association of Los Angeles (IV-D-47)
Asamoah, Nikiya (IV-D-09)
Bagnarol-Reyes, Carolina, et. al. (IV-G-24)
Barrett, Bruce (IV-D-93)
Beeman, Nora, et. al. (IV-G-09)
Braun, Carl and Norma (IV-D-69)
Carson Forest Watch (IV-D-106)
Chung, Payton, et. al. (IV-D-133)
Connor, Thomas, et. al. (IV-D-132)
Corcoran, Janet (IV-D-128)
Davidson, Karin, et. al. (IV-D-79)
Delsener, Ron (IV-D-152)
Dickson, Victoria, et. al. (IV-D-77)
Dolman, Suzanne, et. al. (IV-D-341)
Ens and Outs, UUCA (IV-D-107)
Fleming, Scott, et. al. (IV-D-13)

Franczyk, Catherine A., et. al. (IV-D-233)
Golland, Laurie, et. al. (IV-G-33)
Halady, E. (IV-D-340)
Hirschi, Alexander (IV-D-07)
Hopkins, Steve, et. al. (IV-G-07)
Kachik, Thomas (IV-D-11)
Khalsa, Mha Atma S. (IV-D-71)
Kinyon, John, et. al. (IV-G-13)
Kryston, Sheila (IV-D-76)
Landfall Productions, Inc. (IV-D-27)
Lichtman, Elijah (IV-D-08)
Lind, Karen, et. al. (IV-D-121)
Lipka, Richard P. (IV-D-92)
Margolis, Benjamin (IV-D-33)
Meek, M. (IV-D-774)
Meyer, Edgar A. (IV-D-108)
Montgomery, Jack, et. al. (IV-D-78)
Mothers for Clean Air (IV-D-95)
Nerode, Gregory, et. al. (IV-D-04)
O'Leary, Cathy and John Carey (IV-G-5)
Oregon DEQ (IV-D-145) **p. 1**
Private citizen (IV-D-12)
Riggles, Ruth, et. al. (IV-D-102)
Roberts, R. (IV-G-12)
Robin, Susan (IV-D-302)
Rodriguez, Dolores, et. al. (IV-D-91)
Rutherford, Jolene, et. al. (IV-D-347)
Schmitz, Randy, et. al. (IV-D-46)
Sherrill, Faye (IV-G-30)
Smith, Bryan R., et. al. (IV-D-105)
Smith, Curt, et. al. (IV-D-49)
Smith, Maria (IV-D-72)
Toxics Action Center (IV-G-02)
Tseng, Joyce, et. al. (IV-D-03)
Varsbergs, Krista, et. al. (IV-D-38)
Wanzer, Sidney (IV-D-82)
Williams, Mary, et. al. (IV-D-122)
Zweig, Robert (IV-D-30)

<u>Response to Comment 2.1(A)(2):</u>

We agree in general with comments supporting the rule due to adverse health effects associated with heavy-duty engine emissions.

(3) Cities in New England have poor air quality which has created major problems with asthma and cancer in the area.

<u>Letters:</u>

CT Coalition for Environmental Justice (IV-D-131) **p. 1**

<u>Response to Comment 2.1(A)(3):</u>

We agree with the comment.

(B) Children are particularly at risk from ozone exposure because they typically are active outside.

(1) For example, summer camp studies in the eastern U.S. and southeastern Canada have reported clinically significant reductions in lung function in children who are active outdoors. Further, children are more at risk than adults from ozone exposure because their respiratory systems are still developing.

Letters:

American Lung Association (IV-D-270) **p. 3**

Response to Comment 2.1(B)(1):

We agree with the comment.

(C) VOC emissions that would be addressed in part by this rule are detrimental not only for their role in forming ozone, but also for their role as air toxics.

(1) At elevated concentrations and exposures, human health effects from air toxics can range from respiratory effects to cancer. Other health impacts include neurological, developmental, and reproductive effects.

Letters:

American Lung Association (IV-D-270) **p. 13**

Response to Comment 2.1(C)(1):

We agree with this comment.

(D) Besides their role as an ozone precursor, the NO_x emissions that would be addressed in part by this rule produce a wide variety of adverse health and welfare effects.

(1) Nitrogen oxide can irritate the lungs and lower resistance to respiratory infection (such as influenza).

Letters:

American Lung Association (IV-D-270) **p. 14**
NY State Attorney General's Office (IV-D-238) **p. 5**

Response to Comment 2.1(D)(1):

We agree with the comment.

(2) Commenter provides no further supporting information or detailed analysis.

Letters:

City of Chicago (IV-D-240) **p. 4**

Response to Comment 2.1(D)(2):

We agree with the comment.

(3) NO_x also plays a role in the formation of particulate nitrate particularly in colder weather. The NPS has monitored increases in winter nitrate concentrations in western national parks, and these increases could decrease visibility and increase nitrogen deposition in these areas. Thus, NO_x reductions will have benefits other than ozone benefits (contrary to statements in the preamble), and thus continuous compliance standards are important.

Letters:

National Park Service (IV-D-180) **p. 4**

Response to Comment 2.1(D)(3):

We agree with the comment.

(E) Particulate matter that would be addressed in part by this rule has adverse health effects.

(1) The effects are particularly adverse for those with respiratory illnesses, the elderly, and children. Diesel particulate is especially hazardous. One commenter cites the Health Effects Institute's Synopsis of the Particle Epidemiology Reanalysis Project and National Morbidity, Mortality, and Air Pollution Study Part II: Morbidity, Mortality, and Air Pollution in the United States (http://www.healtheffects.org/news.htm).

Letters:

American Lung Association (IV-D-270) **p. 5-10**
American Lung Association of CT (IV-D-63) **p. 1**
Boulder County Clean Air Consortium (IV-D-35) **p. 1**
Clean Air Coalition and AK organizations (IV-D-350) **p. 1**
Clean Air Network (IV-D-292) **p. 1**
Environmental Defense (IV-D-748) **p. 4-6**
Environmental Health Coalition (IV-D-286) **p. 1**
Larand International, Inc. (IV-D-52) **p. 1**
PennFuture (IV-D-225) **p. 1**
STAPPA/ALAPCO (IV-D-295) **p. 8**
Sierra Club, PA Chapter (IV-D-53) **p. 1**
Volusia-Flagler Environmental Action Committee (IV-D-120) **p. 1**

Response to Comment 2.1(E)(1):

We agree with the comment.

(2) Key health effects include premature mortality, aggravation of respiratory and cardiovascular disease, aggravated asthma, acute respiratory symptoms, and decreased lung function. One commenter provided copies of toxicological studies on the link between diesel exhaust and asthma. Another commenter cited a 1996 report which estimated that about 500 residents of metropolitan areas in Oregon die prematurely from breathing particulate pollution.

Letters:

American Lung Association of NH (IV-D-116) **p. 1**
American Lung Association of WI (IV-D-32) **p. 1**
Children's Environmental Health Network (IV-D-244) **p. 1**
City of Portland (IV-D-198) **p. 1**
Clean Air Coalition (IV-D-322) **p. 2**
Clean Air Coalition and AK organizations (IV-D-350) **p. 1**
Clean Air Network (IV-D-292) **p. 1**
Landrigan, Philip (IV-D-37) **p. 1**
Landrigan, Philip [Duplicate of IV-D-37, without attach (IV-D-10) **p. 1**
MI Environmental Council (IV-D-290) **p. 1**
NESCAUM (IV-D-315) **p. 2**
Natural Resources Defense Council (IV-D-110) **p. 1**
OR Environmental Council (IV-D-68) **p. 2**
Prabhu, Sudhir (IV-D-127) **p. 1**
The Coalition for Sensible Energy (IV-D-264) **p. 1**

Response to Comment 2.1(E)(2):

We agree with the comment.

(3) Across the country there are neighborhoods and communities near highways that are exposed to serious risk of cancer as a result of diesel particulates.

Letters:

Environmental Defense (IV-D-748) **p. 4**
Environmental Law and Policy Center (IV-D-331) **p. 2**

Response to Comment 2.1(E)(3):

EPA has found that diesel exhaust, including diesel PM, is a likely human carcinogen at environmental levels of exposure. Ambient concentrations of diesel exhaust are likely to be higher in urban areas than in rural areas due to relative traffic densities. The precise magnitude of the risk posed by diesel exhaust exposure in these areas cannot currently be determined.

(4) NY DEC requests EPA evaluate whether PM mass standards alone are adequate and urges EPA to consider requiring that manufacturers collect measurements to aid EPA's decision.

Letters:

NY DEC (IV-D-239) **p. 5**

Response to Comment 2.1(E)(4):

Almost all diesel PM can be considered fine PM. The regulations adopted today will require emission control devices which will reduce the amount of PM across the range of particle sizes. At this time, there is no evidence to support the need for a standard based on the size or number of particles; a mass based standard will be effective in reducing the health risk of diesel PM emissions.

Regarding the requirement to have manufacturers supply addition size-based data, the majority of PM emitted is produced during transient operation, in particular during transient events that lead to fairly low excess-air ratios. There are currently no suitable instrumentation packages capable of capturing the entire particle size distribution of diesel particulate matter during transient operation. There are also considerable questions with respect to the effects of dilution rate and dilution ratio on the formation of ultra-fine, nucleated PM. EPA is currently in the process of evaluating and developing transient particle size measurement instrumentation, and a number of independent studies (in particular the CRC E-43 Study) are currently underway to investigate the role of dilution on particle formation and particle size. It is premature to collect data on engine particle number emissions or particle size distribution until a suitable, standardized instrumentation for such measurements is developed, and until dilution characteristics and effects are better understood. See also comment 3.2.1(G).

(5) Public health studies have linked fine particulates to increased hospital admissions for cardiovascular disease, pneumonia, and pulmonary disease.

Letters:

WA Environmental Council (IV-D-164) **p. 1**

Response to Comment 2.1(E)(5):

We agree with the comment.

(F) Reducing diesel particulates through this rule will lower toxic and non-toxic threats to health.

(1) Diesel particulate is of particular concern because not only does it contribute to traditional forms of morbidity and mortality, but many studies of workers exposed to diesel exhaust link such exposure to a 20-40% increase in lung cancer. A number of international, national, and state health agencies have identified diesel particulate as a probable carcinogen.

Letters:

American Lung Association (IV-D-270) **p. 16**
NYC DEP (IV-D-209) **p. 1**
Oregon DEQ (IV-D-145) **p. 1**
Ozone Transport Commission (IV-D-249) **p. 2**

Response to Comment 2.1(F)(1):

We agree with the comment.

(G) Numerous environmental and health agencies have classified diesel exhaust as a toxic air contaminant and probable human carcinogen.

(1) Diesel engines emit over 40 known carcinogens and many other toxic substances with non-cancer health effects.

Letters:

CT DEP (IV-D-142) **p. 1**
City of Portland (IV-D-198) **p. 1**
Clean Air Coalition (IV-D-322) **p. 2**
NESCAUM (IV-D-315) **p. 3**
NY State Attorney General's Office (IV-D-238) **p. 5**
NYC DEP (IV-D-209) **p. 1**
Udall, Mark (IV-D-173) **p. 2**

Response to Comment 2.1(G)(1):

We agree in general with the comments indicating health hazards due to diesel particulate exhaust.

(2) Commenter provided no further supporting information or detailed analysis.

Letters:

Boulder County Clean Air Consortium (IV-D-35)

Response to Comment 2.1(G)(2):

We agree with the comment.

(H) The importance of EPA's proposed rule is underscored by the apparent toxicity and hazard of diesel particulate emissions. Most of these commenters referenced recent studies indicating that there is a link between diesel emissions and cancer.

(1) Commenters provided general discussion on the harmful health impacts that can be attributed to diesel particulate emissions, but did not provide further supporting documentation. This comment was made by approximately 13,800 private citizens.

Letters:

20/20 Vision (IV-D-74)
Acoff, Jeffrey, et. al. (IV-G-11)
American Lung Association (IV-F-60, 72)
American Lung Association of Colorado (IV-D-54)
American Lung Association of Los Angeles (IV-D-47)
Asamoah, Nikiya (IV-D-09)
Bagnarol-Reyes, Carolina, et. al. (IV-G-24)
Barrett, Bruce (IV-D-93)
Beeman, Nora, et. al. (IV-G-09)

Braun, Carl and Norma (IV-D-69)
CA Environmental Protection Agency (IV-F-501)
CA Natural Gas Vehicle Coalition (IV-F-535)
Carson Forest Watch (IV-D-106)
Children's Environmental Health Network (IV-D-244) **p. 1**
City of NY, Manhattan Community Board (IV-F-68)
Clean Air Coalition (IV-D-322) **p. 2**
Clean Air Coalition and AK organizations (IV-D-350) **p. 1**
Clean Air Council (IV-F-641)
Clean Air Network (IV-D-292) **p. 1**
Commissioner of Clear Creek County (IV-F-901)
Congress of the United States (IV-D-294) **p. 2**
Chung, Payton, et. al. (IV-D-133)
Connor, Thomas, et. al. (IV-D-132)
Corcoran, Janet (IV-D-128)
Davidson, Karin, et. al. (IV-D-79)
Delsener, Ron (IV-D-152)
Dickson, Victoria, et. al. (IV-D-77)
Dolman, Suzanne, et. al. (IV-D-341)
Ens and Outs, UUCA (IV-D-107)
Environmental Advocates (IV-F-35)
Environmental Defense (IV-F-812, 902)
Environmental Health Coalition (IV-D-286) **p. 1**
Fleming, Scott, et. al. (IV-D-13)
Fox, John (IV-F-911)
Franceshini, Charles (IV-F-604)
Franczyk, Catherine A., et. al. (IV-D-233)
Golland, Laurie, et. al. (IV-G-33)
Hacienda Heights Improvement Association (IV-F-172)
Halady, E. (IV-D-340)
Hirschi, Alexander (IV-D-07)
Hopkins, Steve, et. al. (IV-G-07)
INFORM, Inc. (IV-F-47)
Kachik, Thomas (IV-D-11)
Khalsa, Mha Atma S. (IV-D-71)
Kinyon, John, et. al. (IV-G-13)
Kryston, Sheila (IV-D-76)
LA Dept of Water & Power (IV-F-518)
Landfall Productions, Inc. (IV-D-27)
Levy, David (IV-F-37)
Lichtman, Elijah (IV-D-08)
Lind, Karen, et. al. (IV-D-121)
Lipka, Richard P. (IV-D-92)
Lu, Rong (IV-F-162)
MI Environmental Council (IV-D-290) **p. 1**
Margolis, Benjamin (IV-D-33)
Mayor and citizens of Fort Collins, CO (IV-F-942)
McIntosh, Alice (IV-F-605)
Meek, M. (IV-D-774)
Meyer, Edgar A. (IV-D-108)
Montgomery, Jack, et. al. (IV-D-78)
Mothers for Clean Air (IV-D-95)

NJ PIRG (IV-F-637)
NY City Comptroller (IV-F-70)
NY DEC (IV-F-52)
NY DEP (IV-F-606)
NY State Assembly (IV-F-601)
NY State Attorney General's Office (IV-F-61)
NY State Senator (IV-F-50, 57)
NYC Environmental Justice Alliance (IV-F-638)
Natural Resources Defense Council (IV-D-168) **p. 1**, (IV-F-910)
Nerode, Gregory, et. al. (IV-D-04)
O'Leary, Cathy and John Carey (IV-G-5)
Oregon DEQ (IV-D-145) **p. 1**
Pastor of Culver-Palms United Methodist Church (IV-F-177)
Private citizen (IV-D-12)
Riggles, Ruth, et. al. (IV-D-102)
Roberts, R. (IV-G-12)
Robin, Susan (IV-D-302)
Rodriguez, Dolores, et. al. (IV-D-91)
Rutherford, Jolene, et. al. (IV-D-347)
Schmitz, Randy, et. al. (IV-D-46)
Sherrill, Faye (IV-G-30)
Smith, Bryan R., et. al. (IV-D-105)
Smith, Curt, et. al. (IV-D-49)
Smith, Maria (IV-D-72)
South Bronx Clean Air Coalition (IV-F-610)
Stead, Craig (IV-F-607)
Toxics Action Center (IV-G-02)
Tseng, Joyce, et. al. (IV-D-03)
U.S. PIRG (IV-F-71, 546)
Varsbergs, Krista, et. al. (IV-D-38)
Wanzer, Sidney (IV-D-82)
West Harlem Environmental Action (IV-F-608)
West Harlem Environmental Action/Envr Justice Network (IV-F-76)
Williams, Mary, et. al. (IV-D-122)
Zellers, Tim (IV-F-619)
Zweig, Robert (IV-D-30)

Response to Comment 2.1(H)(1):

We agree with the comment and we are in the process of finalizing a Health Assessment Document for Diesel Exhaust that concludes that diesel exhaust is likely to be carcinogenic to humans by inhalation. On October 12-13, 2000 the Scientific Advisory Boards' Clean Air Scientific Advisory Committee (CASAC)[1] concurred with the Agency conclusions presented in the draft Health Assessment for Diesel Exhaust.

(2) Along with a discussion regarding the estimated health impacts of diesel emissions, commenters referred to the final report of the South Coast Air

[1] EPA (2000) Review of EPA's Health Assessment Document for Diesel Exhaust (EPA 600/8-90/057E). Review by the Clean Air Scientific Advisory Committee (CASAC) December 2000 EPA-SAB-CASAC-01-003.

Quality Management District entitled "Multiple Air Toxics Exposure Study in the South Coast Air Basin (MATES II)" as documentation that supports their assertion that diesel exhaust can be toxic and cancerous. This report includes extensive analysis and has concluded that of the cancer risk posed by air pollution, 70 percent is attributable to diesel particulate emissions. STAPPA/ALAPCO has extended the analysis to other cities and has concluded that diesel emissions may be responsible for roughly 125,000 cancers over a lifetime.

Letters:

Coalition for Clean Air (IV-F-545)
Environmental Defense (IV-F-169)
GA Forest Watch (IV-D-67) **p. 1**
Grand Canyon Trust (IV-D-317) **p. 1**
Natural Resources Defense Council (IV-F-75, 910)
Northwest District Association (IV-D-117) **p. 1**
OH Environmental Council (IV-D-130) **p. 1**
OR DEQ (IV-F-930)
OR Environmental Council (IV-D-68) **p. 1**
OR Toxics Alliance (IV-D-175) **p. 1**
STAPPA/ALAPCO (IV-F-32, 78, 502, 804, 904)
Stewart, Jim (IV-F-170)
U.S. PIRG (IV-F-704)

Response to Comment 2.1(H)(2):

The Agency recognizes the California MATES II report and has reviewed it in the context of preparing the Agency's Health Assessment for Diesel Exhaust Document, which is discussed at section A.3 of the RIA. The Agency does not believe that at this time the data support a confident determination of a unit risk for diesel exhaust and therefore lifetime mortality attributable to diesel exhaust exposure cannot be precisely determined.

(3) In 1998, California declared particulate emissions from diesel fueled engines a toxic air contaminant. Diesel exhaust has also been classified as a probable human carcinogen by the National Institute for Occupational Safety and Health (NIOSH) in 1988, the International Agency for Research of Cancer (IARC) in 1989, the EPA in a draft report in 1994, the World Health Organization in 1996, the California EPA in 1998, and the Department of Health and Human Service's National Toxicology Program in 2000 (9th edition of Report on Carcinogens).

Letters:

10th District PTA (IV-F-166)
American Lung Association (IV-F-164)
CA Air Resources Board (IV-F-500)
Chicagoland Bicycle Federation (IV-F-19)
Citizen, physician (IV-F-517)
Citizens for a Better Environment (IV-F-3)
Coalition for Clean Air (IV-F-545)
Environmental Defense (IV-D-748) **p. 2-4**, (IV-F-56, 169)

NESCAUM (IV-F-63)
Natural Resources Defense Council (IV-F-524)
OR Environmental Council (IV-D-68) **p. 1**
South Coast Air Quality Management District (IV-F-185)
WA Environmental Council (IV-D-164) **p. 1**

Response to Comment 2.1(H)(3):

We agree with the comment and we are in the process of finalizing the Health Assessment Document for Diesel Exhaust which concludes that diesel exhaust is likely to be carcinogenic to humans by inhalation.

(4) A 1998 report by EPA and a 1991 report by the Illinois Pollution Control Board (titles not specified) shows that diesel exhaust is linked to cancer, lung impairment, and other adverse health effects.

Letters:

Village of Oak Park Dept. of Public Health (IV-F-8)

Response to Comment 2.1(H)(4):

We concur with the commenters statement. The Agency position is that diesel exhaust is likely to be carcinogenic to humans by inhalation and that acute and chronic exposure to diesel exhaust can lead to symptoms of irritation to the respiratory system as well as lung impairment.[2]

(5) A risk assessment performed by the California Air Resources Board estimates that diesel particulates account for 70% of the cancer risk statewide.

Letters:

CA Air Resources Board (IV-F-500)
Environmental Law and Policy Center (IV-D-331) **p. 3**

Response to Comment 2.1(H)(5):

EPA recognizes CARB's estimates that diesel PM accounts for 70 percent of cancer risk statewide, but notes that the Agency does not have a cancer unit risk factor for diesel exhaust or diesel PM.

(6) The Health Effects Institute, which is jointly funded by EPA and industry, found that the risk of lung cancer among persons occupationally exposed to diesel exhaust generally increased 20-50%, based on more than 40 epidemiological studies.

Letters:

---

[2] U.S. EPA (2000) Health Assessment Document for Diesel Exhaust: SAB Review Draft. EPA/600/8-90/057E Office of Research and Development, Washington, D.C. The document is available electronically at www.epa.gov/ncea/dieslexh.htm.

Environmental Defense (IV-D-748) **p. 2**
NY State Attorney General's Office (IV-D-238) **p. 2**

<u>Response to Comment 2.1(H)(6):</u>

The Agency concurs with the findings of the Health Effects Institute in finding that exposure to diesel exhaust is associated with an increase in the incidence of lung cancer in occupationally exposed populations as reported in numerous epidemiological studies. Accordingly, the Agency has concluded that diesel exhaust is likely to be carcinogenic to the human lung.[3] The Clean Air Scientific Advisory Committee (CASAC), in their public meeting on the draft Health Assessment for Diesel Exhaust held on October 12-13, 2000, concurred with the Agency position regarding the likely cancer hazard.[4]

In the 1995 Health Effects Institute study, Cohen and Higgins reviewed 34 epidemiological studies and concluded that “the available evidence suggests that occupational exposure to diesel exhaust from diverse sources increases the rate of lung cancer by 20% to 40% in exposed workers generally and to a greater extent among workers with prolonged or intense exposure.”[5] In the same summary Cohen and Higgins stated that “The studies reviewed above suggest that exposure to diesel exhaust in a variety of occupational circumstances is associated with small to moderate relative increases in lung cancer occurrence and/or mortality. These elevations do not appear to be fully explicable by confounding due to cigarette smoking or other sources of bias. Therefore, at present, exposure to diesel exhaust provides the most reasonable explanation for these elevations.”

(7) There are a number of articles that establish a link between diesel emissions and cancer: Krewski et al., "Synopsis of the Particle Epidemiology Reanalysis Project," Health Effects Institute, Cambridge MA July 2000; The State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officers, "Cancer Risk from Diesel Particulate: National and Metropolitan Area Estimates for the U.S.," March 15, 2000; Kaplan, "Dangers of Diesel" US PIRG, Washington DC July 2000; Zeger et al., "National Morbidity, Mortality and Air Pollution in the US, Report 94 Part II, Health Effects Institute, Cambridge MA, May 2000.

<u>Letters:</u>

NY State Attorney General's Office (IV-D-238) **p. 2**

<u>Response to Comment 2.1(H)(7):</u>

---

[3] U.S. EPA (2000) Health Assessment Document for Diesel Exhaust: SAB Review Draft. EPA/600/8-90/057E Office of Research and Development, Washington, D.C. The document is available electronically at www.epa.gov/ncea/dieslexh.htm.

[4] EPA (2000) Review of EPA's Health Assessment Document for Diesel Exhaust (EPA 600/8-90/057E). Review by the Clean Air Scientific Advisory Committee (CASAC) December 2000 EPA-SAB-CASAC-01-003.

[5] Health Effects Institute (1995) Diesel Exhaust: A Critical Analysis of Emissions, Exposure, and Health Effects. Health Effects of Diesel Exhaust: Epidemiology; A.J. Cohen and M.W.P. Higgins. p. 268.

We agree that there are a number of articles that establish a link between diesel exhaust emissions and lung cancer. The Agency has concluded that diesel exhaust is likely to be carcinogenic to humans by inhalation based on the existing scientific evidence.[6] On October 12-13, 2000 the Scientific Advisory Boards' Clean Air Scientific Advisory Committee (CASAC)[7] concurred with the Agency conclusions presented in the draft Health Assessment for Diesel Exhaust.

(8) Commenter cites an NRDC estimate that diesel pollution in Manhattan could yield 9000 potential cancers. Half of PM emissions in Manhattan are from diesel (10 times the national average); asthma rates in NYC are 4-6 times the national average; and one-third of smog forming nitrogen oxide emissions come from diesel in the Northeast.

Letters:

Transportation Alternatives (IV-D-332) **p. 2**

Response to Comment 2.1(H)(8):

The Agency recognizes that populations that live and work in densely-populated urban areas such as Manhattan are typically subject to significantly greater concentrations of air pollution than those populations that inhabit rural areas. The Agency does not believe that, at this time, the data support the determination of a unit risk for diesel exhaust and therefore lifetime mortality attributable to diesel exhaust exposure cannot be precisely determined. Additional source apportionment studies are needed to understand potential daily versus annual average contributions of diesel exhaust to total ambient particulate matter concentrations in the Manhattan area.

(9) EPA should note the neurobehavioral impairment from diesel exhaust documented in Kilburn, Kaye, "Effects of Diesel Exhaust on Neurobehavioral and Pulmonary Functions," Archives of Environmental Health, Jan/Feb. 2000.

Letters:

Consumer Policy Institute (IV-D-186) **p. 4**

Response to Comment 2.1(H)(9):

The Agency is aware of the work by Kilburn (2000) and will give this information consideration in the development of the final Health Assessment Document for Diesel Exhaust to be published early in 2001. This reference is in docket A-99-06.

(I) Supports EPA's use of source-receptor models, dispersion models, and elemental carbon measurements to evaluate ambient concentrations of diesel

---

[6] U.S. EPA (2000) Health Assessment Document for Diesel Exhaust: SAB Review Draft. EPA/600/8-90/057E Office of Research and Development, Washington, D.C. The document is available electronically at www.epa.gov/ncea/dieslexh.htm.

[7] EPA (2000) Review of EPA's Health Assessment Document for Diesel Exhaust (EPA 600/8-90/057E). Review by the Clean Air Scientific Advisory Committee (CASAC) December 2000 EPA-SAB-CASAC-01-003.

particulate matter and the relative contribution of diesel engines to ambient particulate matter levels.

(1) Commenter provided discussion on the issue of health effects related to particulates and cited the Harvard Six Cities Study (1993), and the American Cancer Society Study (1995), which were released by HEI as well as the National Morbidity, Mortality and Air Pollution Study (NMMAPS) as commissioned by HEI as supporting documentation. Commenter provides significant discussion on these and other studies to support its position.

Letters:

American Lung Association (IV-D-270) **p. 5-9**

Response to Comment 2.1(I)(1):

We agree with the comment.

(J) EPA has failed to demonstrate that public health or welfare is sufficiently impacted by diesel emissions to justify the proposed rule.

(1) Because the NAAQS were established at a level to protect public health, EPA should not allege that serious health effects occur at PM levels below the NAAQS to justify the proposed diesel rule. EPA overstates the scientific certainty that PM is causing mortality and morbidity. API incorporates its comments related to health effects submitted in the Tier 2 rulemaking, and provides further detail in its Attachment 1.

Letters:

American Petroleum Institute (IV-D-343) **p. 5, 16**
Marathon Ashland Petroleum (IV-D-261) **p. 7, 10**

Response to Comment 2.1(J)(1):

EPA disagrees with this comment. In the review of the PM NAAQS that was completed in 1997, EPA concluded that PM, alone or in combination with other pollutants, is associated with adverse effects at levels below those allowed by the current standards. As a result, EPA revised the NAAQS to add new standards for fine particles. The revised standards are now in litigation; however, as discussed further in response to 2.1 (K) the issues in the litigation do not include the scientific evidence underlying EPA's decision to establish new fine particle standards.

EPA believes that health effects from fine PM (as well as diesel exhaust) occur at levels that may exist even in areas where levels of coarse PM (PM10) are at or below the NAAQS for PM10. EPA has reviewed the substantial literature on this topic and believes that health and welfare effects do result from levels of PM2.5 that occur even in areas that are in attainment with the PM10 NAAQS. Thus, we do not believe it is inconsistent to recognize that health effects may be occurring at levels below the levels of the PM10 NAAQS. In any case, EPA has independent authority under section 202(a) to regulate PM emissions, as well as emissions that indirectly cause PM, based on these distinct health and welfare issues.

(2) EPA cannot quantify the cancer benefits that will be achieved from reductions in diesel emissions of PM. The methodology used by EPA to assess the cancer risk uses the scientific data that CASAC determined was inadequate for assessing cancer risks. EPA ignores the scientific belief that 90% of the background lung cancer risk in the US is attributable to smoking, radon and ETS. One commenter (API) states that EPA misrepresents the available epidemiological data in developing their estimate of cancer risk by not considering the dose that occupational workers received or the change in fuels and engine technologies that have occurred since the exposures occurred. This commenter adds that EPA did not evaluate the difference in risk between a 15 ppm and 50 ppm sulfur standard, and notes that EPA appears to base its rule on a "more is better" approach without regard to feasibility, costs, or proven health benefits. API cites to its comments related to this issue as submitted in response to the Tier 2 rulemaking and provides further detail in its Attachment 1.

Letters:

American Petroleum Institute (IV-D-343) **p. 16-17**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 32-33**
Marathon Ashland Petroleum (IV-D-261) **p. 7-8, 11-12**

Response to Comment 2.1(J)(2):

Available data from numerous studies support the Agency conclusion that diesel exhaust is likely to be carcinogenic to the human lung and that the potential for significant environmental risks attributable to diesel exhaust exposure is of public health concern. It is on this basis that we are taking action to protect the public's health.

The Clean Air Scientific Advisory Committee (CASAC), in their public meeting on the draft *Health Assessment for Diesel Exhaust* held on October 12-13, 2000, concurred with the Agency position regarding the likely cancer hazard as well as the cancer risk perspective that there is a reasonable potential that environmental lifetime cancer risks from diesel exhaust may exceed 10^{-5} and could be as high as 10^{-3}.[8] The CASAC panel requested some clarifications regarding the uncertainties and limitations of the approach used, but did not object to the Agency's method in developing the risk perspective using the existing epidemiological database. For a further discussion please see section II of the preamble.

Contrary to the commenters assertion that the Agency ignores the important contribution of smoking, radon and environmental tobacco smoke (ETS) to background lung cancer risk, the background lifetime lung cancer risk in the U.S. population that was used in the Agency analysis includes lung cancer attributable to smoking, radon, environmental tobacco smoke. In deriving the risk perspective the Agency used a technique to relate the increased relative risk of cancer observed in occupationally exposed populations to the background rate of cancer. The conversion of relative risk to population risk is not specific to the diesel exhaust data as it would apply to any pollutant exposure for

[8] EPA (2000) Review of EPA's Health Assessment Document for Diesel Exhaust (EPA 600/8-90/057E). Review by the Clean Air Scientific Advisory Committee (CASAC) December 2000 EPA-SAB-CASAC-01-003.

which cancer risk increases are observed and there is a known background rate for the cancer in question. In the case of diesel exhaust, an approximate relative risk of lung cancer attributed to exposure to diesel exhaust in the workplace is 1.4.[9] The relative risk of 1.4 means that occupationally exposed workers experience an extra risk that is 40 percent higher than the 5 percent background lifetime lung cancer risk in the U.S. population.

We disagree with the comment that we misrepresent the available epidemiological data in developing the environmental cancer risk range. Among the 30 epidemiological studies on diesel exhaust analyzed in the meta-analyses to which the relative risk of 1.4 refers, there is only one study that has information regarding the diesel exhaust dose. We have chosen not to use this study to develop a dose-response relationship for diesel exhaust, a decision that CASAC supports.[10] It is due to the absence of exposure (and therefore dose) data that a unit risk has not been developed for diesel exhaust. Regarding the change in fuels and engine technologies over time, there are insufficient data to presume that these changes have resulted in a decrease in risk. There are no data to suggest that changes in the composition of diesel particulate matter or diesel exhaust in the ambient air have resulted in an increase or a decrease in risk over time.

In the draft *Health Assessment for Diesel Exhaust*,[11] EPA acknowledged the limitations in confidently characterizing a unit risk for diesel exhaust and instead provided a perspective regarding the possible cancer risk consistent with occupational epidemiological findings of increased risk and relative exposure ranges in the occupational and environmental settings. The environmental risk estimates included in the Agency's risk perspective are meant to gauge the possible magnitude of risk with the goal of understanding the potential significance of the lung cancer hazard. The environmental risk estimates are not to be construed as cancer unit risk estimates and are not suitable for use in analyses which would estimate the number of possible lung cancer cases in exposed populations, or to quantify health benefits. Accordingly, EPA did not evaluate the difference in risk between a 15 ppm and 50 ppm sulfur standard. In any case, analysis of reduction in risk is based on reductions in emissions, which derive from the level of emissions standards. EPA discusses elsewhere the level of sulfur needed to meet the level of emissions standards we are setting. It should be noted that EPA believes that PM traps have not been shown to be reliable at 50 ppm sulfur. See discussion at Section III.F.1.a. of the preamble.

The analysis presented by the Agency supports the conclusion that diesel exhaust plays an important role in contributing to the lung cancer risk in the population. Today's action will reduce exposure to the toxic gaseous and PM component of diesel exhaust as a result of the new NMHC and PM standards. We expect that the particulate matter standard in today's action will result in the implementation of particulate matter control technology (catalyzed particulate traps) that will significantly reduce particulate matter and additionally remove gaseous hydrocarbons.

---

[9] U.S. EPA (2000) Health Assessment Document for Diesel Exhaust: SAB Review Draft. EPA/600/8-90/057E Office of Research and Development, Washington, D.C. The document is available electronically at www.epa.gov/ncea/dieslexh.htm. Specifically, see Chapter 8.

[10] EPA (2000) Review of EPA's Health Assessment Document for Diesel Emissions: Review by the Clean Air Scientific Advisory Committee (CASAC). EPA-SAB-CASAC-00-004. www.epa.gov/sab.

[11] U.S. EPA (2000) Health Assessment Document for Diesel Exhaust: SAB Review Draft. EPA/600/8-90/057E Office of Research and Development, Washington, D.C. The document is available electronically at www.epa.gov/ncea/dieslexh.htm.

(3) For this rule, EPA relied on modeling performed for the Tier 2 rule which determined that the program would reduce peak ozone concentrations by 2 ppb in 2007 and 5 ppb in 2030. Given the inherent uncertainties and inaccuracies in ozone modeling, this levels of benefit hardly seems to provide sufficient basis for concluding that additional mobile source controls are necessary for attainment of the NAAQS.

Letters:

American Petroleum Institute (IV-D-343) **p. 3-4**

Response to Comment 2.1(J)(3):

EPA disagrees with the commenter. Today's rule will provide a substantial reduction in emissions of ozone precursors, particularly NOx. These emissions reductions will greatly lower ozone concentrations which will help federal and State efforts to bring about attainment with the current 1-hour ozone standard. As described in the Air Quality Modeling Technical Support Document for this rule, EPA performed regional scale ozone modeling for the Eastern U.S. to assess the impacts of the controls in this rule on predicted 1-hour ozone exceedances. The results of this modeling were examined for those 37 areas in the East for which EPA's modeling predicted exceedances in 2007, 2020 and/or 2030 and current 1-hour design values are above the standard or within 10 percent of the standard. The results for these areas combined indicate that there will be substantial reductions in the number of exceedances and the magnitude of high ozone concentrations in both 2020 and 2030 due to this rule. The modeling also indicates that without the rule exceedances would otherwise increase by 37 percent between 2020 and 2030 as growth in emissions offsets the reductions from Tier 2 and other current control programs.

For all areas combined, the rule is forecast to provide a 33 percent reduction in exceedances in 2020 and a 38 percent reduction in 2030. The total amount of ozone above the standard is expected to decline by nearly 37 percent in 2020 and 44 percent in 2030. Also, daily maximum ozone exceedances are lowered by 5 ppb on average in 2020 and nearly 7 ppb in 2030. The modeling forecasts an overall net reduction of 39 percent in exceedances from 2007, which is close to the start of this program, to 2030 when controls will be fully in place. In addition, the results for each individual area indicate that all areas are expected to have fewer exceedances in 2030 with the HDV controls than without this rule.

(4) Section 211(C)(2)(A) requires EPA to assess all relevant evidence, and therefore EPA should complete its own diesel fuel health assessment before finalizing the rule. Commenter cites issues raised by CASAC which is asking EPA to revise its report quantifying PM effects because EPA has not explicitly stated a case for dealing with diesel PM differently than with ambient PM; EPA should strengthen its discussion of the linkages between health hazards from diesel PM and other ambient PM; and EPA needs to discuss why the current ambient PM does not confer adequate protection from diesel PM.

Letters:

National Petrochemical & Refiners Association (IV-D-218) **p. 13**

Response to Comment 2.1(J)(4):

The draft Health Assessment for Diesel Exhaust[12] used in the current rulemaking, summarizes the currently available scientific knowledge regarding the cancer and noncancer health effects of exposure to diesel exhaust. On October 12-13, 2000 the Scientific Advisory Boards' Clean Air Scientific Advisory Committee (CASAC)[13] concurred with the Agency findings presented in the draft Health Assessment for Diesel Exhaust. The Agency is in the processes of preparing a final Health Assessment document that will address the comments made by the CASAC panel in public session as well as written comments received by committee members and the public.

The Agency has satisfactorily addressed CASAC comments on an earlier draft Health Assessment for Diesel Emissions (November 1999)[14] to which the commenter refers. To assess the noncancer impact for diesel PM, EPA uses data regarding chronic health effects that are specific to diesel PM (as a surrogate for whole diesel exhaust exposure) and also provides a discussion of diesel PM as a component of ambient PM. It is the Agency position, as stated in the Health Assessment for Diesel Exhaust (July 2000), that both acute and chronic exposure to diesel exhaust (as measured by diesel PM) can result in adverse health effects. For chronic diesel exhaust exposure, only a limited amount of human data exist. These data are suggestive of respiratory distress; however, animal test data are quite definitive in providing a basis to anticipate a hazard to the human lung resulting from diesel exhaust exposure based on the irritant and inflammatory reactions observed in test animals. Thus, EPA believes, and CASAC concurred, that it is appropriate to use the animal data to determine a reference concentration of the noncancer impacts of diesel exhaust (as measured by diesel PM).

In the July 2000 Health Assessment for Diesel Exhaust, we have strengthened the discussion of linkages between the health hazards attributable to diesel PM and other ambient PM. A qualitative comparison of adverse effects of exposure to ambient fine PM and diesel exhaust particulate matter shows that the respiratory system is adversely affected in both cases, although a wider spectrum of adverse effects has been identified for ambient fine PM. The primary health effects resulting from chronic exposure of laboratory animals to diesel exhaust are pulmonary inflammation, functional changes in the pulmonary and tracheobronchial regions of laboratory animals, and histopathological changes, including fibrosis. It is also important to note the emerging issue of allergenicity caused or exacerbated by diesel exhaust, which may at some later date, as more information is collected, result in a re-assessment of the diesel exhaust reference concentration. Relative to the diesel PM database, there is a wealth of human data for fine PM noncancer effects that can also be applied to understand the potential health effects of exposure to diesel exhaust (as measured by diesel PM). The primary health effects reported in the epidemiological literature resulting from chronic exposure to ambient PM include mortality and morbidity (as measured by increased hospital admissions, respiratory symptom rates, and decrements in lung function).

---

[12]U.S. EPA (2000) Health Assessment Document for Diesel Exhaust: SAB Review Draft. EPA/600/8-90/057E Office of Research and Development, Washington, D.C. The document is available electronically at www.epa.gov/ncea/dieslexh.htm.

[13] EPA (2000) Review of EPA's Health Assessment Document for Diesel Exhaust (EPA 600/8-90/057E). Review by the Clean Air Scientific Advisory Committee (CASAC) December 2000 EPA-SAB-CASAC-01-003.

[14] Environmental Protection Agency (1999) Health Assessment Document for Diesel Emissions: SAB Review Draft. EPA/600/8-90/057D Office of Research and Development, Washington, D.C.

The ambient $PM_{2.5}$ standard did not independently confer adequate protection from diesel PM, although the Agency agrees that the fine PM health effects database can be informative in characterizing protective levels because diesel PM is part of ambient fine PM. The Agency believes that animal test data are definitive in providing a basis on which to calculate an inhalation reference concentration for diesel exhaust which is a more direct approach for delineating a protective level for diesel PM. CASAC concurred with this approach in public session October 12-13, 2000.

(5) Commenter points to the National Emissions Summary for 1998 to document that diesel vehicle emissions account for only small percentages of national emissions of PM (0.4%), SOx (0.4%), VOC (1%) and NOx (11%), and therefore reductions in on-road emissions will be insignificant in relation to total emissions inventories and will not materially affect attainment status.

Letters:

Murphy Oil Corporation (IV-D-274) **p. 11**

Response to Comment 2.1(J)(5):

EPA disagrees with the comment. The primary air pollution problems targeted by this rule are ambient concentrations of ozone, particulate matter and diesel exhaust. Adverse health effects from 1-hour ozone and PM10 are related to concentrations above their respective NAAQS. Also of concern are ambient concentrations of ozone at moderate levels over prolonged and repeated exposures, and fine PM. Diesel exhaust has recently been determined to be a probable human carcinogen at environmental level of exposure. National inventories of NOx, PM and diesel exhaust are therefore of primary interest. Other HDV emissions are also of concern, and their contributions and corresponding reductions, though less than NOx and PM, are still important. Moreover, the heavy-duty portion of the inventory is often greater in the cities, and the reductions in this rulemaking will have a relatively greater benefit in those areas.

A more detailed description of inventory contribution is found in the response to comment 2.3(B)(2). In short, heavy-duty vehicles are important contributors to the national inventories of NOx emissions. Without NOx reductions from this rule, HDVs are expected to contribute significantly (approximately 18 percent) to annual NOx emissions in 1996. The HDV contribution is predicted to fall to 15 percent in 2007 and 14 percent in 2020 due to reductions from the 2004 heavy-duty rulemaking, and then rise again to 16 percent of total NOx inventory by 2030 as VMT growth overwhelms the reductions of the 2004 HDV program..

The contribution of heavy-duty vehicles to NOx inventories in many MSAs is significantly greater than that reflected in the national average. NOx emissions also contribute to the formation of fine particulate matter, especially in the West. In all areas, NOx also contributes to environmental and welfare effects such as regional haze, and eutrophication and nitrification of water bodies.

Nationally, we estimate that primary emissions of PM_{10} to be about 33 million tons/year in 2007. Fugitive dust, other miscellaneous sources and crustal material (wind erosion) constitute approximately 90 percent of the 2007 PM_{10} inventory. But there is little opportunity to control these sources. Additionally, there is evidence from ambient studies that emissions of these materials may be overestimated and/or that once emitted they have less of an influence on monitored PM concentration than this inventory share would suggest. Commenter's use of the PM inventory figure of 0.4% is apparently based on the HDV portion of total PM, rather than that portion of PM excluding natural and miscellaneous sources. Mobile sources account for 22 percent of the PM_{10} inventory (excluding the contribution of miscellaneous and natural sources) and highway heavy-duty engines, the subject of today's action, account for 20 percent of the mobile source portion of national PM_{10} emissions in 2007.

The contribution of heavy-duty vehicle emissions to total mobile source PM emissions in some metropolitan areas is substantially higher than the national average. This is not surprising, given the high density of these engines operating in these areas. For example, in Los Angeles, Atlanta, Hartford, San Diego, Santa Fe, Cincinnati, and Detroit, the estimated 2007 highway heavy-duty vehicle contribution to mobile source PM_{10} ranges from 25 to 38 percent, while the national percent contribution to mobile sources for 2007 is projected to be about 20 percent.

The city-specific investigations of ambient $PM_{2.5}$ based on monitored and modeled data indicate that the contribution of diesel engines to PM inventories in several urban areas around the U.S. is much higher than indicated by the national and city-specific PM emission inventories presented in Table 2.3(C)(1)-c. For example, diesel PM ranges up to as high was 68 percent as a portion of total PM in Manhattan (1993); up to 38 percent in Brighton, Colorado (1996-1997); and up to 27 percent in Phoenix, AZ (1994-1995). Reader should refer to the chapter 2 of the RIA, Table II.A-21 and surrounding text for a compilation and explanation of all such studies.

One possible explanation for the higher contribution of diesel PM emissions to total PM in these studies as compared to national inventories is the concentrated use of diesel engines in certain local or regional areas which is not well represented by the national, yearly average presented in national PM emission inventories. Another reason may be underestimation of the in-use diesel PM emission rates. Our current modeling incorporates deterioration only as would be experienced in properly maintained, untampered vehicles. We are currently in the process of reassessing the rate of in-use deterioration of diesel engines and vehicles which could significantly increase the contribution of HDVs to diesel PM.

Whether or not HDVs are a large or small percentage of national inventories is not determinative of the need for emission control. What is important is that HDV emissions contribute to a significant health and welfare problem. Thus while the HDV contribution to SOx, VOCs and air toxics in 2007 is less than 5 percent of their respective inventories, these emissions do play a role in secondary formation of fine particles, acid rain, ozone formation, acid rain, POM deposition and other public health and welfare effects. It is a fundamental aspect of controlling pollution that comes from many sources that it is important to review emissions from all sources and attempt to reduce such emissions in order to achieve cleaner air. Controlling emissions from this source allows us to cost-effectively gain large reductions in a variety of pollutants.

(6) There is evidence that PM2.5 is more harmful than PM10 and the proposed standards may not adequately address the health issues associated with the smaller particles. Also, in considering the sulfate portion of PM, half of the measured sulfate mass is water vapor. These concerns, as well as the measurement technology used to determine PM levels, should be addressed before the health benefits are estimated and the rule is finalized.

Letters:

American Petroleum Institute (IV-D-343) **p. 14**

Response to Comment 2.1(J)(6):

Almost all PM emitted from diesel engines falls into the category of PM2.5 or below (i.e., almost all diesel PM has a mass mean diameter less than 2.5 microns). Greater than 90 percent of the PM emissions from diesel engines have a mass mean diameter less than 1 micron. The phase 2 PM standard set here reduces the mass of PM emissions from diesel engines by approximately 90% based upon the application of the catalyzed diesel particulate filter (CDPF) technology. Therefore the mass of PM2.5 emissions from heavy-duty diesel engines meeting the phase 2 standards will be reduced by 90 percent.

It is true, as noted by the commenter, that aqueous sulfuric acid (sulfate PM) is made up substantially of water whether in diesel exhaust or in the atmosphere. However, if the commenter means to infer that because some portion of a solution is made up of water that the solution is benign, we disagree.

Sulfute PM is a public health concern as evidenced by several morbidity and mortality studies.[15] Sulfate PM commonly exist as ultra-fine aerosols which have been implicated in some studies as potentially more toxic than other fine PM. Ultra-fine particles reach the sensitive, deep airway tissues in the lung where they have a long residence time compared to gaseous compounds. In addition to the toxic effects specific to sulfuric acid, these ultra-fine particles can also act as carrier particles for other toxic species including hydrocarbons. We have no evidence to suggest that sulfate PM is not linked to the carcinogenic concerns with diesel PM in general. Finally, for purposes of SIP development, States have to consider total PM including sulfate PM.

(K) EPA should wait until the PM-2.5 litigation is resolved to move forward with the proposal because the health and welfare risks are most closely associated with fine PM and not the PM-10 concerns EPA is forced to rely on because of the fine PM litigation.

(1) Commenter provides no further supporting information or detailed analysis.

Letters:

Cenex Harvest States Cooperatives (IV-D-232). **p. 4**

Response to Comment 2.1(K)(1):

The commenter asks "why is EPA moving so far so fast on coarse PM10?" In fact, PM10 includes both fine and coarse fraction particles and in many areas of the U.S., fine fraction particles predominate. Health effects associated with PM10 may be associated with either or both fine and coarse fraction particles. Thus, EPA does not agree that the PM10 NAAQS are limited to protection against coarse particle effects. EPA also does not agree that all regulatory activities should be placed on hold when some regulations are under

[15] Reanalysis of the Harvard Six Cities Study and the American Cancer Society Study of Particulate Air Pollution and Mortality, 2000. Health Effects Institute: Special Report of the Institute's Particle Epidemiology Reanalysis Project. Available on the web at www.healtheffects.org/pubs-recent.htm.

litigation. The scientific evidence that supported the establishment of new PM2.5 NAAQS was not challenged in the U.S. District Court of Appeals decision; in fact, the panel of judges stated that this evidence “amply justifies establishment of new fine particle standards.” (May 14, 1999, p. 47) While EPA is not implementing the PM2.5 NAAQS in light of ongoing litigation, we believe that it remains appropriate to recognize the scientific evidence of health effects associated with PM10 and the benefits of reducing the fine fraction of PM10 in other rulemaking proceedings.

(L) The scientific evidence and epidemiology studies to date are insufficient to determine whether diesel exhaust is a cause of cancer in humans. EPA should not calculate a lung cancer risk from exposure to ambient levels of diesel exhaust and should withdraw its population risk estimates since they are scientifically unsupportable.

(1)(a) The proposed rule provides an unbalanced view of the scientific evidence linking diesel exhaust to cancer. EPA's proposed rule incorrectly concludes that diesel exhaust causes lung cancer and the assumptions regarding this link is based on a revised HAD that has not passed independent review by CASAC. The scientific evidence and epidemiology studies to date are insufficient to determine whether diesel exhaust is a cause of cancer. Virtually all of the studies lack quantitative data on exposure to diesel particulates or exhaust during the relevant time of exposure, did not adequately control for confounding with other environmental factors, and incorporate little or no historical information on the components of diesel exhaust at the time of exposure. One commenter notes that there have been dramatic changes in the diesel engine technology, particularly over the last decade, that may have significantly changed the composition of diesel exhaust such that epidemiology studies evaluating the effects of diesel engines in the 1950's through the 1980's will not accurately predict human health effects from current diesel exhaust. One commenter states that EPA’s application of the “Hill criteria” in the November 1999 draft Health Assessment Document for Diesel Emissions for evaluating the evidence of causality provided by epidemiological studies is flawed and refers to the critique of Dr. Vedal of the CASAC panel. One commenter cites two HEI publications [Diesel Exhaust: A Critical Analysis of Emissions, Exposure, and Health Effects, April 1995; and Diesel Emissions and Lung Cancer: Epidemiology and Quantitative Risk Assessment, June 1999] and notes that HEI has found that only a few studies are statistically significant and those studies lack sufficient data on exposure and confounding. To support their position, the commenter refers to Morgan, W.D.C., Reger, R.B., and Tucker, D.C. (1997). "Health Effects of Diesel Emissions," Ann. Occup. Hyg. 41: 643-658; Muscat, J.E. and Wynder E.L. (1995). "Diesel Engine Exhaust and Lung Cancer: An Unproven Association," Environ. Health Perspect. 103. 812-818.

<u>Letters:</u>

Engine Manufacturers Association (IV-D-251) **p. 75-79**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 31-33**
International Truck & Engine Corp. (IV-D-25) **p. 1-2**
International Truck & Engine Corp. (IV-D-257) **p. 25-30**
Marathon Ashland Petroleum (IV-D-261) **p. 7-8**

Mercatus Center at GMU (IV-D-219) **p. 10**

Response to Comment 2.1(L)(1)(a):

We disagree with the comment that we provide an unbalanced view of the scientific literature linking diesel exhaust to lung cancer in humans. In the NPRM, we made the statement that "Individual epidemiological studies numbering about 30 show increased lung cancer risks of 20 to 89 percent within the study populations depending on the study." Twenty eight of these studies are presented by Cohen and Higgins in the 1995 Health Effects Institute (HEI) study the commenter cites[16] and additional studies have since been published that report an increased risk for workers exposed to diesel exhaust.[17] [18] [19] The draft Health Assessment for Diesel Exhaust evaluated only 22 of these studies because those were identified as being the most relevant for risk assessment. Among these 22 studies, 16 reported statistically significant increased lung cancer risks, ranging from 20 to 167 percent, associated with diesel exhaust exposure. Of the remaining six studies, the authors report either negative or inconclusive results. We conclude that the consistent finding of elevated lung cancer risk across several different occupational workers (including truck drivers, railroad workers, heavy equipment operators, and farm tractor drivers) support our determination that diesel exhaust is likely to be carcinogenic to humans by inhalation exposure.

Contrary to the commenters assertion, our interpretation of the data is consistent with that of several experts, including an expert panel (the Diesel Working Group) formed by HEI. In the 1995 HEI study to which the commenter refers, Cohen and Higgins reviewed 34 epidemiological studies and concluded that "The studies reviewed above suggest that exposure to diesel exhaust in a variety of occupational circumstances is associated with small to moderate relative increases in lung cancer occurrence and/or mortality. These elevations do not appear to be fully explicable by confounding due to cigarette smoking or other known sources of bias. Therefore, at present, exposure to diesel exhaust provides the most reasonable explanation for these elevations."[20] EPA and HEI have concluded that the epidemiological database lacks sufficient data on exposure to conduct a confident quantitative assessment of the cancer risk.[21] [22] This issue is discussed

---

[16] Health Effects Institute (1995) Diesel Exhaust: A Critical Analysis of Emissions, Exposure, and Health Effects. Health Effects of Diesel Exhaust: Epidemiology; A.J. Cohen and M.W.P. Higgins.

[17] Steenland, K., Deddens, J., Stayner, L. (1998) Diesel Exhaust and Lung Cancer in the Trucking Industry: Exposure-Response Analyses and Risk Assessment. *Am. J Indus. Medicine* 34:220-228.

[18] Hansen, J., Raaschou-Nielsen, O., Olsen, J.H., et al. (1998) Increased risk of lung cancer among different types of professional drivers in Denmark. Occup. Environ. Med. 55:115-118.

[19] Bruske-Holfeld, I., Mohner, M., Ahrens, W., et al. (1999) Lung cancer risk in male workers occupationally exposed to diesel motor emissions in Germany. Am. J Ind. Med. 36:405-414.

[20] Health Effects Institute (1995) Diesel Exhaust: A Critical Analysis of Emissions, Exposure, and Health Effects. Health Effects of Diesel Exhaust: Epidemiology; A.J. Cohen and M.W.P. Higgins. p. 268.

[21] U.S. EPA (2000) Health Assessment Document for Diesel Exhaust: SAB Review Draft. EPA/600/8-90/057E Office of Research and Development, Washington, D.C. The document is available electronically at www.epa.gov/ncea/dieslexh.htm.

[22] Health Effects Institute (1999) Diesel Emissions and Lung Cancer: Epidemiology and Quantitative Risk Assessment.

in greater detail in comment L(1)(b) below.

The commenter asserts that the lack of quantitative exposure data render the epidemiological data insufficient to assess the potential for a cancer hazard. While few of the epidemiological studies measured worker exposures to diesel exhaust, the use of surrogate estimates for exposure (e.g., worker years in a diesel-exposed job) provides a useful exposure paradigm to determine the relative risk in the occupational groups. The use of surrogate estimates of exposure are considered to provide adequate assessment of exposure for purposes of identifying potential agents causally related to the disease under investigation. The lack of exposure concentration estimates does not preclude the use or importance of the epidemiological database in the qualitative weight of evidence determination to identify a potential cancer hazard, but does significantly limit our ability to calculate a unit risk or potency estimate.

Regarding changes in engine technology and fuel composition over time, available data clearly indicate that toxicologically significant organic components of diesel exhaust (e.g., polyaromatic hydrocarbons, polyaromatic hydrocarbon derivatives, nitro-polyaromatic hydrocarbons) were present in diesel PM and diesel exhaust in the 1970s and are still present in diesel exhaust. There are insufficient data to provide insight into the changes in total polyaromatic hydrocarbon emissions over time or specific organic constituents such as benzo[a]pyrene and 1-nitropyrene. A significant fraction of diesel PM in the ambient air (possibly more than 50%) is emitted by non-road equipment and there are no data available to characterize changes in the chemical composition of diesel PM from non-road equipment over time. Given the variation in fuel, engine technology, and in-use operational factors over the years, and the very important fact that we do not know the mode of action for the cancer and noncancer health effects observed with exposure to diesel exhaust, we cannot presume that changes in emissions or emission constituents have resulted in a decrease in risk.

In the November 1999 draft Health Assessment Document for Diesel Emissions we summarized the application of the Hill criteria[23] to inform our evaluation of the potential for diesel exhaust to be causally related to lung cancer. Dr. Vedal's concern, as expressed in his most recent comments on the draft Health Assessment Document for Diesel Exhaust, is not the lack of evidence provided by the epidemiology data suggesting a causal relationship between diesel exhaust exposure and lung cancer, but the application of the Hill criteria to demonstrate causality. Based on Dr. Vedal's comments on the application of the Hill criteria in the November 1999 draft Health Assessment Document for Diesel Emissions, we revised this discussion in the July 2000 draft Health Assessment Document for Diesel Exhaust and include the modifications to the Hill criteria provided by Rothman.[24] We state that none of the Hill criteria should be considered either necessary (except temporality of exposure) or sufficient in itself to demonstrate causality and that the absence of a positive finding for one or even several of the criteria does not prevent a causal interpretation. Dr. Vedal's comments on the application of the Hill criteria in the July 2000 draft Health Assessment Document for Diesel Exhaust are provided here:

> "The application of the Hill criteria [(pp. 65-68) of the July 2000 Health Assessment Document for Diesel Exhaust] for assessing the likelihood of causation is improved

---

[23] Hill, A.B. (1965) The environment and disease: association or causation. Proceedings of the Royal Society of Medicine 58:295-300.

[24] Rothman, K.J. (1986) Modern Epidemiology. Boston/Toronto: Little, Brown and Co. Pp. 16-21.

> in this version of the document. It should be appreciated that modern views on the usefulness of the Hill criteria, such as those expressed by Rothman as referenced in the document, have significantly limited the usefulness of the criteria for this purpose. In brief, the general point of these views is that none of the Hill criteria, except for temporality, need to be satisfied by an association that is, in fact, a causal association. That is, none are necessary. Specifically, neither a strong association, specificity of effect, dose-response, plausibility nor consistency are required. One wonders about the utility of applying the Hill criteria when so little is gained by their use.... The Hill criteria that are probably met are the consistency criterion and the biological plausibility criterion. It is not clear that the dose-response criterion is met. Specificity is partially met, although studies have either not addressed other effects or have lacked power to do so. The temporality criterion is assumed and not tested.... I would recommend basing arguments for causality, when using the epidemiological data, not on the Hill criteria, but rather on those characteristics of studies that determine validity."[25]

Additional evidence supporting the identification of a cancer hazard for diesel exhaust includes the observation tumors in animals following applications of various fractions of the diesel exhaust mixture to skin, and implantation of diesel particles in respiratory tissue. Recognizing that diesel exhaust is a complex mixture of carbon particles and associated organics and other inorganics, it is unclear what fraction or combination of fractions is responsible for the carcinogenicity and other respiratory effects. It has been shown, however, that the carbon particles as well as the organics have the potential to be active toxicological agents, either because of the potential to be irritants which cause inflamation, or because of a capacity to produce mutagenic and/or carcinogenic activity. In the case of the organics (which exist both in particle and gaseous states in diesel exhaust) some have potent mutagenic and carcinogenic properties. In addition, some evidence for the bioavailability of these particle adsorbed compounds has been demonstrated which supports a hypothesis that the adsorbed organics are bioavailable to the lung as well as being transported to sites distant from the lung.

The commenter provides two references to support their view that the epidemiological data do not support the determination that diesel exhaust is likely to be carcinogenic to humans by inhalation exposure. Morgan et al., (1997) reviewed 23 epidemiological studies and employed the Hill criteria to conclude that the epidemiological data do not provide convincing evidence that there is an increased risk of cancer from diesel exhaust emissions. Muskat and Wynder (1995) reviewed 14 epidemiological studies and concluded, largely on the basis of possible confounding by cigarette smoking that the epidemiological studies do not provide evidence for a carcinogenic effect of diesel exhaust.

We disagree with the findings of these two assessments. They do not represent the dominant view among the scientific bodies that have reviewed the epidemiological and toxicological literature. While the epidemiological studies are of varying quality in terms of design and controlling for factors that might confound a lung cancer response, we believe that these data provide compelling evidence that diesel exhaust is likely to be carcinogenic to humans by inhalation.

The Clean Air Scientific Advisory Committee (CASAC) of the Science Advisory Board concurred with the Agency that the epidemiological literature form a basis for the

[25] Final Combined Panel Comments on the Health Assessment Document for Diesel Exhaust: SAB Review Draft (EPA/600/8-90/057E).

conclusion that diesel exhaust is likely to be carcinogenic to humans by inhalation.[26]

EPA joins many other organizations in finding that diesel exhaust or diesel particulate matter is a likely or probable human carcinogen. In the late 1980s, the International Agency for Research on Cancer (IARC) determined that diesel exhaust is "probably carcinogenic to humans" and the National Institute for Occupational Safety and Health classified diesel exhaust a "potential occupational carcinogen."[27] [28] In 1996, the International Programme on Chemical Safety of the World Health Organization listed diesel exhaust as a "probable" human carcinogen.[29] In 1998, the California Office of Environmental Health Hazard Assessment (OEHHA, California EPA) identified diesel PM as a toxic air contaminant due to the noncancer and cancer hazard and because of the potential magnitude of the cancer risk.[30] Most recently, the U.S. Department of Health and Human Services National Toxicology Program designated diesel exhaust particles as "reasonably anticipated to be a human carcinogen" in its Ninth Report on Carcinogens.[31]

The information provided by EPA in the Health Assessment for Diesel Exhaust and in the preamble and RIA provide the proper scientific basis for establishment of PM and NMHC standards for diesel engines based on the toxicity of diesel exhaust.

(1)(b) Commenters disagreed with EPA's intent (in the RIA) to publish the information in its revised Health Assessment Document for Diesel Emissions (HAD) and reviewed EPA's conclusions regarding the risk from diesel exhaust. EPA's risk estimate is scientifically unsupportable given the weakness of the existing diesel epidemiology data-base and its unsuitability for quantitative risk assessment (QRA). A meta-analysis is only as reliable as the underlying studies from which it is derived and since EPA has acknowledged that none of the studies cited in the diesel meta-analysis could support QRA, using these studies as a whole to support QRA is scientifically unwarranted. One commenter notes that these analyses do not represent the overall epidemiological database, and that only two of the studies used to support EPA's QRA include exposure analysis and those studies have deficiencies that make them unsuitable for QRA. Therefore, the current epidemiological studies and state of the science are not sufficient to provide any quantitative relationship between exposure to

[26] EPA (2000) Review of EPA's Health Assessment Document for Diesel Exhaust (EPA 600/8-90/057E). Review by the Clean Air Scientific Advisory Committee (CASAC) December 2000. EPA-SAB-CASAC-01-003.

[27] National Institute for Occupational Safety and Health (NIOSH) (1988) Carcinogenic effects of exposure to diesel exhaust. NIOSH Current Intelligence Bulletin 50. DHHS, Publication No. 88-116. Centers for Disease Control, Atlanta, GA.

[28] International Agency for Research on Cancer (1989) Diesel and gasoline engine exhausts and some nitroarenes, Vol. 46. Monographs on the evaluation of carcinogenic risks to humans. World Heath Organization, International Agency for Research on Cancer, Lyon, France.

[29] World Health Organization (1996) Diesel fuel and exhaust emissions: International program on chemical safety. World Health Organization, Geneva, Switzerland.

[30] Office of Environmental Health Hazard Assessment (1998) Health risk assessment for diesel exhaust, April 1998. California Environmental Protection Agency, Sacramento, CA.

[31] U.S. Department of Health and Human Services (2000) Ninth report on carcinogens. National Toxicology Program, Research Triangle Park, NC. ehis.niehs.nih.gov/roc/toc9.html.

diesel exhaust and a risk of cancer. One commenter noted that EPA has concluded that the Garshick studies cannot be used for QRA since a negative dose-response curve was found in that study. One commenter refers to their previous comments (Navistar/International Truck and Engine Corp.) "Comments on the Clean Air Science Advisory Committee Draft of the November 1999 Revised Health Assessment Document of Diesel Emissions (November 24, 1999)" as well as "Supplemental Comments on the Clean Air Science Advisory Committee Draft of the November 1999 Revised Health Assessment Document of Diesel Emissions (December 15, 1999)" that provides detailed explanation on why the Steenland study is unsuitable for QRA. The commenter asserts that other analyses of the diesel epidemiology database have concluded that quantitative risk estimates cannot be done. Two commenters state that the risk range serves no purpose but to misinform the public and that the inaccuracy of the calculation can be readily seen by comparing the reported risk range to reported incidence data of lung cancer. The commenter cites National Cancer Institute reports that the annual incidence of lung and bronchus cancer reported in the United States during the 1990-1996 was approximately 150,000 cases. The commenter states that when one considers the lower end of the range of lung cancer cases potentially attributable to cigarette smoking, radon, and environmental tobacco smoke and subtracts these from the annual incidence rate, there are not enough cancer cases such that diesel exhaust could have an environmental lifetime risk of 10^{-3}.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 80**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 31-32**
International Truck & Engine Corp. (IV-D-25) **p. 1-2**
International Truck & Engine Corp. (IV-D-257) **p. 25-30**
Marathon Ashland Petroleum (IV-D-261) **p. 7-8**
Mercatus Center at GMU (IV-D-219) **p. 10**

Response to Comment 2.1(L)(1)(b):

The EPA agrees that the available data are currently considered inadequate to confidently establish a cancer unit risk factor (cancer potency); however, significant activities are underway to improve the epidemiologic database for dose-response assessment and the Agency will monitor these activities to determine their potential use in conducting dose-response analysis and deriving a unit risk.[32] In the absence of a unit risk estimate, we provide a perspective on the possible environmental cancer risk posed by exposure to diesel exhaust to gain a better understanding of the potential significance of the cancer hazard for the general population. The Agency concluded in developing its perspective on risk that, there is a reasonable potential that environmental lifetime cancer

[32] U.S. EPA (2000) Health Assessment Document for Diesel Exhaust: SAB Review Draft. EPA/600/8-90/057E Office of Research and Development, Washington, D.C. The document is available electronically at www.epa.gov/ncea/dieslexh.htm.

risks from diesel exhaust may exceed 10^{-5} and could be as high as 10^{-3}.[33] This environmental cancer risk range provided by EPA is significantly different from the derivation of a unit risk factor. A unit risk estimate is derived from dose-response data in the epidemiological or toxicological literature. The perspective on risk provided in the RIA and the draft Health Assessment Document for Diesel Exhaust is based on the possible cancer risk consistent with occupational epidemiological findings of increased risk and relative exposure ranges in the occupational and environmental settings. Such an approach does not produce estimates of cancer unit risk and are not suitable for use in analyses which would estimate possible number of lung cancer cases in exposed populations. Rather, this approach provides a perspective on the possible magnitude of environmental cancer risk and thus insight about the possible significance of the cancer hazard. The Agency believes that the risk estimation techniques that were used in the draft Assessment to gauge the potential for and possible magnitude of risk are reasonable and the CASAC panel has concurred with the Assessment's discussion of the possible environmental risk range with an understanding that some clarifications and caveats would be added to the final version of the Assessment. This is discussed in greater detail in the RIA.

EPA recognizes that, as in all such risk assessments, there are uncertainties in this assessment of the environmental risk range including limitations in exposure data, uncertainty with respect to the most accurate characterization of the risk increases observed in the epidemiological studies, chemical changes in diesel exhaust over time, and extrapolation of the risk from occupational to ambient environmental exposures. As with any such risk assessment for a carcinogen, at this time EPA cannot rule out that the possible lower end of the environmental cancer lifetime risk range includes zero. However, it is the Agency's best scientific judgement that the assumptions and other elements of this analysis are reasonable and appropriate for identifying the risk potential based on the scientific information currently available.

We disagree that the environmental risk range misinforms the public and is inaccurate when compared to reported incidences of lung cancer. The commenter cites National Cancer Institute reports that the annual incidence of lung and bronchus cancer reported in the United States during the 1990-1996 was approximately 150,000 cases. The majority of these cases are attributed to cigarette smoking, with additional cases caused by environmental tobacco smoke, radon, and other causes. The absolute numbers of cases of lung cancer attributable to each of these causes is highly uncertain. The commenter correctly calculates that using the upper limit of the possible number of cancer cases attributed to cigarette smoking, environmental tobacco smoke, radon exceeds the annual number of lung cancer cases reported. The commenter states that subtracting the lower end of the ranges of lung cancer attributed to cigarette smoking, environmental tobacco smoke, and radon suggests there are approximately 7,000 cases of lung cancer attributable to other causes. From this annual value of 7,000 lung cancer cases, the commenter incorrectly calculates the lifetime population risk potentially attributable to diesel exhaust as 2 x 10^{-5} (this is the annual risk that diesel exhaust exposure might pose if one assumed it accounted for the 7,000 deaths per year, calculated by dividing 7,000 by the estimated population in 1996 of 272 million). The lifetime population risk that diesel

[33] As used in this rule, environmental risk is defined as the risk (i.e. a mathematical probability) that lung cancer would be observed in the population after a lifetime exposure to diesel exhaust. Exposure levels may be occupational lifetime or environmental lifetime exposures. An environmental risk in the magnitude of 10^{-5} translates as the probability of lung cancer being evidenced in one person in a population of one hundred thousand having a lifetime exposure.

exhaust might pose if exposure to this substance caused the remaining 7,000 lung cancer cases per year is 2×10^{-3} (the lifetime risk is calculated by multiplying the number of annual lung cancer cases by 70, the estimated lifetime, and dividing by the estimated population). The population risk of 2×10^{-3} is clearly in agreement with the upper end of the environmental risk range that EPA presents in the draft Health Assessment Document for Diesel Exhaust and in the RIA. For further information on the risk range, see section II of the preamble.

In addition, among the cancer cases attributed to radon, 85 percent of these are estimated to be smokers and therefore a more accurate assessment of lung cancer attributable to radon only is much lower than that used by the commenter.[34] Calculation of the lung cancer cases attributable to radon only (as opposed to radon-exposed individuals who are also smokers), indicates that there are thousands of additional lung cancer cases for which a cause has not been determined (e.g., the lifetime population risk attributable to diesel exhaust exposure may be as high as 10^{-3} and still not account for all of the unexplained cancer cases in the population).

(2) One commenter states that the 2007 HDE rulemaking is expressly designed to address ozone and PM air quality objectives, and not mobile source air toxics concerns and is not an appropriate forum for addressing any perceived cancer risks associated with diesel emissions.
Letters:

International Truck & Engine Corp. (IV-D-25) **p. 2**

Response to Comment 2.1(L)(2):

We disagree with this comment. The EPA, under the authority granted in Section 202(a) and Section 211(c) of the Clean Air Act Amendments is allowed to regulate engines and their fuels that contribute to air pollution which reasonably may be anticipated to endanger public health or welfare. This authority is not limited to compliance with the NAAQS for ozone and PM, but includes any pollutant that may reasonably be anticipated to endanger public health or welfare, including public heath or welfare concerns raised by exposure to air toxics or likely human carcinogens.

(M) EPA should revise and expand its discussion of non-cancer health effects of diesel exhaust.

(1) The discussion of non-cancer health effects is misleading in that it neglects to report on the findings and conclusion of the HAD. Commenter cites to EPA's Draft 1999 document, Chapter 5, Noncancer Health Effects and notes that there is inadequate assurance that the reference concentration presented in the document was appropriate. The absence of information in the proposal from the HAD indicating that there appears to be little if any long term health effects from diesel emissions is misleading and needs correction.

Letters:

[34] http://www.cdc.gov/tobacco/sgr_1989/1989SGRChapter3.pdf

Engine Manufacturers Association (IV-D-251) **p. 81**

<u>Response to Comment 2.1(M)(1):</u>

We disagree with the commenter. The discussion of noncancer health effects in the rulemaking document accurately and adequately summarizes the findings and conclusions of the draft Health Assessment for Diesel Exhaust. The commenter cites the 1999 draft Health Assessment Document for Diesel Emissions in which we stated that noncancer effects in humans from long-term chronic exposure to diesel particulate matter are not evident. We also state in the 1999 and July 2000 Health Assessments that while most of the epidemiologic data indicate an absence of an excess risk of chronic respiratory disease associated with exposure to diesel exhaust, a few studies report a higher prevalence of respiratory symptoms, primarily cough, phlegm, or chronic bronchitis among the exposed. Relative to the diesel PM database, there is a wealth of human data for fine PM noncancer effects, in part, possibly due to the fact that for chronic diesel exhaust exposure, only a limited amount of human data exist. The fine PM database can also be applied to understand the potential health effects of exposure to diesel exhaust (as measured by diesel PM). A qualitative comparison of adverse effects of exposure to ambient fine PM and diesel exhaust particulate matter shows that the respiratory system is adversely affected in both cases, although a wider spectrum of adverse effects has been identified for ambient fine PM including increased hospital admissions, respiratory symptom rates, decrements in lung function and increased mortality.

We state in the final rulemaking document that the data specific to diesel exhaust are suggestive of respiratory distress; however, the database regarding animal exposure to diesel exhaust is robust enough to provide calculation of a reference concentration. It is also noteworthy that we state in the 1999 and 2000 versions of the Health Assessments that it is also apparent that diesel exhaust, as measured by diesel particulate matter, has the potential to stimulate allergen-induced allergic airway disease in sensitive humans, a finding not reported in the ambient PM database.

In their Review of EPA's 1999 draft Health Assessment Document for Diesel Emissions[35] CASAC questioned the use of allergenicity data in the derivation of the reference concentration (RfC) because the critical effect on which the RfC is based focuses on pulmonary histopathology. We subsequently have removed the uncertainty factor associated with the allergenicity data from the RfC derivation. In public session on October 12-13, 2000, CASAC concurred with the calculation of the RfC presented in the July 2000 Health Assessment Document with the addition of an uncertainty factor of three to extrapolate the observed health effects in animals to humans.[36] This additional uncertainty factor is being used on the recommendation of CASAC and will result in an RfC of approximately 5 ug/m^3.

(2) Non-cancer health effects from diesel should not be a concern. By 2007, under the current control program, ambient levels of diesel PM will average only 0.4 Mg/m3, which is an order of magnitude or more below the RfC range

---

[35] EPA (2000) Review of EPA's Health Assessment Document for Diesel Emissions: Review by the Clean Air Scientific Advisory Committee (CASAC). EPA-SAB-CASAC-00-004. www.epa.gov/sab.

[36] EPA (2000) Review of EPA's Health Assessment Document for Diesel Exhaust (EPA 600/8-90/057E). Review by the Clean Air Scientific Advisory Committee (CASAC) December 2000. EPA-SAB-CASAC-01-003.

currently being considered by EPA and CASAC. Since the RfC is a concentration at which there is no appreciable risk of non-cancer effects, this factor should not be a concern to the Agency.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 33**

Response to Comment 2.1(M)(2):

Chronic and acute noncancer health effects attributed to diesel exhaust exposure are of concern to the Agency. For chronic noncancer health effects the Agency recognizes that diesel PM is a ubiquitous component of ambient PM and therefore the health effects attributed to ambient PM are of considerable concern to the Agency. As discussed in the RIA, these health effects include increased hospital admissions, respiratory symptom rates, decrements in lung function, and mortality. The fact that diesel PM concentrations, if considered in isolation, may be below the RfC, does not lessen our concern about their contribution to overall ambient PM levels and health effects. A threshold for noncancer health effects attributed to ambient PM has not been established and therefore, the contribution of diesel exhaust particulate matter to the ambient PM mixture is of concern to the Agency.

Regarding the reference concentration, while average ambient levels of diesel particulate matter may be lower than the chronic reference concentration in the future, the Agency acknowledges that some studies suggest there are locations in which people are exposed to levels of diesel exhaust (as measured by diesel particulate matter) that exceed the reference concentration (‘hot spot’ exposure situations such as near roadways and bus depots).

In addition, acute exposure to diesel exhaust can result in decreases in lung function, wheezing, chest tightness, increases in airway resistance, and there is also evidence of immunological effects including increased reaction to allergens and some symptoms associated with asthma. These acute effects data currently lack sufficient detail to permit the calculation of protective levels for human exposure, however, the Agency will revisit this issue as additional data become available. We believe that this information provides sufficient cause for concern and accordingly, the Agency continues to collect information regarding exposure to diesel exhaust, including short-term microenvironmental exposures that may far exceed annual average exposures.

See also our response to issues 2.1(M)(1) and 2.1(M)(3).

(3) EPA should use the draft reference concentration (RfC) for non-cancer endpoints for any quantitative health benefit analysis. Worst case estimates of diesel contribution to ambient PM are well below the proposed RfC of 5.0 micrograms per cubic meter. As listed in Table II.A-22, California EPA determined worst-case exposures in 1990, 2007 and 2020 at 1.5, 1.3 and 1.2 micrograms per cubic meter, respectively.

Letters:

American Petroleum Institute (IV-D-343) **p. 13, 18**
Marathon Ashland Petroleum (IV-D-261) **p. 8**

Response to Comment 2.1(M)(3):

We disagree with the commenter that the draft reference concentration provides the only tool for assessing the noncancer endpoints attributable to diesel PM and ambient PM of which diesel PM is a ubiquitous component. As discussed above in the response to comment 2.1(M)(1) and 2.1(M)(2) and in the preamble, relative to the diesel PM database, there is a wealth of human data for fine PM noncancer effects that are relevant to the quantitative assessment of benefits realized as a result of the implementation of this rule. This approach provides the advantage that in addition to direct diesel exhaust particulate exposure, assessment of ambient PM includes the contribution of secondary PM attributed to diesel exhaust emissions.

(N) The association and causality between PM concentrations and mortality is uncertain.

(1) Existing epidemiological studies associate many factors with health statistics including meteorological, environmental, social, and economic components and since all of those factors may contribute to the noted correlations, it is currently inappropriate to indicate, based on these studies, that there is a causal role in mortality from presently observed ambient PM concentrations.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 76**

Response to Comment 2.1(N)(1):

EPA does not agree with the commenter. EPA reviewed these issues in detail in the Particulate Matter Criteria Document (US EPA 1996, Docket A-99-06/II-A-18, 19, 20) and Response to Comments document for the 1997 PM NAAQS rulemaking (Docket number A-95-54 and ECAO-CD-92-0671). As stated in the response to comments: "The causal relationship of adverse human health effects due to exposure to ambient air containing high concentrations of airborne particles was established beyond any reasonable scientific doubt by high-level incidents such as those observed in the Meuse Valley of Belgium in 1930, in Donora, PA in 1948, and in London in 1952." (1997 PM NAAQS RTC, p. A-5) With regard to the overall body of evidence for PM-related health effects at lower concentrations, EPA has concluded: "While the lack of demonstrated mechanisms that explain the range of epidemiologic findings is an important caution which limits conclusions as to causality, qualitative information from laboratory studies of the effects of particle components at high concentrations and dosimetry considerations suggest that the kinds of effects observed in community studies (e.g., respiratory- and cardiovascular-related responses) are at least plausibly related to particulate matter. Indeed, the Criteria Document points to the consistency of the results of the epidemiologic studies from a large number of different locations and the coherent nature of the observed effects as being suggestive of a likely causal role of ambient PM in contributing to the reported effects." (Staff Paper, p. VII-3, Docket A-99-06/II-A-23)

(2) The evidence correlating PM concentrations with mortality and morbidity remains uncertain. Commenter cites to recent publications by the Health Effects Institute (HEI) as supporting documentation. These studies have raised a number of questions and associations that argue against a causal role for PM. [see Reanalysis of the Harvard Six Cities Study and the American Cancer Society Study of Particulate Pollution and Mortality; and The National Morbidity, Mortality, and Air Pollution Study Part II: Morbidity, Mortality, and Air Pollution in the U.S. (NMMAPS)]. Commenter provides additional discussion on the conclusions and assumptions in these studies.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 77**

Response to Comment 2.1(N)(2):

EPA does not agree with the commenter's interpretation of the Reanalysis of the Harvard Six Cities Study and the American Cancer Society Study of Particulate Air Pollution and Mortality (Krewski et al., 2000). EPA has never claimed that one individual epidemiology study can be the basis for determining a causal relation between air pollution and mortality. In the 1996 PM CD, EPA evaluated the findings of many epidemiology studies, and found them to provide a consistent and coherent body of evidence, and the two studies cited by the commenter add further support to EPA's previous conclusions.

With regard to the specific study findings, the authors report that "The risk estimates reported by the Original Investigators were remarkably robust to alternative specifications of the underlying risk models, thereby strengthening confidence in the original findings. Specifically, the inclusion of additional individual-level covariates beyond those considered by the Original Investigators had little impact on the original risk estimates." (Krewski et al., 2000, p. 234) Dozens of additional risk factor covariates were tested in these models, and only education level was found to have a modifying effect; the authors suggest that this variable may be a marker for socioeconomic status which may in turn be correlated with fine particle air pollution.

The commenters include a quote from this study stating that more than one component of air pollution may contribute to increased mortality risk, and cite the findings regarding associations between sulfur dioxide and mortality. EPA has also never claimed that PM was the only component of air pollution associated with health effects; however, in the 1996 PM CD it was found that PM was more consistently associated with mortality than other gaseous criteria pollutants. With regard to the associations found with sulfur dioxide, the authors state "The absence of a plausible toxicological mechanism by which sulfur dioxide could lead to increased mortality further suggests that it might be acting as a marker for other mortality-associated pollutants." (Krewski et al., 2000, p. 235)

EPA also disagrees with the commenter's interpretation of the findings of the National Morbidity, Mortality and Air Pollution Study (NMMAPS). The authors state clearly: "together, the 2 sets of analyses - that of mortality in 90 cities and of hospitalization in persons 65 years and older in 14 cities - provide new and strong evidence linking particulate air pollution to adverse health effects." (Samet et al., 2000, p. 42) While it is true that the magnitude and direction of the relative risks vary for each of the 90 cities, it is also true that the risks are predominantly greater than 1.0, as reflected in the positive, significant relative risk for all cities combined. The authors also argue against focusing on the single-city results: "We caution against attempts to interpret estimates for any specific city, particularly if the goal is to gauge whether PM is having a greater or lesser effect than in other locations." (Samet et al., 2000, p. 43).

(3) Most studies that have alleged an association between PM and health effects have measured PM-10 and diesel PM is only a very small fraction of PM-10. Even if there was a causal relationship between PM and health, the contribution of diesel would only represent an extremely small portion of any potential health risk.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 77**

Response to Comment 2.1(N)(3):

As summarized in the Health Assessment Document for Diesel Exhaust, diesel PM constitutes about 23% of the total ambient PM2.5 inventory (excluding natural and miscellaneous sources), with annual average estimates ranging up to 36% and daily estimates ranging up to 68% in some urban areas. As noted in the PM CD, recent scientific studies indicate that some of the serious health effects associate with PM, such as mortality, are more strongly associated with the fine fraction of PM. This conclusion was supported not only by studies using directly measured fine particles, but PM10 in areas dominated by fine particles. EPA believe that this evidence does not support the commenter's statement that diesel particles "represent an extremely small portion of any potential health risk."

(4) The statement that diesel PM is unique is incorrect. Diesel PM is not known to be unique and cannot be measured directly since it is indistinguishable from other sources of PM. No adequate case has been made to separate diesel PM and distinguish different health effects as compared to other sources of combustion PM.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 77**

Response to Comment 2.1(N)(4):

We did not state in the NPRM that diesel PM is unique and disagree that diesel PM cannot be distinguished from other sources of PM. We stated that "While diesel particulate matter contributes to ambient levels of $PM_{2.5}$, the high content of elemental carbon with the adsorbed organic compounds and the high number of ultrafine particles (organic carbon and sulfate) in diesel exhaust distinguish it from other noncombustion sources of $PM_{2.5}$. In addition, diesel particulate matter from mobile source diesel engines is emitted into the breathing zone of humans and thus has a greater potential for human exposure (per kg of emissions) compared to other combustion particulates emitted out of stacks."

Diesel PM is most accurately distinguished from other combustion sources of ambient PM based on extensive chemical source profiles that include speciation of organic components as well as elemental carbon, trace elements and inorganic ions.[37 38 39]

The health effects database that distinguishes diesel exhaust from other sources of combustion PM includes the rat animal studies from which the reference concentration for diesel exhaust is developed and studies suggesting a role for diesel exhaust in the stimulation of allergen-induced allergic airway disease in sensitive humans. Also of note are the recent studies suggesting an association between ambient elemental carbon concentrations (a large component of diesel exhaust particulate emissions) and cardiovascular disease.[40 41] Diesel exhaust is also of concern because it is emitted into the breathing zone of people, unlike the majority of other combustion sources which are emitted higher into the atmosphere and therefore undergo greater dispersion and dilution before being inhaled. Recent studies are suggesting an important role for mobile source emissions in ambient PM-related health effects. In one study, factor analysis was used with indicators of particulate matter from several sources, and the authors reported that among these sources, particulate matter from mobile sources had the largest association with mortality in six U.S. cities.[42] An additional new analysis uses the results of a number of new epidemiological studies to assess the public health impact of outdoor and traffic-related pollution for three European countries. The authors report findings of "considerable" public health impacts for both mortality and morbidity (e.g., bronchitis, asthma) effects.[43]

(5) Because ultrafine particles are much more hazardous than PM-10 or PM-2.5, EPA's mass based standard is inappropriate, and a particle number standard is more protective of human health.

Letters:

Marathon Ashland Petroleum (IV-D-261). **p. 12-13**

---

[37] Fujita, E; Watson, JG; Chow, JC; et al. (1998) Northern Front Range Air Quality Study, volume C: source apportionment and simulation methods and evaluation. Prepared for Colorado State University, Cooperative Institute for Research in the Atmosphere, by Desert Research Institute, Reno, NV.

[38] Schauer, JJ; Rogge, WF; Hildemann, LM; et al. (1996) Source apportionment of airborne particulate matter using organic compounds as tracers. Atmos Environ 30(22):3837-3855.

[39] U.S. EPA (2000) Health Assessment Document for Diesel Exhaust: SAB Review Draft. EPA/600/8-90/057E Office of Research and Development, Washington, D.C. The document is available electronically at www.epa.gov/ncea/dieslexh.htm.

[40] Tolbert, P.E., Klein, M., Metzger, K.B. et al. (2000) Interim results of the study of particulates and health in Atlanta (SOPHIA). J Exposure Analysis and Env. Epidemiology 10:446-460.

[41] Mar TF, Norris GA, Koenig JQ, Larson TV. (2000) Associations between air pollution and mortality in Phoenix, 1995-1997. Environ Health Perspect 108:347-353.

[42] Laden F, Neas LM, Dockery DW, Schwartz J. 2000. Association of fine particulate matter from different sources with daily mortality in six U.S. cities. Environ Health Perspect 108:941-947.

[43] Kunzli N, Kaiser R, Medina S, et al. 2000. Public-health impact of outdoor and traffic-related pollution: a European assessment. Lancet 356:795-801.

Response to Comment 2.1(N)(5):

EPA disagrees with the commenter's assertion; we believe that the currently available scientific evidence on PM health effects does not lead one to conclude that ultrafine particles are much more hazardous than PM10 or PM-2.5. During the last PM NAAQS review, the Staff Paper included a brief discussion of the evidence on ultrafine particles that was reviewed in the Criteria Document, and concluded "For these reasons, it is questionable whether ultrafine aerosols could be playing a major role in the reported epidemiologic associations between the measured mass of fine or PM10 particles and health effects in sensitive populations." (Staff Paper, p. V-73) Newly published studies will be reviewed in the PM Criteria Document that is now being prepared, and the findings will be assessed in considering the adequacy of the current PM NAAQS.

Regarding the assertion that a particle number standard would be more protective of human health than the mass based standard being adopted today, the technology that we expect industry to use to comply with the new PM standards will reduce PM mass and number. Modern catalyzed diesel particulate filters (CDPF, also referred to as catalyzed filters or catalyzed traps, along with the very similar continuously regenerating DPF or CR-DPF) have been shown to be very effective at reducing PM mass, and recent data shows that they are also very effective at reducing the overall number of emitted particles when operated on low sulfur fuel. Hawker, et. al., found that a modern CDPF reduced particle count by over 95 percent, including some of the smallest measurable particles (< 50 nm), at most of the tested conditions. The lowest observed efficiency in reducing particle number was 86 percent. No generation of particles by the CDPF was observed under any tested conditions.[44] Kittelson, et al., confirmed that ultra-fine particles can be reduced by a factor of ten by oxidizing volatile organics, and by an additional factor of ten by reducing sulfur in the fuel. CDPFs efficiently oxidize nearly all of the volatile organic PM precursors, and elimination of as much fuel sulfur as possible will substantially reduce the number of ultra-fine PM emitted from diesel engines. The combination of CDPFs with low sulfur fuel is expected to result in very large reductions in both PM mass and the number of ultra-fine particles. Therefore, the mass-based standard will also achieve the reduction in particle contribution the commenters seems to wish to achieve.

(O) In addition to primary health impacts, diesel pollution also contributes to adverse environmental impacts such as regional haze, acid rain, global warming, and the eutrophication of lakes and streams.

(1) Commenters provide no further supporting information or detailed analysis.

Letters:

Boulder County Clean Air Consortium (IV-D-35) **p. 1**
Environmental Defense (IV-D-748) **p. 1, 8-9**
NESCAUM (IV-D-315) **p. 3**
STAPPA/ALAPCO (IV-D-140) **p. 1**
The Mountaineers (IV-D-184) **p. 1**

Response to Comment 2.1(O)(1):

[44] Hawker, P., et. al., Effect of a Continuously Regenerating Diesel Particulate Filter on Non-Regulated Emissions and Particle Size Distribution, SAE 980189.

EPA agrees that diesel pollution may contribute to ecosystem or welfare effects. Discussion of those effects can be found in Chapter II of the RIA.

(P) EPA has not quantified the proposal's impact on various environmental issues such as visibility, acid deposition and eutrophication. These concerns are not sufficiently concrete to support a finding under CAA section 202(a)(1) that further HD emission reductions are necessary.

(1) Commenter provides no further detailed analysis or supporting information.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 34**

Response to Comment 2.1(P)(1):

We agree that diesel exhaust emissions contribute to adverse environmental impacts, but we disagree that we have not adequately quantified them. We have quantified the benefits of those for which adequate methods and data exist in the RIA (see Table VII-22). These include visibility, eutrophication, agricultural impact and to some extent commercial forestry. However, a number of important effects cannot be quantified. We present these in the Table V-G.2 of the preamble to the final rule. Nevertheless, our inability to monetize all environmental impacts does not lessen the impact that current diesel emissions are having on these important resources. The scientific basis of the effect of the emissions are well established. We summarize some of the key effects below.

Acid Rain

Acid deposition primarily affects bodies of water that rest atop soil with a limited ability to neutralize acidic compounds. The National Surface Water Survey (NSWS) investigated the effects of acidic deposition in over 1,000 lakes larger than 10 acres and in thousands of miles of streams. It found that acid deposition was the primary cause of acidity in 75 percent of the acidic lakes and about 50 percent of the acidic streams, and that the areas most sensitive to acid rain were the Adirondacks, the mid-Appalachian highlands, the upper Midwest and the high elevation West. The NSWS found that approximately 580 streams in the Mid-Atlantic Coastal Plain are acidic primarily due to acidic deposition. Hundreds of the lakes in the Adirondacks surveyed in the NSWS have acidity levels incompatible with the survival of sensitive fish species. Many of the over 1,350 acidic streams in the Mid-Atlantic Highlands (mid-Appalachia) region have already experienced trout losses due to increased stream acidity. Emissions from U.S. sources contribute to acidic deposition in eastern Canada, where the Canadian government has estimated that 14,000 lakes are acidic. Acid deposition also has been implicated in contributing to degradation of high-elevation spruce forests that populate the ridges of the Appalachian Mountains from Maine to Georgia. This area includes national parks such as the Shenandoah and Great Smoky Mountain National Parks.

A recent study of emissions trends and acidity of waterbodies in the Eastern United States by the General Accounting Office (GAO) found that sulfates declined in 92 percent of a representative sample of lakes from 1992 to 1999, nitrate levels increased in 48 percent of the lakes sampled. The decrease in sulfates is consistent with emissions trends, but the increase in nitrates is inconsistent with the stable levels of nitrogen emissions and deposition. The study suggests that the vegetation and land surrounding these lakes have lost some of their previous capacity to use nitrogen, thus allowing more of the nitrogen to flow into the lakes and increase their acidity. Recovery of acidified lakes is expected to take a number of years, even where soil and vegetation have not been “nitrogen saturated,” as EPA called the phenomenon in a 1995 study. *Acid Deposition Standard Feasibility Study: Report to Congress*, EPA 430R-95-001a, October, 1995. This situation places a premium on reductions SOx and especially NOx from all sources, including HDVs, in order to reduce the extent and severity of nitrogen saturation and acidification of lakes in the Adirondacks and throughout the United States.

The SOx and NOx reductions from today's action will help reduce acid rain and acid deposition, thereby helping to reduce acidity levels in lakes and streams throughout the country and help accelerate the recovery of acidified lakes and streams and the revival of ecosystems adversely affected by acid deposition. Reduced acid deposition levels will also help reduce stress on forests, thereby accelerating reforestation efforts and improving timber production. Deterioration of our historic buildings and monuments, and of buildings, vehicles, and other structures exposed to acid rain and dry acid deposition also will be reduced, and the costs borne to prevent acid-related damage may also decline. While the reduction in sulfur and nitrogen acid deposition will be roughly proportional to the reduction in SOx and NOx emissions, respectively, the precise impact of today's action will differ across different areas.

Eutrophication and Nitrification

Eutrophication is the accelerated production of organic matter, particularly algae, in a water body. This increased growth can cause numerous adverse ecological effects and economic impacts, including nuisance algal blooms, dieback of underwater plants due to reduced light penetration, and toxic plankton blooms. Algal and plankton blooms can also reduce the level of dissolved oxygen, which can also adversely affect fish and shellfish populations. In the RIA we quantified reduction in nitrogen loading for 12 eastern estuaries (including two on the Gulf Coast).

In 1999, NOAA published the results of a five year national assessment of the severity and extent of estuarine eutrophication. An estuary is defined as the inland arm of the sea that meets the mouth of a river. The 138 estuaries characterized in the study represent more than 90 percent of total estuarine water surface area and the total number of US estuaries. The study found that estuaries with moderate to high eutrophication conditions represented 65 percent of the estuarine surface area. Eutrophication is of particular concern in coastal areas with poor or stratified circulation patterns, such as the Chesapeake Bay, Long Island Sound, or the Gulf of Mexico. In such areas, the "overproduced" algae tends to sink to the bottom and decay, using all or most of the available oxygen and thereby reducing or eliminating populations of bottom-feeder fish and shellfish, distorting the normal population balance between different aquatic organisms, and in extreme cases causing dramatic fish kills.

Severe and persistent eutrophication often directly impacts human activities. For example, losses in the nation’s fishery resources may be directly caused by fish kills associated with low dissolved oxygen and toxic blooms. Declines in tourism occur when low dissolved oxygen causes noxious smalls and floating mats of algal blooms create unfavorable aesthetic conditions. Risks to human health increase when the toxins from algal blooms accumulate in edible fish and shellfish, and when toxins become airborne, causing respiratory problems due to inhalation. According to the NOAA report, more than half of the nation’s estuaries have moderate to high expressions of at least one of these symptoms – an indication that eutrophication is well developed in more than half of US estuaries.

In recent decades, human activities have greatly accelerated nutrient inputs, such as nitrogen and phosphorous, causing excessive growth of algae and leading to degraded water quality and associated impairments of freshwater and estuarine resources for human uses. *Deposition of Air Pollutants to the Great Waters, Third Report to Congress*, June, 2000. Since 1970, eutrophic conditions worsened in 48 estuaries and improved in 14. In 26 systems, there was no trend in overall eutrophication conditions since 1970. *Deposition of Air Pollutants to the Great Waters, Third Report to Congress*, June, 2000. Great Waters are defined as the Great Lakes, the Chesapeake Bay, Lake Champlain, and coastal waters. The first report to Congress was delivered in May, 1994; the second report to Congress in June, 1997. On the New England coast, for example, the number of red and brown tides and shellfish problems from nuisance and toxic plankton blooms have increased over the past two decades, a development thought to be linked to increased nitrogen loadings in coastal waters. Long-term monitoring in the United States, Europe, and other developed regions of the world shows a substantial rise of nitrogen levels in surface waters, which are highly correlated with human-generated inputs of nitrogen to their watersheds.

On a national basis, the most frequently recommended control strategies by experts surveyed by National Oceanic and Atmospheric Administration (NOAA) between 1992- 1997 were agriculture, wastewater treatment, urban runoff, and atmospheric deposition. Bricker, Suzanne B., et al., *National Estuarine Eutrophication Assessment, Effects of Nutrient Enrichment in the Nation's Estuaries*, National Ocean Service, National Oceanic and Atmospheric Administration, September, 1999. In its Third Report to Congress on the Great Waters, EPA reported that atmospheric deposition contributes from 2 to 38 percent of the nitrogen load to certain coastal waters. *Deposition of Air Pollutants to the Great Waters, Third Report to Congress*, June, 2000. A review of peer reviewed literature in 1995 on the subject of air deposition suggests a typical contribution of 20 percent or higher. Valigura, Richard, et al., *Airsheds and Watersheds II: A Shared Resources Workshop,* Air Subcommittee of the Chesapeake Bay Program, March, 1997. Human-caused nitrogen loading to the Long Island Sound from the atmosphere was estimated at 14 percent by a collaboration of federal and state air and water agencies in 1997. *The Impact of Atmospheric Nitrogen Deposition on Long Island Sound*, The Long Island Sound Study, September, 1997. The National Exposure Research Laboratory, US EPA, estimated based on prior studies that 20 to 35 percent of the nitrogen loading to the Chesapeake Bay is attributable to atmospheric deposition. Dennis, Robin L., *Using the Regional Acid Deposition Model to Determine the Nitrogen Deposition Airshed of the Chesapeake Bay Watershed*, SETAC Technical Publications Series, 1997. The mobile source portion of atmospheric NOx contribution to the Chesapeake Bay was modeled at about 30% of total air deposition. Dennis, Robin L., *Using the Regional Acid Deposition Model to Determine the Nitrogen Deposition Airshed of the Chesapeake Bay Watershed*, SETAC Technical Publications Series, 1997.

Deposition of nitrogen from heavy-duty vehicles contributes to elevated nitrogen levels in waterbodies. In the Chesapeake Bay region, modeling shows that mobile source deposition occurs in relatively close proximity to highways, such as the 1-95 corridor which covers part of the Bay surface. The new standards for heavy-duty vehicles will reduce total NOx emissions by 2.6 million tons in 2030. The NOx reductions will reduce the airborne nitrogen deposition that contributes to eutrophication of watersheds, particularly in aquatic systems where atmospheric deposition of nitrogen represents a significant portion of total nitrogen loadings.

<u>POM Deposition</u>

POM is generally defined as a large class of chemicals consisting of organic compounds having multiple benzene rings and a boiling point greater than 100 degrees C.

Polycyclic aromatic hydrocarbons are a chemical class that is a subset of POM. POM are naturally occurring substances that are byproducts of the incomplete combustion of fossil fuels and plant and animal biomass (e.g., forest fires). Also, they occur as byproducts from steel and coke productions and waste incineration. Evidence for potential human health effects associated with POM comes from studies in animals (fish, amphibians, rats) and in human cells culture assays. Reproductive, developmental, immunological, and endocrine (hormone) effects have been documented in these systems. Many of the compounds included in the class of compounds known as POM are classified by EPA as probable human carcinogens based on animal data.

EPA's Great Waters Program has identified 15 pollutants whose deposition to water bodies has contributed to the overall contamination loadings to the these Great Waters. *Deposition of Air Pollutants to the Great Waters-Third Report to Congress, June, 2000,* Office of Air Quality Planning and Standards *Deposition of Air Pollutants to the Great Waters-Second Report to Congress*, Office of Air Quality Planning and Standards, June 1997, EPA-453/R-97-011. One of these 15 pollutants, a group known as polycyclic organic matter (POM), are compounds that are mainly adhered to the particles emitted by mobile sources and later fall to earth in the form of precipitation or dry deposition of particles. The mobile source contribution of the 7 most toxic POM is at least 62 tons/year and represents only those POM that adhere to mobile source particulate emissions. *The 1996 National Toxics Inventory*, Office of Air Quality Planning and Standards, October 1999. The majority of these emissions are produced by diesel engines.

Evidence for potential human health effects associated with POM comes from studies in animals (fish, amphibians, rats) and in human cells culture assays. Reproductive, developmental, immunological, and endocrine (hormone) effects have been documented in these systems. Many of the compounds included in the class of compounds known as POM are classified by EPA as probable human carcinogens based on animal data.

The particulate reductions from today's action will help reduce not only the particulate emissions from highway diesel engines but also the deposition of the POM adhering to the particles, thereby helping to reduce health effects of POM in lakes and streams, accelerate the recovery of affected lakes and streams, and revive the ecosystems adversely affected.

Visibility and Regional Haze

Visibility impairment, also called regional haze, is a complex problem caused by a variety of sources, both natural and anthropogenic (e.g., motor vehicles). Regional haze masks objects on the horizon and reduces the contrast of nearby objects. The formation, extent, and intensity of regional haze are functions of meteorological and chemical processes, which sometimes cause fine particle loadings to remain suspended in the atmosphere for several days and to be transported hundreds of kilometers from their sources (NRC, 1993).

Visibility has been defined as the degree to which the atmosphere is transparent to visible light (NRC, 1993). Visibility impairment is caused by the scattering and absorption of light by particles and gases in the atmosphere. Fine particles (0.1 to 2.5 microns in diameter) are more effective per unit mass concentration at impairing visibility than either larger or smaller particles (NAPAP, 1991). Most of the diesel particle mass emitted by diesel engines falls within this fine particle size range. Light absorption is often caused by elemental carbon, a product of incomplete combustion from activities such as burning diesel fuel or wood. These particles cause light to be scattered or absorbed, thereby reducing visibility.

Heavy-duty vehicles contribute a significant portion of the emissions of direct PM, NOx, and SOx that result in ambient PM that contributes to regional haze and impaired visibility. The Grand Canyon Visibility Transport Commission's report found that heavy-duty diesel vehicles contribute 41% of fine elemental carbon or soot, 20% of NOx, 7% of fine organic carbon, and 6% of SOx. The report also found that reducing total mobile source emissions is an essential part of any program to protect visibility in the Western U.S. The Commission identified mobile source pollutants of concern as VOC, NOx, and elemental and organic carbon. The Western Governors Association, in later commenting on the Regional Haze Rule and on protecting the 16 Class I areas on the Colorado Plateau, stated that the federal government, and particularly EPA, must do its part in regulating emissions from mobile sources that contribute to regional haze in these areas. As described more fully later in this section, today's action will result in large reductions in these pollutants. These reductions are expected to provide an important step towards improving visibility across the nation. Emissions reductions being achieved to attain the 1-hour ozone and PM10 NAAQS will assist in visibility improvements. Moreover, the timing of the reductions from the standards fits very well with the goals of the regional haze program. We will work with the regional planning bodies to make sure they have the information to take account of the reductions from this final rule in their planning efforts.

The Clean Air Act contains provisions designed to protect national parks and wilderness areas from visibility impairment. In 1999, EPA promulgated a rule that will require States to develop plans to dramatically improve visibility in national parks. Although it is difficult to determine natural visibility levels, we believe that average visual range in many Class I areas in the United States is significantly less (about 50-66% of natural visual range in the West, about 20% of natural visual range in the East) than the visual range that will exist without anthropogenic air pollution. The final Regional Haze Rule establishes a 60-year time period for planning purposes, with several near term regulatory requirements, and is applicable to all 50 states. One of the obligations is for States to representative conduct visibility monitoring in mandatory Class I Federal areas and determine baseline conditions using data for year 2000 to 2004. Reductions of particles, NOx, sulfur, and VOCs from this rulemaking will have a significant impact on moving all states towards achieving long-term visibility goals, as outlined in the 1999 Regional Haze Rule.

In the RIA we quantified the improvements in visibility for recreational values in Class I areas. In 2030, the value is $3.26 billion (in 1999 dollars) from the HD Engine/Diesel Fuel program. We were not able to quantify all visibility effects.

In conclusion, the commenter is mistaken that the environmental benefits are not an adequate basis for the rule. The total monetized benefits from the environmental effects we are able to quantify alone is $4.38 billion, which alone exceeds the estimated cost of the rule in 2030.

(Q) Although EPA notes that reduced crop damage is one benefit of the proposal, ozone impacts on crops are almost not noticeable as separate factors in nature.

(1) Crop yields have been increasing over the last ten years, and the influence of man and nature on crops mute any factor of air composition on crop yields. This negligible relationship between the proposal and crop concerns is further justification for providing increased flexibility to farmer co-op refiners.

<u>Letters:</u>

Cenex Harvest States Cooperatives (IV-D-232) **p. 3-4**

Response to Comment 2.1(Q)(1):

The Ozone Criteria Document notes that "ozone affects vegetation throughout the United States, impairing crops, native vegetation, and ecosystems more than any other air pollutant" (U.S. EPA, 1996). Effects can include "(1) visible foliar injury; (2) premature needle/leaf senescence; (3) reduced photosynthesis; (4) reduced carbohydrate production and allocation; (5) reduced plant vigor; and (6) reduced growth or reproduction or both" (U.S. EPA, 1996). This can result in yield loss in agricultural crops. Laboratory and field experiments have shown reductions in yields for agronomic crops exposed to ozone, including vegetables such as lettuce and field crops such as cotton and wheat. The most extensive field experiments, conducted under the National Crop Loss Assessment Network (NCLAN) examined 15 species and numerous cultivars. These studies "were a tremendous improvement over earlier studies because crops were grown 1) using typical farm practices and 2) using open top chambers, which produce the least amount of environmental modification of any outdoor chamber." (U.S. EPA, 1996). Based on the results of these experiments, at least half of the species/cultivars showed a 10 percent yield loss at a 7-hour seasonal mean ozone concentration of 0.05 ppm or more (U.S. EPA, 1996). The NCLAN results show that "several economically important crop species are sensitive to ozone levels typical of those found in the U.S." (U.S. EPA, 1996). In addition, economic studies have shown a relationship between observed ozone levels and crop yields (Garcia et al., 1986).

While overall yields per acre have increased for most crops over time, the relevant comparison is between crops exposed to high levels of ozone versus crops exposed to lower levels of ozone in a given year, holding all else equal. Thus, the expectation is that when ozone levels are reduced relative to baseline conditions, then holding other factors constant, crop yields will be increased. Thus, even though yields may be increasing over time, they will increase more if ozone levels are reduced. And, while these increases in yields may not be noticeable to the individual farmer, when added up over the entire farm sector, the increases in production may be substantial. These aggregate changes in production can have real impacts on farmer and consumer welfare which is a legitimate component of the benefits of ozone reductions. EPA provides quantified estimates of agricultural benefits associated with ozone reductions as part of its benefits analysis in the Regulatory Impact Analysis for the final rule.

Garcia, Philip; Dixon, Bruce L.; Mjelde, James W.; Adams, Richard M.. 1986. "Measuring the Benefits of Environmental Change Using a Duality Approach: The Case of Ozone and Illinois Cash Grain Farms." *Journal of Environmental Economics and Management*, 13: 69-81.

U.S. Environmental Protection Agency. 1996. Air Quality Criteria for Ozone and Related Photochemical Oxidants, Volume II. EPA/600/P-93/004bF, July 1996.

Issue 2.2: Air Quality Monitoring Data & Modeling Projections

(A) Without the anticipated emission reductions from the proposed rule, there is a significant risk that the ozone standard will be violated in some areas.

(1) A number of areas with a population exceeding 100 million will violate the 1 hour ozone standard within the time frame in which the standards would be imposed and implemented. The anticipated emission reductions are

necessary to help attain the ozone NAAQS in many areas.

Letters:

American Lung Association (IV-D-270) **p. 4-5, 14**

Response to Comment 2.2(A)(1):

We agree in general with the comment. The air quality modeling and other analyses completed by EPA as part of the justification for the HDV rule concluded that an appreciable number of 45 areas with 128 million people (1999) face a significant risk of continued, or newfound, nonattainment during the period of analysis (2007 to 2030), even after the 2004 or later model year standards for HDVs are taken into account. Furthermore, the analysis showed that the implementation of the HDV rule would significantly reduce the remaining high concentrations of ozone over large areas of the U.S. For instance, the total number of projected exceedances is projected to decline from 1226 to 756 one-hour ozone exceedances nationwide in 2030, or a significant reduction in the number of 1-hour ozone exceedances of 470.

(B) EPA generally relies on erroneous modeling assumptions in its demonstration of the need for the proposed rule.

(1) EPA should develop measures that more accurately characterize population exposure to concentrations in excess of the NAAQS. Currently EPA relies on nonattainment status of an area based upon one monitor among a set of monitors in a given metropolitan area. These monitors are often downwind of the urban core and register readings that are significantly higher than the other monitors, and therefore the reliance upon the metropolitan population overstates the accurate risk of exposure.

Letters:

American Petroleum Institute (IV-D-343) **p. 4**

Response to Comment 2.2(B)(1):

EPA's discussion of the number of areas not attaining the ozone and PM standards was never characterized as a population exposure assessment. Rather, it served as an indication of the substantial proportion of the U.S. population that currently lives in areas where NAAQS levels have been exceeded. EPA notes that, for PM10, official nonattainment determinations for the annual PM10 NAAQS are made based on the average of 12 quarterly PM10 averages and are thus unlikely to be driven by individual high measurements. Also, in Section II.B.1.b of the proposed rule, extensive discussion is provided regarding the EPA's review of the basis for ozone nonattainment area designations. These evaluations indicated that these areas are indeed likely to be experiencing elevated levels of ozone or PM10 in more than an isolated area or time period at one monitor.

More importantly, this discussion in the preamble was never characterized as a population exposure assessment nor was it characterized as a forecast of future nonattainment areas; it was intended as a general indication of the U.S. population that may be exposed to pollution levels exceeding the NAAQS. In light of the regional nature of pollutants like ozone and fine particles EPA believes that these data support the statement made in the preamble that millions of Americans live in areas with unhealthful air quality that currently endangers public health and welfare.

(2) EPA inappropriately justifies the rule by relying upon an unsubstantiated assumption that there will be a potentially large future increase in the sales and operation of light-duty diesel-powered cars and trucks. The needs of light-duty diesel vehicles should not drive fuel requirements because they consume a small fraction of diesel fuel.

Letters:

American Petroleum Institute (IV-D-343) **p. 5, 40**
Marathon Ashland Petroleum (IV-D-261) **p. 5, 34-35**

Response to Comment 2.2(B)(2):

The diesel fuel sulfur standard is driven by the need in heavy-duty applications. We do not rely on projecting an increase in the sales of light-duty diesel cars and trucks in the emissions inventory analyses for this rule. We only presented a discussion in the preamble for the proposed rule to point out that if, as many commenters expect, there is growth in the sales of light-duty diesel cars and trucks, then there would be additional benefits to the low sulfur diesel requirements beyond what is claimed in this rule.

(C) EPA relies on inaccurate data or modeling assumptions regarding NO_x reductions and the attainment of the ozone NAAQS.

(1) Projected emission impacts of the proposal are misleading due to the uncertainties and inaccuracies inherent in ozone modeling that make reliance on such models insufficient to necessitate the rule for the attainment of the ozone NAAQS. Given the level of uncertainty, the ozone benefits estimated under Tier 2, used in part to justify this rule, are not significant enough to warrant additional mobile source reductions.

Letters:

American Petroleum Institute (IV-D-343) **p. 3**

Response to Comment 2.2(C)(1):

We disagree with the comment. The commenter correctly observes that the entire process of air quality modeling, by definition, is based on assumptions and uncertain approximations. However, the commenter follows this statement with the implication that such models should then not be used in instances where model response is within the range of uncertainty (e.g., Tier 2 modeling results). The use of air quality models to assess the potential effects of emissions reduction strategies is well-established, even in instances where the response may be of a smaller magnitude than the aggregate uncertainty of the modeling system. The utility and need for such modeling analyses is affirmed in the upcoming NARSTO Science Assessment Document (Roth, et al., 2000) which notes that there are no viable alternative approaches for estimating the impacts of a given control strategy. However, the burden is on the modeler to ensure that the tool is: a) satisfactorily replicating the processes involved in ozone formation, transport, and destruction, and b) not being used in a manner inconsistent with its capabilities. Based on the model performance evaluation (discussed in the air quality TSD) and the consistency of the response signal with other independent analyses (both modeling and non-modeling), EPA believes that the UAM-V tool is an appropriate means to estimate the future impacts of the HDV rulemaking. Furthermore, the commenter mistakenly states that the model was used in the Tier 2 process (and by inference states it will be used in the HDV process) to conclude that the "additional mobile source controls are necessary for attainment of the NAAQS". The model is not being used in the HDV analyses, nor was it used in the Tier 2 effort, to assess future year attainment/nonattainment determinations. Instead, the modeling is being used for two main purposes: 1) to estimate those areas which are expected to have a potential need for additional ozone precursor controls in the future, and 2) to assess the relative air quality and economic benefits of the HDV rule. These two goals are entirely consistent with the capabilities of a successfully evaluated air quality grid model. Regarding the significance of the ozone reductions estimated for this rule, as well as the Tier 2 rule, EPA believes that there are substantial reductions resulting from this rule. No single strategy is likely to provide all the reductions needed for all areas to attain the NAAQS. This is why continuing to reduce emissions from various different sources is a necessary strategy for attaining the NAAQS.

(2) EPA did not determine changes in ozone due to the proposed standards nor demonstrate any effect on attainment and maintenance of the ozone NAAQS. EPA did not calculate the incremental ozone benefits or disbenefits and until this is completed, it is not possible to determine whether the proposed HD emission standards will actually improve air quality. The EPA claimed risk of post-2007 nonattainment is based on the "exceedance" method. Commenter refers to their comments submitted in response to the Tier 2 Rule and the 2004 HD rule, which explain in detail why this method greatly overestimates the risk of nonattainment. The use of this model along with an artificially inflated HD emissions inventory has led to an exaggeration of the risk of post-2007 nonattainment. Commenter provides significant discussion on this issue and notes inconsistencies regarding EPA's justification for using the exceedance method versus the rollback method. In the context of addressing problems related to the "exceedance" method, the commenter also challenges EPA's determination that certain areas are at "risk" of not being able to maintain compliance with the NAAQS in the absence of anticipated reductions under the proposed rule.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 10-15**

Response to Comment 2.2(C)(2):

As noted in the preamble to the final regulations, EPA has determined the estimated changes in ozone expected to occur by 2020 and 2030 due to the HDV standards. This was accomplished through the use of a photochemical grid model. For more details on the application of the ozone model, please see the Technical Support Document.

The commenter advances several arguments to support the idea that the EPA air quality modeling approach "severely exaggerates the risk of post-2007 ozone nonattainment". First, the commenter notes that the number of ozone nonattainment areas have declined over the past decade and that some of the remaining nonattainment areas are close to attaining the NAAQS (i.e., expected exceedances are less than 2.0). Combining that fact with EPA's own modeling which shows that the trend from 1996 to 2007 is a broad reduction in the geographic extent of high ozone values, the commenter questions how can so many areas be at risk of future NAAQS violations. The commenter also notes an inconsistency by EPA in the justification for using an exceedance-based approach versus a rollback approach to quantify the future need for HDE controls relative to ozone attainment.

EPA agrees with the commenter that substantial progress has been made in reducing elevated levels of ozone over the past 10-15 years. These reductions are presumably the direct result of State and Federal emissions control measures implemented in the 1990's. However, when ozone trends are normalized for annual weather variations between 1989 and 1999, they reveal a downward trend in the early 1990's followed by a leveling off, or an upturn in ozone levels, over the past several years in many urban areas.[45]

EPA also agrees with the commenter that some additional progress in lowering ambient ozone is expected between 1996 and 2007. Additionally, as noted in the preamble to the final rule, national ozone precursor emissions are projected to decline for some time after 2007, largely due to the penetration of Tier-2 compliant vehicles into the light duty vehicle fleet. However, ozone precursor emissions are expected to begin increasing again around 2015 or 2020, through 2030 due to economic growth. Thus, EPA believes that a) the present-day meteorologically-adjusted ozone trends and b) the expected precursor emissions trends actually support the model predictions of NAAQS exceedance risk.

Regarding the comment about an exceedance-based versus rollback-based approach, it is important to note first that EPA is not using this rule as an attainment demonstration for the 1-hour ozone standard. Rather, the intent is to determine which areas are expected to be at risk of having difficulty with attaining and/or maintaining the standard in the future. EPA's approach to determining this risk is based on current ambient measurements (i.e., areas with ambient 1-hour design values >=125 ppb and areas within 10% of the standard) coupled with a forecast of ozone exceedances in the future within these areas based on modeling. It should be noted that this approach is consistent with EPA's current guidance for modeling to attain the 1-hour standard.

The modeling attainment procedures in this guidance first require an exceedance-based test which compares model predicted 1-hour daily maximum concentrations in all grid cells for the attainment year to the level of the NAAQS. There is both a deterministic and a statistical form of the exceedance-based test. The deterministic form requires that predicted 1-hour daily maximum ozone concentrations be 124 ppb or less in order for the area to demonstrate attainment. The statistical form of the test takes into account the fact that the form of the 1-hour ozone standard allows exceedances. If, over a three-year period, the area has an average of one or fewer exceedances per year, the area is not violating the standard. Thus, if a very extreme day is modeled, the statistical test provides that a prediction above 0.124 ppm up to a certain upper limit may be consistent with attainment of the standard. (The form of the 1-hour standard allows for up to three readings above the standard over a three-year period before an area is considered to be in violation.)

When the modeling does not conclusively demonstrate that the area will attain using the exceedance-based test, additional analyses may be presented to help determine whether the area will attain the standard. As with other predictive tools, there are inherent uncertainties associated with modeling and its results. For example, there are uncertainties in some of the modeling inputs, such as the meteorological and emissions data bases for

---

[45] USEPA (2000). Latest Findings on National Air Quality: 1999 Status and Trends. EPA-454/F-00-002, Office of Air Quality Planning and Standards, Research Triangle Park, NC, 27711, 28 pp.

individual days and in the methodology used to assess the severity of an exceedance at individual sites. The EPA's guidance recognizes these limitations, and provides a means for considering other evidence to help assess whether attainment of the NAAQS is likely. The process by which this is done is called a weight of evidence (WOE) determination.

Under a WOE determination, the State can rely on and EPA will consider factors such as other modeled attainment tests (e.g., a rollback analysis); other modeled outputs (e.g., changes in the predicted frequency and pervasiveness of exceedances); actual observed air quality trends; estimated emissions trends; analyses of air quality monitored data; the responsiveness of the model predictions to further controls; and, whether there are additional control measures that are or will be approved into the SIP but were not included in the modeling analysis. This list is not an exclusive list of factors that may be considered and these factors could vary from case to case.

Consistent with the guidance, we have relied on an exceedance-based approach to identify those areas are at risk of having an problem attaining or maintaining the standard in the future because they currently have a nonattainment problem or have measured concentrations just below the standard and have exceedances predicted in the future. We have examined both the deterministic and statistical forms of this test and draw similar conclusions. In addition, we have used a rollback technique based on relative reduction factors calculated from our modeling and applied to ambient data in order to supplement this analysis. This analysis indicates that 26 areas in the Eastern U.S. alone with a total population of 78 million are projected to have 1-hour ozone design values greater than the standard or within 10 percent of the standard in 2030 without this rule. Thus, using either the exceedance-based or rollback-based approach leads to the same general result that a large number of areas are at risk of a future 1-hour ozone problem and, therefore, need controls in this rule to reduce ozone precursor emissions. Additional information about the exceedances and relative reduction factors can be found in the Air Quality Modeling Technical Support Document.

(3) EPA cannot base its need argument on the now-remanded 8-hour ozone NAAQS or a surrogate (i.e. 'prolonged and repeated exposures' to ozone). Commenter cites to the RIA (p. II-59) and the preamble (65 FR 35445) and notes that EPA is relying on health effects that occur below the ozone NAAQS. EPA's discussion of this issue focuses on the effects of ozone exposure between 0.08 and 0.12 ppm, which is precisely the level of exposure that was to be addressed in EPA's proposed 8-hour ozone standard, which has been firmly rejected by the DC Circuit in ATA v. EPA, 195 F.3d 4 (DC Cir 1999).

Letters:

American Petroleum Institute (IV-D-343) **p. 13**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 25-26**
Marathon Ashland Petroleum (IV-D-261) **p. 8**

Response to Comment 2.2(C)(3):

EPA disagrees with the commenters which suggest that we are relying on the 8-hour NAAQS to justify this rule or that we are precluded from acting except to attain a NAAQS. EPA has independent authority under section 202(a) to promulgate standards "applicable to the emission of any air pollutant from any class or classes of new motor vehicles or ...

engines, which in his judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare." The commenters appear to claim that standards promulgated under section 202(a) are restricted to what is needed to attain and maintain a NAAQS. Yet nothing in section 202(a) so restricts it. On its face, this provision does not tie such standards to the attainment and maintenance of a NAAQS. Indeed, there are numerous types of air pollution regulated under the Act that are not covered by the section 109 NAAQSs. For example, EPA has authority under section 112 to regulate 189 "hazardous air pollutants," ("HAPs") and may add to the list of HAPs any "pollutants which present, or may present,...a threat of adverse human health effects ... or adverse environmental effects." The Clean Air Act also regulates visibility (section 169A and 169B), acid rain (Title IV) and depletion of stratospheric ozone (Title VI). All of these air pollution concerns can, by any measure, be "reasonably anticipated to endanger public health or welfare."

Further, it is clear from the language of the statute that section 202(a) was not intended to be restricted to meeting the NAAQSs. Section 202(i) specifically references attainment and maintenance of the NAAQS as a criterion for regulations. What this evidences, however, is that Congress was well aware of its ability to confine EPA's review to NAAQS attainment, and has so confined EPA when it wished to. However, unlike section 202(i), section 202(a) has no such restriction.

Similarly, as the commenter notes, section 202(a) was enacted in 1965, prior to section 109 being added to the Act. It therefore had to be a source of authority independent from section 109 for determining the appropriateness of promulgating motor vehicle standards. When Congress added sections 108 and 109 in 1970, Congress could have revised section 202(a) to restrict its review to meeting and maintaining NAAQSs, but Congress did not so revise section 202(a), preserving the independent authority provided in 1965.

Section 202(l) also makes clear that section 202(a) is not restricted to NAAQSs. Under section 202(l), EPA is required to promulgate standards <u>under subsection (a)</u>, containing reasonable requirements to control hazardous air pollutants from motor vehicles and fuels. If section 202(a) were restricted to NAAQS-related standards, then EPA could not promulgate standards "under section 202(a)" regulating hazardous air pollutants, which are not NAAQS related pollutants.

The commenters also imply that the air quality test for promulgating a standard under section 109 is as stringent or more stringent than the test under section 202(a), so the air quality need criteria under section 202(a) should not be more stringent than that under section 109. EPA does not agree that the language of section 109 and the level of air quality control established under that section binds it in acting under section 202(a). Section 202(a) does not refer to sections 108 or 109 and contains different language than those sections, in particular, the standard-setting section 109. The judicial precedent and legislative history of this section clearly show that EPA is not limited by sections 108 and 109 in promulgating its rules under section 202(a). See <u>Ethyl Corp. v EPA</u>, 541 F.2d 1 (D.C. Cir. 1976); <u>Small Refiner Lead Phasedown Task Force v. EPA</u>, 705 F.2d 506 (D.C. Cir. 1983); HR Rep. 95-294, Committee on Interstate and Foreign Commerce, May 12, 1977, at 43-51.

As the foregoing discussion demonstrates, EPA has made a decision under section 202(a) of the Act that emissions of ozone pollution from heavy duty engines "cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare," based on available scientific evidence relating to, among other things, prolonged and repeated exposures to ozone pollution. Although that evidence overlaps with information that EPA has reviewed in other contexts, such as the 8-hour ozone NAAQS rulemaking, EPA has not based this decision on previous EPA findings as to the proper level of a NAAQS relating to exposure to these levels of ozone pollution but has acted under its section 202(a) authority alone. Accordingly, the current litigation relating to the 8-hour ozone standard promulgated pursuant to section 108/109 of the CAA, is not legally relevant to this standard setting process under section 202(a) of the Act, and relates to the specific language in section 108/109. Nor does EPA agree with the commenters' characterization of the outcome of the litigation. The Court of Appeals remanded the ozone standard to EPA on the basis of constitutional concerns and did not address the issues relating to the scientific bases for setting the 8-hour standard. The Court of Appeals did not vacate the standard and the case is on appeal to the Supreme Court.

(D) EPA should address the issue of NO_x disbenefits in the context of the proposed rule.

(1) EPA's model for predicting future ozone levels is overly-sensitive to NO_x reductions and is not sensitive to VOC reductions. If there are significant NO_x disbenefits from the proposed HD rule, it may aggravate the nation's ozone situation rather than help maintain compliance. Commenter provides significant discussion on the issue of NO_x disbenefits and why EPA's methods have underestimated the impact of this phenomenon. The commenter references their comments as submitted in response to Tier 2 on this issue and notes that EPA has only selectively responded to the NO_x disbenefit concerns raised in those comments. Commenter notes that EPA has not addressed the reason why horizontal grid size is important (see Morris, R., "Review of Recent Ozone Measurement and Modeling Studies in the Eastern United States," ENVIRON International Corporation, March 1996), the overestimation of isoprene emission in the high biogenic emission area of the Ozarks (which changes the preferred ozone control strategy in downwind areas such as St. Louis), the fact that the model-response to precursor emissions is inconsistent with prior ozone and emission trends (see Zalewsky, et al., "Trends in Ozone and Its Precursors in the Northeastern United States," in Tropospheric Ozone: Nonattainment and Design Value Issues, Air and Waste Management Association, p. 459-476), or the fact that widespread improvements in ozone levels occurred between 1975 and 1981 (see Air Quality and Emission Trends Report, EPA, 1981). Commenter notes that in the context of biogenics, EPA's BEIS2 model overestimates the isoprene emissions and that a new methodology for biogenic emissions, GLOBEIS, has been developed that has updated emission factors and the ability to model the seasonal variation in biomass. Commenter concludes that if EPA believes that the sensitivity to NO_x and VOC in its latest modeling system is different from the initial Tier 2 modeling system, they should demonstrate that the model can now accurately predict the air quality impact of the emission reductions and should conduct sensitivity analyses to determine which areas are VOC-limited and which areas are NO_x-limited, including analyses that incorporate a combination of reduced fine grids and altered biogenic inventories.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 15-19**

Response to Comment 2.2(D)(1):

The Agency examined the above mentioned comments and responded to them in detail in the Tier 2 Response to Comments. Given that the commenter largely based his response on those earlier comments, EPA has included the response that it provided in the Tier 2 RTC on NOx disbenefits in its record for the HDV rule. In addition to that, the response below addresses the NOx disbenefits issue in the specific context of the HDV rule.

Horizontal Grid Size

EPA addressed the aforementioned comments regarding horizontal grid sizes in the Tier 2 Response to Comments document. For the sake of completeness, we will reiterate some of the main arguments which rebut the commenters' claims.

According to the commenter, "EPA does not address the reason (as explained) by Morris why horizontal grid size is important." It goes on to reference a quote from Morris (1996) which concludes that finer grid resolutions tend to yield lower VOC to NOx ratios within urban plumes and that these lower ratios "result in more negative effects of NOx reductions and more positive effects from VOC reductions". EPA agrees with this statement and states so on page 27-34 of the Tier 2 RTC by quoting from the OTAG Final Report. "VOC reductions produce significant local ozone decreases with either the fine or the coarse grid, although the magnitude and spatial extent of the decreases are greater with the fine grid. NOx emissions reductions can also produce local ozone increases with the fine or the coarse grid, although the magnitude and spatial extent of the increases are greater with the fine grid."

In the absence of other material to the contrary, one could advance the argument that the general observations noted by Morris (1996) and OTAG (1997) suggest the 12 km Tier 2 (and HDV) modeling underestimates disbenefits of NOx control (i.e., the isolated ozone increases amidst the more widespread regional benefits). However, as pointed out in the Tier 2 RTC there are at least two corroborating analyses that indicate the Tier 2 modeling does not underestimate the magnitude of the disbenefits resulting in isolated areas from NOx control. The first is the 4 km modeling submitted by General Motors as part of the Tier 2 comments. Even with substantial differences in the base year inventories and a different photochemical grid model (CAMx), the spatial extent of the ozone increases are very similar between the commenter's 4 km modeling and EPA's 12 km model runs over the Houston, Chicago, and New York areas. This does not support the commenter's claim that EPA's modeling system is overly NOx sensitive. The second corroborating analysis is a series of UAM-V simulations completed for the Lake Michigan region (LADCO, 2000) which indicated that model response to the Tier 2/Low Sulfur controls was not highly sensitive to grid resolution between 12 and 4 km. Since the Chicago region is one of the few areas in which model-predicted NOx control disbenefits may be important, these results appear to moot the commenter's generalized grid size criticisms.

Biogenics:

The commenter points to a single study which measured biogenic emissions for a narrow region of the eastern U.S. It is difficult to extrapolate these results to large generalizations about the possible overprediction of the biogenic VOC inventory. However, even if EPA were to accept the argument that isoprene was overestimated in the HDV modeling by a factor of two, we still do not believe it would necessarily leave the model overly sensitive to NOx controls as the commenter claims. As noted in the Tier 2/Gasoline Sulfur

RTC, several emissions sensitivity analyses were completed as part of the Ozone Transport Assessment Group (OTAG) modeling comparing the effects of across the board VOC and NOx reductions using biogenic emissions data sets derived from the Biogenic Emissions Inventory System (BEIS) and BEIS2 methodologies. The isoprene estimates from BEIS2 were found to be 2-5 times higher than that of BEIS. The OTAG modeling concluded (OTAG, 1997) that the model response to reductions in VOC and NOx emissions were comparable with either BEIS or BEIS2 emissions. Certainly the ozone improvements due to NOx control were somewhat greater in the BEIS2 scenarios, but these tests do not appear to support the commenters' claims of a fundamentally flawed modeling system.

In terms of the new methodology for estimating biogenic emissions (GLOBEIS) advocated by the commenters, EPA notes that in our modeling we used the best, peer-reviewed, data and science available at the time of the modeling. At the start of the HDV modeling, this was the BEIS2 methodology for the generation of biogenic emissions estimates. While the BEIS-2 was the best tool available at the time for the quantification of biogenic emissions, EPA has continued our longstanding research effort to improve biogenic estimation. The next-generation biogenic model (BEIS-3) is expected to be released in 2001.

EPA agrees with the NARSTO Science Assessment that substantial uncertainties exist in the estimation of biogenic VOC emissions, however, based on the OTAG sensitivity tests we believe that even a substantial decrease (i.e., factor of two) in the amount of emitted VOC would not change the basic conclusions of the HDV modeling which are: a) that a significant number of areas are at risk of continuing exceedances of the ozone standard in the future, and b) that the emissions reductions that will result from the HDV rulemaking will substantially lower regional ozone levels over the eastern U.S. Ultimately, the commenter has submitted no technical material which indicates otherwise.

<u>Prior ozone and emissions trends:</u>

The commenter cites the earliest pair of sensitivity simulations performed by EPA as part of the Tier 2 modeling analysis to conclude that EPA's modeling system predicts virtually the whole country is NOx-limited (i.e., NOx control would be most effective path to lower ozone). These earliest sensitivity runs (OMS1 and OMS2) employed different emissions estimates and different meteorological inputs than were used in both the final Tier 2 and HDV modeling simulations and thus have no relevance to the final HDV rulemaking. The commenter also cites data from a study by Zalewsky et al., in which ozone levels and VOC concentrations in urban areas decreased between 1988 and 1993, while NOx concentrations remained relatively constant. Given that the baseline emissions inventory in 1996 already includes the mobile source VOC controls that yielded the ozone reductions in the late 1980's and early 1990's, it is not be unexpected that the post-1996 response of the model differs from the historical response with its different mix of initial VOC and NOx. Furthermore, according to more recent emissions trends data from the National Emissions Trend database, there were substantial reductions in NOx emissions in the Northeast U.S. during the period of decreasing ozone that occurred between 1990 and 1996. Table 2.2(D)(1)-a compares percentage ozone precursor emissions reductions from 1990 to 1996 for States in the Northeast U.S. that have 1-hour ozone attainment problems.

Table 2.2(D)(1)-a: Ozone Precursor Emissions Reductions for Northeastern States

Percent Emissions Change: 1990 vs. 1996	National Emissions Trends (NET) Inventory	
	VOC	NOx
Connecticut	-5.8%	-6.6%
Delaware	-13.2%	-23.1%
Dist. Columbia	-11.3%	-5.6%
Maryland	-30.1%	-8.3%
Massachusetts	-11.2%	-14.2%
New Jersey	-22.4%	-12.4%
New York	-22.7%	-16.2%
Pennsylvania	-19.3%	-5.0%
Rhode Island	-18.9%	-10.5%
Total NE States	-20.0%	-10.8%

Contrary to the commenters' assertions above, EPA's modeling system frequently does indicate a VOC-limited regime. For 86 urban areas in the eastern U.S., the model indicated periods of VOC-limitation at some time during periods of high ozone at 12 of them (14 percent). In most of these areas, the VOC-limited conditions occurred relatively infrequently and were more localized than NOx-limited conditions. The premise that the EPA modeling system uniformly predicts NOx-limited conditions is false, and thus the commenters' assertions that the model predictions are rendered invalid by a presumed inconsistency with prior ozone and emissions trends are unsupported.

The commenter states that if "the Agency believes that the sensitivity to NOx and VOC in its latest modeling system is different from the initial Tier 2 modeling system, it is incumbent upon EPA to demonstrate that the model can now accurately model the air quality impact of emissions reductions." The commenter goes on to suggest that a suite of sensitivity runs could be completed to identify areas that are VOC vs. NOx limited. EPA does not believe that such diagnostic modeling was required as part of this analysis, for several reasons. First, the modeling results were evaluated against a large set of surface ozone observations and found to replicate those ambient measurements fairly accurately for the three 1995 episodes. On average, the model exhibited an under prediction bias of about 7 percent, with an average gross error value of about 23 percent. Second, based on existing control strategy simulations and comparisons against Tier 2 base year model runs, it is already fairly evident where the model is VOC-limited, NOx-limited, or in the "transition zone". Generally, urban areas and grid cells immediately downwind of large utility plumes have the strongest tendency for VOC-limitation while suburban and rural areas tend to be NOx-limited. From a temporal perspective, the early morning hours tend to be VOC-starved in urban and suburban areas. The transition to NOx-starved conditions occurs in most locations in the mid-morning hours and most (but not all) locations become fully NOx-starved by 2 pm. While direct comparisons are not possible against observational modeling results for these episode days, these results generally match the findings of observational studies like Blanchard (1998).

Summary of Modeling Results for HDV rule

As noted in the preamble to the final regulations, EPA has analyzed the potential for localized increases in ozone that might occur as a result of this rule. In so doing, EPA carefully studied information provided by commenters as well as conducted its own analyses of this issue that are summarized below. As indicated in the preamble, EPA's modeling of the final rule shows that improvements in ozone levels and public health benefits are expected because of the HDV rule.

The rule will provide a substantial reduction in emissions of ozone precursors, particularly, NOx. These emissions reductions will greatly lower ozone concentrations which will help federal and State efforts to bring about attainment with the current 1-hour ozne standard. As described in the Air Quality Modeling Technical Support Document for this rule, EPA performed regional scale ozone modeling for the Eastern U.S. to assess the impacts of the controls in this rule on predicted 1-hour ozone exceedances. The results of this modeling were examined for those 37 areas in the East for which EPA's modeling predicted exceedances in 2007, 2020, and/or 2030 and current 1-hour design values are above the standard or within 10 percent of the standard. The results for these areas combined indicate that there will be substantial reductions in the number of exceedances and the magnitude of high ozone concentrations in both 2020 and 2030 due to this rule. The modeling also indicates that without the rule exceedances would otherwise increase by 37 percent between 2020 and 2030 as growth in emissions offsets the reductions from Tier 2 and other current control programs.

For all areas combined, the rule is forecast to provide a 33 percent reduction in exceedances in 2020 and a 38 percent reduction in 2030. The total amount of ozone above the standard is expected to decline by nearly 37 percent in 2020 and 44 percent in 2030. Also, daily maximum ozone exceedances are lowered by 5 ppb on average in 2020 and nearly 7 ppb in 2030. The modeling forecasts an overall net reduction of 39 percent in exceedances from 2007, which is close to the start of this program, to 2030 when controls fully in place. In addition, the results for each individual area indicates that all areas are expected to have less exceedances in 2030 with the HDE controls than without this rule.

There was one metropolitan area that EPA modeled as having exceedances with the one-hour ozone standard under baseline conditions in 2007 through 2030, which the Agency's modeling estimated could have small increases in its peak ozone levels in 2020 and 2030 and a small net increase in levels above the 1-hour standard in 2030. Yet, EPA's air quality modeling did not predict an increase in the number of exceedances in this area in 2020 and a decrease occurred in 2030. In another CMSA/MSA in another State, in 2030 there was less than a one percent increase in the summer peak level. Yet, this area had few exceedances and lower ozone above the 1-hour standard in both 2020 and 2030 under the rule. EPA expects that the States will have State Implementation Plans that will consider federal controls and complement them with State actions to provide attainment and will work with the State to ensure this occurs.

Collectively, EPA believes its air quality modeling results for the HDV rule indicate that it will make it much easier for states to develop their State Implementation Plans (SIPs) which will attain and maintain compliance with the one-hour ozone standard. (There are also other upcoming federal measures to lower ozone precursors that will aid the States efforts.) Furthermore, EPA's Regulatory Impact Analysis for this rule shows significant health and welfare benefits occurring from the ozone reductions that the rule provides.

Further details on these conclusions are provided below.

Air Quality Modeling

EPA conducted air quality modeling to consider the ozone air quality without the HDV rule in 2007, 2020, and 2030 and with the HDV rule in 2020 and 2030[46]. The analysis covered the Eastern U.S. and focused on the areas with current ambient design values exceeding the 1-hour standard or within 10 percent of the standard. EPA's air quality modeling predicted that 37 of these CMSAs/MSAs are expected to have exceedences of the ozone standard in 2007 without the HDV rule. For 2020 and 2030, the number of CMSAs/MSAs with predicted exceedances without the HDV rule in effect was 35 areas and 36 areas, respectively. The following discussion is based on the results of EPA's modeling for 2020 and 2030 as quantified in terms of various "metrics" or measures of the impact of the HDV controls on predicted exceedances in these CMSA/MSAs. Details on the calculation of these metrics are in the Air Quality Modeling Technical Support Document for this rule.

Overall, EPA found that the final HDV rule substantially lowers model-predicted exceedances of the ozone NAAQS in areas that are predicted to have exceedances in the future without the rule. In 2020, the number of exceedances in CMSA/MSAs is forecasted to decline by nearly 33 percent with the rule. In 2030, the program lowers such exceedances by about 38 percent. Table 2.2(D)(1)-b is a summary of the changes from the base case in predicted exceedances . In 2020 and 2030, respectively, about 91 percent and 100 percent of the areas that EPA forecasts will have future exceedances in the base case have fewer exceedances with the HDV rule. Table 2.2(D)(1)-c shows which CMSA/MSAs are predicted to have less exceedances under the HDV rule.

Table 2.2(D)(1)-b:
Summary of Changes in Exceedances Due to the HDV Rule
Based on Final Rule Air Quality Modeling for Eastern CMSA/MSAs

Effect of HDV Rule on CMSA/MSA Ozone Exceedances	**Number of Areas in 2020**	**Number of Areas in 2030**
Areas with Exceedances in Base	35	36
No Longer Have Any Exceedances in Control	3	3
Decrease in Exceedances in Control	29	33
No Change in Exceedances	3	0
Increase in Exceedances in Control	0	0

Table 2.2(D)(1)-c:
List of CMSA/MSAs with Reductions in Exceedances and/or Reduction in Total Ozone above the Standard in 2020 and/or 2030 Due to HDV Rule

Metropolitan Areas	**Reduction of NAAQS Exceedances**		**Reduction of Ozone above the NAAQS**	
	2020	**2030**	**2020**	**2030**
Atlanta	X	X	X	X

[46] EPA's modeling covered 2020, because it would provide a sense of the early impacts of the HDV rule and 2030, a year when the heavy duty vehicle fleet covered by HDV standards will have nearly turned over completely under coverage with the rules.

Barnstable	N.A.[1]	X	N.A.	X
Baton Rouge	X	X	X	X
Beaumont	X	X	X	X
Benton Harbor	X	X	X	X
Biloxi	X	X	X	X
Birmingham	X	X	X	X
Boston	X	X	X	X
Charleston, WV	N.C.[2]	X	X	X
Charlotte	X	X	X	X
Chicago	X	X	X	X
Cincinnati	X	X	X	X
Cleveland	N.C.[2]	X	X	X
Detroit	N.C.[2]	X	X	I[3]
Grand Rapids	X	X	X	X
Hartford	X	X	X	X
Houma	X	X	X	X
Houston	X	X	X	X
Huntington	X	X	X	X
Lake Charles	X	X	X	X
Louisville	X	X	X	X
Macon	X	X	X	X
Memphis	X	X	X	X
Milwaukee	X	X	X	X
Nashville	X	X	X	X
New London	X	X	X	X
New Orleans	X	X	X	X
New York City	X	X	X	X
Norfolk	X	X	X	X
Orlando	X	X	X	X
Pensacola	N.A.	N.A	N.A	N.A
Philadelphia	X	X	X	X

Providence	X	X	X	X
Richmond	X	X	X	X
St. Louis	X	X	X	X
Tampa	X	X	X	X
Washington-Baltimore	X	X	X	X

1. "N.A." indicates that the area did not have any exceedances predicted in the base case for this scenario.
2. "N.C." indicates no change.
3. "I" indicates an increase.

In these same metropolitan areas, the total amount of ozone above the standard is forecasted to decline by about 37 percent in 2020 and by about 44 percent in 2030. Table 2.2(D)(1)-c shows which areas have a reduction in total ozone above the standard as a result of the HDV controls. Table 2.2(D)(1)-d shows a summary of the types of net changes occurring in the total amount of ozone above the standard in the areas where EPA's modeling predicts exceedances in the base case.

Table 2.2(D)(1)-d: Summary of Net Change in Total Ozone above the Standard Due to the HDV Rule Based on Final Rule Air Quality Modeling for Eastern CMSA/MSAs

Effect of HDV Rule on Ozone Levels above the NAAQS	**Number of Areas in 2020**	**Number of Areas in 2030**
Net Reduction of Ozone above NAAQS	35	35
No Net Change in Ozone above NAAQS	0	0
Net Increase of Ozone above the NAAQS	0	1

In the vast majority of areas, the air quality modeling predicts that the HDV rule will lower peak summer ozone concentrations in both 2020 and 2030. The reduction in daily maximum ozone is about 5 ppb, on average in 2020 and about 7 ppb, on average in 2030. Table 2.2(D)(1)-e shows a summary of the number of areas that have different types of changes in peak 1-hour ozone predictions. Detroit is the only area with an increase in peak ozone in 2020. However, as shown in Table 2.2(D)(1)-c, Detroit has no increases in exceedances in this year and a small decrease in the total amount of ozone above the 1-hour standard. In 2030, both Detroit and Louisville have increases in the peak ozone. Detroit also has an increase in total ozone above the standard in 2030, but fewer exceedances of the standard. Even though Louisville has an increase in peak ozone in 2030, there are fewer exceedances and less ozone above the standard in this year.

Table 2.2(D)(1)-e: Summary of Changes in Peak 1-Hour Ozone Due to the HDV Rule Based on Final Rule Air Quality Modeling for Eastern CMSA/MSAs

Effect of HDV Rule on Ozone Peak Levels	**Number of Areas in 2020**	**Number of Areas in 2030**
Reduction	33	34
No Change	1	0
Increase	1	2

The more-detailed results of the changes that occur in each CMSA/MSA in Table 2.2(D)(1)-f show that nearly all areas experience only decreases in total ozone above the standard. There are some areas which may have times and areas when ozone levels increase in some portion of the area and other times and/or locations when ozone decreases as a result of controls during the course of the episodes modeled. As indicated in Table 2.2(D)(1)-f, the net change is always a decrease, except in only one area, Detroit in 2030.

Table 2.2(D)(1)-f: Summary of Increases and Decreases in Ozone Due to the HDV Rule Based on Final Rule Air Quality Modeling for Eastern CMSA/MSAs

Effect of HDV Rule on Increases/Decreases in Ozone Levels	**Number of Areas in 2020**	**Number of Areas in 2030**
Only Increases	0	0
Only Decreases	28	29
Increase & Decrease - Net: Decrease	6	6
Increase & Decrease - Net: Increase	1	1
Increase & Decrease - Net: No Change	0	0
No Change	0	0

By-and-large, EPA's air quality analysis shows that the HDV rule substantially improves ozone air quality for areas predicted to have exceedances of the NAAQS in the base case. Table 2.2(D)(1)-a shows no areas are forecast to have additional exceedances as a result of the HDV rule in 2020 or 2030. Considering all of the other metrics, EPA expects widespread benefits in ozone reductions from the rule. There are only two areas (i.e., Detroit and Louisville) where, based on EPA's modeling, that it is not entirely clear that any increases will be far outweighed by the forecasted decreases in ozone above the standard.

Most importantly, this type of situation (isolated ozone increases) should not occur when other governmental actions beyond the scope of the HDV rule are considered. Michigan and Kentucky are in the process of conducting local modeling that will consider the impacts of this rule and their own local programs that should be designed to complement this and other national programs. We expect that the States will be able to design reasonable programs to provide attainment, which means that even in the case discussed directly above ozone levels will be reduced in the future.

The Agency is also going to take further actions on both VOCs and NOx which we expect will further lead to air quality improvements. For example, the planned non-road programs include emissions standards for stern-drive recreational marine engines and for commercial marine engines.

State Support

We also note that no state responsible for achieving attainment of the ozone NAAQS has commented that HDV rule will make achieving attainment harder, and many have commented positively. For example, the Northeast States for Coordinated Air Use Management (NESCAUM) and the State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials (STAPPA/ ALAPCO) have strongly supported the rule. Several individual states have also expressed support for the rule, including New York State, Alabama, Toledo, New Jersey, Pennsylvania, Oregon, Connecticut, San Joaquin Valley, South Carolina, Illinois, Ohio, Wisconsin, North Carolina, Delaware, New Hampshire, Iowa, Alaska, Rhode Island, Maryland, Guam, Texas (TNRCC), and Georgia. The City of Chicago, which has often been cited by commenters as a place where there can be counterproductive effects of NOx reduction, has submitted comments in favor of the rule. Other cities that have gone on record in support of the rule are New York City, Atlanta, Los Angeles, Houston, Ventura, Sacramento, San Francisco, Denver, and Boulder. Comments by these organizations are in Air Docket A-99-06.

Ozone-related Health and Welfare Improvements

EPA has examined all of the important changes in ozone air quality predicted to occur at the county level over the ozone season in its final analysis of the health and environmental effects of this rule. It has considered how areas experience both increases and decreases in ozone levels throughout the course of the season. The Agency has developed estimates of all the important ozone parameters that are necessary for estimating health and environmental effects at the county level. The Agency then used county population projections out to 2030 to estimate how many people will either experience, or avoid different types of health effects due to the HDV rule. These results are then aggregated to come up with a national estimate of the benefits of the rule. The relevant results are summarized below and further details of this process can be found in the Regulatory Impact Analysis (RIA) for the final rule and the TSD for the health and welfare effects estimation process.[47]

EPA's RIA estimates that there will be substantial benefits to the public from the ozone reductions that result from the NOx reductions that EPA is requiring in the HDV rule. As NOx reductions start in 2007 and increase over time this should lead to fewer hospital admissions for respiratory and cardiovascular diseases, including emergency room admissions for asthma, and reduce the occurrence of nonemergency asthma attacks and other acute respiratory symptoms and minor restricted activity days. EPA's analysis of ozone reductions also indicates that there should be increases in worker productivity and other benefits to the public's welfare.

By 2030 (when turnover of the vehicle fleet has occurred), in the Eastern US alone,

[47] U.S. Environmental Protection Agency, "Final Tier II Rule: Air Quality Estimation, Selected Health and Welfare Benefits Methods, and Benefits Analysis Results," December 1999.

the HDV rule NOx reductions will provide reductions in ozone concentrations that annually lead to 300 fewer emergency room visits for asthma and 1,500 fewer hospital admissions from other respiratory and cardiovascular diseases. There is an estimated annual reduction in 185,500 asthma attacks. There should also be an annual reduction of more than 1.8 million incidences of minor restricted activity days. Additionally, EPA estimates that there will be increased worker productivity valued at $ 140 million annually and reductions in crop damage valued at close to $ 1,120 million per year as well as other significant, although unquantified, public health and welfare benefits. This substantial level of health and welfare benefits from ozone-related improvements in air quality clearly rebuts the assertions by GM et al that the HDV rule's NOx reductions are counterproductive.

Other Benefits Resulting from NOx Reductions

Furthermore the NOx reductions in conjunction with the SOx and direct particulate matter reductions leads to reduced fine particle concentrations in 2030 that EPA estimates in the RIA will prevent 8,300 premature deaths, 5,500 cases of chronic bronchitis, 17,600 cases of acute bronchitis, 175,900 asthma attacks, and substantial reductions in other harmful respiratory and cardiovascular effects. The fine particle reductions will lead to about $3.3 billion of visibility benefits in the West and Southeast alone, as well as many other types of unquantified welfare benefits.

EPA also found similar results in overall air quality improvement and health and welfare benefits in comparable analysis of its Tier 2 program. The Agency's response to similar comments about the counterproductive effects of NOx reduction can be examined in the docket (IV-A-08).

(2) There is growing evidence indicating that on weekends, ozone levels increase while NO_x decreases. Commenter notes that industry commented on this under the Tier 2 and acknowledged that there are ongoing efforts to improve understanding on the issue. EPA should work with other interested stakeholders to better understand the mechanisms that cause higher ozone as an apparent by-product of NO_x reductions.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 83**

Response to Comment 2.2(D)(2):

All issues related to weekend/weekday studies are addressed in the response to Issue 2.2 (D)(3), below.

(3) Observational evidence from weekday/weekend studies indicates that the spatial extent of the VOC-limitation/NO_x-disbenefit effect is larger than EPA's model predicts. The reduction in NO_x emissions during the weekend is due in part to the reduced emissions of the HD trucks during this time. Commenter provides significant discussion on this issue and references their comments on this issue in response to the Tier 2 rulemaking as well as the draft report issued by CARB "The Ozone Weekend Effect in California" April 2000. Commenter cites to the data and conclusions in this report, which supports the conclusion that NO_x reductions on the weekend are a likely cause of increased ozone levels. Commenter also cites to an independent analysis that also supports this conclusion (see "Spatial Mapping of VOC and NO_x-

Limitation of Ozone in Central California," Blanchard, Charles, R., report to the Bay Area Air Quality Management District, 1999). Commenter notes that EPA has not adequately addressed the comments on this issue as submitted in response to the Tier 2 rulemaking (and suggests that EPA meet with industry representatives to discuss this issue) and asserts that failing to determine whether a proposed rule will improve or degrade air quality before finalization would be arbitrary and capricious. Commenter asserts that any potential for ozone nonattainment past 2007 is precisely in those areas where the HD NO_x reductions are most likely to be counterproductive and concludes that the proposed NO_x reductions will aggravate, rather than help reduce, ozone levels in (and downwind of) the nation's large cities.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 19-25**

Response to Comment 2.2(D)(3):

As stated previously in comments on the Tier 2 rulemaking, GM asserts that, because some monitoring locations exhibit higher ozone levels on weekends than on weekdays, we should conclude that further NOx reductions from Tier 2 will produce increases in ozone concentrations in future years. As EPA responded to this comment previously, the state of current scientific understanding is insufficient to support this conclusion.

As part of their comments, GM frequently cites a draft California Air Resources Board (CARB) report in establishing the existence of the so-called “weekend effect”. EPA does not dispute the existence of generally higher levels of elevated ozone[48] (and lower measured VOC/NOx ratios) on the weekend, but disagrees with the commenters’ conclusions arising from this “weekend effect”. Significantly, the introductory chapter of the draft CARB report directly addresses the conclusion GM reached from the data within the report’s analyses.

“From the Weekend Effect, some conclude that NOx reductions could be counterproductive as an ozone control strategy in the California. However, ARB staff maintain that the pattern of variable ozone precursor reductions during the day are not representative of the uniform reduction (for all hours of the day and days of the week) that would occur under an ozone control plan.”

“Furthermore, ozone concentrations have declined for all days of the week at all sites in the (South Coast Air Basin) and the (San Francisco Bay Area Air Basin). Although aggressive VOC control plans are in place in both of these air basins, the NOx control plan in the (South Coast Air Basin) is more aggressive than the one in the (San Francisco Bay Area Air Basin).”

The draft report lists four possible hypotheses to explain the phenomena of higher weekend ozone, only one of which is consistent with the concept of extrapolating these results to determine the effects of a general NOx reduction strategy. The other three hypotheses, if true, would not allow weekend/weekday ozone trends to be used as a surrogate for identifying areas of NOx control disbenefits. One hypothesis is that due to the lack of a marked morning rush hour on the weekend, the timing of NOx emissions into the

---

[48] Although the day of the week with the most ozone exceedances in the South Coast Air Basin is Thursday. Followed by Friday, then Saturday. (*CARB, 2000*).

airshed is much different on a weekend than a weekday. Without the NOx titration which occurs in the early morning hours on weekends, the system becomes NOx-limited earlier in the day and any fresh NOx injected at that point will lead to higher ozone. A second hypothesis is that there is a carryover of ozone precursors aloft from the preceding weekdays which when mixed with surface layer emissions from a weekend results in a more ozone conducive state. The third hypothesis is based on the known uncertainty in emissions estimates and postulates that there are weekend-specific activities which result in higher VOC and NOx emissions on weekends. CARB, industrial representatives, and other interested parties are presently engaged in a multi-year data collection and analysis study to determine which of the hypotheses accounts for the weekend effect phenomenon.

The commenter also resubmitted several pieces of information that were addressed within the Tier 2/Low Sulfur RTC. First, the commenter cites 1996-1998 ozone data and concludes that more sites had higher ozone on the weekends (373) than lower ozone on the weekends (132). This analysis is apparently based on mean ozone values as opposed to exceedance-level values and therefore has no relevance to the issue of whether NOx controls would aggravate ozone concentrations on the highest ozone days, even if one assumed that weekend/weekday data could be used as a proxy for the NOx control signal.

The commenter questioned a comprehensive regional study related to this issue done for the Air Quality Analysis Workgroup of the Ozone Transport Assessment Group (OTAG) in September 1996. (Husar, 1996) This group was composed of nationally-known air quality analysis experts from the federal and state government, industry, and major university research centers. In the study, Husar used monitoring data from EPA, States, and other sources from 1988 to 1995 to examine the weekly pattern of ozone over the eastern United States. The study concluded that daily exceedances (ozone values >120 ppb) are reduced on Sundays to one-third of the exceedances on Fridays. The study also concluded that the strongest differences between Friday ozone levels and Sunday ozone levels occurred in major metropolitan areas. These conclusions are consistent with the expectation that NOx reductions are beneficial over large geographical scales, even if the benefits vary on a local scale. The commenter speculated that Fridays were not a representative day of the week because “a substantial fraction” of the populations travels to recreational areas in advance of the weekend. EPA believes the central point of the argument (i.e., over a large part of the eastern U.S., no compelling evidence of a weekend effect has yet been advanced) still exists, independent of any small mobile source emissions differences between Friday and other weekdays

In summary, EPA continues to maintain that the NOx reductions associated with the HDV rulemaking will have wide-ranging air quality benefits over the entire United States. PM concentrations and regional ozone levels, in particular, will be significantly reduced. It is possible that transitory ozone increases in some areas may be related to NOx reductions, but the extent and applicability of such results is confounded at best. No compelling air quality evidence has yet been submitted that past NOx reductions have led to any widespread ozone increases. In fact, the data shows the opposite. According to the emissions trends listed CARB report, total VOC and NOx decreased by approximately: 13 and 1 percent from 1985-1990, 20 and 12 percent from 1990-1995, and 20 and 15 percent from 1995-2000. This entire period has been characterized by a consistent trend to fewer ozone exceedances and lower mean ozone values (weekends as well as weekdays).

(E) The proposed rule is necessary to reduce PM levels, which are high according to air quality monitoring data.

(1) In the East, upwards of 65% of PM fine mass is composed of primary and

secondary products of combustion and other anthropogenic sources. Chief constituents of fine particles include elemental and organic carbon, ammonium, sulfates, and nitrates. In urban areas such as New York City and Boston, monitoring data show elevated levels of PM2.5. This is of special concern because low income communities are disproportionately impacted by the high levels of PM and toxic air pollution found in urban areas.

Letters:

NESCAUM (IV-D-315) **p. 2**

Response to Comment 2.2(E)(1):

EPA agrees with the commenter that monitoring data for fine PM demonstrates a significant contribution from anthropogenic sources. This is of particular concern in urban areas with high population densities and low income neighborhoods.

(2) Commenter provided detailed supplemental information on HD emissions in New York.

Letters:

NY DEC (IV-D-239) **p. 7**

Response to Comment 2.2(E)(2):

EPA recognizes the elevated levels of fine PM found in ambient air in New York City.

(3) Prevailing winds carry PM 2.5 and ozone into Mt. Ranier National Park, and a reduction in PM 2.5 would lead to improved regional visibility and would reduce the effects of acid rain on the environment.

Letters:

WA Environmental Council (IV-D-164) **p. 1,2**

Response to Comment 2.2(E)(3):

EPA recognizes the environmental impacts of emissions from heavy-duty vehicles, and appreciates the location-specific examples provided by the commenter.

(4) Particulates impair visibility up to 70%.

Letters:

OR Environmental Council (IV-D-68) **p. 2**

Response to Comment 2.2(E)(4):

EPA agrees with the commenter that particulate matter impairs visibility.

(5) At Acadia National Park, the primary source of visibility impairment is from

fossil fuel particles. Some plants at Acadia are suffering damage from acidification. This is also true at other northeast states and eastern Canadian provinces.

Letters:

The Coalition for Sensible Energy (IV-D-264) **p. 1**

Response to Comment 2.2(E)(5):

Adverse environmental impacts from heavy-duty vehicle emissions are well-established and described in detail in the rulemaking documents. EPA appreciates the location-specific examples provided by the commenter.

(F) EPA relies on inaccurate data or modeling assumptions regarding PM reductions and the attainment of the PM NAAQS.

(1) Reducing sulfur from diesel fuel will not significantly reduce coarse particles from diesel exhaust because 80-90% of particles emitted from diesel engines are fine or ultrafine particles; and PM traps form larger numbers of the ultra-fine particulates. Commenter provides additional data and discussion on this issue to support their position that reductions in diesel emissions are unnecessary to prevent exceedances of the PM10 standard and notes that since only a couple areas in California currently exceed the PM10 standard and very few other areas are in danger of exceeding the standard, a national approach based on reduced diesel emissions cannot be justified. (cites to W.G. Tucker, Fuel Processing Technology 65-66 (2000) 379-392).

Letters:

American Petroleum Institute (IV-D-343) **p. 13-15**
Marathon Ashland Petroleum (IV-D-261) **p. 9**

Response to Comment 2.2(F)(1):

The commenters assert that these regulations are not justified based on health concerns related to PM10 nonattainment areas for three reasons: (1) diesel PM is a small fraction of PM10, (2) there are only a few PM10 nonattainment areas, most of which are located in California; (3) reducing sulfur from diesel fuel will not significantly reduce coarse particles of diesel exhaust since 80-90% of particles emitted from diesels are in the fine or ultrafine range.

EPA disagrees with the commenters.

The regulations address emissions from heavy-duty vehicles (diesel and gasoline). Ambient concentrations of PM are composed, in part, of direct particles emitted from HDVs, and from gaseous emissions that form particles in the atmosphere. The standard that must be met to justify this rule is whether heavy-duty vehicle emissions cause or contribute to air pollution that may reasonably be anticipated to occur in the future. The fact that these sources may not be the only or the largest sources of contribution does not change the legal justification of the rule, although in many cases the inventory contribution from HDVs is substantial. In the case of PM10 nonattainment areas, while HDV emissions may not be the dominant reason for the nonattainment status, it is well-established that heavy -duty vehicle emissions contribute to the current levels of ambient PM10.

Second, the Agency finds that there are ten PM10 nonattainment areas currently violating the PM10 NAAQS and that inventory increases from 1996 to 2030 demonstrate that these areas face a significant risk of exceeding the standard in the future without additional reductions. The ten areas are not only in California, but across the nation in six states: California, Nevada, Arizona, Ohio, Texas, and New York. Moreover there is no reason to exclude emission reductions in California since California will benefit significantly from this national rule.

Importantly, there are also 25 unclassifiable areas that have recently recorded ambient concentrations of PM10 above the PM10 NAAQS. EPA adopted a policy in 1996 that allows areas with PM10 exceedances that are attributable to natural events to retain their designation as unclassifiable if the State is taking all reasonable measures to safeguard public health regardless of the sources of PM10 emissions. Areas that remain unclassifiable areas are not required under the Clean Air Act to submit attainment plans, but we work with each of these areas to understand the nature of the PM10 problem and to determine what best can be done to reduce it. With respect to the monitored violations reported in 1997-99 in the 25 areas designated as unclassifiable, we have not yet excluded the possibility that factors such as a one-time monitoring upset or natural events, which ordinarily would not result in an area being designated as nonattainment for PM10, may be responsible for the problem. Emission reductions from today's action will assist these currently unclassifiable areas to achieve ambient PM10 concentrations below the current PM10 NAAQS.

Third, We also disagree with the assertion in the comment that PM traps (CDPFs) increase ultra-fine PM emissions which contribute to PM10. As we explain in response to issue 3.2.1(G) ultra-fine PM emissions are reduced substantially through the application of CDPFs and low sulfur diesel fuel. The new heavy-duty vehicle standards and low sulfur diesel fuel requirements will enable the use of new aftertreatment technologies that will result in significant reductions in a number of pollutants that directly (diesel PM) or indirectly (secondary formation of ambient PM from NOx, SOx, and VOCs) affect ambient concentrations of PM10.

(2) EPA provides no data or evidence to support the claim that PM emissions will rise steadily in the absence of new controls and in fact, these emissions are likely to decline in future years. EPA's prediction that emissions of PM-10 will rise steadily unless new controls are implemented is misleading since ambient concentrations of PM-10 have been declining steadily over the past decade (cites to EPA National air Quality and Emission Trends Report, 1998). Also, direct PM-10 emissions are just one portion of the total PM-10 inventory. EPA's estimates of gaseous precursors of secondary PM (in the final Tier 2 rule) indicate that emissions of SO_x, NO_x, and VOC are all projected to be below 1996 levels in 2030 under the current control program. One commenter also noted that EPA cannot justify the rule by assuming that PM emissions will rise based on estimates of future increases in the number of light-duty diesel engines sold and operated.

Letters:

American Petroleum Institute (IV-D-343) **p. 5**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 28-29**

Marathon Ashland Petroleum (IV-D-261) **p. 5, 10**

Response to Comment 2.2(F)(2):

The central issue in this comment is EPA's assertion that at least 10 areas across the nation face a significant risk of exceeding the PM10 NAAQS between 2007 and 2030. Commenters make several arguments.

First, commenters assert that EPA has not provided any data to substantiate the claim that PM inventories for relevant areas will rise in the future. This is not accurate. In the proposal, EPA based its assertion on "control case" inventories prepared for the Tier 2 rulemaking. We updated our inventories for the final rule, and placed those inventories into the docket as they became available. The areas that face a significant risk of future violations of the PM10 NAAQS have significant increases in particulate matter emissions projected from 1996 to 2007. This information is presented in Table II.A-14 in the Regulatory Impact Analysis for the final rule.

Second, commenters note that PM10 ambient concentrations have declined over the last decade. This is true. Ambient concentrations and particulate matter emissions inventories have declined over the last ten years (EPA Trends, 1998, at 40, and Table A-6). However, particulate matter emissions are projected to increase between 1996 and 2030, and thus the ten nonattainment areas that are currently violating the standard, or and those areas that are within 10 percent of exceeding the standard, face a significant risk of exceeding the standard between 2007 and 2030.

Third, the commenters point out that gaseous compounds such as NOx, SOx, and VOCs also contribute to the formation of PM10 concentrations. While this is accurate, in most areas these gaseous pollutants represent only a small fraction of PM10. In the west, 70 percent of PM10 particles are comprised of particulate matter composed of minerals from natural and anthropogenic sources. The sulfate portion (SO_4) is 3.1 percent and the NH_4 portion is 0.8%. There was insufficient data available to determine the proportion of nitrate, organic carbon and elemental carbon. This inventory data shows that the critical data set related to prospects of future nonattainment is the PM inventories. That said, it is important to note that SOx inventories for the 10 areas that the Agency predicts face a significant risk of nonattainment in the future are projected to increase substantially from 2007 to 2030. See table below.

Table 2.2(F)(2) – SOx Emissions for Areas Facing a Significant Risk of Exceeding the PM10 NAAQS between 2007 and 2030.

Area	**Percent Increases in SOx Emissions (2007-2030)**
Areas Currently Exceeding the PM_{10} standard	
Clark Co., NV (Las Vegas)	9%
El Paso, TX *	22%
Hayden/Miami, AZ	21%
Los Angeles South Coast Air Basin, CA	20%
Nogales, AZ	55%
Phoenix, AZ	30%
Areas within 10% of Exceeding the PM_{10} Standard	

Cuyahoga Co., OH (Cleveland)	-1%
Harris, Co., TX (Houston)	28%
New York Co., NY	5%
San Diego Co., CA	25%

Finally, commenters state that it is not appropriate for the Agency to include projected increases in diesel emissions due to penetration of diesels into the LDV fleet. The Agency concurs and has not done so. The paragraph in the preamble was included to show that emissions from diesels would be even higher if diesels penetrated the LDV market in significant numbers.

(3) EPA provides no explanation or documentation for its revised approach in determining the PM inventory. EPA has failed to explain the increases in the base case emission inventory and has provided inadequate information, which prevents stakeholders from developing their own analyses.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 83**

Response to Comment 2.2(F)(3):

We disagree with the commenter. As discussed in the NPRM, the primary revision to the PM inventory is in the estimate of vehicle miles traveled (VMT) by heavy-duty diesel engines. Although the Tier 2 and this analysis both base VMT estimates on the Federal Highway Administration total VMT for motor vehicles, our new analysis uses updated VMT splits by class and by fuel type. These new VMT splits were developed in our efforts to create an updated version of MOBILE and were presented in a memo to the docket prior to the publication of the NPRM.[49] As a result, our VMT projections increased by 40 percent for HDVEs. Because we use the same growth rate projections as in the Tier 2 analysis this increase is constant into the future.

The PM inventory is also affected by the use of lower emission factors than were used in the Tier 2 inventory analysis. These new emission factors are also due to our efforts to update MOBILE[50] We discussed the emission factor updates in detail in the NPRM and in the docket. These emission factor updates result in about a 12 percent decrease in PM in the 2007 calendar year. The combined effect of the VMT increase and emission factor decrease is about a 23 percent increase in exhaust PM projections. This rough calculation shows a similar result as is presented below in Table 2.2(F)(3).

In its comments, EMA presents a table (Table 2) which incorrectly presents the increase from the Tier 2 PM inventory to the PM inventory we presented in our NPRM. The mistake in the EMA table is that EMA presents the total 2007 PM inventory from heavy-duty gasoline and diesel (and motorcycle) engines as 52,600 tons. This number should have

[49] "VMT Estimates for the 2007 Heavy-Duty Final Rule Analysis," EPA memorandum from Penny Carey and Michael Sklar to Docket A-99-06, May 9, 2000.

[50] "Update of Heavy-Duty Emission Levels (Model Years 1988-2004+) for Use in MOBILE6," U.S. Environmental Protection Agency, EPA420-R-99-010, April 1999.

been 97,300 tons. Table 2.2(F)(3) presents the Tier 2 and HD 2007 FRM inventories for PM10. In this table, we only present the contribution of HDDEs so that a direct comparison can be made. Crankcase PM is not included here because it was not included in the Tier 2 PM inventory.

Table 2.2(F)(3): Comparison of HDDE Baseline PM Inventories (short tons/year)

Rule	*Vehicles*	*2007*
Tier 2 FRM	HDDEs	89,800
HD 2007 FRM	HDDEs	109,500
Percent Increase, Tier 2 to HD 2007		22%

As discussed in the response to issue 2.2(F)(8), other commenters have expressed concern that we have significantly underestimated our PM inventories because we did not include tampering and malmaintenance in our PM inventory calculations. We did not include tampering and malmaintenance in our analysis, so we may be conservatively low in projecting PM emissions from heavy-duty engines.

(4) EPA's analysis of the HD emission inventory is flawed since the PM inventory analysis ignores indirect PM reductions. EPA's model (PART5) estimates that 12% of the SO_2 reacts to form sulfate PM on an annual average basis. However, analyses referenced by EPA in its June 1990 RIA on Control of Diesel Sulfur and Aromatic Content indicate that the reaction rate during the summer months is much higher - as much as 6% per hour. If EPA had estimated indirect PM emissions, either on an annual average or episodic basis, the sulfate PM reductions of its proposed rule would be much greater and the SO_2 emission reductions would have been less. EPA should take indirect sulfate reductions into account in its final rule and should also estimate the amount of SO_2 converted to SO_4 during more episodic conditions. Including indirect PM sulfates in the analysis would increase the estimated overall PM reductions of the diesel fuel sulfur portion of the proposal.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 6-7**

Response to Comment 2.2(F)(4):

We include indirect sulfate PM in our air quality modeling of particulates for the FRM. Because the NPRM used a spreadsheet model to calculate a single national emission factor, we were not able to calculate indirect PM emissions which are a function of local area inputs. In addition, our NPRM inventory analysis was only intended to project emissions directly emitted from heavy-duty engines and was not intended to perform complex atmospheric modeling such as analyzing indirect PM or ozone formation.

(5) There is no national need for additional PM-10 reductions in the 2007 to 2030 time period. The arguments EPA uses to demonstrate that there is a national PM-10 attainment problem are flawed. The current PM-10 attainment problem is not a national issue since it is limited to 24-hour violations in California and a few other western states. Also, the projection technique EPA

used for PM-10, the source-receptor matrix approach, is not appropriate to model specific PM 24-hour exceedances and is not suitable for determining whether a current nonattainment area is at risk of PM-10 nonattainment at a future date. This model is overly simplistic and cannot be used to obtain accurate projections of PM-10 attainment status, particularly when questionable emission inventories projected to 2030 are used. EPA should evaluate the areas potentially at risk using SIP-quality models for projecting 24-hour PM-10 concentrations.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 26-28**

Response to Comment 2.2(F)(5):

EPA disagrees with the commenter's assertion that the scope of the nation's PM10 nonattainment problem is spread among too few states to justify a national-scale control program. Based on analyses of projected increases in emissions in areas which are currently violating or are within 10% of the 24-hour PM10 NAAQS, there are ten areas that the Agency finds face a significant risk of exceeding the PM10 NAAQS between 2007 and 2030. These areas are located in six states spread throughout the nation -- California, Nevada, Arizona, Texas, Ohio, New York.

Although the S-RM was used at the time of proposal for initially estimating future particulate concentrations, we have not relied on these results for the final rule. While it would be preferable to use state-of-the-science air quality modeling to estimate the degree of reductions needed to meet the NAAQS in any particular location, for areas which are already measuring air quality close to or above the level of the NAAQS, it is sufficient to rely on projected increases in emissions to ascertain the potential risk of future violations of the PM10 NAAQS.

Typically, concentrations of PM10 are more significantly affected by direct emissions of particles. This is in contrast with ozone, which involves a number of complex photochemical processes to convert precursor emissions into ozone and other products, and PM2.5, which involves a combination of individual pollutant species, several of which undergo intermediate transformation in the atmosphere. For this reason, it is more reasonable to make judgments about ambient air quality from assessments of PM10 emissions than from ozone precursors or intermediate components of PM2.5. Given that current air quality in many areas is close to or above the level of the PM10 NAAQS, and given that emissions of PM10 in a number of these areas are projected to increase over time, it is reasonable to conclude that many of these areas may experience future air quality that is worse than currently measured. Thus, for the final rule, the Agency examined the emissions inventories for each of the PM10 nonattainment areas that are currently measuring violations of the PM10 standard, and for areas that have measured concentrations within 10% of the standard. Of these 18 areas, there were ten areas that are projected to have increases in emissions inventories of PM from all sources. As a consequence, these ten areas were then determined by the Agency to face a significant risk of future nonattainment.

(6) Attainment of the NAAQS constitutes adequate protection of public health and welfare with a margin of safety (CAA Section 109(b)(1)). However, EPA has proposed these additional regulations despite the lack of evidence and certainty that PM NAAQS violations will occur in the future. This is an arbitrary and capricious interpretation of EPA's obligation under the CAA to

determine which emissions endanger public health and welfare and to establish health based standards for these emissions.

Letters:

American Petroleum Institute (IV-D-343) **p. 5**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 29**

Response to Comment 2.2(F)(6):

First, as discussed elsewhere in this docket and the RIA and preamble, there is a significant risk of future violation of the PM10 NAAQS in several areas of the country without the reductions in this rule. As described in the RIA and preamble for this rule, we believe the reductions from the program completed today are fully justifiable based on the continuing need for further reductions in PM (as well as NOx) from mobile sources in the coming decades to attain and maintain the current PM_{10} NAAQS.

Second, section 202(a) provides EPA with independent authority to regulate "emission of any air pollutant from ... motor vehicles ... which in his judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare." On its face, this provision does not tie such standards to the attainment and maintenance of a NAAQS. Indeed, there are numerous types of air pollution regulated under the Act that are not covered by the section 109 NAAQSs. For example, EPA has authority under section 112 to regulate 189 "hazardous air pollutants," ("HAPs") and may add to the list of HAPs any "pollutants which present, or may present,... a threat of adverse human health effects ... or adverse environmental effects." The Clean Air Act also regulates visibility (section 169A and 169B), acid rain (Title IV) and depletion of stratospheric ozone (Title VI). All of these air pollution concerns can, by any measure, be "reasonably anticipated to endanger public health or welfare."

EPA believes that consideration of air quality need under section 202(a) is not limited to consideration of pollutants for which a NAAQS has been established. EPA has provided independent information regarding the health effects of fine PM and diesel exhaust which also justify the standards promulgated today.

(7) EPA cannot base its need determination on the now-remanded PM2.5 NAAQS. Commenter cites to EPA's consideration of fine particulates in justifying the proposed rule (RIA at p. II-67 and 65 FR 45449) and notes that this intention is inconsistent with President Clinton's Memorandum to the EPA Administrator (7/16/97) which directs EPA to complete the next periodic review of particulate matter by July 2002 so that "the determination of whether to revise or maintain the standards will have been made before any areas have been designated as "nonattainment" and before imposition of any new controls related to the PM2.5 standards." To justify the proposed rule based in part on fine PM also conflicts with EPA's finding of need for the recent Tier 2 rulemaking. It is currently inappropriate to attempt to promulgate the proposed standards on the basis of fine PM effects.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) p. 30-31

Response to Comment 2.2(F)(7):

EPA's use of information regarding the health effects of fine PM does not contradict the President's Memorandum. That memorandum refers to actions taken regarding labeling areas as not attaining the PM2.5 NAAQS. EPA is taking no action today regarding the PM2.5 NAAQS. EPA is acting under its independent authority under section 202(a) to regulate pollutants from motor vehicles. Nor does today's action contradict the action of the D.C. Circuit remanding the PM2.5 NAAQS. EPA is taking no action to implement the PM NAAQS in this rule. Though we use scientific data that was also relied on in support of the NAAQS, today's action is separate and based on our authority under a different section of the statute. It should be noted that, though the D.C. Circuit remanded (but did not vacate) the PM2.5 NAAQS on legal grounds, the court did not take issue with the scientific findings of that rule; in fact, the panel of judges stated that the evidence "amply justifies establishment of new fine particle standards." ATA, slip op. at 47.

In addition, the fact that we did not base our Tier 2 rulemaking on fine PM concerns does not prevent us from taking our concerns regarding fine PM into account when determining whether this heavy duty engine regulation is appropriate under section 202(a). In fact, we stated at the time of the Tier 2 rule that we had authority to take fine PM into account in regulating heavy duty engines, but chose not to do so for the purposes of the Tier 2 rule.

(8) EPA underestimates emissions due to in-use deterioration and needs to consider in-use tampering and maintenance. The commenter recognizes the severe shortage of in-use HDV emissions data, but cites a study showing large deterioration rates (EFEE Inc., 9/30/98).

Letters:

STAPPA/ALAPCO (IV-D-295) **p. 6**

Response to Comment 2.2(F)(8):

We are also concerned that current modeling may not fully represent in-use tampering or malmaintenance. However, we have not fully evaluated the limited data currently available and we are in the process of collecting more data on in-use emission deterioration. If it becomes apparent that we need to revise our particulate model, we intend to do so in a timely manner.

In Chapter 2 of the Regulatory Impact Analysis, we present a sensitivity analysis using PM in-use deterioration rates from the EMFAC2000 emission model developed by the California Air Resources Board.[51] These deterioration rates are derived, in part, from the EFEE Report cited by the commenters. This sensitivity analysis gives PM results that are about 50% higher than we project in our inventory analysis. We are still investigating the accuracy of the EFEE report, but this report still gives an indication that we may be underestimating deterioration. In any case, this suggests that our analysis is conservative in that using the EMFAC2000 deterioration rates would increase emissions projections which would indicate an even greater need for our new standards. It is unlikely, however, that

[51] "Public Meeting to Consider Approval of the Revisions to the State's On-Road Motor Vehicle Emissions Inventory: Technical Support Document," California Air Resources Board, Chapter 10, May 2000.

higher emission inventories would cause EPA to adopt different regulations. These regulations set PM standards for diesel engines at the lowest level we believe are feasible beginning in 2007.

(G) EPA bases the rule on models that are known to be flawed or that are undocumented and have not been subject to peer-review.

(1) EPA has indicated that it intends to rely upon a modified version of the MOBILE5b model for the development of emissions inventories and air quality analyses for the final rule. However, MOBILE5b is almost universally recognized as a model that is extremely outdated in terms of both the inputs on which it relies and the outputs that it generates. MOBILE6 will not be available until January 1, 2001.

Letters:

American Petroleum Institute (IV-D-343) **p. 10**
Marathon Ashland Petroleum (IV-D-261) **p. 5**

Response to Comment 2.2(G)(1):

We disagree with this comment and believe our modeling assumptions and analyses are generally well documented and have been adequately reviewed to assume their credible use. We have used the latest version of MOBILE that is publically available. For the FRM analyses, we apply adjustment factors to the MOBILE5b output to account for updated information that was collected as part of the MOBILE6 development effort. These adjustments are described in the Regulatory Impact Analysis and are discussed further in the response to issue 2.2(G)(2).

(2) Engine manufacturers have worked extensively with EPA, ARB, NESCAUM and OTAG to develop robust, peer-reviewed inventory models that currently exist, are generally well accepted and provide accurate results. Unfortunately, EPA did not use any of these models. EPA relied on HD emission factors from a spreadsheet type model not previously used elsewhere. Even though elements of this model were incorporated within a report that was published as part of the MOBILE6 process, EPA did not subsequently address the comments it received on that report. MOBILE6 is not scheduled for release until January of 2001; therefore, EPA is unfairly using results of an air burden model in the proposal using a tool that is not widely available nor peer reviewed. Stakeholders cannot with certainty determine the effects of the underlying assumptions and/or modeling techniques used by EPA. There was no peer review of the spreadsheet model. Consequently, the calculations upon which EPA is basing its final rule may change significantly by the time the models are finalized. EPA should not finalize a rule based on benefits that are subject to such uncertainty.

Letters:

American Petroleum Institute (IV-D-343) **p. 10**
Cummins, Inc. (IV-D-231) **p. 41-42**
Engine Manufacturers Association (IV-D-251) **p. 81-82**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 7-9**

Marathon Ashland Petroleum (IV-D-261) **p. 5**

Response to Comment 2.2(G)(2):

As is discussed above in the response to issue 2.2(G)(1), there is concern that our current emission factor models are outdated and need to be updated. The spreadsheet model used for the NPRM was intended to incorporate the most recent information available so that we could essentially update the calculations in the MOBILE5 and PART5 emission factor models to conform to those being developed for MOBILE6.[52] All of the new information used to update our inventory calculations was collected as part of the MOBILE6 development process, and the spreadsheet model is intended to be consistent with the upcoming MOBILE6 model. All of this data has not only been placed in the docket for this rule prior to the rulemaking, but has been available for stakeholder review for years. Because the upcoming MOBILE6 model will not be available until January, we were not able to use it for the inventory calculations in this rule.

The spreadsheet model was placed in the docket concurrent with the publication of the NPRM. In addition, the Draft RIA provided a detailed description of the calculations and data used in the spreadsheet model. This description provides citations for the documents which contain the data, developed for the upcoming MOBILE6 model, that were used in the spreadsheet model. We address specific comments received on the calculation methodology used in the spreadsheet model in the responses to issues 2.2(F)(3) and 2.2(G)(3). We are not aware of any unaddressed comments that would significantly affect the results of the emission factor calculations, and we expect that the emission factors used in the inventory analysis for this rule will be similar to those generated by the upcoming MOBILE6 model.

In the FRM, we used MOBILE5 and PART5 emission factor models with adjustment factors to generate our emissions inventory. This analysis was built from the county level and summed into a national total, and we used the adjustment factors to account for the new information discussed above. The development of these adjustment factors is described in a memo which was placed in the docket concurrent with the publication of the NPRM.[53] Chapter 2 of the RIA presents more detail on the methodology for the FRM inventory analysis.

(3) EPA's analysis of the HD emission inventory is flawed because the baseline HD inventory is inappropriately inflated by 100% in 2007 to 140% in 2030 as compared to the HD inventory recently estimated for the final Tier 2 emission standards. Even when the HD inventories are appropriately adjusted to account for slight differences in the sources and areas covered and EPA's reasons why the new HD inventory is higher are considered, it remains clear that the HD inventory used for this rule is inflated. Commenter provides significant discussion on this issue and attempts to refute each one of EPA's reasons why the inventory is higher (i.e. additional 3 states, 2004 emission factors, conversion factors, speed correction factors, VMT and PM inventory).

---

[52] We also used a spreadsheet model with updated information in developing the emissions inventory for the Tier 2 rule to address stakeholder comments that MOBILE5 was outdated and that we should use the most recent data available.

[53] Memorandum from Michael Samulski and John Koupal to Docket A-99-06, “Heavy-Duty Vehicle Emission Factors and Adjustment Factors for the Final 2007 Heavy-Duty Rule Inventory Analysis,” May 26, 2000.

EPA has not provided an adequate explanation for the changes in the model. The removal of the speed correction factors and the changes in VMT have had the greatest impact and EPA appears to have eliminated these factors simply because the spreadsheet model was incapable of incorporating detailed speed effects. For VMT, EPA provides no explanation or justification for the change in VMT between the Tier 2 rule and the proposed rule.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 82-83**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 7-9**

Response to Comment 2.2(G)(3):

The NPRM NOx inventory was 93% higher than Tier 2 inventory for 2007, and 124% higher in 2030. The reasons for the changes in inventory were discussed in detail in the Draft RIA and are repeated in the final RIA. In the FRM rule inventory, the NOx projections have changed only slightly due mostly to the addition of a speed correction factor which was not included in the NPRM inventory. Table 2.2(G)(3) presents a comparison of the Tier 2 and HD 2007 FRM NOx inventories. Although we do not claim benefits from medium-duty passenger vehicles from this rule, we include them in the HDGV inventory presented below to be consistent with the Tier 2 inventory.

Table 2.2(G)(3): Comparison of HDV Baseline NOx Inventories (short tons/year)

Inventory Analysis (Rule)	*Vehicles*	*2007*	*2030*	*% change 2007 to 2030*
Tier 2 FRM	HDDE+ HDGV	1,670,000	1,410,000	-16%
HD 2007 FRM	HDDE+ HDGV	3,030,000	2,940,000	-3%
% Increase, Tier 2 to HD 2007		81%	108%	

The commenter disputes the effects of the inventory updates described in the Draft RIA. These inventory updates are discussed separately followed by a discussion of the net effects on the NOx emissions inventory.

47 vs 50 States

Table 2.2(G)(3) above includes 50 state estimates for both the Tier 2 and HD 2007 inventories. Therefore, this is not an issue for the comparison presented here.

2004 and Later Model Year Emission Factors

The NMHC and NOx emission factors for 2004 and later model years HDDEs are intended to represent a combined NMHC+NOx standard of 2.5 g/bhp-hr. The Tier 2 analysis used our earlier assumption that this would be about equivalent to designing to a 2.0 g/bhp-hr

NOx standard and a 0.5 g/bhp-hr NMHC standard. Under the new emission factor study,[54] we found that NMHC levels are already around 0.2-0.3 g/bhp-hr. We also now believe that HDDE manufacturers will design for very low NMHC in 2004 to allow them more relaxed NOx levels. Therefore we are now considering the combined standard to be equivalent to a 2.3 g/bhp-hr NOx standard and a 0.2 g/bhp-hr NMHC standard. This was discussed in detail in the draft RIA for the NPRM. We recognize that this is an analytical approach and individual manufacturers will design their engines differently according to their own constraints. This assumption results in a 15 percent increase in projected NOx emissions from 2004 and later model year HDDEs.

HDGVs are projected to account for only 13 percent of baseline HDV NOx emissions in 2007 and 6 percent in 2030. Because they are a small part of the HDV NOx inventory, our NOx inventory is not as sensitive to our new assumptions for these engines. However, we use significantly lower emission factors for 2005 and later model year HDGVs than were used in the Tier 2 inventory. This is because we have reproposed (and finalized) new standards for these engines beginning in 2005 of 1.0 g/bhp-hr NMHC+NOx. The Tier 2 inventory considers a 2.5 g/bhp-hr NMHC+NOx standard (although the engines were assumed to certify well below this standard).

Conversion Factors

The commenter correctly points out that the new conversion factors used in the NOx inventories for this rule change little for each of the HDDE classes from those used in the Tier 2 rule. However, the weighted average conversion factor from g/bhp-hr to g/mile increases about 25 percent compared to MOBILE5 when the new VMT splits between LHDDE, MHDDE, HHDDE, and urban buses are considered. This is because the conversion factors are much higher for heavier vehicles and we now estimate that a higher fraction of the VMT is from heavier vehicles. MOBILE5 lumps all HDDE engines together into one class and uses a conversion factor of 2.03 bhp-hr/mile. This was discussed in detail in the draft RIA for the NPRM. Using the updated VMT splits,[55] we calculate a weighted average conversion factor of 2.54 bhp-hr/mile.

Speed Correction Factors

In the FRM inventory, we use the MOBILE5 speed correction factors. Because these correction factors are a function of speed, we did not include them in the top-down national inventory spreadsheet used for the NPRM inventory estimates. However, the FRM inventory is calculated from the ground up by roadway type for each county using MOBILE5 updated with data developed for use in MOBILE6. Therefore, we were able to include the effect of speed on NOx. We estimate that the speed correction reduces the NOx inventory by 5-10 percent nationally. Because the same speed corrections are used in Table 2.2(G)(3) for both inventories, they are not an issue for this comparison.

Vehicle Miles Traveled

[54] "Update of Heavy-Duty Emission Levels (Model Years 1988-2004+) for Use in MOBILE6," U.S. Environmental Protection Agency, EPA420-R-99-010, April 1999.

[55] "Fleet Characterization Data for MOBILE6: Development and Use of Age Distributions, Average Annual Mileage Accumulation Rates and Projected Vehicle Counts for Use in MOBILE6," U.S. Environmental Protection Agency, EPA 420-P-99-011, April 1999.

As is discussed in the draft RIA for the NPRM, we adjusted our estimates of the VMT fraction of highway miles traveled for heavy-duty vehicles to make use of the most recent data available. As discussed in the response to issue 2.2(F)(3), this resulted in a 40 percent increase in our projections of HDDE VMT. This analysis also showed a 60 percent increase in our projections of HDGV VMT. As discussed in the response to issue 2.4(E)(3), we compared our fuel consumption estimates (based on our new VMT projections) with those projected by the Energy Information Administration (EIA). In 2007, we are within 4 percent of the EIA projection of highway diesel fuel consumption; in 2030, we are within 2 percent. This comparison provides some confirmation of the accuracy of our VMT projections.

Summary

For HDGVs, the impact of the increased projection in VMT and decreased emission factor assumptions nearly offset each other. As a net result, we see an increase in HDGV NOx, compared to Tier 2, of 20 percent in 2007 and of only 6 percent in 2030 when the fleet has a larger fraction of 2005 and later model year engines. Because HDGVs are only a small part of the HDV NOx inventory, this is only a minor effect on the differences presented above in Table 2.2(G)(3).

The major differences between the two HDV NOx inventories are due to the 15 percent increase in the HDDE NOx emission factors for 2004 and later model year engines, the 25 percent increase in the weighted average conversion factor for HDDEs, and the 40 percent increase in HDDE VMT. The increase in the NOx emission factor results in the difference in the percent change from 2007 to 2030 shown in Table 2.2(G)(3) above. The net effect of all three of these factors is an 82 percent increase in HDDE NOx in 2007 and a 101 percent increase in 2030. The overall effects of these changes on the inventories can be seen in Table 2.2(G)(3), presented above.

The other change presented in Table 2.2(G)(3) is the percent reduction in annual NOx between 2007 and 2030. In both cases, the VMT growth is the same, and the difference is due to the change in the NOx emission factor. This is consistent with the change in the 2004 and later model year NOx emission factor. The Tier 2 analysis uses a 50 percent reduction in HDDE NOx due to the 2004 standards while the FRM analysis only produces a 42 percent reduction in NOx. This is equal to a 15 percent difference, between the two analyses, in the reduction in NOx from full turnover of a fleet meeting the 1998 NOx standard to a fleet meeting the 2004 standard.

(4) EPA has indicated that it intends to use the NONROAD model for the development of emissions inventories and air quality analyses for the final rule. The current version of the NONROAD model is still in draft from and there are significant data gaps that remain to be filled before the model can be finalized.

Letters:

American Petroleum Institute (IV-D-343) **p. 10**
Marathon Ashland Petroleum (IV-D-261) **p. 5**

Response to Comment 2.2(G)(4):

Although the NONROAD model is in draft form, it represents our current best understanding of the emission contributions of nonroad engines. The version of the model used for the proposed 2007 Rule was released for public comment in June 2000 with full documentation. This version is a refinement of the model used for the Tier 2 rulemaking, which itself has been available for public comment since May 1999. Furthermore, the methodology and many data inputs for the current model have already been peer reviewed. We are working and will continue to work to improve this draft model, including peer review, in the future and would continue to do so even if it were a “final” model.

(H) Air quality benefits are small to nonexistent for the air toxics examined.

(1) The discussion on page II-108 of the draft RIA misrepresents Table II.A-24 by stating that the proposal will reduce air toxics exposure in 2020 by 37% for benzene, 74% for acetaldehyde, 73% for formaldehyde, and 70% for 1,3-butadiene. The Table reports that in fact the proposal will reduce the year 2020 nationwide average ambient exposure to benzene, acetaldehyde, formaldehyde and 1,3-butadiene by only 3.7%, 16.7%, 28.6% and 0% respectively.

Letters:

American Petroleum Institute (IV-D-343) **p. 18-19**
Marathon Ashland Petroleum (IV-D-261) **p. 5**

Response to Comment 2.2(H)(1):

The reference in the discussion on page II-108 of the NPRM refers to reductions in exposure to gaseous toxics attributed to heavy-duty vehicles only while Table II.A-24 reported exposure to gaseous toxics (and reductions) from all on-highway motor vehicle sources. Additional explanation has been added to the text to clarify this point and an additional column has been added to the table to report the reductions in gaseous toxics from all on-highway motor vehicle sources in 2020 when the regulations in today’s program are in effect.

(2) EPA estimates of HDDE toxics emissions are outdated and not representative of current technology. The EPA's estimates of reductions in air toxic emissions for HDDE in the Draft RIA for the proposed rule rely on data from trucks tested in the 1970s, which is not representative of those HDDE certified to MY 1998 or later emissions standards. Data from only one modern engine was meshed with data from the older vehicles to arrive at the average air toxics exhaust fractions cited in the draft RIA. Adding to the complexity of the emissions estimates are the fact that test procedures and fuel properties have changed over the last 25 years. EPA should expand the database used for developing air toxics emissions benefits, and the commenter recommends using the VE-10 project performed by Southwest

Research Institute for the Coordinating Research Council (CRC) titled "Effects of Fuel Oxygenates, Cetane Number, and Aromatic Content on Emissions from 1994 to 1998 Prototype HDDE."

Letters:

American Petroleum Institute (IV-D-343) **p. 18-19**
Marathon Ashland Petroleum (IV-D-261) **p. 14-15**

Response to Comment 2.2(H)(2):

EPA's estimates of the reductions in gaseous air toxics emissions for heavy-duty diesel engines (HDDE) are based on applying the percent reductions in hydrocarbon emission due to the heavy-duty engine 2007 standards to base case inventories of the air toxics. The base case inventories are derived from data in a 1999 EPA technical report (EPA, 1999). Analysis of the Impacts of Control Programs on Motor Vehicle Toxic Emissions and Exposure in Urban Areas and Nationwide. Report No. EPA420-R-99-029/030). The inventories for HDDE have also been revised to reflect changes in projected VMT, and other updates discussed in the response to comment 2.2(G)(3), since the time the report was issued. The toxic fractions used to develop the inventories in the 1999 report are actually obtained from two modern engines, one tested at Southwest Research and one tested at University of California, College of Engineering, Center for Environmental Research and Technology, along with data from two older engines in a 1979 study done at Southwest Research.

We agree there would be benefit to expanding the database for quantifying air toxics emission benefits obtained by controlling heavy duty diesel engines, and we are currently funding work at the Colorado School of Mines to quantify toxic emissions from HDDE. However, we believe the available data is sufficient to support the conclusion that this rule will significantly reduce gaseous air toxics emissions from heavy-duty engines and vehicles.

One commentor recommended supplementing the toxic emissions data above with some additional data from the VE-10 project performed by the Southwest Research Institute for the Coordinating Research Council (CRC) titled "Effects of Fuel Oxygenates, Cetane Number, and Aromatic Content on Emissions from 1994 to 1998 Prototype HDDE." We have reviewed these data and concluded that incorporating them into gaseous toxic emission estimates for the rule would not have a major impact, although the formaldehyde estimates would increase somewhat.

(3) As documented in Table II.A-24 in the RIA, even without the proposed standards, the reductions are between 65 and 75 percent in ambient exposures between 1990 and 2020 for each toxic compound evaluated. The addition of the proposed rules results in little or no additional reduction in exposure by 2020. In addition, EPA is currently addressing air toxics from mobile sources in a separate rulemaking, and given the incomplete state of that rulemaking, it is inappropriate to justify this proposed rule on the basis of the marginal effects it will have on air toxics.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 33**

Marathon Ashland Petroleum (IV-D-261) **p. 14-15**

Response to Comment 2.2(H)(3):

The standards adopted in this rule will lead to reductions in gaseous air toxics. These reductions are large for formaldehyde and acetaldehyde and will result in about a 15% reduction in acetaldehyde exposure from on-highway vehicles in the year 2020, and a 18% reduction in formaldehyde exposure from on-highway vehicles. Thus, it is inaccurate to say that the addition of the adopted rules will result in little or no additional reduction in exposure to gaseous air toxics.

(I) Because EPA does not project any area in PADD IV or the Central Plains to exceed or be within 10 percent of current ozone and PM NAAQS in 2007 and 2030, EPA has room to be flexible with regulatory approaches for refiners serving these areas.

(1) Commenter provides no further detailed analysis on this point.

Letters:

Sinclair Oil Corporation (IV-D-255) **p. 10**

Response to Comment 2.2(I)(1):

EPA disagrees with commenters assertion that, in essence, diesel fuel produced for the Central Plains may receive some flexibility without adversely impacting the environment or public health. There are several reasons for our disagreement. First, the public health and welfare concerns that form the basis for this rulemaking are broader than those areas and populations exposed to ambient concentrations above the 1-hour ozone and PM10 NAAQS. Studies have found that there are health effects associated with prolonged and repeated exposures to moderate levels of ozone, to levels of fine particulates, and from diesel exhaust and other toxic pollutants in heavy-duty vehicle emissions. Health effects from these types of pollution are well established.

Diesel exhaust, for example, has been recently determined to be a probable human carcinogen at environmental levels of exposure. There are also environmental and welfare impacts such as visibility impairment that affect many areas across the nation, including the Central Plains.

Finally, heavy-duty vehicles travel across the nation on a routine basis, and refilling on high-sulfur fuel in the Central Plains will severely impact the ability of the emission control systems required by this rule. This will have a profound impact on public health and welfare not only in the Central Plains, but throughout the United States.

(J) The proposed standards are not necessary to satisfy the NAAQS.

(1) EPA identified 42 areas as having sufficient risk of future violations of the 1-hour NAAQS. Of the first group (10 areas w/ attainment demonstrations), EPA has approved or proposed to approve eight of the areas attainment plans. These SIPs did not rely on emissions reductions from the proposed rule (for attainment or maintenance). The few areas with defined shortfalls do not require extensive NO_x reductions. It is likely that even these few

remaining areas will attain the NAAQS without a need for the proposed emissions reductions. Of the second group (26 presently-violating areas w/o active attainment demonstrations), many have approved (or have been proposed to approve) attainment demonstrations. Given that motor vehicle emissions trends are down, including the HD component, and projected to be for at least another decade, the CAA provisions for contingency measures and maintenance plans (or targeted, cost effective local/regional controls) should be allowed to govern local nonattainment problems. For the third group (6 areas w/ model exceedances, but with recent design values within 10% of the standard), EPA provides unquantified speculation that meteorological conditions may be more severe in the future which would lead to potential violations.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) p. 4-28

Response to Comment 2.2(J)(1):

Commenter asserts that EPA's basis for finding that an appreciable number of 42 areas (in the proposal, 45 in the final rule) face a significant risk of exceeding the 1-hour ozone NAAQS is not well justified, and thus new standards on heavy-duty vehicles are not warranted. EPA disagrees with this assertion, and will address commenter's concerns related to each group of area.

The Agency's conclusions about the risk of future exceedances of the 1-hour ozone standard for 45 areas (listed in Table II.B-1 in the preamble) are based on photochemical ozone modeling conducted for this rule which predicted that 37 areas are likely to exceed the 1-hour ozone standard in 2007, 2020, or 2030 after accounting for emission reductions from all programs that have been adopted. In addition, there are 8 other areas for which ozone model performance was inadequate, but other evidence such as local air quality modeling, transport from upwind areas with later attainment dates, and the magnitude and persistence of historic ozone levels provides sufficient basis for the Agency's determination that these areas also face a risk of future exceedances between 2007 and 2030.[56] For purposes of clarity of presentation, these areas are separated into two broad groups: (1) those areas with attainment dates in 2007 or 2010 that will benefit from reductions from this rule to attain and maintain the standard; and (2) those areas with attainment dates prior to 2007 that will benefit from reductions from this rule to maintain the standard after their attainment dates. The following paragraphs discuss these areas in turn.

Ten metropolitan areas that fall within ozone nonattainment areas have statutorily-defined attainment dates of 2007 or 2010, or have requested attainment date extensions to 2007. These 10 areas are New York City, Houston, Hartford, New London, Chicago, Milwaukee, Dallas, Beaumont-Port Arthur, Los Angeles, and Southeast Desert.

Each of these areas needs additional emission reductions in order to reach

[56] In the proposal, we relied on photochemical ozone modeling performed for recently promulgated standards on light duty vehicles, or Tier 2. The results presented in this final rulemaking for heavy-duty vehicles and diesel fuel are largely consistent with the findings presented in the proposal, with small differences due to updated emissions inventories. As stated in the proposal, the ozone modeling methodologies used in the proposal and presented here in the final rule are identical.

attainment by 2007, and to maintain the standards in the future. Some of these areas have emission reduction shortfalls that are identified in their attainment demonstrations (i.e., South Coast Air Basin, New York and Houston), and reductions from this rule will assist State efforts to reach attainment.[57] Three other areas -- Southeast Desert, Hartford, New London -- are subject to ozone transport from upwind areas with identified shortfalls (South Coast and New York), and depend upon attainment from these upwind these areas to reach attainment themselves. We have received attainment plans for two areas in Texas (Dallas and Beaumont-Port Arthur), and the Agency is likely to consider the reductions from this rule in its proposed approval of these attainment plans in Federal Register notices. Finally, there are two areas in the Midwest -- Chicago and Milwaukee -- that have incorporated reductions from this rule into their regional ozone modeling, and plan to rely on reductions from this rule to support their 2007 attainment demonstration.[58]

For all ten areas, even if all shortfalls were filled by the States, there is some risk that at least some of the areas will not attain the standards by their attainment dates of 2007, or 2010 for Los Angeles. In that event, the reductions associated with this program, which increase substantially after 2007, will help assure that any residual failures to attain are remedied. Finally, there is also some risk that the areas will be unable to maintain attainment after 2007. Considered collectively, there is a significant risk that some areas will not be in attainment throughout the period when the new standards will reduce heavy-duty vehicle emissions.

The rest of the areas have required attainment dates prior to 2007, or have no attainment date but are subject to a general obligation to have a SIP that provides for attainment and maintenance. These 34 areas, according to our modeling, are at risk of exceeding the ozone NAAQS between 2007 and 2030. These areas will be able to rely on reductions from this rule to continue to maintain the standard after attainment is reached, and will be able to take credit for this program in their maintenance plans when they seek redesignation to attainment of the ozone standard. If any of these areas reach attainment, and then fall back into nonattainment, or fail to reach attainment by 2007, reductions from this rule will assist these areas in achieving the ozone standard. If an area does not choose to seek redesignation, the continuing reductions from this rulemaking will help ensure maintenance (i.e., prevent future exceedances) with the 1-hour standard after initial attainment is reached.

Finally, there are 14 additional metropolitan areas for which the available ozone modeling and other evidence is less clear regarding the need for additional reductions. Our ozone modeling predicted these areas to need further reductions to avoid exceedances in 2007, 2020 or 2030. The recent air quality monitoring data for these areas shows ozone levels with less than a 10 percent margin below the NAAQS. We believe there is a risk that future ozone levels will be above the NAAQS because of the year-to-year variability of meteorological conditions conducive to ozone formation, or because local emissions inventories may increase faster than national inventories.

---

[57] The South Coast's "additional measures" which rely on new technologies, are located in its 1994 SIP.

[58] *Technical Support Document, Midwest Subregional Modeling: 1-Hour Attainment Demonstration for Lake Michigan Area* and *Emissions Inventory*, Illinois Environmental Protection Agency, Indiana Department of Environmental Management, Michigan Department of Environmental Quality, Wisconsin Department of Natural Resources, September 27, 2000, at 14 and at 8.

Issue 2.3: Heavy-duty Vehicle Contribution

(A) Heavy-duty vehicle emissions of VOC, CO, NOx, SOx, and PM currently contribute a substantial percentage to ambient concentrations of a number of pollutants, including one or more of the following: ozone, PM, sulfur, and nitrogen compounds, aldehydes, and substances known or considered likely to be carcinogens.

(1) Inventory data indicate that heavy duty diesel vehicles and engines emit one third of all NO_x pollution in the NESCAUM region and up to 80 percent of mobile source particulate pollution. In addition, ambient monitoring and modeling data show that up to 60 percent of aldehyde emissions result from diesel engine pollution.

Letters:

Environmental Law and Policy Center (IV-D-331) **p. 3**
NESCAUM (IV-D-315) **p. 1**
NH DES (IV-D-150) **p. 1**

Response to Comment 2.3(A)(1):

While we have not verified the specific estimates, we agree that heavy-duty vehicles are a large part of the emissions inventory from on-highway vehicles and that emission control from these vehicles is necessary to achieve our air quality goals.

(2) CARB estimates that a typical onroad heavy-duty truck in 2004 will emit 104 times more NO_x and 26 times more PM than a typical car. Even on the basis of work performed, the typical line haul truck will emit 200 times more NO_x and 25 times more PM per horsepower-hour.

Letters:

STAPPA/ALAPCO (IV-D-295) **p. 5-6**
Transportation Alternatives (IV-D-332) **p. 1**

Response to Comment 2.3(A)(2):

While we have not verified the specific estimates, we agree that heavy-duty vehicles are a large part of the emissions inventory from on-highway vehicles and that emission control from these vehicles is necessary to achieve our air quality goals.

(3) When coupled with the emission reductions projected to result from the Phase I (model year 2004) HDV standards, the emission reductions from heavy-duty vehicles are predicted to be as large as the substantial reductions EPA expects from light-duty vehicles as a result of the recently promulgated Tier 2 rule.

Letters:

American Lung Association (IV-D-270) **p. 14-16**

Response to Comment 2.3(A)(3):

We agree that the emissions reductions from this rule will be significant in comparison to the recently promulgated Tier 2 rule and will result in significant air quality benefits.

(4) The percentage of highway emissions from HD diesel vehicles will increase as Tier II standards come into effect.

Letters:

PA DEP (IV-D-100) **p. 1**

Response to Comment 2.3(A)(4):

We agree, that without further emission control, the emissions fraction from HD diesel vehicles would increase as the Tier II standards come into effect. This supports the need for our new standards.

(5) The increase in truck speed and miles traveled contributed to the San Joaquin Valley's failure to meet the ozone NAAQS.

Letters:

San Joaquin Valley Air Pollution Control District (IV-D-56) **p. 1-2**

Response to Comment 2.3(A)(5):

While we have not verified the specific estimates, we agree that heavy-duty vehicles are a large part of the emissions inventory from on-highway vehicles and that emission control from these vehicles is necessary to achieve our air quality goals.

(6) Commenter provided no further supporting information or detailed analysis.

Letters:

Arab Community Center for Economic and Social Services (IV-D-112) **p. 1**
IL Environmental Council (IV-D-115) **p. 2**
NY State Assembly (IV-D-266) **p. 1**
Stuckey, Stephanie (IV-D-182) **p. 1**
Udall, Mark (IV-D-173) **p. 1**

Response to Comment 2.3(A)(6):

We agree that heavy-duty vehicle emissions currently contribute a substantial percentage to ambient concentrations of a number of pollutants, including those listed by the commenters.

(7) Diesel trucks emit three times as much pollution as coal-fired power plants per unit energy. Citing "Rolling Smokestacks: the Next Battle for Clean Air," Nucleus, Vol 22, No. 2 (summer 2000).

Letters:

Environmental Law and Policy Center (IV-D-331) **p. 2**

Response to Comment 2.3(A)(7):

While we have not verified the specific estimates, we agree that heavy-duty vehicles are large contributers to air pollution.

(B) The contribution of emissions from heavy duty vehicles to overall NOx pollution is expected to increase in the future since heavy duty VMT continues to grow rapidly.

(1) Future increases in heavy-duty diesel VMT and light duty diesel vehicle penetration could offset any emissions reductions resulting from the existing federal control program unless more stringent standards are adopted.

Letters:

Bay Area Air Quality Management District (IV-D-139) **p. 1**
Consumer Policy Institute (IV-D-186, 289) **p. 2 (both)**
NC DENR (IV-D-151) **p. 1**
NESCAUM (IV-D-315) **p. 1**
NY State Attorney General's Office (IV-D-238) **p. 11**
NYC DEP (IV-D-209) **p. 2**
San Joaquin Valley Air Pollution Control District (IV-D-56) **p. 1**
Southwest Air Pollution Control Authority (IV-D-149) **p. 1**
WI DNR (IV-D-144) **p. 1**
WI Department of Transportation (IV-D-241) **p. 1**

Response to Comment 2.3(B)(1):

We agree that these new standards, coupled with the recent Tier 2 light-duty standards, are necessary to reduce emissions increases in the future due to increased VMT from highway vehicles.

(2) In Washington D.C. total VMT are expected to increase at an annual rate of 1.5%, causing tremendous air quality challenges in future years. Commercial VMT is growing much faster in Wisconsin than personal VMT and is expected to increase 94% from 1995 to 2020. In the northeast, heavy-duty VMT is increasing at approximately 5% per year.

Letters:

Metropolitan Washington Air Quality Committee (IV-D-34, 58) **p. 2 (both)**
Wisconsin Department of Transportation (IV-D-241) **p. 1**
NESCAUM (IV-D-315) **p. 1**

Response to Comment 2.3(B)(2):

These projections for growth in heavy-duty vehicle VMT are consistent with the projections in our inventory analysis. However, we use a linear growth rate in VMT rather that a compounded growth rate so the growth rate effectively decreases over time. In 2007 we project an annual growth rate of about 3% and in 2030 we project an annual growth rate of about 1.5%. This translates to a 96% increase in VMT from 1995 to 2020. As discussed later in the response to issue 2.4(E)(3), our VMT projections are also consistent with projections used by the Energy Information Administration.

(C) Heavy-Duty on-highway emissions are only minor contributors to current inventories and will continue to decrease absent further controls.

(1) EPA's general claim that HD emissions will continue to contribute greatly to serious air pollution problems absent further controls is misleading. One commenter (GM) noted that EPA's Final Tier 2 Regulatory Impact Analysis (RIA) indicates that HD on-highway NO_x emissions are less than one-tenth of the U.S. (excluding CA) ozone season NO_x emissions in 1996 and that modest contribution is projected to decrease 39% by 2007 and 47% by 2030 without further controls. This commenter added that the Tier 2 RIA also indicates that PM-10 from HD on-highway vehicles is less than 0.5% of the U.S. (excluding CA) PM-10 emissions inventory in 1996 and is also projected to decrease 46% by 2007 with the current control program.

Letters:

American Petroleum Institute (IV-D-343), **p. 7-10**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 5-6**

Response to Comment 2.3(C)(1):

EPA agrees with the commenter that HDV emissions are projected to decline in the near-term absent additional controls. However, as described in greater detail in the response to comments 2.4(D)(3), we have taken these reductions into account in our air quality modeling analyses for ozone (1-hour and prolonged and repeated exposures to moderate levels of ozone) and particulate matter (PM10 and fine PM) and have determined that even with reductions expected from all controls currently in place, a significant number of areas and populations are expected to face a significant risk being exposed to unhealthy levels of air pollution between 2007 and 2030. Additionally, we predict that the benefit of controls already in place (including 2004 standards) will be overwhelmed by expected VMT increases and emissions from HDVs will start to increase in the 2015-2020 time frame absent today's rule.

Commenters also claim that the contribution from heavy-duty vehicles is relatively insignificant to national emissions inventories provided in the Tier 2 rulemaking. We have updated our inventories for this rulemaking, and will discuss these changes below. Based on the inventories used for this rule, nationwide, heavy-duty vehicles are projected to contribute about 15 percent of the total NOx inventory, and 28 percent of the mobile source inventory in 2007. Heavy-duty NOx emissions also contribute to fine particulate concentrations in ambient air due to the transformation in the atmosphere to nitrates. The NOx reductions resulting from today's standards will therefore have a considerable impact on the national NOx inventory. All highway vehicles account for 34 percent and heavy-duty highway vehicles account for 20 percent of the mobile source portion of national PM_{10} emissions in 2007. The heavy-duty portion of the inventory is often greater in the cities, and the reductions in this rulemaking will have a relatively greater benefit in cities where air quality tends to be worse than in rural areas.

NOx Emissions

Heavy-duty vehicles are important contributors to the national inventories of NOx emissions. Without NOx reductions from this rule, HDVs are expected to contribute approximately 18 percent of annual NOx emissions in 1996, which are predicted to fall to 15 percent in 2007 and 14 percent in 2020 due to reductions from the 2004 heavy-duty rulemaking, and then rise again to 16 percent of total NOx inventory by 2030 (Table 2.2(C)(1)-a). Annual NOx reductions from this rule are expected to total 2.6 million tons in 2030.

Table 2.3(C)(1)-a: NOx Emissions from HDVs With and Without Reductions from this Rule

	Without this Rule (Base Case)		With this Rule (Control Case)
Year	HDV annual NOx tons	HDV annual NOx tons as a percent of total NOx.	Reductions in annual HDV NOx tons.
1996	4,810,000	18%	n/a
2007	3,040,000	15%	58,000
2020	2,560,000	14%	1,820,000
2030	2,960,000	16%	2,570,000

The contribution of heavy-duty vehicles to NOx inventories in many MSAs is significantly greater than that reflected in the national average. For example, HDV contributions to total annual NOx is greater than the national average in the eight metropolitan statistical areas listed in Table 2.3(C)(1)-b. Examples of major cities with a history of persistent ozone violations that are heavily impacted by NOx emissions from HDVs include: Los Angeles, Washington, DC, San Diego, Hartford, Atlanta, Sacramento. As presented in the table below, HDV's contribute from 22% to 33% of the total NOx inventories in these selected cities. NOx emissions also contribute to the formation of fine particulate matter, especially in the West. In all areas, NOx also contributes to environmental and welfare effects such as regional haze, and eutrophication and nitrification of water bodies.

Table 2.3(C)(1)-b: Heavy-Duty Vehicle Percent Contribution to NOx Inventories in Selected Urban Areas in 2007

MSA, CMSA / State	HDV NOx as Portion of Total NOx	HDV NOx as Portion of Mobile Source NOx
National	***15%***	***28%***
Sacramento, CA	33%	37%
Hartford, CT	28%	38%
San Diego, CA	25%	28%
San Francisco, CA	24%	29%
Atlanta, GA	22%	34%
Los Angeles	22%	26%
Dallas	22%	28%
Washington-Baltimore, MSA	22%	36%

PM Emissions

Commenters point out that based on the Tier 2 inventories, PM10 emissions inventory for on-highway vehicles is less than 0.5% of the US (excluding California) emissions inventory in 1996. EPA does not dispute that the fact that fugitive dust, other miscellaneous sources and crustal material (wind erosion) constitute approximately 90 percent of the PM_{10} inventory. This category of PM10 emissions is called “natural and miscellaneous sources” in our emissions inventories. However, as EPA points out in the RIA to this rule, ambient samples of PM10 show that emissions of these “natural and miscellaneous” materials may be overestimated and/or that once emitted they have less of an influence on monitored PM10 concentrations than this inventory share would suggest.

The results of ambient PM studies show that the contribution of HDD emissions to ambient PM concentrations is heavily dependent on the location. One modeling study at a Manhattan street corner in 1993 found that on-road and off-road heavy-duty diesel PM emissions contribute up to 68 percent of total ambient PM concentrations (Manhattan, Source Receptor Model, 1993). Other studies in less urban areas – Lennox, CA(13%); Claremont, CA (8%); Rochester, NY (2-9), and Welby, CO (0-26%) – found lower but still significant contributions from HDVs. Nationally, on-highway heavy-duty diesel emissions are approximately one-third of total HDDV emissions. On a local level, HDV emissions may contribute a much higher fraction to total PM. For greater detail about each approach to measuring the contribution of HDV emissions to ambient concentrations of PM, the reader should refer to section A.3(c)(i) of chapter 2 of the RIA.

Inventory Estimates

Nationally, we estimate that primary emissions of PM_{10} to be about 33 million tons/year in 2007. Mobile sources account for 22 percent of the PM_{10} inventory (excluding the contribution of miscellaneous and natural sources) and highway heavy-duty engines, the subject of today’s action, account for 20 percent of the mobile source portion of national PM_{10}

emissions in 2007.

The contribution of heavy-duty vehicle emissions to total PM emissions in some metropolitan areas is substantially higher than the national average. This is not surprising, given the high density of these engines operating in these areas. For example, in Los Angeles, Atlanta, Hartford, San Diego, Santa Fe, Cincinnati, and Detroit, the estimated 2007 highway heavy-duty vehicle contribution to mobile source PM_{10} ranges from 25 to 38 percent, while the national percent contribution to mobile sources for 2007 is projected to be about 20 percent. As illustrated in Table 2.3(C)(1)-c, heavy-duty vehicles operated in El Paso, Indianapolis, San Francisco, and Minneapolis also account for a higher portion of the mobile source PM inventory than the national average. These data are based on updated inventories developed for this rulemaking . Importantly, these estimates do not include the contribution from secondary PM, which is an important component of diesel PM.

Table (2.3)(C)(1)-c:
2007 Heavy-Duty Vehicle Contribution to Urban Mobile Source PM Inventories

MSA, State	***HDV PM Contribution to Mobile Source PM*** [a]
National (48 State)	***20%***
Atlanta, GA MSA	25%
Cincinnati-Hamilton, OH-KY-IN CMSA	26%
Detroit-Ann Arbor-Flint, MI CMSA	25%
El Paso, TX MSA	23%
Hartford, CT MSA	30%
Indianapolis, IN MSA	23%
Los Angeles-Riverside-Orange County, CA CMSA	25%
Minneapolis-St. Paul, MN-WI MSA	23%
San Diego, CA MSA	27%
San Francisco-Oakland-San Jose, CA CMSA	24%
Santa Fe, NM MSA	38%

[a] Direct exhaust emissions only; excludes secondary PM.

The city-specific emission inventory analysis and investigations of ambient $PM_{2.5}$ summarized in the RIA indicate that the contribution of diesel engines to PM inventories in several urban areas around the U.S. is much higher than indicated by the national PM emission inventories only. One possible explanation for this is the concentrated use of diesel engines in certain local or regional areas which is not well represented by the national, yearly average presented in national PM emission inventories. Another reason may be underestimation of the in-use diesel PM emission rates. Our current modeling incorporates deterioration only as would be experienced in properly maintained, untampered vehicles. We are currently in the process of reassessing the rate of in-use deterioration of diesel engines and vehicles which could significantly increase the contribution of HDVs to diesel PM.

(D) EPA needs to document more clearly the relationship of HDV (and other mobile source) emissions and projected nonattainment so that EPA does not overstate the contribution from the HDV sector.

(1) Not all of the current 12 (projected 10) PM nonattainment areas are in nonattainment because of mobile sources; three of the current areas face nonattainment because of point sources. EPA should publish the percentages of each major PM-10 source to help focus on the largest

contributors. This type of demonstration would also show that rural America does not face nonattainment problems, which would help justify flexibility to farmer co-op refiners in these rural areas.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 3**

Response to Comment 2.3(D)(1):

Commenter attempts to make the point that because HDV emissions are not the dominant reason for an area's PM10 nonattainment, the reductions from this rulemaking are not warranted. EPA disagrees. The PM10 NAAQS finds that there are adverse health effects to populations exposed to concentrations of PM10 above the standard. HDV emissions contribute to PM10 nonattainment to various degrees depending on the area, the particular location (e.g., streetcorner or agricultural land), and the measurement method employed. Emission reductions from this rule will lower ambient concentrations of PM10, and will have a positive impact on public health and welfare in PM10 nonattainment areas. EPA does not disagree that reductions from other sources would also be helpful, particularly in areas where PM10 emissions are dominated by point or area sources.

However, one of the fundamental aspects of controlling pollution that comes from numerous sources is that it is important to review emissions from all sources and attempt to reduce such emissions in order to achieve cleaner air.

(2) EPA fails to differentiate between on-road and off-road sources in documenting the source of PM and NO_x emissions. EPA should wait until it publishes dispersion modeling of county-specific concentrations that would clarify the contributions of on-road versus off-road sources.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 4**

Response to Comment 2.3(D)(2):

The contribution of on-road vehicles compared with total PM and NOx has been provided in this rule. The inventories created for this rulemaking do differentiate between on-road and non-road sources of PM and NOx. The contribution from nonroad engines are significant. The benefits from controlling on-road heavy-duty engine emissions are clear and significant and present a compelling case for finalizing these rules now.

Issue 2.4: Anticipated Emission Benefits

(A) EPA's proposed engine/vehicle and fuel standards are necessary since they will allow States to provide adequate SIPs demonstrating attainment nationwide. [See also Issue 1.1, Point (A).]

(1) There are numerous States that are developing SIPs to address their nonattainment status for ozone and/or PM levels and others that will be developing SIPs to address nonattainment in the year 2007. In order to ensure that these States are able to achieve attainment under the CAA,

pollution control must be obtained from the manufacturers of fuel and heavy duty engines and vehicles. EPA must adopt the cleanest possible standards for all diesel engines as early as technologically and economically feasible.

Letters:

CA Trucking Association (IV-D-309) **p. 3-4**

Response to Comment 2.4(A)(1):

We agree that the emission reductions resulting from this rule will assist states in attaining or maintaining attainment. We also believe the standards adopted today are the most stringent standards available with timely implementation.

(B) The proposed sulfur standard will result in immediate PM reductions from existing engines.

(1) A technical analysis presented in an SAE paper concluded that every .1% increase in diesel fuel sulfur results in a 0.025 g/bhp-hr particulate matter increase (Baranescu, 1988). Decreasing fuel sulfur levels can reduce particulate emissions from 11 to 30 percent in existing diesel engines. Thus the proposed diesel fuel sulfur cap will result in a substantial and immediate reduction in diesel particulate emissions from existing engines.

Letters:

NESCAUM (IV-D-315) **p. 9**

Response to Comment 2.4(B)(1):

We agree. Our estimates of the direct sulfate PM reductions from existing engines are presented in Chapter 2 of the Regulatory Impact Analysis.

(2) A national low-sulfur diesel fuel will provide direct sulfate emission reductions in pre-2007 diesel vehicles that do not have PM or NOx aftertreatment, helping reduce sulfate particulate matter, acid deposition (due to reduced sulfur dioxide emissions) and other harmful air pollution.

Letters:

Natural Resources Defense Council (IV-D-168) **p. 6**

Response to Comment 2.4(B)(2):

We agree. Our estimates of the SOx reductions from pre-2007 vehicles are presented in Chapter 2 of the Regulatory Impact Analysis.

(C) The proposed heavy-duty vehicle and engine emission standards, along with the diesel fuel sulfur standard, would have a dramatic impact in reducing the large contribution of heavy-duty vehicles to air pollution.

(1) The new engine and vehicle standards will result in national reductions of 2.8

million tons NOx, and 110,000 tons PM. In addition, it will reduce approximately 336,000 tons of NOx in the NESCAUM region by 2030.

Letters:

American Lung Association (IV-D-270) **p. 14-16**
NESCAUM (IV-D-315) **p. 2, 4**
Texas Natural Resource Conservation Commission (IV-G-03) **p. 1**

Response to Comment 2.4(C)(1):

We agree. It should be noted, however, that we have revised our estimates slightly in the FRM. These revisions are discussed in Chapter 2 of the Regulatory Impact Analysis.

(2) With a dual fuel approach, emissions reductions will be drastically reduced in future years because truck users will hold on to their older vehicles to avoid higher fuel costs.

Letters:

CA Trucking Association (IV-D-309) **p. 1**

Response to Comment 2.4(C)(2):

We do not believe that the low sulfur fuel temporary compliance option that we are finalizing will result in significantly higher fuel prices for 15 ppm sulfur diesel compared to 500 ppm sulfur diesel fuel. Therefore we do not expect the program to cause delayed purchases of new vehicles. This is discussed below under Issue 6.1. As a result, we do not model this effect in our emissions inventory calculations.

(D) EPA has failed to provide an adequate assessment of the air quality benefits resulting from its proposed rule.

(1) The only items in the Docket that address air quality issues of the proposal are those which describe the methodologies that EPA intends to use for developing the final emissions inventories. There is no information on actual emission inventory estimates or air quality modeling outputs. Commenter is concerned that there will not be adequate time to constructively review and comment on the modeling efforts given EPA's timetable for finalizing the rule by the end of 2000.

Letters:

American Petroleum Institute (IV-D-343) **p. 4**

Response to Comment 2.4(D)(1):

As outlined in the proposal, EPA provided its methodologies and notice that as soon as emissions inventories and air quality modeling results were available, they were placed in the public docket. Beginning in October, 2000, various EPA memoranda were placed in the public docket and posted to the OTAQ web page titled "Special Modeling in Support of the Heavy Duty Engine/Vehicle and Highway Diesel Fuel Final Rule", providing additional information on the emissions inventories and air quality characterizations that have been performed. EPA believes that the public has adequate notice and time to review and comment on the modeling efforts and inputs.

(2) EPA does not predict that implementation of their proposal will yield significant national reductions in PM and ozone precursors. Most areas of the U.S. are expected to meet the PM and ozone standards under existing regulatory programs and both ozone and PM can be characterized as a regional, rather than a national, problem. EPA suggests but fails to demonstrate that the propose rule would substantially reduce ozone levels in any of the areas predicted to be out of attainment in 2030. In addition, EPA has not fully addressed the issue of NO_x disbenefits in evaluating expected ozone reductions. (See also Issue 2.2.)

Letters:

Mercatus Center at GMU (IV-D-219) **p. 8-9**

Response to Comment 2.4(D)(2):

EPA disagrees with the comment. Extensive information on emission reductions of PM and ozone precursors (NOx and VOCs) can be found in chapter 2 of the preamble and the RIA to the proposal and the final rule. As an example of the information provided in these chapters, in 2030, we estimate a NOx reduction of 2.6 million tons, VOC reductions of 115,000 tons, and PM reductions of 109,000 tons.

The Agency conducted ozone and PM modeling, as well as an analysis of PM10 emissions, and based on this work has determined that many areas across the nation face a significant risk of exceeding health-based standards for 1-hour ozone and PM10, as well as moderate levels of ozone and PM fine. A more detailed discussion of these comments is presented in response to comments 2.2(F) [PM10 nonattainment], 2.2(J) [1-hour ozone nonattainment], 2.3(C)(1) [inventory trends]. For disbenefits, refer to response to 2.2(D).

Reductions in emissions of ozone precursors are expected to result in significant reductions in peak ozone levels and number of exceedance days even for those areas that are still predicted to have exceedances in 2007, 2020 and 2030. See response to comment 2.4(E)(4) for a description of this type of ozone reduction.

(3) EPA has failed to show that a 97 percent reduction in diesel fuel sulfur is necessary to achieve national air quality objectives particularly since the technologies for which this level of reduction is required have not been adequately demonstrated to be commercially available for use in HD vehicles. In addition, EPA has not demonstrated that a 90 percent decrease in PM and NO_x emissions from HD vehicles as opposed to a lesser degree of reduction, is essential to meet national air quality objectives. EPA has not persuasively demonstrated that further reductions in HD vehicle emission will play any major role in bringing current and projected nonattainment areas into compliance. The reductions promised by this rule constitute only a very small part of the overall PM and NO_x reduction effort now being conducted under the CAA.

Letters:

U.S. Chamber of Commerce (IV-D-329) **p. 1-3**

Response to Comment 2.4(D)(3):

Heavy-duty vehicle emissions contribute to air pollution with a wide range of adverse health and welfare impacts, including, but not limited to, adverse health effects associated with exceedances of national ambient air quality standards. Emissions of VOC, CO, NOx, SOx, and PM from HD vehicles contribute a substantial percentage of the precursors or direct components of ambient concentrations of ozone, PM, sulfur and nitrogen compounds, aldehydes, and substances known or considered likely to be carcinogens. Emissions of VOCs include some specific substances known or suspected to cause cancer. Of particular concern is human epidemiological evidence linking diesel exhaust to an increased risk of lung cancer, and the Agency is also concerned about the noncancer health effects of diesel exhaust Heavy-duty vehicle emissions also cause adverse environmental effects including visibility reductions, acid rain, nitrification and eutrophication of water bodies.

For each of the pollutants addressed in the public health and welfare justification for the rule, as described in detail in chapter 2 of the preamble and RIA, heavy-duty vehicle emissions are a significant portion of total inventories, especially in urban areas with air pollution problems. Importantly, the air quality modeling performed for this rulemaking demonstrates that even with the reductions expected from 15 ppm sulfur level in diesel fuel, there will still be a significant number of areas and population that are expected to be exposed to unhealthy levels of ozone and particulate matter. Thus, given that they are both feasible and cost-effective, the reductions resulting from this rule are fully justified.

The Agency conducted ozone and PM modeling to predict future ambient concentrations of ozone and PM after accounting for emissions reductions from this rule. In 2030, the Agency's photochemical ozone modeling predicts exceedances of the 1-hour ozone standard in 32 areas with a total of 89 million people in 2030. For prolonged and repeated exposure to moderate ozone concentrations, the modeling predicts 125 million are likely to live in areas with at least 2 days with model-adjusted 8-hour average concentrations of 0.08 ppm to 0.119 ppm.

For PM fine, the Agency's relied on the REMSAD model. However, the most appropriate method of making these projections relies on the model to predict changes between current and future states. Thus, we have estimated future conditions only for the areas with current PM2.5 monitored data (which covers about a third of the nation's counties). For these counties, REMSAD predicts the current level of 37 percent of the population living in areas where fine PM levels are at or above 16 $\mu g/m^3$ to increase to 49 percent in 2030 even after reductions from new standards on HDVs and diesel fuel sulfur levels.

(E) EPA's demonstration of the emissions inventory impacts of its proposal is misleading and problematic.

(1) The NPRM equates the proposed standards with air-quality benefits; yet this representation is misleading because it assumes that reductions in NO_x will automatically translate into lower ozone levels. Such an assumption ignores the non-linearity of ozone-formation processes and the role of meteorology. EPA must reassess the direction and magnitude of ozone changes resulting

from anticipated NO_x reductions.

Letters:

American Petroleum Institute (IV-D-343) **p. 6-10**
Marathon Ashland Petroleum (IV-D-261) **p. 4**

Response to Comment 2.4(E)(1):

As requested by the commenter, EPA assessed the direction and magnitude of ozone changes resulting from the emissions reductions (including NOx) in this rule. This assessment was based on photochemical modeling for the Eastern U.S. using the UAM-V model which includes the Carbon Bond IV chemical mechanism that reflects the non-linearities in ozone formation processes. The model applications were made using meteorological conditions typically associated with the formation and transport of high ozone concentrations in the Eastern U.S. The results of this modeling, as documented in the Air Quality Modeling Technical Support Document, demonstrate the large reductions in ozone that are expected to occur from the emissions reductions required by this rule. See also response to comment 2.2(D).

(2) The timing of the air quality "need" is not in accordance with the phase-in of the NO_x standard or the timing of the expected emissions benefits. EPA's assessment of need focuses on the ability of urban areas to meet the NAAQS in 2007-2010, but the emissions benefits from the proposal are minuscule during that time period. A phase-in results in 24% fewer NO_x emissions benefits in 2010 than full implementation beginning in 2008, based on EPA spreadsheet models referenced in the RIA. There is no indication in the NPRM or the RIA that EPA has considered other options that may be more cost effective. Another commenter also raised concerns that the discussion of benefits ignores the fact that the proposal achieves very little emission reduction in the early years of the program (such as only 32,000 tons of NO_x nationwide in 2007), and thus is not suited to addressing the stated risk of urban areas not meeting the 1-hour ozone standard in 2007 and later.

Letters:

American Petroleum Institute (IV-D-343) **p. 6-7**
Marathon Ashland Petroleum (IV-D-261) **p. 4**
Murphy Oil Corporation (IV-D-274) **p. 11**

Response to Comment 2.4(E)(2):

The commenter implies that because the timing of the reductions fall largely beyond the current 1-hour ozone attainment deadlines, the basis for this rule is questionable. EPA disagrees with the commenter.

Ten metropolitan areas that fall within ozone nonattainment areas have statutorily-defined attainment dates of 2007 or 2010, or have requested attainment date extensions to 2007. These 10 areas are New York City, Houston, Hartford, New London, Chicago, Milwaukee, Dallas, Beaumont-Port Arthur, Los Angeles, and Southeast Desert.

Each of these areas needs additional emission reductions in order to reach attainment by 2007, and to maintain the standards in the future. Some of these areas have emission reduction shortfalls that are identified in their attainment demonstrations (i.e., South Coast Air Basin, New York and Houston), and reductions from this rule will assist State efforts to reach attainment.[59] Three other areas -- Southeast Desert, Hartford, New London -- are subject to ozone transport from upwind areas with identified shortfalls (South Coast and New York), and depend upon attainment from these upwind these areas to reach attainment themselves. We have received attainment plans for two areas in Texas (Dallas and Beaumont-Port Arthur), and the Agency is likely to consider the reductions from this rule in its proposed approval of these attainment plans in Federal Register notices. Finally, there are two areas in the Midwest -- Chicago and Milwaukee -- that have incorporated reductions from this rule into their regional ozone modeling, and plan to rely on reductions from this rule to support their 2007 attainment demonstration.[60]

For all ten areas, even if all shortfalls were filled by the States, there is some risk that at least some of the areas will not attain the standards by their attainment dates of 2007, or 2010 for Los Angeles. In that event, the reductions associated with this program, which increase substantially after 2007, will help assure that any residual failures to attain are remedied. Finally, there is also some risk that the areas will be unable to maintain attainment after 2007. Considered collectively, there is a significant risk that some areas will not be in attainment throughout the period when the new standards will reduce heavy-duty vehicle emissions.

The rest of the areas have required attainment dates prior to 2007, or have no attainment date but are subject to a general obligation to have a SIP that provides for attainment and maintenance. These 34 areas, according to our modeling, are at risk of exceeding the ozone NAAQS between 2007 and 2030. These areas will be able to rely on reductions from this rule to continue to maintain the standard after attainment is reached, and will be able to take credit for this program in their maintenance plans when they seek redesignation to attainment of the ozone standard. If any of these areas reach attainment, and then fall back into nonattainment, or fail to reach attainment by 2007, reductions from this rule will assist these areas in achieving the ozone standard. If an area does not choose to seek redesignation, the continuing reductions from this rulemaking will help ensure maintenance (i.e., prevent future exceedances) with the 1-hour standard after initial attainment is reached.

Finally, there are 14 additional metropolitan areas for which the available ozone modeling and other evidence is less clear regarding the need for additional reductions. Our ozone modeling predicted these areas to need further reductions to avoid exceedances in 2007, 2020 or 2030. The recent air quality monitoring data for these areas shows ozone levels with less than a 10 percent margin below the NAAQS. We believe there is a risk that future ozone levels will be above the NAAQS because of the year-to-year variability of meteorological conditions conducive to ozone formation, or because local emissions inventories may increase faster than national inventories.

In addition, this rule is designed to reduce several types of air pollution. The timing of

---

[59] The South Coast's "additional measures" which rely on new technologies, are located in its 1994 SIP.

[60] *Technical Support Document, Midwest Subregional Modeling: 1-Hour Attainment Demonstration for Lake Michigan Area* and *Emissions Inventory*, Illinois Environmental Protection Agency, Indiana Department of Environmental Management, Michigan Department of Environmental Quality, Wisconsin Department of Natural Resources, September 27, 2000, at 14 and at 8.

this rule is compatible with the need to reduce all types of pollution as soon as possible.

(3) EPA's projections of HDDE emissions are misleading and inconsistent with EIA data. EPA has overstated the emissions benefits of the proposal by relying on overly optimistic projections of the increase of diesel vehicle use. The Energy Information Administration (EIA) projections of VMT growth rates are lower, calling into question the reasonableness of EPA's estimates. EPA used EIA's Annual Energy Outlook to forecast highway diesel consumption, yet the difference in projected growth rates is significant. EPA has not adequately justified the growth projections of new vehicle HDDEs. Similarly, EPA's projected diesel production estimates are also out of line with EIA data. EPA overstated highway diesel demand and baseline emissions, and as a result, has overstated the emissions reductions benefits of the rulemaking.

Letters:

Marathon Ashland Petroleum (IV-D-261) **p. 34**
National Petrochemical & Refiners Association (IV-D-355) **p. 1-3**

Response to Comment 2.4(E)(3):

We disagree that our HDDE emission projections are misleading and inconsistent with EIA data. We base our on-highway diesel fuel consumption estimates on our assumptions of vehicle miles traveled (VMT) and fuel economy of heavy-duty diesel engines. Our methodology for determining VMT is described above in response to issue 2.2(F)(3). Historical fuel consumption estimates (1987-1996) come from a report performed to support the upcoming MOBILE6 model.[61] These historical fuel consumption estimates suggest that fuel economy is improving. For future fuel consumption estimates, we extrapolate the historical estimates into the future using a constant, linear improvement in terms of miles per gallon. Chapter 2 of the Regulatory Impact Analysis presents per-vehicle HDDE fuel economy estimates and diesel fuel consumption estimates for selected years.

As a check on our diesel fuel consumption estimates, we used EIA's 1999 Annual Energy Outlook (AEO) to project highway diesel fuel production for use in the U.S. According to AEO 1999, highway fuel consumption was projected to increase 1.5% per year. Commenters correctly point out that this is inconsistent with AEO 2000 which projects the lower growth rate of 1.0% per year. This change in growth rate projections is based on calculations using the gross domestic product index which are described in the EIA report. EIA is currently in the process of completing the analyses for AEO 2001 which is expected to show even higher diesel fuel growth projections than AEO 1999. Based on the early release of AEO 2001[62], transportation diesel fuel consumption is expected to increase by 2.3% annually from 1999 to 2020. Based on these estimates, we believe that our fuel consumption projections are supported by the projections made by EIA.

---

[61] "Update Heavy-Duty Engine Emission Conversion Factors for MOBILE6: Analysis of Fuel Economy, Non-Engine Fuel Economy Improvements, and Fuel Densities," U.S. Environmental Protection Agency, EPA-420-P-98-014, May 1998.

[62] "Early Release of the Annual Energy Outlook 2001," www.eia.doe.gov/oaif/aeo/earlyrelease/index.html, Energy Information Administration, downloaded from EIA web site on 12/7/00.

AEO 2001 projects annual growth in VMT from freight trucks to be 2.6% from 1999 to 2020. Over this same period, we project an annual growth rate of 2.8% for heavy-duty diesel vehicles. Based on these estimates, we believe that our emission inventory projections, and therefore our emission reductions benefits, are supported by the projections made by EIA.

(4) EPA has not adequately calculated the ozone reductions it anticipates from the proposal or the number of nonattainment areas that will become attainment as a result of this rule. In addition, EPA's ozone calculations ignore the fact that ozone is primarily a summertime urban problem, which results in an emissions benefit calculation that may be off by a factor of three. To address these and other concerns related to emissions benefits and resulting ozone reductions, EPA should conduct detailed ozone modeling and should make those results publicly available.

Letters:

American Petroleum Institute (IV-D-343) **p. 7, 75-77**
Marathon Ashland Petroleum (IV-D-261) **p. 4**

Response to Comment 2.4(E)(4):

EPA has performed photochemical modeling for the Eastern U.S. to quantify the ozone reductions expected from the emissions reductions in this rule. This modeling was performed for three summertime episodes in 1995 during which there were high ozone concentrations measured in many urban, suburban and rural locations in the Eastern U.S. Collectively, these episodes cover 30 days in June, July, and August 1995. The emissions used in this modeling reflect summertime emissions levels and patterns, including the effects of ambient temperatures on temperature-sensitive mobile source and biogenic emissions. Thus, for the final rule, EPA has adequately determined the extent that emissions reductions are expected to reduce ozone concentrations in the Eastern U.S. For all areas combined, the rule is forecast to provide a 33 percent reduction in exceedances in 2020 and a 38 percent reduction in 2030. The total amount of ozone above the standard is expected to decline by nearly 37 percent in 2020 and 44 percent in 2030. Also, daily maximum ozone exceedances are lowered by 5 ppb on average in 2020 and nearly 7 ppb in 2030. The modeling forecasts an overall net reduction of 39 percent in exceedances from 2007, which is close to the start of this program, to 2030 when controls fully in place. In addition, the results for each individual area indicates that alareas are expected to have less exceedances in 2030 with the HDV controls than without this rule. The results of this modeling are described in more detail in the Air Quality Modeling Technical Support Document for this rule. See also the response to comment 2.2(D).

The commentor implies that we are using the direct results from our episodic UAM-V modeling to estimate environmental benefits of ozone reductions. However, we do not directly employ these model results. Instead, we convert the eposidic modeling results into full ozone season profiles. In this process, we calibrate the predicted hourly ozone concentrations to develop 2030 ozone profile at monitor sites by normalizing the observations to the actual 1996 ozone data from each monitor site. For areas without ozone monitoring data, we interpolated ozone values using data from surrounding monitors. We the use the 2030 base and control profiles to calculate the relevant daily and seasonal ozone metrics for our benefits estimation. Details on this method may be found in the technical support document prepared by Abt Associates, "Final Heavy Duty Vehicle Standards: Air Quality Estimation, Selected Health and Welfare Benefits Methods, and

Benefit Analysis Results" December, 2000.

(5) One commenter notes that EPA must account for aftermarket replacement of catalyst devices because reduced emission control performance will undermine the environmental benefits claimed by EPA.

Letters:

Marathon Ashland Petroleum (IV-D-261) **p. 34**

Response to Comment 2.4(E)(5):

We do not have sufficient information suggesting how aftermarket replacement of catalyst devices would affect emissions reductions, and such information was not provided by the commenter. Therefore, we have not included this effect in our inventory modeling. This issue is discussed in more detail later in response to issue 3.2.1(E)(3).

(F) EPA has greatly overestimated the SO_x reductions to be achieved by its proposal.

(1) EPA has assumed an average of 7 ppm sulfur but the exhaust system will see the equivalent of 17 ppm sulfur after contamination and lubricating oil are factored in. EPA also underestimated by a factor of four the amount of oxidation of sulfur into sulfates by the CDPF technology. Both EMA and MECA have stated that 40-60% of the sulfur will be oxidized.

Letters:

American Petroleum Institute (IV-D-343) **p. 76**

Response to Comment 2.4(F)(1):

We agree that SOx reductions and direct sulfate PM reductions are linked and assumptions that we make about the proportion of one pollutant effects the amount of the other (mass is conserved). In the inventory analysis in the RIA we have assumed that the fuel sulfur level on average for modeling purposes would be eight ppm constituted of a seven ppm refinery average plus one ppm for oil contamination. For simplicity the inventory analysis does not include contamination of the fuel during distribution, although for the technology feasibility case we assumed that the average fuel sulfur level would be between seven and 10 ppm. We believe that the one ppm sulfur contribution from lube oil contamination is the right assumption based upon the observed PM rates from modern diesel engines as described in chapter III of the RIA. Therefore, we believe that the actual average fuel sulfur level will be between eight and 11 ppm. The difference between the SOx reduction estimates based upon an eight ppm average fuel sulfur level and an 11 ppm fuel sulfur level would not be significant since the reductions are from a baseline of 341 ppm (340 ppm from the fuel plus one ppm from the oil). The potential SOx reductions among any of the three estimates (the limits of our range, 8 and 11 and the commenters suggested level of 17 ppm) vary by less than three percent. The difference between the limits of the assumptions which we believe to be most accurate is less than one percent.

In our inventory analysis we assume that 30 percent of sulfur in the exhaust will be oxidized to sulfate PM on vehicles meeting the phase 2 PM standard. As noted by the commenter, a variety of assumptions can be made as to the appropriate level of average sulfur oxidation to sulfate. As described in the RIA, under some conditions sulfur oxidation can be as low (or lower) than 10 percent while under other conditions it can be as high as the 40 to 60 percent levels suggested in the comment. We believe that by assuming 30 percent oxidation of sulfur to sulfate PM we have made a reasonable estimation of the amount of direct sulfate PM from vehicles meeting the phase 2 PM standard. Changes to this assumption simply shift the fraction of sulfur assumed to enter the atmosphere as SOx versus direct PM.

(G) EPA's calculation of emission benefits from the 50 ppm cap/30 ppm average sulfur as proposed by the oil industry is questionable and the basis on which EPA determined the benefits of a 50 ppm standard is unclear.

(1) Commenter provides no further supporting information or detailed analysis.

Letters:

ExxonMobil (IV-D-228) **p. 21**

Response to Comment 2.4(G)(1):

See response to 2.4(G)(2), below.

(2) The commenter references Section IX.C. of the draft RIA and notes that the draft RIA totally ignores the real world experience of thousands of vehicles in Europe, which are already demonstrating the ability to meet Euro 5 standards on 50 ppm sulfur diesel fuel. The commenter notes that the industry's proposed 50 ppm/30 ppm average sulfur level enables virtually the same PM benefits as EPA's proposal of a 15 ppm sulfur cap. Over 8,000 European diesel vehicles, both light and heavy duty, are currently operating catalyzed diesel particulate filters (CDPFs) satisfactorily on 50 ppm sulfur fuel. Both Johnson-Matthey and Engelhard have publicly released data showing that PM emissions below EPA's proposed FTP PM standard of 0.01 gm/bhp-hr can be achieved using 50 ppm sulfur. In this context, this commenter addresses some of EPA's concerns including the failure of fourteen retrofitted buses in Finland (which were due to the inability to maintain the required temperature levels to assure regeneration), sulfate make and PM compliance over the SS and NTE test procedures, and the use of SCR. The commenter adds that the "DEC-SE" study shows that on 30 ppm fuel, current traps can meet PM levels of 0.02 g/bhp-hr over the OICA cycle - an 80% reduction from today's levels. In addition, EPA's proposal with its 5 percent loss in fuel economy and the loss in BTUs resulting from the desulfurization process will cause an increase in overall CO2 emissions, while API's 50 ppm cap/30 ppm average diesel fuel standards along with an SCR/CDPF system has only a 1 percent fuel economy penalty, minimizes the loss of BTUs in the desulfurization process, and will lead to lower CO2 emissions overall.

Letters:

American Petroleum Institute (IV-D-343) **p. 28-29**
Marathon Ashland Petroleum (IV-D-57) **p. 1-2**

Response to Comment 2.4(G)(2):

In the NPRM we estimated the emission benefits possible from the use of 50 ppm capped sulfur fuel based upon enabling diesel oxidation catalysts and lean NOx catalysts as explained in the Preamble of the NPRM. The reductions we estimated for these technologies are explained in the draft RIA.

We disagree with the assumptions made here by the commenters that with a 30 ppm fuel sulfur average (50 ppm cap) substantial NOx and PM reductions would be possible. As we detail in responses to issues 3.3.1 (A-F) we do not believe that catalyzed diesel particulate filters CDPFs are enabled through the use of fuel with a sulfur content above 15 ppm. Further, as we explain in responses to issues 3.2.1(C) and 3.5(A-E) we do not believe that there are acceptable means to ensure widespread compliance under an SCR program where an entirely new fluid needed to be added in order to ensure proper emission control system function. Therefore, we continue to believe that setting a fuel sulfur standard with a 30 ppm average / 50 ppm cap would only enable the modest emission reductions we estimated in the NPRM.

(3) API's proposal of a 30 ppm average/ 50 ppm cap sulfur content achieves almost the same emissions benefits as EPA's 15 ppm cap. EPA's rule anticipates 110,000 tons of PM reductions; while API's generates 104,000 tons of PM reductions. EPA's proposal and a SCR/CDPF system will have the same VOC reductions benefit. API's proposal will have the same reductions as EPA's for those toxic compounds emitted as VOC or PM.

Letters:

American Petroleum Institute (IV-D-343) **p. 75-76**
Marathon Ashland Petroleum (IV-D-261) **p. 80-81**

Response to Comment 2.4(G)(3):

We disagree with the assumptions made here by the commenters that with a 30 ppm fuel sulfur average (50 ppm cap) substantial NOx and PM reductions would be possible. As we detail in responses to issues 3.3.1 (A-F) we do not believe that catalyzed diesel particulate filters CDPFs are enabled through the use of fuel with a sulfur content above 15 ppm. Further, as we explain in responses to issues 3.2.1(C) and 3.5(A-E) we do not believe that there are acceptable means ensure widespread compliance under an SCR program where an entirely new fluid needed to be added in order to ensure proper emission control system function. Therefore, we continue to believe that setting a fuel sulfur standard with a 30 ppm average / 50 ppm cap would only enable the modest emission reductions we estimated in the NPRM.

(4) EPA acknowledges that a 50 ppm sulfur cap for highway diesel will deliver a corresponding reduction in PM and NO_x from control technology, even if the reduction is somewhat less than it would otherwise be at the 15 ppm level. EPA has not demonstrated that the lower sulfur cap is essential in order to meet the nation's air quality goals and has provided no evidence that the emission reductions derived from a 50 ppm sulfur diesel cap, in addition to other ongoing air quality measures, would be insufficient to bring nonattainment areas into compliance.

Letters:

U.S. Chamber of Commerce (IV-D-329) **p. 2-3**

Response to Comment 2.4(G)(4):

We believe the emission reductions achieved with a 50 ppm sulfur cap on diesel fuel would be minimal compared to a 15 ppm sulfur cap; see response to comment 2.4(G)(2). We further believe the emission reductions enabled by the 15 ppm sulfur cap will have significant impact on the ability of many area to reach or maintain attainment; see response to comment 2.2(D), and 2.4(D)(3).

(H) Expressed support for an evaluation of the impact or effectiveness of this rule as soon as it is feasible.

(1) Commenter provided no supporting information or detailed analysis.

Letters:

West Harlem Environmental Action/Envr Justice Network (IV-F-76)

Response to Comment 2.4(H)(1):

In the RIA, we provide a detailed cost-effectiveness and benefit-cost analysis of this rule. This analysis looks at the projected emission reductions, costs of compliance, and the impact of the projected emission reductions on society. We find it most useful to evaluate the effects of the standards prior to finalizing the rule so that we can make informed decisions on appropriate standards. However, we will continue in our efforts to refine our emission inventory projections in the future. This will help us make informed decisions in the future on the need for further pollution control.

(I) EPA fails to discuss the negligible benefits to rural areas.

(1) This is important, because the lack of benefits in rural America is one reason to justify flexibility measures provided to small refiners (especially farm refiner co-ops) that operate in and serve rural America.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 2-3**

Response to Comment 2.4(I)(1):

In Section IV of the preamble, we present the rationale for our conclusion that it is not necessary or appropriate to provide separate treatment for farmer cooperative refiners as a class. Farmer cooperatives, while unique in structure, are not unique compared to privately held refiners in terms of their ability to raise capital. Furthermore, the health and environmental benefits of the program in rural areas are important. In the absence of compelling economic or programmatic reasons for such special treatment of farmer cooperative refiners as a class, reasons which we have concluded do not exist, then there is also no reason to give up real benefits of the program. See also response to 2.2(I)(1).

(J) EPA should account for the additional reductions from LDVs and diesel autos

because those reductions will be significant in rural areas, and provide further justification for providing flexibility to farmer co-ops.

(1) Commenter provides no detailed analysis on this point.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 4**

Response to Comment 2.4(J)(1):

As the commenter observes, we do not claim emission benefits for the effect of the rule on light-duty diesel vehicles and trucks. Any additional emission impact resulting from light-duty diesel vehicles would have no effect on our conclusion that it is not necessary or appropriate to provide farmer cooperative refiners, as a class, with separate regulatory treatment. See also the response to Issue 2.4(I).

(K) EPA's proposal will not lead to reductions in diesel smoke.

(1) A reduction in sulfur levels in diesel fuel will have very little impact on diesel smoke given that modern diesel engines are virtually smokeless using current fuels. Older, poorly maintained vehicles are the cause of diesel smoke and better vehicle maintenance is the key to improvements in this area.

Letters:

American Bus Association (IV-D-330) **p. 4**

Response to Comment 2.4(K)(1):

We agree with the commenter that modern diesel engines are virtually “smokeless” when appropriately maintained (have little to no visible smoke). Likewise, we agree with the commenter that improvements in vehicle maintenance could reduce visible smoke emissions as well as PM emissions. However, we disagree with any implication that just because modern diesels are “smokeless” that further control of diesel emissions are unwarranted. Modern diesel engines still produce substantial amounts of PM emissions which can be reduced dramatically through the application of catalyzed diesel particulate filters (CDPFs). These PM emission reductions are needed in order to address the PM10 nonattainment areas, areas with elevated levels of PM fine, and the serious health concerns associated with diesel PM. Further, it should be noted that because CDPFs are highly effective at controlling PM emissions, CDPF equipped vehicles continue to be smokeless even when engine out PM emission levels increase due to malmaintenance.

(L) EPA should provide information to clarify the anticipated emissions benefits, particularly since the aftertreatment technologies are not yet available.

(1) Commenter requests that EPA provide additional information regarding a comparison of the exhaust emissions of the current diesel fuel and the low-sulfur diesel fuel as well as an update on the development status of the technologies that will be used to meet the standards.

Letters:

American Public Transportation Association (IV-D-275) **p. 4**

Response to Comment 2.4(L)(1):

Please see our response to issue 3.2.1(C) which details the emission benefits of the advanced emission control technologies enabled through the application of diesel fuel. There you will see that PM and NOx emissions can be reduced by more than 90 percent through the application of these technologies coupled with low sulfur diesel fuel. For a more detailed discussion of the technologies please refer to chapter 3 of the RIA.

(M) EPA's claim that there will be additional environmental benefits beyond reductions in ozone precursors and PM is unsubstantiated.

(1) The assumption that the proposed standards would result in reductions in carbon monoxide, SO_x, and air toxics is misleading since the ambient levels of these pollutants are already at low levels. Commenter provides a discussion of the assumptions associated with each of these pollutants and concludes in each case that the anticipated reductions as a result of the proposed rule would lead to minimal benefits.

Letters:

Mercatus Center at GMU (IV-D-219) **p. 11**

Response to Comment 2.4(M)(1):

We disagree with the comment. There are 28 areas in nonattainment with the SO_2 standard, and 17 areas designated as CO nonattainment areas. Ambient concentration and exposure to air toxics emitted by heavy-duty vehicles have been found at levels of regulatory concern, especially in urban areas. The standards being finalized today will reduce ambient concentrations of these three pollutants, and thus lead to reductions in adverse health effects. For those populations exposure to unhealthful ambient concentrations of these pollutants, the benefits of this rule are significant.

(2) EPA has suggested that the proposed rule would provide substantial benefits by reducing visibility/haze, acid deposition, eutrophication/nitrification, and polycyclic organic matter (POM) deposition, but does not quantify the benefits in any of these cases.

Letters:

Mercatus Center at GMU (IV-D-219) **p. 12**

Response to Comment 2.4(M)(2):

See response to comment 2.2(P)(1).

(N) EPA should evaluate the impact to air quality if small refiners are allowed to take advantage of a delayed implementation schedule.

(1) The question of the potential air quality impact of allowing small refiners to

delay compliance with the proposed rule deserves EPA analysis, as required by the Regulatory Flexibility Act. However, given that small refiners represent only 4 percent of the market for highway diesel fuel and contribute little to PM and/or ozone nonattainment, it is likely that a delayed implementation schedule will have a negligible impact on air quality.

Letters:

U.S. Small Business Administration (IV-G-20) **p. 2**

Response to Comment 2.4(N)(1):

We agree with the commenter that small refiners represent a small fraction (our current estimate is 5 percent) of diesel fuel production nationally, and that any direct emission impacts of small refiner relief provisions -- positive or negative -- will be small. The strong need for the air quality benefits of this rule requires even small refiners, the refiners most likely to be financially stressed by this rule, comply expeditiously. However, by providing additional temporary options that small refiners can pursue, the program can be implemented for other refiners on the fastest possible schedule. In this way, the overall program will achieve the most air quality benefit in the shortest possible time.

(O) EPA has underestimated the adverse effects that its regulations will have on global climate change.

(1) The continuous reduction of atmospheric sulfur can now be directly correlated to rising global warming temperatures. Sulfur has served a vital role in our planet's biogenic and atmospheric system since its formation. The beneficial attributes of sulfur aerosols should not be ignored when formulating environmental regulations. Reductions in fuel sulfur translate into reductions of atmospheric sulfur. Commenter notes that sulfur's positive and negative attributes must both be evaluated and balanced in any environmental regulation and provides significant discussion and analysis on this issue. Commenter cites to several scientific papers and documents to support their position on this issue. Commenter recommends that to address this issue, EPA should consider pursuing a strategy that would include the use of diesel fuel additives along with sulfur trap technology instead of reducing the sulfur levels in fuel.

Letters:

National Alternative Fuels Foundation (IV-D-214) **p. 5-16**

Response to Comment 2.4(O)(1):

EPA is aware of the issues raised in this comment.

EPA monitors climate change research and current scientific analysis of greenhouse gas emissions and impacts. The role of aerosols in the atmosphere is not new, nor is it well understood. As the comment states, there is data suggesting that aerosols play a significant role in cloud formation, which does play a role in climate change. However, the direct results of these interactions are not well known and there is not yet clear evidence that sulfur-based aerosols are responsible for significant climate cooling. In response to the comment, these impacts have not been ignored, but the science is not so well known as to allow us to draw the conclusions given in the comment. In addition, the data presented in the comment are not scientifically significant or rigorous enough to adequately support the conclusions.

The basic science involved can be readily described. Aerosols are liquid or solid particles small enough to stay suspended in the air. Both human and non-human processes generate aerosols. Different aerosol types have different impacts upon the climate. Sulfate aerosols will tend to reflect light or cause clouds to brighten, exerting a cooling effect on the atmosphere. Most particulate matter also increases the formation and lifetime of clouds, further affecting the reflection of incoming solar radiation back to space. However, unlike greenhouse gases which remain in the atmosphere for decades to centuries, aerosols do not remain in the atmosphere for long periods of time, tending to be "rained out" regularly. For this reason, sulfate cooling cannot be considered a straightforward offset to greenhouse gas warming. The offsetting impact varies geographically depending on local aerosol concentrations. Therefore, aerosol cooling and greenhouse warming do not directly offset each other because their effects occur at different times and in different parts of the atmosphere. Aerosols have greater impact regionally, with more limited impact on global climate.

Estimates of the possible cooling effect of all tropospheric aerosols of anthropogenic origin indicate a small effect (estimated at a direct forcing of about -0.4 to -0.5 W/m^2), offsetting perhaps 20 percent of the greenhouse gas warming effect.[63] [64] Anthropogenic sulfates are only about 4% of total aerosol particulate, the largest source of which is SO2 emissions. Further, our emission inventories indicate that the heavy-duty SO2 emissions affected by this rule are less than 1 percent of national SO2 emissions. Clearly, any effect on total tropospheric aerosols and any reductions in global cooling effect due to the SO2 reductions from this rule would be extremely small.

In addition to the impact of the SO2 reductions from this rule we also note that there are likely global warming benefits (i.e., reductions in global warming) from other emission reductions that will result from this rule. First, tropospheric ozone, unlike stratospheric ozone, is a known contributor to global warming, contributing a positive forcing of about 0.4 W/m^2, [65] which is nearly as large as the negative direct aerosol effect and which makes it the third largest climate forcing factor among the greenhouse gases.[66] Thus, the ozone reductions expected from this rule, which are one of the primary motivations for its adoption, will also act to reduce global warming effects.

A second global warming benefit of this rule comes from the reductions of non-sulfate diesel PM which it will produce (approximately 25,000 tons per year in 2010, growing to almost 90,000 tons per year by 2030). While sulfate aerosol tends toward global cooling, as noted by the commenter, carbon aerosol such as diesel PM, acts in the opposite direction. These aerosols act by heating the atmosphere and thereby reducing large-scale cloud cover, and by decreasing cloud brightness.[67] The balancing positive and negative characteristics of aerosols are such that it is unclear at the present time which dimensions drive the overall trend in aerosol

[63] "IPCC Second Assessment - Climate Change 1995" A Report of the Intergovernmental Panel on Climate Change (IPCC 1995). Page 21

[64] "Global warming in the twenty-first century: An alternative scenario" James Hansen et al., NASA Goddard Institute for Space Studies.. June 16, 2000 (Hansen et al. 2000). Page 2

[65] Hansen et al. 2000, page 5

[66] "An Open Letter on Global Warming," James Hansen, Goddard Institute for Space Studies, Oct 25, 2000. Page 2.

[67] Hansen et al. 2000, page 2

forcing.[68]

Finally, this rule will produce reductions in methane from the reductions in the HD gasoline-fueled engine and vehicle hydrocarbon standards which it contains. Methane, of course, is an extremely potent greenhouse gas, being the second largest source of anthropogenic climate forcing.[69] Methane reductions from this rule will exceed 2,000 tons per year by 2015, and will exceed 6,500 tons per year by 2030.

Producing an assessment of the overall global warming impact of this rule would be a complex and difficult task. Clearly the effects of SO2 reductions cannot be considered in isolation from the other changes the rule will produce. We have not done such an analysis because we believe that, whatever the directional nature of the outcome, it would be extremely small. Furthermore, given the scientific uncertainties that would be involved in modeling the global effects of a regional United States program, any results would be expected have a degree of uncertainty that would exceed the magnitude of the results.

The known health and welfare benefits which this rule will produce stand in clear contrast to this rather uncertain global warming effect. Our benefit-cost analysis presented in Chapter VII of the RIA has identified and quantified benefits that will have a value of over $70 billion once complying vehicles have been phased-in to the HD vehicle fleet. These benefits come from reductions in premature mortality, reductions in hospital admissions and emergency room visits, reductions in acute bronchitis, lower respiratory symptoms and upper respiratory symptoms in children, reductions in asthma attacks, reductions in work loss days and a variety of other health effects and welfare effects (e.g., reductions in agricultural crop damage). The benefits of the rule are discussed at length in Chapters II and VII of the RIA.

The sulfur reductions we are requiring in diesel fuel are an indispensable component of all of the health and welfare benefits we expect from this rule. This is because we have determined that removing most of the sulfur from diesel fuel is an essential requirement for the engine technology needed to produce the NOx and PM reductions that, along with SO2 reductions, result in these benefits.

In summary, we believe that any concern about global warming due to SO2 reductions would be offset by the other global warming benefits which this rule will produce, such that it is not possible to claim that the rule will have adverse effects on global warming. Furthermore, in the context of the clearly identified benefits of the rule, the concerns about a possible negative effect on global warming become insignificant.

The commented also recommended the EPA consider an alternative strategy based upon diesel fuel additives along with sulfur trap technology instead of low sulfur diesel fuel. This issue is addressed in our responses to issues 3.5(G), 3.3.5(A) and 3.3.5(E).

---

[68] "We do not even know the sign of the current trend of aerosol forcing, because such information would require knowledge of the trends of different aerosol compositions." Hansen et al 2000, page 4.

[69] Hansen et al. 2000, page 3

ISSUE 3: HEAVY DUTY ENGINE/VEHICLE STANDARDS

Issue 3.1: Engine and Vehicle Standards

Issue 3.1.1: Engine Exhaust Standards

(A) Expressed support specifically for the engine standards as proposed by EPA.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Air Pollution Control District (IV-D-55) **p. 1**
American Lung Association (IV-D-270) **p. 17**, (IV-F-181, 191) **p. 146**
American Lung Association of Metropolitan Chicago (IV-D-237) **p. 1**
American Lung Association of NH (IV-D-116) **p. 1**
American Lung Association of NJ (IV-D-224) **p. 1**
American Lung Association of OR (IV-D-165) **p. 1**
American Lung Association of Orange County (CA) (IV-D-176) **p. 1**
American Lung Association of SD (IV-D-31) **p. 1**
American Lung Association of VA (IV-D-205) **p. 1**
American Lung Association of WI (IV-D-32) **p. 1**
Bay Area Air Quality Management District (IV-D-139) **p. 1**
Bressler, Daniel J. (IV-D-104) **p. 1**
CA Air Pollution Control Officers' Association (IV-D-109) **p. 1**
CA Air Resources Board (IV-D-203) **p. 2**
CA Environmental Protection Agency (IV-F-190) **p. 18**
CT DEP (IV-D-142, 320) **p. 1 (both)**
Center for Environmental Health (IV-D-89) **p. 1**
Chicago DEP/Chicago Metropolitan Mayors Caucus Clean Ai (IV-D-335) **p. 3**
City of Arcata (IV-D-200) **p. 1**
City of Portland (IV-D-198) **p. 1**
City of Seattle (IV-D-297) **p. 1**
Clean Air Network (IV-D-292) **p. 2**
DE Dept. of Natural Resources & Environmental Control (IV-D-146) **p. 1**
DE Nature Society (IV-D-285) **p. 1**
Downtown Community Association (IV-D-118) **p. 1**
Environmental Health Watch (IV-D-212) **p. 1**
GA Department of Natural Resources (IV-D-268) **p. 1**
Grand Canyon Trust (IV-D-317) **p. 1**
Hinds, William (IV-F-190) **p. 202**
Hoosier Environmental Council (IV-D-281) **p. 1**
Kern Oil & Refining Co. (IV-F-173)
League of Women Voters of New Orleans (IV-D-210) **p. 1**
Legal Environmental Assistance Foundation (IV-D-126) **p. 1**
MD DOE (IV-D-59, 163) **p. 1 (both)**
MO Coalition for the Environment (IV-D-235) **p. 1**
Manufacturers of Emission Controls Association (IV-F-191) **p. 120**
Mayor and citizens of Fort Collins, CO (IV-F-191) **p. 211**
NC DENR (IV-D-151) **p. 1**
NC Waste Awareness and Reduction Network (IV-D-51) **p. 1**

NESCAUM (IV-D-315) **p. 4-5**, (IV-F-63)
NH DES (IV-D-150) **p. 1**
NH State Governor's Office (IV-D-156) **p. 1**
NY DEC (IV-D-138, 239) **p. 1 (both)**
NY State Assembly (IV-D-266) **p. 1**
NY State Attorney General's Office (IV-D-238) **p. 1**
NYC DEP (IV-D-159) **p. 1**
Natural Resources Defense Council (IV-F-75, 191) **p. 68**
Office of the Governor, Guam (IV-D-60) **p. 1**
RI Dept. of Environmental Management, et al (IV-D-61) **p. 1**
STAPPA/ALAPCO (IV-F-32, 78, 117) **p. 29** (IV-F-191) **p. 32**
San Joaquin Valley Air Pollution Control District (IV-D-56) **p. 1**
Sierra Club, GA Chapter (IV-D-348) **p. 1**
Sierra Club, Lone Star Chapter (IV-D-287) **p. 2**
Sierra Club, PA Chapter (IV-D-53) **p. 1**, (IV-D-197) **p. 2**, (IV-D-204) **p. 1**
Southern Queens Park Association, Inc. (IV-D-36) **p. 1**
Southwest Air Pollution Control Authority (IV-D-149) **p. 1**
U.S. Oil & Refining Co. (IV-F-190) **p. 159**)
Udall, Mark (IV-D-173) **p. 1**
Unity Center (IV-D-75) **p. 1**
Vigo County Air Pollution Control (IV-D-137) **p. 1**
Village of Burr Ridge (IV-D-316) **p. 1**
WA Department of Ecology (IV-D-141) **p. 1**
WI DNR (IV-D-291) **p. 1**

(2) The standards are feasible. MECA believes the proposed standards are achievable in a cost-effective manner within the time allotted, if very low sulfur diesel fuel is available. EPA and others have successfully relied on MECA's sound forecasts in the past and should do so in this matter.

Letters:

City of Chicago (IV-D-240) **p. 4**
IL Environmental Protection Agency (IV-D-193, 308) **p. 1 (both)**
Metropolitan Washington Air Quality Committee (IV-D-34, 58) **p. 2 (both)**
NY DEC (IV-D-239) **p. 2**
Natural Resources Defense Council (IV-D-168) **p. 6-8**
Ozone Transport Commission (IV-D-249) **p. 2**
STAPPA/ALAPCO (IV-D-295) **p. 2, 9-10**

(3) Supports the engine standards as proposed but notes that EPA should eliminate the four-year phase-in of the NO_x standard. [see Issue 3.1.4]

Letters:

Natural Resources Defense Council (IV-D-168) **p. 6-7**
Nolan, Catherine (IV-D-169) **p. 1**
PA DEP (IV-D-100) **p. 2**
Stuckey, Stephanie (IV-D-182) **p. 1**
WI DNR (IV-D-144) **p. 1**

(4) Supports the engine standards as proposed but believes the standards can

be met with a 30 ppm average sulfur fuel. [see Issue 4.1]

Letters:

Kern Oil & Refining Co. (IV-D-310) **p. 2, 4**

Response to Comment 3.1.1(A):

We agree with commenters that the diesel engine standards as proposed are indeed feasible in the 2007 model year timeframe. Furthermore, we believe the standards can be achieved in a cost effective manner. Our reasoning behind the feasibility of the diesel engine standards is the topic of Chapter III.A of the final RIA contained in the docket for this rule. The economic impacts and cost effectiveness of the standards are discussed in detail in Chapters V and VI of the final RIA. Some commenters suggested that we eliminate the proposed phase-in and require compliance to the proposed NO_x standard on 100 percent of new engines in the 2007 model year. As discussed in the preamble to this rule and below in our Response to Comment 3.1.4, we disagree with those commenters. Lastly, one commenter suggested that the proposed NO_x standard was feasible but that it could be met with a diesel fuel having a 30 ppm average sulfur requirement. As discussed at length in the preamble and in Chapter III.A of the final RIA, we firmly believe that the standards we have put forth for Phase 2 of our highway diesel program can only be met if diesel fuel sulfur levels are capped at 15 ppm.

(B) It will be a significant challenge for diesel engines to meet the PM and NO_x emission standards at the same time.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Alliance of Automobile Manufacturers (IV-F-9, 59,190) **p. 114** (IV-F- 117) **p. 168** (IV-F-191) **p. 89**

(2) The DECSE program on which EPA relies did not test integrated systems with NO_x and PM control functions. Without data on integrated systems there is no basis for the proposed standards.

Letters:

ExxonMobil (IV-D-228) p. 8

Response to Comment 3.1.1(B):

Engine and vehicle manufacturers have historically overcome significant challenges in the past in order to cost effectively reduce vehicle and engine emissions and in the process have simultaneously provided improvements in engine efficiency, durability, and driveability. The diesel emissions standards finalized are technology forcing, thus they are inherently challenging. EPA believes that the challenge can be met using a combination of technologies as described in Chapter 3, section A of the RIA and that sufficient leadtime is available for refining these technologies and integrating them into the engine/vehicle system.

EPA tested a system integrating both NO_x and PM control functions (see Chapter 3, section A3 of the RIA) demonstrating simultaneously greater than 90% NO_x reduction and greater than 95% PM reduction efficiencies. Toyota has demonstrated an exhaust aftertreatment device that integrates both a NO_x adsorber catalyst and a catalyzed diesel particulate filter into a single monolithic device (see document number IV-E-31 in the docket for this Final Rule).

(C) EPA should implement a combined standard for NO_x and NMHC, which would be consistent with the approach taken under the 2004 HD rule.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

Environmental Defense (IV-F-169)

(2) EPA has proposed separate NO_x and NMHC standards for HDEs in this proposal. However, this is inconsistent with the 2004 HD rule, which imposes a singe NO_x + NMHC combined standard. Separating the standards make them more stringent since a feasible control strategy must be designed for individual criteria pollutants and does not provide as much flexibility in emission compliance planning for manufacturers. With this proposal, EPA has failed to rationalize why the standards have been separated. If EPA chooses to finalize separate standards, then EPA should prove that these standards are feasible across the board. Commenters provided significant discussion on this issue and noted that EPA should work with industry to determine an appropriate combined standard. Commenters suggested a combined standard of 1.0 g/bhp-hr and noted that if a lower standard is adopted, then separate standards for different classifications should be adopted that are proven feasible for all groups. One commenter recommended a combined standard of 1.0 g/bhp-hr for HD gasoline and diesel engines greater than 14,000 GVWR and a combined standard of 0.8 g/bhp-hr for HD gasoline and diesel engines and incomplete vehicles less than or equal to 14,000 GVWR. Another noted that a combined standards of 0.6 g/bhp-hr would represent a reasonable target. (See also Issue 3.2.1 and 3.2.2.)

Letters:

DaimlerChrysler (IV-D-284) **p. 9**
Detroit Diesel Corporation (IV-D-276) **p. 12-13**
Engine Manufacturers Association (IV-D-251) **p. 40**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 41-42, 51**
International Truck & Engine Corp. (IV-D-257) **p. 16**

(3) EPA provides no explanation why, just three years after implementation of a combined standard, EPA proposed separate standards.

Letters:

American Petroleum Institute (IV-D-343) **p. 20**
Marathon Ashland Petroleum (IV-D-261) **p. 16**

(4) EPA should set a combined standard at 0.5 g/bhp-hr, which is still 5 times lower than the 2004 standard, would be technology forcing, would address environmental needs and may be technologically feasible.

Letters:

Mack Trucks (IV-D-324) **p. 2**

Response to Comment 3.1.1(C):

We have chosen to move back to the approach of having separate NO_x and NMHC standards, as opposed to the combined NO_x+NMHC standards required by the Phase 1 rule, to ensure that very low NO_x levels are achieved in the real world. When the combined standards were first promulgated back in *1997* we placed less emphasis on NO_x emissions and more emphasis on total NO_x and NMHC emissions. (See 62FR54694, October 21, 1997) Since that time, as evidenced by the focus on NO_x in our light-duty Tier 2 rule we have begun to place more emphasis on NO_x emission reductions because of the critical importance of reducing NO_x for both ozone and ambient particulate matter reductions. (See 65 FR 6698, February 10, 2000). The separation of NO_x and NMHC standards for the Phase 2 rule allows us to be sure that very low levels of NO_x are achieved in the real world. If the standard were combined, say at 0.34 g/bhp-hr NO_x+NMHC, it is conceivable that engines would emit at levels as high as ~0.3 g/bhp-hr NO_x, fully 50 percent above the standard we are finalizing. Therefore, we believe that the separation of the standards provides a more effective emission control program.

As for comments on feasibility, we believe the 0.20, 0.14, and 0.01 g/bhp-hr NO_x, NMHC, and PM standards are indeed feasible, as discussed in detail in Chapter III.A of the final RIA contained in the docket. Regarding the suggestions for higher standards, such as 0.6, 0.8, and 1.0 g/bhp-hr NO_x+NMHC, because we believe the standards being finalized are feasible, that they can be met in a cost effective way, and that they are needed to protect public health, we do not believe that any standards set higher than those we are finalizing would satisfy our responsibility under the Clean Air Act.

(D) EPA's proposal to limit exhaust emissions to the Maximum Allowable Emission Limits (MAELs) would be costly and adds no value to EPA's program.

(1) Commenter refers to their comments submitted in response to the 1999 Feasibility Review (2004 rule), p. 35-38 for additional information and comments on this issue.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 62**

Response to Comment 3.1.1(D):

We have concluded that the anticipated emission reductions will result without the added compliance burden of the MAEL requirements as they apply to the standards established in this rule and considering the technologies likely to be used. Therefore, we have eliminated the MAEL requirements from the Phase 2 program. The regulations for model year 2007 have been changed such that the MAEL requirements do not apply to engines certified to the standards established in this rule.

The Phase 1 HDDE rule (see 65 FR 59896, October 6, 2000) established the MAEL requirements beginning in model year 2007 as a means to ensure that the engine calibration strategies used to comply with the FTP and SET tests were used across the engine speed-torque zone, not just the 13 test points which comprise the SET. The NTE requirements apply to the same engine operating conditions as many of the individual steady-state modes which make-up the SET, however, the Phase 1 NTE standard is on the order of 0.625 g/bhp-hr NMHC+NO_x greater than the Phase 1 SET standard. To ensure compliance with the Phase 1 MAEL, the regulations allow EPA, at the time of certification, to select up to three additional test points (referred to as "mystery points" in the regulations). The measured emissions from these mystery points must comply with the MAEL standard. The MAEL standard is determined as described here. The Phase 1 regulations define a region of the engine's torque map which is bounded by the 12 non-idle modes of the SET, this area of the engine map is defined as the "steady-state control area." The Phase 1 regulations specify that gaseous emissions within the steady-state control area, when tested under steady-state laboratory conditions, must comply with a value determined by a mathematical interpolation process defined in the regulations. The interpolation process defines the "Maximum Allowable Emission Limit" (MAEL), which the measured emission values must comply with. The MAEL interpolation process includes a 10 percent cushion value, that is, the MAEL value is 10 percent higher than the value determined from the mathematical interpolation equations.

The MAEL and mystery point requirements were established in the context of the 2004 FTP emission standards (e.g., 2.4 g/bhp-hr NMHC+NO_x, 0.1 g/bhp-hr PM). The MAEL ensures that the emission control strategies manufacturers utilize to comply with the SSS standard are also used as the steady-state modes not specifically included in the 13 modes which constitute the SSS test. The MAEL provides for a 10 percent cushion, roughly equivalent to 0.25 g/bhp-hr NO_x and 0.01 g/bhp-hr PM for 2004 technology engines. This 10 percent allowance provides needed flexibility within the context of the 2004 FTP standards, and it recognizes that not every point within the steady-state control area could comply with the mathematical interpolation value.

In the context of the 2007 FTP and SET emission standards (i.e., 0.20 g/bhp-hr NO_x, 0.14 g/bhp-hr NMHC, and 0.01 g/bhp-hr PM), the MAEL interpolation process, even with the 10 percent allowance, is overly restrictive and is not needed to ensure that emission control technologies which are used to comply with the FTP and SET are used across the engine map. For Phase 1 engines the MAEL was necessary to ensure this potential for gaming did not occur because the difference between the FTP and SET standards and the NTE standard could be large, on the order of 0.625 g/bhp-hr for NMHC+NO_x. However, for Phase 2 engines the NTE requirements are a mere 0.10 g/bhp-hr NO_x greater than the FTP and SET standard. Considering this small increment, we have eliminated the MAEL for Phase 2 engines because it is redundant with the NTE. For the same reasons, we have eliminated the certification "mystery points" for engines complying with today's diesel engine standards.

(E) EPA's definition of "defeat device" increases the stringency of the proposed standards.

(1) The change to the scope of the defeat device prohibition in the 2004 rule is unnecessarily restrictive and operates to increase the stringency of those standards as well as the proposed 2007 standards. For light duty vehicles, manufacturers "must show to the satisfaction of the Administrator that the vehicle design does not incorporate strategies that unnecessarily reduce emission control effectiveness exhibited during the [FRP] when the vehicle is

operated under conditions which may reasonably be expected to be encountered in normal operation and use." [40 CFR 86.094-16(d)(1)] Under this language, if a vehicle design necessarily reduces emission control effectiveness, then its design is not considered to be a defeat device, which insulates manufacturers that must institute certain design features that could result in minor emissions impacts. However, for HDEs, EPA has not included the "unnecessarily" modifier in its regulatory language and should do so in the final rule. It is not immediately apparent that any of the exceptions included in the proposed rule [see 40 CFR 86.004-2] extend to emissions control strategies that are "necessary" notwithstanding that they may result in small emissions increases that are still below applicable FTP levels. This could present a compliance problem for manufacturers. [see also Issue 3.2.1 for discussion of this issue in the context of NTE feasibility]

<u>Letters:</u>

International Truck & Engine Corp. (IV-D-257) **p. 24-25**

<u>Response to Comment 3.1.1(E):</u>

We have not changed the definition of defeat device in this rule. Therefore, the comment is not appropriately made within the context of this rule; however, we believe it is appropriate to respond to the substance of the comment. We disagree that the definition of defeat devices contained in the Phase 1 final rule, or the language in 40 CFR 86.004-16 on the prohibition of defeat devices, increases the stringency of the standards. The commenter suggests that the revisions made to 40 CFR 86.004-16 in the Phase 1 rule, as compared to 40 CFR 86.094-16, prevents emission control strategies which would normally be used during the FTP to trade-off control of one emission for another, while keeping both below the applicable emission standard, and therefore increases the stringency of the rule by prohibiting such well know emission control strategies. This is not the case. 40 CFR 86.004-16(d)(1) states:

> "*The manufacturer must show to the satisfaction of the Administrator that the vehicle or engine design does not incorporate strategies that reduce emission control effectiveness exhibited during the Federal emissions test procedures, described in subpart N of this part, when the vehicle or engine is operated under conditions which may reasonably be expected to be encountered in normal operation and use, unless one of the specific exceptions set forth in the definition of "defeat device" in § 86.004-2 has been met.*"

40 CFR 86.004-2 states:

> *<u>"Defeat device</u> means an auxiliary emission control device (AECD) that reduces the effectiveness of the emission control system under conditions which may reasonably be expected to be encountered in normal vehicle operation and use, unless:*
>
> > *(1) Such conditions are substantially included in the applicable Federal emission test procedure for heavy-duty vehicles and heavy-duty engines described in subpart N of this part:*
> > *(2) The need for the AECD is justified in terms of protecting the vehicle against damage or accident; or*
> > *(3) The AECD does not go beyond the requirements of engine*

starting."

The commenter implies the three exclusions in 86.004-2 are narrowly defined, and could exclude many control strategies. This is incorrect. The first provision 40 CFR 86.004-2 for an AECD to be excluded from consideration as a defeat device are conditions which are substantially included in the applicable Federal emission test procedure for HDDEs, which in 2007 includes the pre-existing transient FTP, the SET, and the NTE. Emission control strategies which are substantially included in these test procedures would not be considered a defeat device. Emission control strategies which trade off NO_x for PM emissions control during the FTP, SET, and NTE are widely expected to be used, and therefore if such strategies are substantially used during the FTP, SET, or NTE, such strategies would not be considered to be a defeat device. Therefore, we disagree with the comment that the prohibition of defeat device regulatory language in 40 CFR 86.004-16 impacts the stringency of the emission standards.

(F) In setting the standards, EPA should consider emissions legislation in Europe and Japan.

(1) EPA has failed to take into consideration the Euro 4/2 emissions standards set forth in Europe for 2008 (PM standard of 0.02 g/bhp-hr). These standards are very demanding, require the introduction of advanced engine and aftertreatment technology, and will considerably improve air quality. Contrary to EPA's proposal, they are considered to be technologically feasible and should be used as the "Initial" standards for HDDE emissions.

<u>Letters:</u>

DaimlerChrysler (IV-D-344) p. 6

<u>Response to Comment 3.1.1(F):</u>

We disagree with the commenter. We have specifically considered the Euro standards for 2008 (0.02 g/bhp-hr PM) in setting our 0.01 g/bhp-hr PM standard and have generally considered the existing and anticipated emission control legislation in both Europe and Japan. However, we have concentrated on our Clean Air Act responsibility to set standards as low as can be reasonably achieved considering factors such as feasibility, cost, and safety. In so doing, we have reached the conclusion that the standard should be set at 0.01 g/bhp-hr, a level we believe is feasible and cost effective. The rationale behind that belief is discussed in full in Chapter III.A of the final RIA for this rule.

(G) EPA should reduce the formaldehyde standard to .01 grams per brake-horsepower hour, instead of 0.16.

(1) Commenter provided no further supporting information or detailed analysis.

<u>Letters:</u>

CA Air Resources Board (IV-D-203) **p. 3**
Coalition for Clean Air (IV-F- 190) **p. 177**
NY DEC (IV-D-239) **p. 2**
Natural Resources Defense Council (IV-F-190) **p. 102**
Ozone Transport Commission (IV-D-249) **p. 3**

(2) This standard was determined to be feasible by CARB in its recent Transit Bus Rule.

Letters:

American Lung Association (IV-D-270) **p. 18-19**
STAPPA/ALAPCO (IV-D-295) **p. 2, 16**

(3) Ambient monitoring and modeling data demonstrate that formaldehyde levels exceed the 1 in 100,000 cancer risk benchmark in almost all urban areas in the U.S.

Letters:

American Lung Association (IV-D-270) **p. 18**
NESCAUM (IV-D-315) **p. 3, 5**

Response to Comment 3.1.1(G):

We have decided to eliminate the formaldehyde standard from the final requirements for diesel and gasoline engines. We believe these engines will emit well below the standard level we proposed and, importantly, that they will do so not because of the formaldehyde standard, but because they will be indirectly controlled via the stringent NMHC standard being finalized. We plan to monitor the issue of formaldehyde emissions from diesel engines to ensure that formaldehyde emissions continue at very low levels. If we find that formaldehyde emissions are indeed a concern, we would reconsider the possibility of setting a formaldehyde standard.

We are adopting the CARB LEV II formaldehyde standards for chassis-certified heavy-duty vehicles. We believe that since manufacturers will already be complying with these standards for CARB certification, their inclusion in this federal rulemaking will not be burdensome. We are not adopting more stringent formaldehyde standards for these vehicles. The primary value of these formaldehyde standards would be for methanol-fueled engines, since they can tend to have high engine-out emissions of formaldehyde. However, since there is no averaging program available for compliance with the formaldehyde standards, we must set the standards to be feasible for the broad variety of heavy-duty engines that will be produced in 2007 and later, including methanol-fueled vehicles.

The Agency shares the commenters' concern about potential adverse health affects from exposure to ambient concentrations of formaldehyde. Monitoring and modeling data suggest that exposure to formaldehyde in 1990 exceeded health benchmark cancer risk levels of 10 in 100,000 in many census tracts across the nation.

Agency action to reduce emissions and exposure to air toxics, including formaldehyde, has been informed by the relative contribution of formaldehyde emissions from various mobile source categories. In 1996, for example, mobile sources accounted for about 50 percent of total formaldehyde emissions from all sources. Within the mobile source inventory, the contribution was split roughly in half between gasoline-powered passenger cars and light duty trucks, and nonroad vehicles and equipment. On-highway heavy-duty vehicles accounted for about 3 percent of total formaldehyde emissions.

Since the passage of the Clean Air Act Amendments in 1990, the Agency has focused primarily on controlling air toxic emissions from light duty vehicles. By 2020, these vehicle and fuel-based controls are expected to result in a 54 percent reduction in formaldehyde emissions from 1996 levels. Most recently, the Agency proposed a mobile source air toxics rule that proposes to cap fuel benzene content at current levels, and finds that more stringent vehicle-based controls on air toxics, including formaldehyde, are not available in the near term. Importantly, the proposed rule commits the Agency to re-evaluate the need for, and feasibility of, additional air toxic controls (including controls on nonroad) in a future rulemaking in 2003 - 2004.

(H) EPA has stated that diesel engines emit significantly below the proposed formaldehyde standard, and therefore no such standard should be established for HDDE.

(1) EPA should not set a formaldehyde standard without meeting the criteria of section 202(a).

Letters:

American Petroleum Institute (IV-D-343) **p. 21**

Response to Comment 3.1.1(H):

See Response to Comment 3.1.1(G).

(I) EPA should apply the NTE limits as currently contained in the Consent Decree between the U.S. and a number of diesel manufacturers, to all heavy-duty engines and vehicles, regardless of the fuel used.

(1) Commenter also opposes any revisions to the NTE limits currently in the Consent Decree.

Letters:

Natural Resources Defense Council (IV-D-168) **p. 9-11**, (IV-F-75, 191) **p. 68**

(2) Basing the emissions standards on a distinct cycle and using the NTE zone to help ensure in-use control creates a comprehensive program.

Letters:

NESCAUM (IV-D-315) **p. 8**
STAPPA/ALAPCO (IV-D-295) **p. 19-21**

Response to Comment 3.1.1(I):

We did not propose to apply NTE emission limits to HD gasoline engines or HD vehicles, and this final rule does not contain NTE limits for these categories of HD engines & vehicles. As discussed in the proposal (see 65 FR 35463 and 65 FR 35465, June 2, 2000) we intend to purse under separate rulemaking actions means of appropriately addressing off-cycle emissions both for HD gasoline engines (such as NTE requirements), and for HD vehicles (such as supplemental FTP requirements), and we do not rule out the possibility that these provisions could be implemented by model year 2007 or earlier.

We generally agree with the comments under (2). We also believe that the somewhat limited type of driving conditions reflected in the pre-existing FTP for HDDE in combination with the defeat device prohibition is not the most effective approach in the long term to ensure appropriate emission control from HDDEs under all conditions in use, and therefore the NTE requirements are necessary and appropriate for HDDEs. As mentioned above in this response, the appropriate measures to ensure control for gasoline-fueled HD engines will be considered in a separate rulemaking.

(J) Agrees with EPA proposal to add a steady-state test cycle.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

American Lung Association (IV-D-270) **p. 29**

(2) The proposed supplemental steady-state test cycle is needed so that the FTP reflects a greater range of driving conditions experienced on the road, especially those relying on the increased use of electronic engine management systems. The mid-speeds and mid-to-high loads represented by the proposed steady-state test are the speeds and loads at which these engines are designed to operate for maximum efficiency and durability.

Letters:

NESCAUM (IV-D-315) **p. 6**
STAPPA/ALAPCO (IV-D-295) **p. 19-20**

Response to Comment 3.1.1(J):

We agree that the steady-state test cycle helps ensure emission performance across the typical range of in-use operation. As discussed in the Phase 1 rule, the supplemental emission test (SET, formerly referred to as the supplemental steady-state test) tests an engine under standard FTP laboratory conditions over engine operation which is not well represented by the pre-existing FTP. Together with the FTP, NTE and prohibition of defeat devices, the SET forms a comprehensive set of emission tests and regulations which ensure the emission reduction benefits the FTP standard is intended to provide actually occur in-use.

(K) The supplemental NTE and steady-state provisions have a very significant impact on the stringency and feasibility of the proposed standards.

(1) Since the final provisions remain unclear, it is difficult to comment on how they would impact the technical feasibility of the proposed standards. Commenter suggested that EPA provide assurances that there will be adequate time for public review and comments on these supplemental provisions after the 2004 rule has been finalized.

Letters:

Detroit Diesel Corporation (IV-F-168, 116) **p. 198**

Response to Comment 3.1.1(K)(1):

We disagree with the comment that commenters were uncertain how to respond to the proposed supplemental requirements (not-to-exceed standard, supplemental steady state standard, MAEL requirements, and load response test requirements). As discussed in the proposal (see 65 FR 35463, June 2, 2000) we proposed to apply the supplemental requirements contained in the October 29, 1999 Phase 1 proposal (64 FR 58472) to the 2007 Phase 2 engines. The Phase 1 proposal contained a detailed description of all aspects of the supplemental requirements, which afforded all commenters ample detail on which to comment on the application of these supplemental requirements to the Phase 2 engines. The Phase 1 final rule was signed on July 31, 2000, and a copy of the final rule was posted on the EPA web site on August 1, 2000, 13 days before the close of the comment period for this rule. An e-mail message notifying interested parties of the signing and posting of the final rule was sent out on August 1, 2000 (see copy of e-mail message from William Charmley, US EPA, with subject line "U.S. EPA final rule for model year 2004/5 on-highway heavy duty engine and vehicle rule signed", available in EPA Air Docket A-99-06). A notice of availability of the Web posting of the final rule was published in the Federal Register on August 3, 2000, 11 days before the close of the comment period for this rule (see 95 FR 47706, August 3, 2000) . Finally, the Agency sent letters to all parties who provided the Agency with a written request for an extension of the comment period, expressing our willingness to make every effort to assess information which we receive after the close of the comment period (see various letters available in EPA Air Docket A-99-06). While there were changes made to the supplemental requirements in the final Phase 1 rule as compared to the October 29, 1999 proposal, these changes all moved supplemental requirements directionally in favor of the comments submitted by engine manufacturers on the Phase 1 rule (e.g., 3 years of additional lead time for NTE and SET compliance, NTE deficiencies), and all commenters were provided at least 13 days on which to comment on these changes before the close of the comment period, in addition to opportunity to comment even after the close of the comment period.

(2) The NTE requirements appear to have no basis, provide no benefit and thus, are not necessary until EPA establishes an in-use program. EPA should withdraw the NTE requirements and should not incorporate them into any final rule.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 61**

(3) Given the inherent variability associated with both engine-out emissions and the reduction efficiency of advanced emission control technologies required under the 2007 standards, it will not be possible to eliminate variability in the emission rates over all engine conditions. Commenter notes that in the context of another attempt by EPA to impose a not-to-exceed cap, the D.C. Circuit cautioned that reasoned decision making requires EPA to "explain how the standard proposed is achievable under the range of relevant conditions which may affect the emissions to be regulated." [National Lime Ass'n v. EPA, 627 F.2d 416, 433 (D.C. Cir. 1980)]. In this case, as in National Lime, EPA has not accounted for routine variations, and has not provided any cost basis for doing so. Commenters provided significant discussion on this issue. (See also Issue 3.2.1.)

Letters:

Cummins, Inc. (IV-D-231) **p. 22-26**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 54-56**

<u>Response to Comment 3.1.1(K)(2)and(3):</u>

We disagree with the comments under (2). The Phase 1 final rule is clear regarding the enforcement provisions which apply to the NTE standard. 65 FR 59911 states:

"As noted above, we are adding two supplemental sets of requirements for HDDEs: (1) a supplemental steady-state test (SSS); and (2) Not-To-Exceed requirements (NTE). Like current emission requirements, these new requirements apply to certification, production line testing, and vehicles in actual use. These supplemental requirements will take effect with the 2007 model year. All existing compliance provisions (e.g., warranty, certification, production line testing, recall) are applicable to these new requirements as well, except as noted in the regulations. The supplemental requirements establish new emission standards for HDDEs, and these new standards will be enforced in the same manner as the preexisting FTP standard. The new SSS will become part of the Agency's existing selective enforcement audit (SEA) program; however, as discussed in the Response to Comments document, the NTE, as well as the MAEL and EPA selected steady-state "mystery points" discussed below have been excluded from the SEA regulations."

These statements contain no ambiguity or uncertainty, it is clear how and when engines must comply with the NTE; the NTE is an emission standard, and it will be enforced as an emission standard in the same way the pre-existing FTP standard has been enforced, unless noted otherwise in the regulations. The only place noted otherwise in the regulations is the selective enforcement audit program (SEA). Engines tested under the regulatory (SEA) program will not be tested against the NTE at this time, but engines must be certified to the NTE. Engines produced for the 2007 and later model years must comply with the NTE, and engines in-use must comply with the NTE. The fact that a regulatory requirement for a manufacturer-run in-use testing program (such as the CAP 2000 program for light-duty vehicles) does not currently exist for HD diesel engines does not mean a manufacturer does not understand their clear obligations under the regulations to produce engines which comply with the applicable emission standards throughout the engines regulatory useful life. HD diesel engine manufacturers do not have a regulatory responsibility to perform manufacturer run in-use testing program(s) to demonstrate compliance with the pre-existing FTP, but their obligations to produce engines which comply with the FTP in-use are clear.

We disagree with the comment that the NTE has no basis and provides no clear benefit. The basis and benefits of the NTE were clearly articulated in the Phase 1 final rule which established the NTE standard, and will not be repeated here (see 65 FR 59896). See also the Response to Comments for the Phase 1 rule, IV-A-11, Issue 8. The reasons provided in the Phase 1 final rule are equally applicable to the regulations promulgated in this rule.

We disagree with the comments regarding variability in emission rates over all engine conditions. It should be noted the commenters provide no relevant data or discussion to support their assertion regarding the "inherent variability" associated with the advanced emission control technologies required under the Phase 2 diesel standards (GM/Isuzu cite data provided in their written comments on the Phase 1 rule regarding heavy-duty <u>gasoline</u> engines). The commenters imply that the NTE standard requires them to remove the variability associated with the advanced emission controls expected to be used to meet the Phase 2 standards. This is incorrect. The NTE does not require engine manufacturers to eliminate engine emissions variability. In fact, the NTE clearly recognizes the variability which can be expected from the technology we anticipate will be used to achieve the 2007 standards. The NTE standard for this rule is 1.5 x the FTP standard. This means that during engine operation subject to the NTE, emissions can be as high as 50 percent above the FTP standard. In the final RIA for this rule we discuss the variability of emissions across the NTE control zone, and we discuss how engines will be able to comply with the NTE standard in 2007. In addition, as discussed in the final RIA, we made changes to the minimum NTE emissions sample time specifically to address the variability of emissions associated with the advanced emission control devices for NO_x and for NMHC.

With regard to the citation to National Lime Ass'n v. EPA, the Agency has in-fact explained in this final rule how the NTE emission standard is achievable under the range of conditions during which the engine must comply with the NTE (see Chapter III of final RIA).

(L) Opposes the SS and NTE standards since these standards would force compliance far below the stated emission standards and since it is unclear whether they provide any benefits.

(1) EPA is claiming no environmental benefits associated with these standards beyond ensuring adequate in-use control. EPA could achieve the same in-use control through design and implementation of an effective EPA compliance and enforcement program.

Letters:

Marathon Ashland Petroleum (IV-D-57) **p. 2,** (IV-D-261) **p. 35-36**

(2) EPA has performed no modeling of the benefits of the proposed SS and NTE standards, and has presented no credible evidence to support the need for the proposed standards. It is not clear whether EPA believes the SS and NTE provide any environmental benefits and thus whether any costs associated with meeting these standards is justified. If EPA does not believe these standards provide any benefits, they should not be adopted. If EPA believes they do provide benefits, then it should revise the emission modeling to take credit for these benefits. Also, the multipliers EPA proposes had their genesis in a settlement agreement, and were not established in a rulemaking process; EPA needs to apply a cost-effectiveness analysis to these multipliers and not simply carry them over. EPA also needs to provide a rationale for the standards as required by section 202(a)(3), or the standards are arbitrary.

Letters:

American Petroleum Institute (IV-D-343) **p. 20, 21-23**
Marathon Ashland Petroleum (IV-D-261) **p. 16, 28, 35**

(3) Of any benefits that the standards may have, according to the DEC-SE report the differences between a 15 ppm or 30 ppm sulfur fuel are negligible: only about 0.01 g/bhp-hr. In fact, raising the SSS and NTE standards would achieve more of EPA's proposed benefits.

Letters:

American Petroleum Institute (IV-D-343) **p. 22**

(4) SSS and NTE standards are not necessary to preserve air quality in urban areas, and are too stringent to apply in rural areas that do not require NO_x and particulate reductions. The NTE specifications are an artifact of testing to ensure that there is no cycle beating on the part of the engine manufacturers, and the petroleum industry should not have to pay to achieve this goal. Commenter asserts that additional in-use testing by EPA, not complicated and unnecessary regulations, is the best way to ensure reasonable in-use emissions.

Letters:

American Petroleum Institute (IV-D-343) **p. 23**

Response to Comment 3.1.1(L):

We disagree with the comment that an EPA run in-use testing program would replace the need for the supplemental emissions requirements (NTE & SET). As discussed in the Phase 1 rule, the NTE and SET requirements serve several important goals which would not be addressed by an EPA run in-use testing program. The SET and the NTE include engine operation which is not well represented by the pre-existing FTP, such as highway cruise operation (as represented by the SET) and transient operation during mid-speed operation (as represented by the NTE). The NTE requires compliance with an emission standard under broader ambient operating conditions (e.g., humidity and temperature) than the pre-existing FTP or the SET. The NTE and SET requirements, when combined with the pre-existing FTP and the prohibition of defeat devices provides the manufacturers with certainty regarding the legality of a large number of auxiliary emission control devices (AECDs) which previously would have been determined by EPA on a case-by-case basis. Finally, the NTE test can be run in-use, on-the-road, in a vehicle, which strengthens the ability of the Agency to perform real world in-use testing, while it would not be possible to perform the SET or the pre-existing FTP test on-the-road. An EPA run in-use testing program would not provide any of the these benefits. Therefore, we disagree with this comment. This is not to say we don't see a benefit in an in-use testing program for on-highway heavy-duty engines; in fact, the NTE requirements would complement an in-use testing program.

We disagree with the suggestion that the NTE and SET standards are not needed. The commenter implies that the Agency must perform a separate emissions benefits modeling analysis for the supplemental emission requirements (SET & NTE), and a separate cost-effectiveness analysis for the supplemental requirements in order to justify the need for the NTE and the SET requirements. This is incorrect. We have clearly articulated the need for the SET and the NTE requirements. As discussed in the Phase 1 rule, the SET and the NTE requirements complement the pre-existing FTP and the prohibition of defeat devices in order to ensure the emission benefits which we model based on the pre-existing FTP standard actually occur in-use. The commenters suggest that if we finalize the supplemental emission requirements we should revise our emissions modeling to take credit for the additional environmental benefit which occurs from the supplemental tests. However, our current and historical modeling has estimated that on average, in-use, HDDEs emit near the FTP emission standard. One purpose of the NTE and SET requirements is to ensure this happens. The commenter implies the emission benefits of the NTE and the SET can easily be separated from the emission benefits of the preexisting FTP; however, this is not the case. The FTP applies to engine operation that is included in the NTE and the SET (though the FTP also covers engine operation which is not covered by the NTE or the SET requirements). In addition, the defeat device prohibition is designed to protect against reduced emission control outside of FTP conditions. It is difficult, if not impossible, to determine how much emission reduction could be attributed separately to the NTE and the SET requirements as compared to the preexisting FTP, or the defeat device prohibition. The Agency is not required to perform a cost-effectiveness analysis of the supplemental requirements. The CAA requires the Agency to consider a number of factors, including costs, which we have done. As discussed in the RIA for this final rule, the emission control technology which manufacturers will use to comply with the FTP is the same control technology which will be used to comply with the NTE and the SET. The only additional costs associated with the supplemental tests are additional development and calibration testing, as well as certification costs, which we have accounted for in this final rule. The comments regarding the genesis of the supplemental requirements in the October 1998 heavy-duty diesel engine consent decrees are not relevant to this rulemaking. In this rule we have met our obligations regarding notice and comments requirements, and have established emission standards for the SET and the NTE for model year 2007 HDDEs which are technologically feasible and are otherwise appropriate under the CAA. Moreover, we have revised the multiplier for the NTE requirements related to the standards promulgated in this rule.

We disagree with the comment that 30 ppm sulfur is sufficient for on-highway diesel fuel. As discussed in the preamble and the RIA for this final rule, there are many reasons why a 15ppm sulfur cap is necessary to achieve the standards established in this rule. This includes, but is not limited to: the ability to meet the NO_x and PM standards, not just for the supplemental requirements, but also the pre-existing FTP, for the full useful life of the engines. As discussed in the RIA, the long term durability of both the NO_x adsorber technology as well as catalyzed diesel particulate filters is dependent on the availability of a 15ppm sulfur cap diesel fuel (see Chapter III of the RIA). The commenter implies that the level of the standard set for the NTE and/or the SET is the driving factor for the Agency's decision that a 15 ppm sulfur cap is required. This is incorrect. Even if the SET and the NTE requirements did not exist, a 15 ppm sulfur cap would be necessary in order for the FTP standards promulgated in this rule to be technologically feasible for the full useful life of HDDEs. Given the need for a 15 ppm cap sulfur fuel to enable the FTP standards to be met, we have established the FTP, SET and the NTE standards at levels which are technologically feasible and appropriate considering the use of 15 ppm sulfur fuel. Please see the preamble and the RIA for this final rule regarding the justification for low sulfur diesel fuel and the environmental need for the 0.01 g/bhp-hr FTP PM standard and the supplemental PM standards promulgated in this rule. The commenters provided no rational explanation or data regarding the comment that raising the SET and the NTE standards would achieve more of EPA's proposed benefits, and we do not believe raising the SET or the NTE standard would result in an increased emissions benefit.

We disagree with the comment that the supplemental requirements are not necessary to preserve air quality in urban areas. The commenters present no data to support such a statement. The commenters suggest the Agency should set one set of standards for HDDEs for urban areas, and one set for rural areas, yet such an approach would be unwise as it ignores the well known air quality issues associated with pollutant transport, as well as the fact that heavy-duty vehicles are by their very nature mobile, and go from urban areas to rural areas on a regular basis. Moreover, this rule will have considerable air quality benefits in many areas that are not urban. In addition, we disagree with the suggestion that the SET and NTE tests would not produce emission benefits in urban areas. Urban areas across the country include roadways which HDDEs travel on during which they would exercise the engine over operating conditions represented by both the SET and the NTE test. We disagree that the NTE requirements are an artifact of "cycle beating" issues on the part of engine manufacturers. As discussed above, the NTE and SET requirements are needed for a number of reasons, not only as a means to strengthen the existing prohibition of defeat devices, but also to strengthen several modes of engine operation not currently covered by the existing FTP, and to ensure that the emission reductions anticipated by the FTP standard occur in-use over a broad range of operating and ambient conditions, not just those conditions represented by the FTP laboratory test. We also disagree with the comment regarding the replacement of the supplemental requirements with an EPA run in-use testing program. As discussed in more detail above, the commenter incorrectly assumes that the supplemental requirements and an EPA run in-use testing program could serve the same purpose, which they do not.

(M) EPA has no authority to promulgate and enforce the high altitude requirements for HDDEs and vehicles as proposed.

(1) EPA must set specific high altitude emission standards for HDDEs and vehicles in order to enforce any high altitude requirements. [cites to CAA Section 202(f)(2); 42 USC Section 7521(f)(2)] EPA has failed to do so and the proposed rule does not contain any analysis or determination of the need for and technological feasibility of the standards proposed.

Letters:

Engine Manufacturers Association (IV-D-251) p. 87

Response to Comment 3.1.1(M):

The commenter misreads the statute. Section 202(f)(2) clearly applies only to engines manufactured before model year 1984. In any case, we provided clear evidence in the Phase 1 rule that the NTE, which explicitly applies at all altitudes up to 5,500 feet, is feasible for all altitudes covered by that requirement. As discussed at length in Chapter III.A of the final RIA contained in the docket for this rule, we believe the NTE PM standard is technologically feasible across the required range of ambient conditions. CDPFs are mechanical filtration devices, and ambient altitude will have minimal, if any, effects on CDPF filtration efficiencies. Particulate sulfate make is sensitive to high exhaust gas temperatures; however, at sea-level conditions, the NTE requirements apply up to ambient temperatures which are only 14°F greater than standard test cell conditions (100°F under the NTE, versus 86°F for HD FTP laboratory conditions). At an altitude of 5,500 feet above sea-level, the NTE applies only up to an ambient temperature within the range of standard laboratory conditions (i.e., 86°F). These small or non-existent differences in ambient temperature should have little effect on the sulfate make of CDPFs, and even when tested under conditions representative of worst case (extended peak-torque operation) engine conditions at 15 ppm S, we believe the engine would comply with the PM NTE standard. Based on the available test data and the expected impact of the expanded, but constrained, ambient conditions under which engines must comply with the NTE, we conclude that the PM NTE standard is technologically feasible by 2007, provided low sulfur diesel fuel (<15 ppm) is available.

Regarding NO_x, the NTE requirements apply not only during laboratory conditions applicable to the transient FTP and the SET tests, but also under the wide range of ambient conditions for altitude, temperature and humidity specified in the regulations. These expanded conditions will have minimal impact on the emission control systems expected to be used to meet the NTE NO_x standard contained in this final rule. In general, it can be said the performance of the NO_x adsorbers are only affected by the exhaust gas stream to which the adsorbers are exposed. Therefore, the impact of ambient altitude will only effect the performance of the adsorber to the extent the ambient conditions change the exhaust gas conditions (i.e., exhaust gas temperature and gas constituents). The effect of altitude on NO_x adsorber performance should be minimal, if any. The NTE test procedure regulations specify an upper bound on NTE testing for altitude at 5,500 feet above sea-level. The decrease in atmospheric pressure at 5,500 feet should have minimal impact on the NO_x adsorber performance. Increasing altitude can decrease the air-fuel ratio for HDDEs which can in turn increase exhaust gas temperatures; however, as discussed in the Phase 1 final rule, Phase 1 technology HDDEs can be designed to target air-fuel ratios at altitude which will maintain appropriate exhaust gas temperatures, as well as maintain engine-out PM levels near the 0.10 g/bhp-hr level, within the ambient conditions specified by the NTE test procedure.

The commenter has provided no data regarding the ability or inability of engines to meet these standards at altitude.

(N) Expressed support for closing the crankcases on turbocharged engines since this is a significant source of toxins.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

NY DEC (IV-F-52)
Natural Resources Defense Council (IV-D-168) **p. 7**

(2) Crankcase ventilation PM emissions are becoming an increasingly important source of PM emissions as EPA continues efforts to reduce exhaust PM emissions from diesel engines. Nearly all turbocharged and aftercooled diesel engines vent their blow-by gases from their crankcase. One commercially available technology option to meet EPA's proposed control requirements is a multi-stage filter system designed to collect, coalesce and return the lube oil to the engine's sump, thereby protecting the turbocharger and the aftercooler and eliminating virtually all PM emissions.

Letters:

Manufacturers of Emission Controls Association (IV-D-267) **p. 3,9**
NY DEC (IV-D-239) **p. 4**
Ozone Transport Commission (IV-D-249) **p. 2**

(3) Commenter provided as an appendix a report on closing road draft tubes.

Letters:

NY DEC (IV-D-239) **p. 12**

Response to Comment 3.1.1(N):

We agree with these commenters and are finalizing the requirement that crankcase emissions be controlled, although the final requirement is slightly different than the proposed requirement. The final requirement will allow manufacturers to continue with their typical current practice of venting crankcase emissions into the engine compartment. However, any such crankcase emissions must be measured and added into the measured exhaust emissions during any compliance test (whether in the lab or on the road). The total of the exhaust and crankcase emissions would have to be below the standards finalized in this rule. Alternatively, the crankcase emissions could be routed into the exhaust stream either upstream or downstream of the exhaust emission control devices. This way, the crankcase emissions would be directly measured during any compliance test. However, given the low levels of the standards being established in this FRM, we believe that this will not be a practical option, and that today's regulations will effectively require manufacturers to close the crankcases of all of their engines by routing them into the air intake. Regardless of the approach taken by the manufacturer, crankcase emissions will be controlled.

(O) All crankcase emissions should be eliminated by the 2005 model year.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

American Lung Association (IV-D-270) **p. 19**
City of Seattle (IV-D-297) **p. 1**
Clean Air Agency (IV-D-207) **p. 1**
NESCAUM (IV-D-315) **p. 8-9**
STAPPA/ALAPCO (IV-D-295) **p. 3, 17**

(2) With the advent of closed crankcase filtration systems, there is no longer a need to wait until MY 2007 to control crankcase emissions. A single truck can emit over 100 lbs. of NO_x, NMHC & PM from the crankcase over the lifetime of the engine.

Letters:

CA Air Resources Board (IV-D-203) **p. 6**
TX Natural Resource Conservation Commission (IV-G-3) p. 2

Response to Comment 3.1.1(O):

The final requirement to control crankcase emissions from turbocharged engines allows for maximum flexibility in how to do so (See Response to Comment 3.1.1(N)). Requiring that crankcase emissions be controlled prior to the requirement that engines be certified to emission levels expected to require exhaust emission control devices would eliminate some of the flexibility provided by the final crankcase emission requirement. Therefore, we believe that the timing for the control of crankcase emissions must coincide with the expected application of exhaust emission control devices, i.e., the 2007 model year timeframe.

(P) Opposes the elimination of the exemption for turbocharged engines from the closed crankcase requirement.

(1) The vast majority of the crankcase emissions are in the form of lube oil vapor

and do not represent an air quality problem. Recirculating this effluent to the engine intake will, on the other hand, have a number of adverse effects which will degrade engine performance and emission control. The deposition of oil vapors on the turbocharger compressor and in the charge cooler will result in fouling and loss of effectiveness. Build-up of deposits in the intake ports and on intake valves is also likely with additional loss in performance. Also, sulfur and ash from the breather oil will accelerate the sulfur poisoning and ash plugging of exhaust catalyst and particulate filter systems. The increased emissions as a result of these effects may more than offset the 100 pound emission reduction that EPA claims is achievable by closing the breather. It is not technologically feasible to achieve the proposed NO_x and PM emission standards for the full useful life of a HD engine in the face of a requirement to recirculate crankcase emissions. One commenter noted that if EPA proceeds with this requirement, it should simply require manufacturers to combine crankcase emissions with exhaust emissions for test purposes and for demonstrating compliance with applicable standards. Another commenter added that EPA has not adequately justified the need for or analyzed the technological feasibility of, any type of crankcase emissions control and should develop a proposal for the control of these emissions that addresses the justification, practicality and feasibility of the controls. (See also Issue 3.2.1.)

<u>Letters:</u>

Cummins, Inc. (IV-D-231) **p. 28-29**
Detroit Diesel Corporation (IV-D-276) **p. 21-23**
Engine Manufacturers Association (IV-D-251) **p. 52-53**

<u>Response to Comment 3.1.1(P):</u>

We disagree with the commenters. We believe that crankcase emissions can be controlled in a manner that will not adversely impact durability. We agree with MECA that there are systems that can remove nearly all of the lube oil vapor from the crankcase gases. Such systems allow the gases to then be routed into the air intake without causing damage to the turbo compressor or charge air cooler, and will likely also allow the gases to be routed into the exhaust upstream of the exhaust emission control systems. Either one of these approaches would essentially eliminate the crankcase emissions and would address any lube oil vapor concern. As suggested by commenters, we have revised our final requirement to provide manufacturers with maximum flexibility in controlling crankcase emissions (please refer to our response to comment 3.1.1(N)).

We also do not agree that crankcase emissions do not represent an air quality concern. As we noted in our proposal, a diesel engine can emit as much as 100 pounds of NO_x, NMHC, and PM from the crankcase during its lifetime. As noted in Chapter II of the RIA, based on limited engine testing, we estimate that crankcase emissions of NMHC and PM from HDDEs are each about 0.01 g/bhp-hr. NO_x data varies, but crankcase NO_x emissions may be as high as NMHC and PM. Therefore, we use the same crankcase emission factor of 0.01 g/bhp-hr for each of the three constituents. With our new crankcase emission control requirements, we assume that these crankcase emissions will be eliminated on Phase 2 engines. Table II.B-10 of the RIA shows our estimated crankcase emission reductions. For the year 2010, these are 3.7 tons each of NO_x, NMHC, and PM.

(Q) An NTE standard for gasoline engines is needed to ensure compliance with the standards over all operating conditions.

(1) The NTE approach takes all of the benefits of a numerical standard and test procedure and expands it to cover a broad range of conditions. With the NTE approach, in-use testing and compliance become much easier, since emissions may be sampled during normal vehicle use.

Letters:

CA Air Resources Board (IV-D-203) **p. 5**
NESCAUM (IV-D-315) **p. 7-8**

Response to Comment 3.1.1(Q):

We agree that an NTE approach may be appropriate for HD gasoline engines, for the reasons articulated by the commenters. However, as discussed in response to comment 3.1.1(I), we did not propose to apply NTE emission limits to HD gasoline engines or vehicles, and this final rule does not contain NTE limits for these categories of HD engines & vehicles. As discussed in the proposal (see 65 FR 35463 and 65 FR 35465, June 2, 2000) we intend to pursue under separate rulemaking actions means of appropriately addressing off-cycle emissions both for HD gasoline engines (such as NTE requirements), and for HD vehicles (such as supplemental FTP requirements), and we do not rule out the possibility that these provisions could be implemented by model year 2007 or earlier.

(R) EPA should eliminate the idle CO emissions standard.

(1) The idle CO emission standard is a completely unnecessary requirement for HD gasoline engines and vehicles, and EPA has proposed no justification for the continuation of such a requirement. Engine manufacturer data to date indicate that idle CO emissions are near zero. There is no air quality benefit from retaining this requirement and the vast majority of the nation is essentially in attainment with respect to the ambient CO concentrations. Elimination of this requirement would be consistent with EPA's action in the Tier 2 rulemaking.

Letters:

Ford Motor Company (IV-D-293) **p. 11**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 42**

Response to Comment 3.1.1(R):

EPA is not required to justify the continuation of an existing requirement, as suggested by the commenters. However, we agree that the idle CO requirement is being met with levels near zero. For that reason, it appears that the idle CO requirement may not be necessary. We did not propose eliminating this requirement and are concerned about doing so unless there is some way to ensure that idle CO emissions will not be a problem during in-use operation. We believe that a properly designed and operating on-board diagnostics (OBD) system provides this assurance because it would detect problems likely to cause high idle CO emissions. For this reason, we believe it is appropriate to eliminate the idle CO requirement for any engines and vehicles certified to the OBD requirements finalized in our Phase 1 rule. Those OBD requirements apply to all heavy-duty engines and vehicles up to 14,000 pounds. Therefore, engines greater than 14,000 pounds will still have to meet the idle CO requirements. We plan to address OBD requirements for engines greater than 14,000 pounds in the future and, with such requirements in place, the idle CO requirement for those engines might be eliminated provided we are confident that idle CO emissions will remain at very low levels.

(S) EPA should revise the PM standard for HD diesel engines.

(1) EPA should impose the following more feasible PM standards for HD diesel engines: 0.03 g/bhp-hr for vehicles greater than 14,000 GVWR and 0.02 g/bhp-hr for vehicles less than or equal to 14,000 GVWR. These are based on an estimate of the lowest feasible standards given PM trap efficiencies and the different durability requirements for engines above and below 14,000 GVWR.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 51-52**

Response to Comment 3.1.1(S):

EPA disagrees with the suggestion that the 0.01 g/bhp-hr PM standard being finalized in this rule is not feasible. However, diesel fuel sulfur levels must be capped at 15 ppm in order for the 0.01 g/bhp-hr standard to be feasible for many reasons including sulfate make and PM trap durability. This issue is discussed in detail in Sections III.E and III.F of the final preamble for this rule and Chapter III.A of the final RIA contained in the docket for this rule.

(T) EPA's proposed emission standards are arbitrary.

(1) EPA does not provide any justification in the proposed rule for the NO_x and PM emission standards and yet, these standards drive the need for the experimental emissions control devices EPA is seeking to mandate as part of the proposal.

Letters:

Society of Independent Gasoline Marketers of America (IV-D-328) **p. 2**

(2) There is no evidence that EPA's proposed standards were calculated based on quantifiable health effects (see Issue 2.1) or that they are necessary to achieve NAAQS (see Issue 2.2).

Letters:

Marathon Ashland Petroleum (IV-D-261) p. 16, 91-92

Response to Comment 3.1.1(T):

EPA disagrees with these comments. EPA’s standards are based on health risks clearly identified in the proposed and final preambles and RIAs. The levels of the standards are governed by section 202 of the Act, and are justified, as well, based on the need for the emission reductions that they will achieve. We respond to the issues raised by these commenters in detail under Issue 2.

(U) Current certification levels do not provide justification for EPA's proposed standards.

(1) Manufacturers must certify to levels well below the standard to ensure in-use compliance. The proposed emission levels would require certification levels roughly half the standard using worst-case DFs to ensure in-use compliance for the expected useful life of the vehicle, which would put the measurement equipment at the limit of capability and decrease the ability of determining an adequate emission safety margin. EPA has not accounted for manufacturers' responsibilities in this case.

Letters:

Ford Motor Company (IV-D-293) **p. 7**

Response to Comment 3.1.1(U):

The comment and this response refer to the proposed heavy-duty gasoline emission standards. We understand that current durability requirements are for typical, or average, deterioration while future requirements will call for worst-case deterioration. Nonetheless, we do not believe that worst-case deterioration will result in a significantly higher certified emission level. We expect that recent advances in catalyst technology will result in far more durable catalysts and that catalyst deterioration, even at worst case levels, will not result in significant emissions deterioration.

As for pushing the measurement equipment to the limit of its capability, we believe that the gasoline standards being finalized are consistent in stringency to the Tier 2 light-duty standards. And, more importantly, they do not require measurement to levels as low as the Tier 2 standards or the California LEV II standards. Therefore, we believe that measurement equipment will be able to measure emissions at these low levels and have demonstrated this in our own laboratory.

Issue 3.1.2: Gasoline Vehicle Exhaust Standards

(A) Expressed support specifically for the vehicle standards as proposed by EPA.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

NESCAUM (IV-D-315) **p. 10-11**, (IV-F-63)
Natural Resources Defense Council (IV-F-75), (IV-|F-191) **p. 68**
STAPPA/ALAPCO (IV-F-32, 78) (IV-F-117) **p. 29** (IV-F-191) **p. 32**

(2) Supports the more stringent gasoline HDE standards since the Tier 2 technologies and the availability of low sulfur gasoline will allow these engines to comply with the proposed standards by 2007.

Letters:

National Automobile Dealers Association (IV-D-280) **p. 3**

Response to Comment 3.1.2(A):

EPA concurs with these comments.

(B) The same supplemental steady state testing should be applied to both diesel and gasoline fueled engines and vehicles.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

NESCAUM (IV-D-315) **p. 8**
WI DNR (IV-D-291) **p. 2**

Response to Comment 3.1.2(B):

We disagree with the comment that the supplemental emission test (the 13-mode steady-state test) is appropriate for HD gasoline engines. We did not propose to apply this test to HD gasoline engines, and this final rule does not apply this test to HD gasoline engines. As discussed in the Phase 1 rule, the SET test is based on the European Euro-III steady-state test, which was developed specifically for heavy-duty diesel engines. With respect to applying the NTE concept to HD gasoline engines, see response to comments 3.1.1(I) and 3.1.1(Q).

As for applying these requirements to gasoline vehicles, we do not believe that would be appropriate given that the supplemental steady-state requirements apply to engine certified systems (vehicles are chassis certified). However, we believe it may be appropriate to require heavy-duty vehicles to comply with an alternative chassis-based test such as the supplemental federal test procedure (SFTP) which is a transient, chassis based procedure analogous to the supplemental steady-state requirements for engines. We hope to address this issue in a future rulemaking.

Issue 3.1.3: Gasoline Evaporative Standards

(A) Expressed general support for the evaporative standards.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

NESCAUM (IV-D-315) **p. 11**, (IV-F-63)
National Automobile Dealers Association (IV-D-280) **p. 4**

Response to Comment 3.1.3(A):

EPA concurs with these comments.

Issue 3.1.4: Phase-ins & Implementation Schedules

(A) Opposes the proposed phase-in of the diesel engine standards since this delay will further compromise efforts to improve air quality with respect to ozone, particulates, and other toxic substances. All engines and vehicles should be required to meet the standard by 2007.

(1) Commenters provided no further supporting information or detailed analysis. This comment was made by approximately 13,900 private citizens.

Letters:

Acoff, Jeffrey, et. al. (IV-G-11)
American Lung Association (IV-F-72)
American Lung Association of Colorado (IV-D-54)
American Lung Association of Los Angeles (IV-D-47)
American Lung Association of TN (IV-D-19) **p. 1**
Asamoah, Nikiya (IV-D-09)
Bagnarol-Reyes, Carolina, et. al. (IV-G-24)
Beeman, Nora, et. al. (IV-G-09)
Braun, Carl and Norma (IV-D-69)
CO Environmental Coalition (IV-F- 191) **p. 237**
CO People's Environmental and Economic Network (IV-F-191) **p. 222**
CO Public Interest Research Group (IV-F-191) **p. 219**
CT DEP (IV-F-49)
Cassara, Bob (IV-F-65)
Chicago Asthma Consortium (IV-F-22)
Chuang, Henry (IV-F- 117) **p. 265**
Chung, Payton, et. al. (IV-D-133)
City of Arcata (IV-D-200) **p. 1**
Clean Air Council (IV-F-116) **p. 333**
Clean Air Network (IV-D-292) **p. 1**, (IV-F-191) **p. 84**
Clean Air Now Campaign (State PIRGs & citizens) (IV-D-357, 358)
Coalition for Clean Air (IV-F-190) **p. 177**
Coalition on the Environment and Jewish Life (IV-F-184)
Communities for a Better Environment (IV-F-190) **p. 129**
Community Coalition for Change (IV-F-190) **p. 74**
Congress of the United States (IV-D-294) **p. 4**
Connor, Thomas, et. al. (IV-D-132)
Corcoran, Janet (IV-D-128)
Davidson, Karin, et. al. (IV-D-79)
Dickson, Victoria, et. al. (IV-D-77)
Dolman, Suzanne, et. al. (IV-D-341)
Economic & Social Justice (IV-F- 117) **p. 236**
Environmental Defense (IV-F-56, 117) **p. 81**
Environmental Law & Policy Center of the Midwest (IV-F-6)
Environmental Law and Policy Center (IV-D-331)
Estler, Danielle (IV-F-21)
Firestone, Ross (IV-F-4)
Fleming, Scott, et. al. (IV-D-13)
Fletcher, Robert E. (IV-F-117) **p. 175**
Flowers, Bobbie (IV-G-67)

Franczyk, Catherine A., et. al. (IV-D-233)
Freechild, Aquene, et. al. (IV-G-60)
GA Forest Watch (IV-D-67) **p. 1**
GA Public Interest Research Group (IV-F-117) **p. 268**
Glendale-La Crescenta Advocates (IV-D-80) **p. 1**
Hackel, Barbara, et al. (IV-D-14) **p. 1**
Higginson, Norman, et. al. (IV-D-196)
Hirschi, Alexander (IV-D-07)
Hopkins, Steve, et. al. (IV-G-07)
Hyatt, Robert E. (IV-D-94)
IL Environmental Protection Agency (IV-D-193) **p. 1**
IL Public Interest Research Group (IV-F-18)
INFORM, Inc. (IV-F-47)
Institute for Global Solutions (IV-F-175)
Kachik, Thomas (IV-D-11)
Khalsa, Mha Atma S. (IV-D-71)
Kinyon, John, et. al. (IV-G-13)
Kotgal, Kalpana (IV-F-192) **p. 17**
L.A. County Bicycle Coalition (IV-F- 190) **p. 131**
La Grange Park (IV-D-39) **p. 1**
Landfall Productions, Inc. (IV-D-27)
Lichtman, Elijah (IV-D-08)
Lind, Karen, et. al. (IV-D-121)
Lu, Rong (IV-F-162)
Margolis, Benjamin (IV-D-33)
Mathews, Erik, et al (IV-D-24) **p. 1**
Mayer Computer Services (IV-D-81)
Mayor and citizens of Fort Collins, CO (IV-F-191) **p. 211**
Mexican-American Community Foundation (IV-F-179)
Mexican-American Legal Defense & Educational Fund (IV-F-160)
Montgomery, Jack, et. al. (IV-D-78)
Mothers for Clean Air (IV-D-95)
NESCAUM (IV-D-315) **p. 5**
NJ PIRG (IV-F-116) **p. 244** (IV-F-116) **p. 314**
NY Assembly - Health Committee (IV-F-38)
NY State Assembly (IV-F-53)
NY State Attorney General's Office (IV-D-238) **p. 1**
NY State Senator (IV-F-50)
NYC Council (IV-F-80)
NYC DEP (IV-D-159) **p. 1**
NYC Environmental Justice Alliance (IV-F-116) **p. 317**
Nadine Garcia (IV-F-183)
National Petrochemical & Refiners Association (IV-F-31)
Nerode, Gregory, et. al. (IV-D-04)
Nolan, Catherine (IV-D-169) **p. 1**
Northwest District Association (IV-D-117) **p. 1,2**
OH Environmental Council (IV-D-130) **p. 1,2**
OR Toxics Alliance (IV-D-175) **p. 1,2**
O'Leary, Cathy and John Carey (IV-G-05)
Packard, Josh (IV-G-54)
Pandey, Stacey (IV-F-117) **p. 274**
Physicians for Social Responsibility (IV-F- 117) **p. 256**

President of Bronx Borough (Fernando Ferrer) (IV-F-69)
Private citizen (IV-D-12)
Rhubert, Pamela J. (IV-D-15) **p. 1**
Richards, Donna and Bill, et. al. (IV-G-19)
Riggles, Ruth, et. al. (IV-D-102)
Rock, Steve, et. al. (IV-G-22)
Rodriguez, Dolores, et. al. (IV-D-91)
Rutherford, Jolene, et. al. (IV-D-347)
STAPPA/ALAPCO (IV-F- 191) **p. 32**
Schmitz, Randy, et. al. (IV-D-46)
Schwartz, Steve (IV-D-85)
Sherrill, Faye (IV-G-30)
Sierra Club (IV-F-159)
Smith, Bryan R., et. al. (IV-D-105)
Smith, Curt, et. al. (IV-D-49)
South Coast Air Quality Management District (IV-D-147) **p. 1**
Southwest Air Pollution Control Authority (IV-D-149) **p. 1**
Stuckey, Stephanie (IV-D-182) **p. 1**
Sullivan, Linda and Thullen, Angela (IV-F-23)
TN Environmental Council (IV-F- 117) **p. 154**
Tacha, Athena and Richard Spear (IV-G-06)
Toltz, Ken (IV-F-191) **p. 215**
Toxics Action Center (IV-G-02)
Tseng, Joyce, et. al. (IV-D-03)
U.S. PIRG (IV-F-71)
Union of Concerned Scientists (IV-F-165)
Varsbergs, Krista, et. al. (IV-D-38)
Vigo County Air Pollution Control (IV-D-137) **p. 1**
Village of Burr Ridge (IV-D-316) **p. 1**
Village of Oak Park Dept. of Public Health (IV-F-8)
WA Department of Ecology (IV-D-141) **p. 1**
WI DNR (IV-D-144)
Washington Regional Network (IV-D-18) **p. 1**
West Harlem Environmental Action/Envr Justice Network (IV-F-76)
Wilderness Society (IV-F-117) **p. 217**
Williams, Mary, et. al. (IV-D-122)
Wilmington North Neighborhood Association (IV-F-190) **p. 265**
Zellers, Tim (IV-F- 116) **p. 209**
Zweig, Robert (IV-D-30)

(2) Some commenters noted generally that the implementation of all engine and vehicle standards at the same time is technically feasible provided low sulfur fuel will be readily available by 2006 and would be easier logistically. One commenter added that if sufficient quantities of low sulfur fuel are available for selected fleets prior to 2006, manufacturers will be able to selectively introduce low NO_x technologies early enough to gain experience prior to 2007.

<u>Letters:</u>

American Lung Association (IV-D-270) **p. 17**, (IV-F-161, 164)
CA PIRG (IV-F- 190) **p. 280**

CT DEP (IV-D-142) **p. 1**
Chicago DEP/Chicago Metropolitan Mayors Caucus Clean Ai (IV-D-335) **p. 5**
DE Dept. of Natural Resources & Environmental Control (IV-D-146) **p. 1**
Estler, Danielle (IV-F-21)
Friends of the Children (IV-F-158)
GA Public Interest Research Group (IV-F-117) **p. 43**
International Center for Technology Assessment (IV-D-313) **p. 2**
Manufacturers of Emission Controls Association (IV-F-190) **p. 108**
Manufacturers of Emissions Controls Association (IV-F-187)
NY DEC (IV-D-239) **p. 5**
Natural Resources Defense Council (IV-D-168) **p. 7**, (IV-F-75, 190) **p. 102**
(IV-F-191) **p. 68**
Stewart, Jim (IV-F-170)
U.S. PIRG (IV-F- 190) **p. 185**

(3) Commenter noted that a delay beyond 2007 in implementing the rule is untenable because hundreds of thousands of new engines will be built in the interim, and diesel's long life will ensure that these engines will continue to pollute at today's levels for decades to come.

Letters:

Environmental Defense (IV-F-169)
SC Dept. of Health and Environmental Control (IV-D-143) **p. 1**
The Coalition for Sensible Energy (IV-D-264) **p. 1**

(4) A number of major metropolitan areas across the country--including New York City, Philadelphia, Baltimore, Atlanta, Houston, Chicago, Dallas, and Washington D.C.--have statutory attainment deadlines to achieve the smog health standard well before 2010. It is untenable for EPA to delay putting in place NO_x reductions that are in fact achievable and could deliver critical NO_x reduction benefits to help these metropolitan areas meet important statutory obligations to remedy harmful levels of smog.

Letters:

CT DEP (IV-D-320) **p. 1**
Environmental Defense (IV-D-346) **p. 7**
NY DEC (IV-D-239) **p. 2**
NYC DEP (IV-D-209) **p. 2**
South Coast Air Quality Management District (IV-D-147) **p. 1**
TX Natural Resource Conservation Commission (IV-G-3) **p. 2**

(5) Some commenters referred to the Manufacturers of Emission Control Association's (MECA) statement that it strongly believes that NO_x adsorber technology and catalyst-based diesel particulate filters will be commercially available by 2007 provided the proposed 15 ppm sulfur standard is achieved. These commenters added that advanced technology vehicles will be more readily available in 2007, which will further assist manufacturers with meeting the proposed standards by this date without a phase-in period.

Letters:

American Lung Association (IV-F-181, 191) **p. 146**
City of Chicago (IV-D-240) **p. 5**
Environmental Defense (IV-D-346) **p. 6**
GA Public Interest Research Group (IV-F-117) **p. 43**
Natural Resources Defense Council (IV-D-168) **p. 7-8**, (IV-F-75), (IV-F-191) **p. 68**
Ozone Transport Commission (IV-D-249) **p. 2**
U.S. PIRG (IV-F- 190) **p. 185** (IV-F-192) **p. 134**

(6) One commenter added that the implementation of the standards all at the same time would minimize the cost of compliance since engine manufacturers and after-treatment companies could distribute new equipment all at the same time without maintaining and tracking the manufacture and commercialization of engines that meet separate standards.

Letters:

Natural Resources Defense Council (IV-D-168) **p. 7**, (IV-F-75), (IV-F-191) **p. 68**

(7) One commenter noted that the implementation of other low-emission HDV standards and programs, such as CARB's urban bus standards and the EC's upcoming requirements, will create incentives for the creation and implementation of technology that could easily meet the proposed standards by 2007 without a phase-in period.

Letters:

Natural Resources Defense Council (IV-D-168) **p. 7**, (IV-F-75), IV-F-191) **p. 68**

(8) One commenter suggested accelerating the implementation schedule to 2005.

Letters:

Firestone, Ross (IV-F-4)

Response to Comment 3.1.4(A):

We strongly believe, as explained in the preamble for this rule, that a phase-in of the NO_x standard is the most appropriate course of action. As stated in the final preamble for this rule, we believe that industry should be provided the flexibility of having a phase-in of the new NO_x standard. While we believe the 0.20 gram NO_x standard is feasible in the 2007 time frame, we also believe a phase-in is appropriate for a couple of reasons. First, the phase-in will provide industry with the flexibility to roll out the NO_x control technology on only a portion of their fleet. This will allow them to focus their resources on that half of their fleet being brought into compliance in 2007. This ability to focus their efforts will increase both the efficiency and the effectiveness of those efforts. Second, a phase-in allows industry the ability to introduce the new technology on those engines it believes are best suited for a successful implementation which, in turn, provides a valuable opportunity to “field test” and refine that technology on only a portion of their product line prior to the next push toward full implementation.

As we discuss in Chapter III.A of the final RIA, we believe that NO_x adsorbers are the most attractive technology for complying with these new standards and that NO_x adsorbers will be feasible in the 2007 timeframe. However, we do not believe this will be an easy task as suggested by some of these commenters. While it is true that MECA has stated their belief that NO_x adsorbers will be commercially available by 2007, MECA does not argue for 100 percent compliance to the 0.20 g/bhp-hr NO_x standard in that year. We do not believe that the phase-in will create logistical problems as suggested by one comment, but we do agree that having sufficient supplies of 15 ppm sulfur fuel prior to 2006 might allow manufacturers to selectively introduce low NO_x technologies early to gain experience prior to 2007. We have created some early introduction incentives in hopes that they encourage manufacturers to do exactly that. However, those incentives are voluntary and we do not believe it would be appropriate to make them mandatory given the arguments put forth in favor of a phase-in.

Some commenters suggested that it is untenable to delay implementation of the standards beyond 2007 because hundreds of thousands of new engines will be built in the interim that will emit at higher levels for their long lifetimes. This is a valid concern, but we believe that the need for a phase-in to this new technology is sufficient to overcome those concerns. We have created incentives to encourage manufacturers to introduce low NO_x and low PM engines prior to the 2007 model year, but we cannot require low NO_x engines and 15 ppm sulfur fuel prior to 2007 given technology/leadtime concerns, fuel supply and refining concerns, and Clean Air Act leadtime and stability provisions. This speaks also to the comments regarding major metropolitan areas and their attainment deadlines. While 100 percent compliance to the NO_x standard in 2007 would help these areas, we must weigh that against the overall success of the program. These areas run the risk of not being helped at all if the program we are requiring is not successfully implemented, which could lead to the loss of the emission reductions we have projected. We have carefully considered many factors in developing our final phase-in of the diesel engine standards and believe that the 50/50/50/100 percent phase-in strikes the proper balance between all of these.

(B) Opposes a phase-in schedule since it violates the 3-year stability requirement of the CAA.

(1) Full implementation of the PM standard in 2007 cannot be followed by implementation of a new NO_x standard in 2008 or 2009. In addition, the SSS and NTE applicable to engines meeting the 2.0/2.5 g/bhp-hr NO_x standard in 2007 cannot be revised in 2008 or 2009 as proposed without violating the 3-year stability requirement. EPA is obligated to provide a 3-year period of stability and four years leadtime for introduction of the standards and must delay implementation of the standards until 2010. (see also Issue 12.2)

<u>Letters:</u>

American Petroleum Institute (IV-D-343) **p. 21**
Cummins, Inc. (IV-D-231) **p. 54**
Marathon Ashland Petroleum (IV-D-261) **p. 17**

<u>**Response to Comment 3.1.4(B):**</u>

Several commenters indicated concerns pertaining to the interaction of the proposed phase-in schedule with the final implementation schedule for the new supplemental requirements (the Supplemental Emission Test, SET, and the Not-to-Exceed, NTE). These requirements, finalized in the Phase 1 heavy-duty final rule, will be implemented in the 2007 model year on all heavy-duty diesel engines. (See 65 FR 59896, October 6, 2000.) Under a 25/50/75/100 percent phase-in schedule of new diesel engine emission requirements, 25 percent of engines in the 2007 model year would meet 0.20 and 0.01 g/bhp-hr NO_x and PM, while 75 percent would meet 2.5 and 0.01 g/bhp-hr NO_x+NMHC and PM. Further, all of those engines would be required, beginning in the 2007 model year, to meet the supplemental requirements based on the FTP emission standards to which they were certified. A 25/50/75/100 percent phase-in schedule would change the supplemental requirements for those 25 percent of engines in the 2008 model year that would have to change to meet the new 50 percent compliance requirement. This change would be required even though the supplemental requirements on those 25 percent of engines were first implemented only one model year earlier, in model year 2007. The commenters believe that this schedule violates the stability provision of section 202(a)(3)(C) of the Act.

The final phase-in schedule, 50/50/50/100 percent, addresses any concerns about violating the stability requirement of the Act. (We need not decide whether the proposed schedule would have violated the stability requirement.) Under the final phase-in, 50% of a manufacturer's fleet would have to meet the 0.2 g/bhp-hr NO_x standard and 0.01 g/bhp-hr PM standard, and the associated SET and NTE requirements, beginning in model year 2007. Those standards would not change. The other 50% of the manufacturer's fleet would have to meet the 2.5 g/bhp-hr NO_x + NMHC standard and 0.01 g/bhp-hr PM standard, and the associated SET and NTE requirements, beginning in model year 2007. Those standards would be stable for three model years, until the 2010 model year, when the engines must meet the 0.20 NO_x standard.

(C) Opposes the proposed phase-in schedule since it is not commercially manageable.

(1) Heavy duty truck customers are influenced in large part by life cycle cost, which is substantially affected by initial product cost. If a manufacturer were to select a particular market segment or customer to receive the new, more costly, engines, they would be at a competitive disadvantage to any other manufacturer that chose to offer similar engines that were not manufactured to meet the standards. It would be very difficult to manage engine sales to achieve the required volumes each year and still remain cost competitive.

Letters:

Mack Trucks (IV-D-324) **p. 2**

(2) The marketplace today consists of several independent engine manufacturers and several vehicle OEMs. Since the cost and fuel economy impact of engines meeting the lower standards are yet to be determined, it is difficult to predict the future make-up of the marketplace. It is unlikely that OEMs would offer two different vehicles to accommodate two different engine designs since there would be substantial physical and cost differences.

Letters:

Cummins, Inc. (IV-D-231) **p. 46**

Response to Comment 3.1.4(C):

EPA agrees that the proposed phase-in could have created difficulties for manufacturers given that one manufacturer's engines in a given weight class may have emission control hardware and another manufacturer's engines may not. This could make it difficult for the first manufacturer to sell its engines given their presumed higher cost. However, it may also make those engines more attractive to some buyers (e.g., city bus fleets). Our final phase-in should provide some measure of control over such a situation given that it becomes more difficult to ignore an entire weight class when 50 percent of engines must comply in 2007 as opposed to only 25 percent under our proposal. Further, with the averaging, banking, and trading provisions we are finalizing, we fully expect manufacturers to equip most, if not all, of their engines with exhaust emission control hardware to take full advantage of the flexibilities provided.

(D) Does not necessarily oppose the concept of a phase-in for the diesel engine standards, but recommends that the phase-in schedule be accelerated.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Bishop, Mark (IV-F-12)
CA Natural Gas Vehicle Coalition (IV-F- 190) **p. 135**
Center for Neighborhood Technology (IV-F-11)
Chicagoland Transportation and Air Quality Commission (IV-F-10)
DaimlerChrysler (IV-F-15)
Environmental Defense (IV-F-169)
Hinds, William (IV-F-190) **p. 202**
Little Village Environmental Justice Organization (IV-F-192) **p. 147**
Mayor of Glendale, CO (IV-F- 191) **p. 177**
NESCAUM (IV-D-315) **p. 4**
Ozone Transport Commission (IV-F-55)
South Bronx Clean Air Coalition (IV-F- 116) **p. 301**

Response to Comment 3.1.4(D):

See our response to comment 3.1.4(A).

(E) If EPA decides that a phase-in is necessary, a two-, or, for one commenter, three-year time frame should be implemented.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Consumer Policy Institute (IV-D-186) **p. 7**
GA Public Interest Research Group (IV-F-117) **p. 43**
IL Environmental Protection Agency (IV-D-193, 308) **p. 1 (both)**
Kotgal, Kalpana (IV-F-192) **p. 17**
PA DEP (IV-D-100) **p. 3**

STAPPA/ALAPCO (IV-D-295) **p. 2, 14-15**
U.S. PIRG (IV-F- 190) **p. 185**

Response to Comment 3.1.4(E):

See our response to comment 3.1.4(A).

(F) Generally supports providing flexibility to manufacturers in the form of phased-in standard(s), but suggests an alternative approach.

(1) Commenters suggested a phase-in schedule that would set a single NO_x emissions standard for all engines in 2007, which would be "stepped-down" between 2007 and 2010. Some noted that the phase-in approach as proposed by EPA will not be as effective at providing relief to manufacturers since customer preferences, cost factors, competition between engine manufacturers and issues related to truck design will make it impossible for manufacturers to manage sales to meet the phase-in schedule. Commenters provided significant discussion regarding the potential technological, compliance, logistical and competitive issues associated with EPA's approach and suggested that instead of the phase-in schedule as proposed, EPA should follow a two-step implementation process that would substantially reduce the NO_x and NMHC standard in 2007 and then again in 2010. Some commenters outlined their proposed approach in detail and in this context, one commenter specifically recommended that EPA set a combined NO_x + NMHC standard of 1.5 g/bhp-hr in 2007 and reduce this standard to 0.6 g/bhp-hr in 2010. Another commenter recommended that EPA set "initial" standards starting in 2008 of 1.5 g/bhp-hr for NO_x and 0.02 g/bhp-hr for PM. These standards should remain in place for at least four years before more stringent "ultimate" standards would apply. The timing of this schedule should be dependent on the availability of a suitable test and measurement procedure. A two-step implementation would address issues associated with competitive obstacles, market disruptions, excessive costs (for testing, development, and certification), the 3-year stability requirement, and would be more aligned with technology readiness and can achieve the same emission reductions as EPA's proposal.

Letters:

Daimler Chrysler (IV-D-344) **p. 7**
Detroit Diesel Corporation (IV-D-276) **p. 13-17**, (IV-F-7, 168), (IV-F-116) **p. 198**
Engine Manufacturers Association (IV-D-251) **p. 42-48**
Ford Motor Company (IV-D-293) **p. 1-2**
International Truck & Engine Corp. (IV-D-257) **p. 12-17**, (IV-F-27, 34, 180, 117) **p. 109** (IV-F-191) **p. 99**

(2) EPA's proposed phase-in of NO_x, NMHC and formaldehyde standards is not feasible or practical and must not be finalized. The phase-in proposal is based on EPA's assumption that the proposed standards can be achieved in 2007, which is not the case. One commenter (EMA) provides significant discussion regarding why the current proposal would be burdensome and unworkable for manufacturers. This commenter notes that EPA's proposal

wrongly assumes that manufacturers are able to control their product mix between 2006 and 2007, fails to recognize that most engine manufacturers have a relatively small number of engine families, and creates the potential for competitive issues among engine manufacturers. EPA should implement an alternative initial standard that is less stringent along with greater stability periods and phase-in of more stringent standards as suitable test and measurement procedures are developed.

Letters:

DaimlerChrysler (IV-D-344) **p. 5-6**
Engine Manufacturers Association (IV-D-251) **p. 42-48**
International Truck & Engine Corp. (IV-D-257) **p. 12-17**

(3) One commenter recommended EPA delay the new engine requirements by two years and compress the phase-in to two years in order to provide lower cost fuel to truckers not subject to the 15 ppm standard, and to give EPA time to complete its rulemaking for nonroad diesel.

Letters:

Conoco (IV-F-191) **p. 154**

(4) Another commenter proposed a 3 year implementation schedule consisting of 25% in 2007, 75% in 2008, and 100% in 2009, resulting in an almost 20% reduction in 2010.

Letters:

CA Air Resources Board (IV-D-203) **p. 3**, (IV-F-190) **p. 13**

(5) EPA should phase-in the standards in a three year rollout beginning in 2008, which would provide rapid introduction and conversion of the fleet while providing manufacturers with sufficient lead time to meet these aggressive standards. EPA should implement a 40/80/100 phase-in schedule for the diesel engine standards (which should also apply to the gasoline engine standards).

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 52**

(6) The alternative cumulative phase-in approach as suggested by EPA has merit but does not offer flexibility with respect to manufacturers with limited product lines nor does it offer manufacturers a chance to significantly alter their phase-in schedule to obtain more flexibility. A better approach is a requirement that at the end of the phase-in period, the cumulative sum of the vehicle percentage phase-in times the number of years that the vehicles meet the 2007 standard during the phase-in period be at least equal to that generated under the standard phase-in schedule. For example, a phase-in schedule of 0/50/50/100 would be acceptable under the cumulative sum of the years/percentages approach. This approach also has the merit of

maintaining total emissions equivalent to the standard phase-in schedule.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 52**

(7) Supports a fixed annual percentage to ensure all manufacturers are in full compliance by 2010 and to simplify air quality planning.

Letters:

WI Department of Transportation (IV-D-241) **p. 2**

(8) Commenters stated the proposed phase-in schedule of the 0.2 g/bhp-hr NO_x standard and the 0.01 g/bhp-hr PM standard is not feasible. Commenters states no technology gives confidence of reliable NO_x control to 0.20 g/bhp-hr NO_x for the commercial life of the engine. Commenters suggest there will be substantial differences in both cost and emission performance between Phase 1 engines manufacturer by companies not bound to the heavy-duty diesel consent decrees signed in 1998, and those engines manufacturer by the Consent Decree (CD) companies which must meet the 2004 FTP standards as well as the supplemental emission requirements (NTE and SET). Commenters state consent decree manufacturers, once the decrees have ended in October, 2004, will be forced to reduce the effectiveness of their emission control systems in order to compete with non-CD companies which must only meet the Phase 1 FTP standards, which will result in 5.5 million tons of excess NO_x between 2004 and 2007. Commenters propose an alternative HDDE emission standards phase-in schedule which they comment would result in a benefit to the environment of 4.05 million tons of NO_x beyond the Phase 2 proposal. This alternative proposal includes: voluntary adoption of the supplemental emission tests for 2005 and 2006, for 2007 - 2009, NO_x standard of 1.5 g/bhp-hr and PM standard of 0.03 g/bhp-hr, for 2010 - 2012, NO_x standard of 0.5 g/bhp-hr and PM standard of 0.03 g/bhp-hr PM, and for 2013 and beyond, NO_x standard of 0.2 g/bhp-hr and PM standard of 0.01 g/bhp-hr PM. Commenter attached additional information and spread-sheet analysis to support their comments.

Letters:

Caterpillar Inc., Cummins Inc., Detroit Diesel Corporation, Mack Trucks, Inc, and Volvo Truck Corporation (IV-G-94)

Response to Comment 3.1.4(F):

We have already responded to the comments regarding competitiveness and logistics under Issue 3.1.4(A). As for suggestions to “step down” the standard from 1.5 g/bhp-hr NO_x+NMHC in 2007 to an “ultimate” standard in a later year, we considered such an approach during development of our final rule. Such an “interim” standard would be attractive in that all engines would meet that standard in 2007 and presumably all engines would be equipped with exhaust emission control devices. However, we must show that both the interim and the ultimate standards are cost effective and fulfill our statutory requirements when setting new standards. We do not believe that the 1.5 g/bhp-hr level, or any level at that general stringency, adequately fulfills our statutory requirement because it is not stringent enough. This is evidenced by our belief that the 0.20 g/bhp-hr NO_x level is indeed feasible, and test and measurement procedures are available to warrant 2007 model year implementation. Therefore, we do not believe we can set an interim standard in the 2007 timeframe as suggested but must set the NO_x standard at the level being finalized.

However, EPA is modifying our averaging, banking and trading program in the final rule to allow manufacturers some amount of flexibility in meeting the 0.20 g/bhp-hr NO_x standard during the phase-in years. Manufacturers may create credits in those years by certifying some or all of the engines meeting the Phase 1 standards to levels below 2.5 g/bhp-hr NO_x+NMHC. The manufacturers may then use such credits, with a 20 percent discount, to meet the 0.20 g/bhp-hr NO_x standard for the remainder of their engines. This will allow manufacturers greater flexibility in introducing the new technologies needed to meet the Phase 2 standards by allowing them to certify to higher levels for some or all of their engines during the phase-in years.

One commenter suggested delaying the standards for two years and then limiting the phase-in to a two year period. This suggestion seems focused on providing EPA with more time to set the non-road fuel sulfur requirement. While this is an interesting suggestion, we do not believe it would be appropriate to delay the NO_x standard and we believe that many others agree (See comments summarized under Issue 3.1.4(A)). We do believe that the issue of non-road diesel fuel sulfur level is important and are working toward a resolution, but we do not believe resolution of that issue merits a two year delay in the highway NO_x standard.

At least one commenter suggested an alternative cumulative phase-in approach in response to our request for comment on the proposed cumulative phase-in approach. While we appreciate the thought given to that request, the comments we received in total suggest little interest in or support of such an approach, and we have decided not to finalize a cumulative phase-in option. We are finalizing some early introduction incentives that could be used to serve the same purpose, but we are not placing such constrictive boundaries on the possible approaches manufacturers might take in using those incentives.

Another commenter suggested a three year 25/75/100 percent phase-in beginning in 2007, while another suggested 40/80/100 percent beginning in 2008. We believe that many commenters would find such a phase-in to be inconsistent with the stability provisions of the Act, claiming that the 75 percent of engines not meeting the 0.20 g NO_x standard in 2007 would not be provided three years of stability by 2009 in the context of the NTE requirements (based on the 2.5 g NO_x+NMHC and new 0.01 g PM standards) to which they would need to certify in the 2007 model year. As discussed in the preamble, our final phase-in does not create any such stability problem.

We have made no changes in this final rule in response to the late comments submitted as Docket Item IV-G-94. The commenters provided these comments on December 5, 2000, nearly 4 months after the close of the comment period, and only a few weeks before the finalization of this rule. There is no new information or data cited in the comments which warrant the very late nature of these comments, i.e., the commenters could have submitted these comments within the time period afforded by the official comment period. Due to the lateness of this submission we were unable to perform a full analysis of their comments. Nevertheless, even a straightforward reading and short analysis of the comments allows us to respond to the basic components of the comments - i.e., the proposed alternative phase-in schedule for HDDE NO_x and PM standards. This final rule requires 100 percent compliance with a 0.01 g/bhp-hr PM standard in 2007. The commenter proposes delaying this standard a full six years, and between 2007 and 2012. They propose a standard three times as high as the standard contained in this final rule. Clearly the commenters proposal does not provide the emission benefits of the PM standards promulgated in this final rule. The commenters proposal delays implementation of the 0.2 g/bhp-hr NO_x level until 2013, while the standards set in this rule require 50 percent compliance in 2007, and 100 percent compliance in 2010. Again, clearly no detailed analysis is necessary to see the commenters proposal does not provide the same emission benefits as the program established in today final rule.

In addition, the commenter suggests the average off-cycle NO_x emissions from HDDEs in 2004 - 2006 will be 5 g/bhp-hr, more than two times the FTP standard. The majority of the emission benefits claimed by the commenters in their alternative proposal is from the elimination of these estimated off-cycle emissions from Phase 1 engines. This suggestion of large off-cycle emissions and the emission calculation is purely speculative, and it ignores the existence of the Agency's long standing regulatory prohibition on defeat devices. We believe the prohibition on defeat devices will prevent manufacturers from employing emission control systems and strategies which have such blatant increases in emission performance off-cycle.

With respect to the commenters suggestion that a NO_x standard of 0.2 g/bhp-hr NO_x is not feasible in 2007, we disagree with this comment, and the commenter provided no additional data to support this comment. See Chapter III of the RIA for this final rule, and our responses to the comments to Issue 3.2 of this document.

As for comments under 3.1.4(F)(2), please refer to our responses to comments 3.1.4(A) through (C).

(G) EPA should delay implementation of the NO_x, NMHC, and formaldehyde standards.

(1) EPA should require all engine manufacturers to meet the same standards for all engine families at the same time. As an alternative to the proposed phase-in schedule, EPA should require the implementation of the NO_x, NMHC and formaldehyde standards in July 2008 for 100 percent of the fleet. PM standards should be implemented in 2007 as proposed.

Letters:

Mack Trucks (IV-D-324) **p. 2-3**

Response to Comment 3.1.4(G):

See our responses to comments 3.1.4(A) through (F), and 3.1.1(G).

(H) Opposes phase-in of gasoline vehicle standards because the technology to meet the proposed standards is currently available.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

American Lung Association (IV-D-270) **p. 17**

STAPPA/ALAPCO (IV-D-295) **p. 15-16**

Response to Comment 3.1.4(H):

We did not propose a phase-in of the gasoline vehicle standard and assume that the commenters merely meant to express their desire that we not finalize one. However, after considering the light-duty Tier 2 phase-in for medium-duty passenger vehicles (MDPVs – the phase-in for which is 50 percent in 2008 and 100 percent in 2009), we have decided that it is most appropriate to phase-in the heavy-duty gasoline vehicle standards on the same schedule. We have decided this for the same reasons as argued in the Tier 2 final rule which were: "The program will require research, development, proveout, and certification of all light-duty models, and manufacturers may need longer lead time for some vehicles, especially HLDTs. Also, manufacturers may wish to time compliance with the Tier 2 standards to coincide with other changes such as the roll out of new engines or new models. In order to begin the introduction of very clean vehicles as soon as possible while avoiding imposing unnecessary inefficiencies on vehicle manufacturers, we believe this practical but aggressive phase-in schedule effectively balances air quality, technology, and cost considerations." (See 65 FR 6742, February 10, 2000). The engines and emission control systems for these vehicles are very similar and often identical. We have decided that requiring the heavy-duty gasoline vehicles to comply 100 percent in 2007 to similarly stringent standards as MDPVs, while providing the MPDVs until 2009 to comply, was not consistent. Therefore, the final gasoline vehicle (and engine) phase-in schedule is 50/100 percent beginning in the 2008 model year.

(I) EPA should delay implementation of the HDG standards.

(1) The implementation of the HD gasoline standards should be delayed since the CAA provides assurance to HD manufacturers that adequate time will be available for the development of technologies needed to meet future standards and protects the investment in new technologies made by manufacturers by assuring that three years of stability will be available to allow a manufacturer time to recover investment costs made in achieving compliance with the same standards. Commenters refer to the CAA (Section 202(a)(3)(C)) and note that since the "Control of Air Pollution for 2004 and Later Model Year Highway and Vehicles" final rule (or "2004 HD rule") was not finalized until July 31, 2000 and is still awaiting publication in the Federal Register, there is a glaring discrepancy with the implementation of the proposed standards for HDG in the 2007 model year. Since the HDG standards will not be implemented until the 2005 model year, the CAA period of stability prevents EPA from imposing standards for HDG until after the 2007 model year. (See also comments on period of stability and lead time in Issue 12.2.)

Letters:

DaimlerChrysler (IV-D-284) **p. 6-7**
Engine Manufacturers Association (IV-D-251) **p. 48-49**

(2) EPA should adopt a phase-in approach for compliance with the 2007 HDG exhaust and evaporative emission standards, since these standards could not be effective until model year 2008 at the very earliest. Under the Tier 2 rule, manufacturers expect that the final roll-out for HLDTs and MDPVs will be in

the 2008-2009 model year. Under EPA's proposal, HDG engines and vehicles would have to meet lower emission standards earlier than MDPVs. In order to provide some consistency with the Tier 2 schedule, a three-year phase-in of the new 2007 HDG standards is recommended: 40% in 2008, 80% in 2009 and 100% in 2010. (See also comments on period of stability and lead time in Issue 12.2.)

Letters:

DaimlerChrysler (IV-D-284) **p. 9-10**
Engine Manufacturers Association (IV-D-251) **p. 51-52**
Ford Motor Company (IV-D-293) **p. 9**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 43**

Response to Comment 3.1.4(I):

EPA agrees with the comments regarding stability. Therefore, we have delayed implementation of the heavy-duty gasoline standards until the 2008 model year. Regarding the comments on consistency with the Tier 2 MDPV phase-in, please refer to our response to comment 3.1.4(H). Regarding the suggested three year 40/80/100 percent phase-in beginning in 2008, the commenters revised their stance on this suggestion in a meeting with EPA on October 19, 2000, and suggested a 50/100 percent phase-in beginning in 2008 for gasoline vehicles. (See docket item IV-E-36.)

(J) EPA should allow small volume manufacturers to come into compliance in the final year of the phase-in.

(1) Traditionally, EPA has recognized the special problems faced by small volume manufacturers (SVM) in developing and implementing new control strategies and in the Tier 2 rule, has provided additional flexibility in allowing SVMs to come into compliance at the 100 percent level in the final year of the phase-in. This provision will be critical to the survival of independent SVMs as they are typically certifying only one engine family and are thus unable to take advantage of the benefits that a phase-in has to offer. A phase-in schedule without special considerations for SVMs would put these types of manufacturers at a clear competitive disadvantage since it would force them to come into full compliance during the first year of the phase-in while larger manufacturers with more resources receive an extra two to three years to reach full compliance. Commenter recommends that the following specific regulatory language be added to the proposed rule: "86.007-11(f)(1)(iv) - Provisions for small volume manufacturers - In lieu of the optional phase-in requirements specified in this section, small volume manufacturers, as defined in 40 CFR 86.094-14, may comply at the 100 percent level beginning with the 2010 model year."

Letters:

General Engine Products, Inc. (IV-D-185) **p. 1-2**

Response to Comment 3.1.4(J):

The commenter requests that small volume manufacturers be given until the final year of the phase-in prior to complying. We do not believe this is a necessary element to our rule. Small volume manufacturers are given considerable flexibilities under existing regulations with respect to testing burden and durability demonstration procedures. Further, our final averaging, banking, and trading program provides considerable flexibility in meeting the new standards. A manufacturer selling only one engine family is allowed to effectively split that family and average across the virtual split in determining its family emission limit. Lastly, we have provided seven years of lead time prior to the first year of the phase-in.

(K) Opposes a phase-in schedule since this approach would not lead to significant emissions benefits.

(1) The proposal to phase in the NO_x standard actually reduces the total nationwide NO_x emission benefits by 110,000 tons or 24 percent in 2010 relative to a scenario in which the standard is delayed by one year and then fully implemented in 2008.

<u>Letters:</u>

American Petroleum Institute (IV-D-343) **p. 6**

<u>Response to Comment 3.1.4(K):</u>

See our responses to comments 3.1.4(A) through (F).

Issue 3.1.5: Scope of Standards

(A) EPA should incorporate into this proposed rule or a similar rulemaking, standards for trucks and buses greater than 14,000 GVWR.

(1) Commenter provided no further supporting information or detailed analysis.

<u>Letters:</u>

Gostafson, Keith (IV-F- 117) **p. 200**

<u>Response to Comment 3.1.5(A):</u>

The standards finalized in this rule apply to all heavy-duty highway vehicles and engines over 8,500 pounds. Therefore, these standards do indeed apply to trucks and buses greater than 14,000 pounds GVWR. The commenter may be confusing the heavy-duty engine and vehicle provisions. Complete heavy-duty gasoline vehicles between 8,500 and 14,000 pounds must be chassis certified (i.e., certified on a chassis dynamometer). Incomplete heavy-duty gasoline vehicles between 8,500 and 14,000 pounds have the option of chassis or engine certification. Heavy-duty gasoline vehicles over 14,000 pounds must be engine certified. For diesels, traditionally all heavy-duty highway diesel vehicles over 8,500 pounds must have a certified engine and that engine must be certified on an engine dynamometer. This rule allows, as an option, that complete heavy-duty vehicles under 14,000 pounds may certify to the chassis standards. Therefore, all heavy-duty highway vehicles are covered by this final rule.

(B) EPA should clarify whether any new requirements would apply to "classic"

cars (i.e. cars built prior to 1973).

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

Tseng, Joyce, et al (IV-D-3)

Response to Comment 3.1.5(B):

The standards finalized in this rule do not apply to classic cars or any cars built prior to 1973 or any cars regardless of when they are built. The standards apply only to heavy-duty highway engines and vehicles.

(C) EPA should enact strict control regulations covering existing diesel engines.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Center for Neighborhood Technology (IV-F-11)
Chicagoland Transportation and Air Quality Commission (IV-F-10)
Kouba-Cavallo Associates (IV-F-1)

(D) EPA should require the retrofit of older engines so that they can be in compliance with the proposed standards as well.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Clean Air Council (IV-F-116) **p. 333**
Environmental Law & Policy Center of the Midwest (IV-F-6)
Hinds, William (IV-F-190) **p. 202**
Kouba-Cavallo Associates (IV-F-1)
South Coast Air Quality Management District (IV-F-185)

(2) EPA should also immediately initiate a program requiring the phased retrofit of existing heavy duty diesel trucks. Unlike passenger vehicles which have a useful life of approximately 100,000 miles, diesel trucks are driven vastly more miles, often undergoing multiple engine rebuilds.

Letters:

American Lung Association (IV-D-270) **p. 25-26**

(3) EPA should establish a mandatory retrofit program such as that which currently exists in the Urban Bus Program.

Letters:

NESCAUM (IV-D-315) **p. 9, 11-12**

Response to Comment 3.1.5(C) and (D):

We discuss the issue of retrofit programs in section I of the final preamble to this rule. In that section we note that, in March 2000 we announced our Diesel Retrofit Initiative to support and encourage fleet operators, air quality planners, and retrofit manufacturers in creating effective retrofit programs. These programs are appealing because the slow turnover of the diesel fleet to the new low-emitting engines makes it difficult to achieve near-term air quality goals through new engine programs alone. Some of the exhaust emission control technologies discussed in this final rule are especially appealing for use in retrofits because they can be fitted to an existing vehicle as add-on devices without major engine modifications, although some of the more sophisticated systems that require careful control of engine parameters may be more challenging. Because of the uncertainty at this time in how and when such programs may be implemented, this rule does not calculate any benefits from them. Nevertheless, we believe that this program can enhance the viability of these retrofit technologies. We expect that large emission benefits from the existing fleet could be realized as a result of the fuel changes we are finalizing here, combined with retrofit versions of the PM technologies that will be developed in response to the finalized engine standards. These benefits will be especially important in the early years of the program when new vehicles standards are just beginning to have an impact, and when States and local areas need to gain large reductions to attain air quality goals.

(E) EPA should encourage or require the retrofit of existing HDDEs instead of imposing a 15 ppm sulfur standard or allowing similar State-imposed sulfur standards.

(1) Commenter notes that a retrofit program would be more effective at reducing PM than the proposed 15 ppm sulfur standard and would be less disruptive to the economy. *[see also 3.6(F)]*

Letters:

American Petroleum Institute (IV-D-343), **p. 6, 83**

Response to Comment 3.1.5(E):

As noted in our response to comment 3.1.5(C), we announced our Diesel Retrofit Initiative in March of 2000. However, we are not addressing diesel retrofit programs in the context on the Phase 2 rule. Despite our efforts on retrofit programs, we currently know of no NO_x emission control device that could be implemented on a retrofit basis that would be capable of delivering NO_x emission control of the same magnitude as that delivered by the Phase 2 standards. Moreover, to ensure long-term emission reductions, in the future, EPA had to adopt more stringent standards for new engines. Since engine-based emission reduction technology has basically reached its limit, sulfur sensitive exhaust emission controls are required to achieve significant reductions from new heavy-duty diesel engines (please see our response to comment 3.2.1(D)). As for PM retrofits, they appear to work in England with a 50 ppm cap fuel (as discussed in Chapter III of the RIA), but we have serious concerns regarding their ability both to work in the US given the greater temperature extremes experienced here, and to work on a very wide variety of vehicles. Please refer to Chapter III.A of the RIA for more detail on PM traps and NO_x control devices and their need for low sulfur fuel.

Issue 3.2: Technical Feasibility of Engine/Vehicle Standards

Issue 3.2.1: Diesel Engine Exhaust Standards

(A) The achievement of all engine and vehicle standards is technically feasible provided low sulfur (i.e. 15 ppm) fuel will be readily available by 2006.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Alliance of Automobile Manufacturers (IV-F-59)
American Lung Association of Metropolitan Chicago (IV-D-237) **p. 1**
American Lung Association of NJ (IV-D-224) **p. 1**
American Lung Association of Orange County (CA) (IV-D-176) **p. 1**
American Lung Association of SD (IV-D-31) **p. 1**
American Lung Association of VA (IV-D-205) **p. 1**
Center for Environmental Health (IV-D-89) **p. 1**
Corning, Inc. (IV-F-77)
DaimlerChrysler (IV-F- 117) **p. 96** (IV-F-191) **p. 173**
Downtown Community Association (IV-D-118) **p. 1**
Engelhard Corp. (IV-F-188)
Engine Manufacturers Association (IV-F-174, 116) **p. 43** (IV-F- 117) **p. 39**
Environmental Health Watch (IV-D-212) **p. 1**
Grand Canyon Trust (IV-D-317) **p. 1**
Hoosier Environmental Council (IV-D-281) **p. 1**
IL Public Interest Research Group (IV-F-18)
La Grange Park (IV-D-39) **p. 1**
MO Coalition for the Environment (IV-D-235) **p. 1**
Manufacturers of Emission Controls Association (IV-F-26(, (IV-F-191) **p. 120**
Metropolitan Washington Air Quality Committee (IV-D-58) **p. 2**
NC Waste Awareness and Reduction Network (IV-D-51) **p. 1**
NESCAUM (IV-F-63)
Natural Resources Defense Council (IV-F-75)
Oregon DEQ (IV-D-145) **p. 1**
PA DEP (IV-D-100) **p. 2**
STAPPA/ALAPCO (IV-F-190) **p. 21**
Sierra Club, GA Chapter (IV-D-348) **p. 1**
Sierra Club, Lone Star Chapter (IV-D-287) **p. 2**
Sierra Club, PA Chapter (IV-D-197) **p. 2**
Unity Center (IV-D-75) **p. 1**

(2) Commenters provided significant discussion and analysis regarding the technological feasibility of the standards based on the use of both particulate filters and NO_x adsorber technology. Commenters note that the standards are achievable using these technologies provided low sulfur fuel is available. Some commenters noted that catalyst-based diesel particulate filters can be used for PM control and are commercially available today - the only remaining engineering effort is to optimize the filter systems for the specific engine in which they will be installed. One of these commenters added that in parts of Europe, where diesel fuel with sulfur levels below 10 ppm is available, a number of diesel filters have operated successfully and have led to significant reduction in PM emissions. The development and optimization of the NO_x adsorber technology for NO_x control is progressing at a rapid rate and with the

availability of low sulfur fuel, is capable of meeting the proposed NO_x standards and could be commercialized in the 2007 time frame. One commenter cites to the DECSE report "Phase I Interim Data Report No. 2: NO_x Adsorber Catalysts," October, 1999 to support their position on this issue. This commenter added that the results of the Diesel Vehicle Emission Control - Sulfur Effects (DVECSE) program at Oak Ridge National Laboratory showed NO_x adsorber technology can achieve NO_x emission reductions in excess of 90% for a light-duty diesel powered vehicle (DVECSE Project, Phase I Final Report, March 2000). Commenters conclude that there are no significant barriers to the commercialization of either catalyst based diesel particulate filters or NO_x adsorber technology. Some also noted that SCR technology is being developed for commercial application and will be available for vehicles in the near future. (See also Issue 3.5 for further discussion on SCR technology.)

Letters:

American Lung Association of OR (IV-D-165) **p. 1**
Environmental Law & Policy Center of the Midwest (IV-F-6)
Johnson Matthey (IV-F-117) **p. 94**, (IV-G-55)
Manufacturers of Emission Controls Association (IV-D-267) **p. 2-6**, (IV-F-26, 187, 190) **p. 108** (IV-F-116) **p. 47** (IV-F- 117) **p. 89** (IV-F-191) **p. 120**, (IV-G-53)
NESCAUM (IV-D-315) **p. 5**
NY DEC (IV-D-239) **p. 3**
Natural Resources Defense Council (IV-F-190) **p. 98** (IV-F-190) **p. 102**
STAPPA/ALAPCO (IV-D-295) **p. 9**

(3) One commenter noted that it will commercialize "green diesel" engine technology in 2001, which will meet or exceed EPA's proposed 2007 NMHC and PM emission standards, because some refiners are already producing 15 ppm diesel fuel.

Letters:

International Truck & Engine Corp. (IV-D-257) **p. 2**, (IV-F-27, 34, 180), (IV-F-117) **p. 109**, (IV-F-191) **p. 99**

(4) Existing NO_x trap or adsorber technology is capable of reducing NO_x emissions by over 90 percent.

Letters:

Johnson Matthey (IV-F-117) **p. 94**
Manufacturers of Emission Controls Association (IV-F-190) **p. 108**

(5) One commenter noted that technology will blossom with the secure knowledge that there will be a market to recover the costs spent on research and development.

Letters:

Hacienda Heights Improvement Association (IV-F-172)

(6) One commenter cited to their report "Catalyst-Based Diesel Particulate Filters and NO_x Adsorbers: A Summary of the Technologies and the Effects of Fuel Sulfur," August 14, 2000, and provided a copy of this report as documentation supporting the conclusion that the PM and NO_x standards are feasible and can be met with anticipated control technologies. This report provides significant discussion, data and analysis regarding the design, effectiveness, development, commercial status, and technological feasibility of diesel particulate filters employing catalyst technology or catalyst-based diesel particulate filters (CB-DPFs) and NO_x adsorbers. In this report, the commenter concludes that new production facilities or modifications to existing facilities for both PM filters and NO_x adsorbers will require 6 to 18 months to be operational. The commenter acknowledges that PM filters are currently produced in limited volumes but that substrate manufacturers and catalyst manufacturers are currently considering methods for large scale manufacturing. NO_x adsorber technology will not be significantly different from current catalyst emission control products with the exception of size and can take advantage of existing production facilities. This report also contains detailed discussion on the effect of fuel sulfur on these technologies. (See Issues 3.3.1 and 3.3.2.) The report concludes that the technologies are technologically feasible and are capable of achieving the proposed PM and NO_x standards provided low sulfur fuel is available in the proposed time frame.

Letters:

Manufacturers of Emission Controls Association (IV-D-267) **p. 2-6, att.**

(7) Assuming a reasonable rate of technology development before 2006, diesel fuel sulfur levels averaging 10 ppm or less will enable emission control devices to operate effectively over the full useful vehicle life and will allow vehicles/engines to meet the standards. However, the emission control devices are still under development and inadequate testing has been completed to define the tolerance of NO_x emission control devices to limited variations in sulfur levels. However, these issues can be addressed with a thorough technology review prior to implementation. (See Issues 3.7.1 and 3.7.2.)

Letters:

U.S. Department of Energy (IV-G-28) **p. 2-3**

Response to Comment 3.2.1(A):

We agree with the points raised by the commenters as detailed in chapter 3 of the RIA, that provided low sulfur diesel fuel with a cap of 15 ppm and an expected refinery average sulfur level of 7 ppm, the emission standards proposed in the NPRM are feasible by 2007 for the reasons stated in the comments.

We agree with the commenter that an average fuel sulfur level of 10 ppm or less will enable emission control devices to operate effectively over the full useful vehicle life and will allow vehicles/engines to meet the standards. The 15 ppm sulfur cap we finalized in this rulemaking is expected to have an average sulfur level below 10 ppm (of approximately 7 ppm at the refinery gate) as detailed in chapter 4 of the RIA. Likewise we agree with the commenter at the difficulty in defining precisely the tolerance of the technologies to variations above this fuel sulfur level. This is why we feel it is prudent to set a fuel sulfur cap of 15 ppm, that will ensure that fuel sulfur perturbations above the average levels are necessarily small.

(B) The proposed standards are feasible by 2004.

(1) NO_x absorbers are expected to be available, the cost is expected to be reasonable, and NO_x emissions are expected to be reduced by more than 70 percent. However, a critical element of this technology and other aftertreatment technologies is the necessity to have low-sulfur fuels.

Letters:

American Lung Association (IV-D-270) **p. 17-18**

Response to Comment 3.2.1(B):

We appreciate the concerns raised by the commenter regarding the need for the large NO_x emission reductions which NO_x adsorbers can provide as quickly as possible. However, as discussed in response to 3.1.4(A), in this rule we have implemented the Phase 2 NO_x standard phase-in scheduled as aggressively as we believe is technologically feasible, giving appropriate consideration to the current state of development of NO_x adsorbers, among other factors. In addition, CAA Section 202(a)(3) requires the Agency to provide at least three years of stability for any new HDDE standards. Therefore, considering the existence of new FTP NMHC+NO_x standards for HDDEs which will be implemented in model year 2004, model year 2007 is the earliest time in which new FTP NO_x standards can be implemented, which is what we have done in this rule (see response to comments under issue 3.1.4(A) for additional discussion).

(C) It is unclear whether the proposed standards will be technologically feasible by 2007 and it is not certain that the standards could be met even with the availability of 15 ppm sulfur diesel fuel.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

American Petroleum Institute (IV-F-16, 182, 117) **p. 161**
Detroit Diesel Corporation (IV-F-7)

(2) The after-treatment technologies and controls that are necessary to reduce PM and NO_x together do not currently exist outside of the lab. EPA should delay the implementation of this rule to allow for additional assessment of technological feasibility. Active regenerative controls which will permit the continued use of the catalysts have not been developed and a determination that these systems are effective would be premature. Given the knowledge of current control technologies as well as those currently under development, it is difficult to determine whether the proposed standards can actually be met. One commenter notes that the aftertreatment systems that will be used to

reduce NO_x and PM emissions have the potential for assisting HDDEs in meeting the standards but only after 2007. Some commenters (Daimler, EMA, GM, Cummins) provided significant discussion on the NO_x and PM standards and the technological feasibility of the technologies that may be used to meet these standards. Some commenters noted that contrary to the mandates of the CAA, EPA has failed to provide any analysis of the technological feasibility of the proposed standards.

Letters:

American Petroleum Institute (IV-D-343) **p. 24-26**
American Trucking Association (IV-D-269) **p. 34-37**
Cooperative Refining, LLC (IV-D-300) **p. 2**
Cummins Engine Company, Inc. (IV-D-352) **p. 1-2**
Cummins, Inc. (IV-D-231) **p. 6-20**, (IV-F-64)
DaimlerChrysler (IV-D-344) **p. 7-12**
Engine Manufacturers Association (IV-D-251) **p. 35-39**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 43-49**
National Ready Mixed Concrete Association (IV-D-271) **p. 2**

(3) The aftertreatment technology for meeting the NO_x standards is not yet known or fully developed. The proposed NO_x standard will require the development and use of an after-treatment system with over 90% effectiveness over a broad range of operating conditions and there are currently no systems that have achieved this level of effectiveness in the lab. In this context, one commenter (EMA) asserts that EPA has failed to carry out its congressional mandate to propose standards that achieve the greatest degree of emission reduction achievable through the application of technology that EPA "determines will be available for the model year to which such standards apply." (CAA Section 202(a)(3)(A)). Another commenter noted that in addition to having inadequate efficiencies to meet the proposed NO_x standards when new, NO_x adsorbers can be expected to deteriorate over time, which will lead to increased emissions. One commenter added that achieving the NO_x standard over the FTP will not only require effective catalyst systems, but sensor and control technology which is yet to be invented. This commenter noted that a NO_x standard of 0.5 g/bhp-hr would be feasible. Commenters provided significant discussion and analysis concerning the feasibility of meeting the NO_x standard.

Letters:

American Petroleum Institute (IV-D-343) **p. 79-81**
Detroit Diesel Corporation (IV-D-276) **p. 10-11**, (IV-F-116) **p. 198**
Engine Manufacturers Association (IV-D-251) **p. 36-38, 84-85**
ExxonMobil (IV-D-228) **p. 6**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 43-49**
Mack Trucks (IV-D-324) **p. 1-2**

(4) EPA's standards are based on unproven, uncertain and effectively unknown after-treatment technological advances. EPA is overly optimistic about the development of the technology, and is willing to impose a 15 ppm standard on refiners without any showing that the aftertreatment technologies could meet

the emissions standards. One commenter added that the agency provides little support for either the technological feasibility (or cost-effectiveness) of the proposed reductions versus less stringent standards. One commenter provides detailed discussion of the risks that the proposed rule will not function properly, estimating that there is only a 27% chance of all the components working together. EPA should complete a cumulative risk analysis of potential control strategies and should select the alternative (i.e. combination of control technologies) with the largest chance of success. The SCR/CDPF system has a greater likelihood of success and is expected to generate more benefits.

Letters:

American Petroleum Institute (IV-D-343) **p. 20, 24, 79-81**
American Trucking Association (IV-F-191) **p. 42**
Marathon Ashland Petroleum (IV-D-261) **p. 2, 17-18, 84-85**
Murphy Oil Corporation (IV-D-274) **p. 12**
Society of Independent Gasoline Marketers of America (IV-D-328) **p. 3**

(5) The proposed PM standard is not feasible with diesel fuel having 15 ppm sulfur. One commenter noted that despite EPA's view of the success of PM traps, no known PM aftertreatment system has demonstrated the level of reductions that will be necessary to comply with the PM standard over the range of exhaust temperatures encountered by a diesel engine during normal operation and use and at 435,000 miles useful life. Nor has any known PM aftertreatment system demonstrated the necessary reductions under those conditions in combination with the NO_x emission limit. The efficiency of PM traps in any case will depend on the specific engine family and engine application. However, commenters acknowledge that the PM standards could be achieved if ultra low (5 ppm) diesel is used and if the PM trap is operating at peak efficiency. One commenter provides significant discussion on this issue and reviews the studies upon which EPA relies to make its conclusions regarding this technology.

Letters:

Detroit Diesel Corporation (IV-D-276) **p. 10**
Engine Manufacturers Association (IV-D-251) **p. 38-39**

(6) EPA should not finalize the proposed formaldehyde standard since it has failed to demonstrate either the need for or the technological feasibility of, the proposed standards. Engine manufacturers typically do not have the emissions testing capability to measure formaldehyde emissions in their labs. In addition, diesel engines are not considered to be a substantial source of formaldehyde emissions. EPA should delay implementation of this standard until additional data is gathered to evaluate the need and feasibility.

Letters:

American Petroleum Institute (IV-D-343) **p. 21**
Cummins, Inc. (IV-D-231) **p. 28**
Detroit Diesel Corporation (IV-D-276) **p. 20-21**

Engine Manufacturers Association (IV-D-251) **p. 41-42**
International Truck & Engine Corp. (IV-D-257) **p. 30**
Marathon Ashland Petroleum (IV-D-261) **p. 16**

(7) After consulting with a cadre of specialists in catalysis, the Cummins Science and Technology Council, which is made up of academics who are noted in their respective fields, has not come to an agreement on the approach to low level NO_x control and does not have confidence that the low emission levels as proposed by EPA in the 2007 timeframe can be achieved. Since many of the aftertreatment technologies are in the earliest stages of research and have far to go in development, they are beyond reach for accurate evaluation.

Letters:

Cummins Engine Company, Inc. (IV-D-352) **p. 1-2**

(8) Commenter suggests EPA talk to diesel engine manufacturers about their effort to build a cleaner burning engine, and how those engines will operate on ultra low diesel fuels.

Letters:

Swain, Edward (IV-D-162) **p. 3**

(9) Commenter suggests that conclusions dran by EPA based upon testing at NVFEL are invalid and not reflective of the actual technology potential

Letters:

American Petroleum Institute (IV-G-160)

Response to Issue 3.2.1(C):

All of the comments summarized here address concerns with EPA's assessment of the technical feasibility of the NOx, PM and NMHC standards proposed in the NPRM. The commenters raise issues with the primary technologies identified in the draft RIA, NOx adsorbers and Catalyzed Diesel Particulate Filters (CDPFs) that can be grouped into the following issues:

1. The technologies exist only in the "laboratory."
2. The technologies can not achieve >90 percent reductions in NOx and PM.
3. The technologies have not been shown to give simultaneous NO_x, PM and NMHC control.
4. The systems (sensors and control) required for application of these technologies (in order to regenerate the systems) are unknown.
5. The system operation of the PM and NOx control technologies are incompatible.
6. The technologies are not enabled by 15 ppm sulfur fuel, but CDPFs would be enabled by five ppm and NOx adsorbers might be enabled at five ppm.
7. The technologies have not been proven over the full life of heavy-duty vehicles.
8. EPA has been "overly optimistic" in assessment of the technology potential.

9. There is not a consensus technology to meet these standards (among a cadre of specialists in technology).
10. It would be better to wait to finalize this rule until the technology is better understood.

All of these issues have been expressly addressed in Chapter III of the RIA associated with the rulemaking. There, we show that greater than 90 percent reductions of NOx and PM have been demonstrated in a variety of settings utilizing CDPFs, NOx adsorbers, and low sulfur diesel fuel. For instance in our draft RIA, we noted that NOx adsorbers had been shown to provide over 90 percent NOx reduction in stationary applications and that Volkswagen had already demonstrated very low NOx emissions on a NOx adsorber equipped diesel passenger car. Moreover, recent testing at NVFEL on a combined system with a CDPF/NOx Adsorber system documented in chapter III of the RIA shows greater than 90 percent reductions in both NOx and PM emissions. In fact, PM emissions were controlled to a level less than half of the Phase 2 PM standard when operated on six ppm sulfur diesel fuel. Seven ppm sulfur fuel is the expected refinery average under the 15 ppm sulfur cap program. These results show that greater than 90 percent reductions are, in fact, possible through the application of the technology. These results also show that the technologies can be integrated into a total emission control system to provide simultaneous control of all of the regulated pollutants. Further, Toyota Motor Corporation has announced that they will produce a similar integrated emission control system beginning in 2003, a full four years before these standards go into effect. The demonstration at NVFEL, along with Toyota's expressed intent to market a similar system, shows clearly that the system technologies (sensors, actuators and system engineering) required to integrate these technologies are known, although further development and refinement is expected before 2007. It is important to note further, contrary to the comments raised here, that testing at NVFEL and information provided by Toyota on their DNPR system show that the combination of the CDPF and the NOx adsorber into a single system can be beneficial due to several synergies between the technologies. The CDPF can serve to protect the NOx adsorber from diesel PM which can foul the catalyst, it can "pre-treat" the NOx reductants (HCs derived from diesel fuel) to make the NOx regeneration event more effective, and the CDPF can oxidize some fraction of the NO to NO_2 prior the exhaust entering the NOx adsorber improving the NOx adsorber NOx storage efficiency. See response to comment 3.2.1(F).

It should be noted that one commenter suggested that a 0.5 g/bhp-hr NOx standard would be appropriate. Clearly this commenter recognizes that the technology is both feasible and highly effective, only raising a lesser concern as to its precise effectiveness. We believe that for the reasons outlined above, this commenter's estimate of the appropriate NOx standard falls short of the actual ability of the technology.

Regarding the diesel fuel sulfur level, chapter III section 7 of the RIA provides a detailed analysis of both the impact of fuel sulfur on emission control technology performance and long term durability. The analysis shows that the necessary emission control and durability are both possible provided fuel sulfur levels are maintained at or below 15 ppm. While lower fuel sulfur levels would provide incrementally better emission control, the test results and our analysis show that the emission standards can be met with a fuel sulfur cap of 15 ppm.

Comments regarding the need for lower fuel sulfur levels with regard to the PM control technology appear to be primarily concerned with high sulfate PM emissions experienced over some portions of the SET and potentially the NTE. See issue 3.2.1 (N&O) for our response to feasibility issues on PM and NOx emission limits over the supplement emissions requirements like the NTE and the SET.

While fleets of complete vehicles equipped with both an integrated system including both a CDPF and a NOx adsorber do not yet exist and as such have not demonstrated assured compliance with the standards over the regulated life, there is considerable evidence that shows that these technologies can be durable for the required life of the vehicle. Chapter III of the RIA details the extensive field experience with catalyzed diesel particulate filters in markets with low sulfur diesel fuel. Some of the vehicles in the test fleets have accumulated in excess of 300,000 miles of operation without significant deterioration of PM or HC control.

Further the RIA details why we believe that NOx adsorber catalysts will prove to be equally durable. The analysis shows, based on an overwhelming body of data from laboratory testing and gasoline vehicle testing, that sulfur in fuel is the primary factor limiting NOx adsorber durability. The data and analysis further shows that the sulfur can be removed from the catalyst so that the NOx reduction efficiency is recovered by performing a desulfation step. Unfortunately, experience in several test programs indicates that the desulfation function itself can lead to thermal degradation (precious metal sintering) degrading catalyst performance. However, this degradation in performance can be limited by controlling the peak temperatures reached during desulfation. As detailed in section III.A.3.b.vii of the RIA and in our response to comment summary 3.2.1(J), some researchers have already shown that the desulfation event can be accomplished in a manner which does not degrade the NOx adsorber performance unacceptably provided that the frequency and number of desulfation events is limited. The best way to limit the number and frequency of desulfation events is by decreasing the amount of sulfur that the catalyst must handle. By lowering the diesel fuel sulfur level to an average level well below 15 ppm, we can conclude with confidence that the frequency and number of desulfation events will allow for the NOx adsorber catalyst to be durable. The data show that NOx adsorbers are poisoned by sulfur in diesel fuel and from the data we can conclude that, with a fuel sulfur level at or below 15 ppm, NOx adsorbers will be durable over the life of heavy-duty vehicles.

While the commenters raise legitimate questions about these technologies and show concern that it is difficult to predict the future maturation of these technologies with absolute certainty, we have addressed all issues raised by commenters in the RIA. Specifically, the commenters do not raise theoretical objections to the technology but instead identify engineering refinements that will need to happen in order for the technology to work. In the RIA, we address our reasons why we believe that these steps can indeed occur. Primary among the steps will be the need to have widely available low sulfur diesel fuel. Moreover, the rapid improvements already shown in these technologies indicate that our assessment of the potential of the devices had not been overly optimistic.

Concerns that there is not a consensus among all parties as to the best technology path are not surprising given the significant lead time provided by this rulemaking. The fact that there are multiple ways in which these technologies can be applied helps to ensure that the technologies can be tailored to particular applications in the future. EPA has been working actively with industry to understand all of the issues involved with these advanced technologies. There have been more than 20 meetings between EPA and engine manufacturers in the period from August 2000 through December 2000 alone. Further, the RIA shows that there is adequate information available today for EPA to predict with confidence that these technological solutions can be applied to meet the emission standards provided that diesel fuel with sulfur levels below 15 ppm is widely available. In addition, EPA has committed to biannual reviews of these technologies in order to monitor their development and will issue reports through the 2008 model year. Should these reviews reveal unexpected limitations in the technologies, EPA has indicated it will address these issues through appropriate modifications of the standards or test procedures.

As for the comment that EPA should not finalize the formaldehyde standard (comment 6), we have decided not to do so. Please refer to our response to Issue 3.1.1(G) for more detail on that decision.

With regards to the comment that EPA has failed in its Clean Air Act obligation to show technical feasibility, EPA is not obligated to promulgate standards based solely on technology that has already been proven and matured in-use. The standards under section 202(a)(3) may require advancements from current technology so long as EPA provides a reasoned explanation of its basis for projecting that the standards can be met by technology that will be available at that time. EPA's NPRM and draft RIA contains a detailed description of the technologies that could be used to meet the standards, the current state of these technologies, and the expected developments that would allow the technologies to meet the proposed standards, including the proposed supplemental requirements. The proposal also discusses the manner in which these technologies can work together to meet the standards. The final rule contains further information regarding technological feasibility, including the results of EPA testing of these technologies on current engines. The final rule also addresses the commenters' concerns regarding the ability of these technologies to meet the standards throughout their useful lives. We have provided a clear roadmap toward the achievement of the final standards. We have met our obligation to show that the standards, though requiring advancements from current technology, are technologically feasible within the timeframe provided.

The comment that "cumulative risk analysis" shows that an SCR based NOx control strategy would be more appropriate is a fundamentally flawed argument due to the inherent issues with compliance under an SCR based technology program. While we believe it may be possible to apply SCR to selected centrally fueled fleets under this program, we have concluded that it would be impossible to ensure widespread compliance under an SCR program where an entirely new fluid needed to be added in order to ensure proper emission control system function. EPA promulgates standards providing the greatest reduction in emissions that is feasible considering specific factors, including cost. Basing a rule on the cumulative risk analysis provided by the commenter does not appear to be consistent with this statutory requirement. Moreover, the cumulative risk analysis is an inherently questionable approach, because it attempts to quantify unquantifiable subjective beliefs. As evidenced by the flawed analysis provided in the comment, simple errors or different assumptions made in this type of subjective analysis can completely skew the "results" of such an analysis. While qualitative analyses are needed in order to make decisions, to pretend that these can be presented in a quantitative manner is simply insupportable. In addition, the particular analysis provided is unsubstantiated based on incorrect assumptions regarding the relative risk of the approaches presented. As discussed elsewhere, we are confident that the final rule will be implemented in full in the time frame provided. NOx adsorbers have been shown to achieve 90% NOx reductions using low sulfur diesel fuel. We are less confident that an approach based on the widespread use of SCR can be implemented successfully in an enforceable manner in the time frame provided. We believe there are significant barriers to its general use for meeting the 2007 standards. SCR systems require vehicles to carry a supply of urea. The infrastructure for delivering urea at the diesel fuel pump would need to be in place for these devices to be feasible in the marketplace; and before development of the infrastructure could begin, the industry would have to decide upon a standardized method of delivery for the urea supply.

In addition to this, there would need to be adequate safeguards in place to ensure the urea is used throughout the life of the vehicle since, given the added cost of urea and the fact that urea depletion would not normally affect driveability, there would be an incentive not to refill the urea tank. This could lead to considerable uncertainties regarding the effectiveness of SCR, even if EPA were to promulgate the regulations that likely would be needed to require the regular replenishment of urea. Some commenters have suggested that this is the key issue with regard to urea SCR systems. One commenter further concludes that this issue could be addressed by designing engines with on-board diagnostic systems utilizing a NOx sensor that would observe a loss of NOx control. When observed, the engine would be designed to reduce power gradually until a 50 percent loss of power was realized. This power loss would serve to encourage the user to replenish the urea tank. While such an approach may be possible, it raises concerns for public safety as poor engine performance could lead to inadequate power for safe merging onto highways and other related driving situations. We remain hesitant to mandate such a program on a national scale when important issues such as driver training on the need to refill the urea tank and the consequences of failure to do so cannot be appropriately controlled. This approach would seem to suggest a need for EPA-mandated spot checks of individual vehicles to ensure compliance with the NOx standard. How such a program would work and the burden that it might place on small business entities was not addressed in the comments. In testimony given at the public hearing held for this rulemaking in Los Angeles, the California Trucking Association raised concerns about the appropriateness of putting this regulatory burden on truckers when a simpler technology such as a diesel NOx adsorber was available instead. Without measures similar to these, we would expect that a substantial number of users would not remember to fill their urea tanks. Since failure to provide urea for a vehicle would lead to a total loss of NOx control for that vehicle, we would need to model the loss of NOx control to be expected from an SCR based program. Such a loss in NOx control most likely would be appreciable and, in effect, the NOx standard would not be met on a fleetwide basis.

The assertion that NOx adsorbers have only been proven in the lab misses the fact that NOx adsorbers are used for NOx control on a production basis for lean burn gasoline engines (primarily in Japan where premium gasoline has an average sulfur level of 6 ppm) and in stationary power applications. Both of these examples show that NOx adsorbers can be used to control NOx emissions on a continuous basis over an extended period of time. Further, the lean burn gasoline vehicles show clearly that the technology can work in mobile sources applications. The differences between these current applications of the NOx adsorber technology and the future use of NOx adsorbers to control NOx emission from diesel engines lies only in the need to adapt the diesel engine operation to the NOx adsorber performance. The RIA and the previous discussion in this response and the response to comment 3.2.1(M) clearly show that these engineering issues can be addressed. No commenter has suggested that there are theoretical limitations of the NOx adsorber technology which must be overcome.

EPA received a letter on December 20 (Air Docket A-99-06 Item IV-G-160) commenting on the NOx adsorber testing completed at EPA's NVFEL testing laboratory (test report contained in Air Docket A-99-06 item IV-A-29).

The letter asks "are the results (of the testing) confounded by the use of different regeneration strategies across different test modes and NOx adsorbers?" The commenter is correct in noting that during the testing the NOx regeneration strategy was adjusted for different engine operating modes and for different NOx adsorber formulations. This approach was used as a surrogate for the control systems that would need to be applied in order to use a NOx adsorber on an engine. Specifically the control system (whether automated, as it was for some testing, or manually-controlled by a test engineer, as it was for some of the test modes) triggered NOx regeneration events based upon observed NOx slip from the adsorber. The NOx slip was observed using a NOx/O2 sensor as EPA expects the manufacturers to use. Additionally the NOx regeneration fuel rate and duration (the quantity of fuel injected) was adjusted again by observing NOx slip and by observing relative air to fuel ratios (lambda) using the O2 function on the combined NOx/O2 sensor. This approach even when done manually by an engineer is representative of the type of engineering optimization that would be done by the engine electronic control system. Most of these algorithms are similar to fuel trim and on board diagnostic (OBD) algorithms used today for gasoline three-way-catalyst equipped cars (although the fuel trimming is done on O2 and not NOx). The testing method does not confound the results, but rather reflects the appropriate control response that would be expected when applying the NOx adsorber technology.

The commenter additionally suggests that the test system developed at NVFEL was unrealistically over-designed and used idealized test conditions in order to achieve the lowest emissions without consideration of commercial viability. The test system used at NVFEL is representative of the type of laboratory equipment that would be typically used to validate a concept and to demonstrate projected future effectiveness. Chapter III of the RIA contains a significant discussion of how EPA arrived at this type of design, and our projections for how this design must evolve in order to be commercially viable. There we show a schematic representation of the type of system we believe can be viable and representative of what we estimated the cost would be. The resulting system is very similar to the Diesel Particulate NOx Reduction (DPNR) technology recently announced by Toyota. Toyota expects to introduce diesel powered trucks using this DPNR technology, a combination of a catalyzed diesel particulate filter (CDPF) and a NOx adsorber, for the MY2003. Based on Toyota's planned introduction date and the DPNR's substantial similarity to the system that we believe can provide the necessary reduction efficiencies to meet the Phase 2 standards, we have concluded that the system tested at NVFEL is appropriately representative and that the results are indicative of potential NOx and PM reductions.

Similarly the commenter emphasizes that the results limited to standard laboratory conditions do not demonstrate that under all conditions the NOx adsorber system can perform as needed. Specifically the commenter raises concerns about extended idle conditions, extended ambient conditions and other test conditions that weren't fully represented in the test program. All of these issues are addressed in the RIA and in response to comments raised on the SET and NTE test provisions in issues 3.2.1 (C,J,M,N,O and P). The commenter is correct to note that the testing, while covering a significant fraction of the NTE zone as well as the conditions represented over the FTP and SET procedures, does not cover all possible ambient conditions and potential vehicle driving situations. However, the testing provides significant insight into how these systems can be expected to operate under a wide range of driving conditions based upon its ability to store and release NOx emissions. The NVFEL results show for example that NOx emissions can be controlled even outside of the range of the best steady-state results due to the dynamic characteristics of the NOx adsorber catalyst. We therefore believe that the testing provides significant insight into the way the NOx adsorber technology will function in the future. This, along with the other substantial information in the public docket on NOx adsorbers including the DOE DECSE program, provides a firm basis to draw conclusions about the feasibility of the Phase 2 standards across all of the applicable test conditions.

The commenter raises further questions about how the test results were averaged and reported in the referenced test report. The confusion seems to lie in how to compare the averaged results presented for the testing at individual test modes. The NOx and HC results for the steady state testing were calculated by averaging the aggregate emissions over a single NOx regeneration cycle to generate one data point. Several of these aggregated emissions values were then used to calculate an average and a standard deviation for each of the test points. The standard deviations between each of the data points taken at a single test condition were all very small due to the high repeatability of the NOx adsorbers during regeneration. The commenter is apparently specifically concerned about whether or not statistically significant differences can be observed between the results from different NOx adsorber technologies. Although such comparisons can be made based upon the data, we would caution against using these results to compare the relative effectiveness of any one of the NOx adsorbers to another. Because the control system used for NOx regeneration improved throughout the test program the NOx reduction efficiency of the total system improved as well. Therefore, the NOx adsorbers evaluated during the initial testing phases were disadvantaged with regards to their potential performance. A better conclusion to draw among the four NOx adsorbers tested is that all of the adsorbers were highly effective at controlling NOx in spite of the rudimentary control system used and the trial and error manual tuning approach.

(D) EPA should adopt standards based on emission control technologies that could withstand higher sulfur levels if necessary.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Petroleum Marketers Association of America (IV-F-67)

(2) Requiring ultra-low sulfur levels based only on specific sulfur-sensitivity technology such as NO_x adsorbers, may lead to poor market response and high social costs. EPA is underestimating the capabilities and ingenuity of engine and emission control hardware designers since they may be able to develop more sulfur sensitive technologies.

Letters:

Phillips Petroleum Company (IV-D-250) **p. 4**

Response to Comment 3.2.1(D):

We agree that emission control technologies that are robust with regard to any fuel property are more desirable than technologies which are sensitive to fuel properties such as sulfur. We have carefully reviewed technologies which are capable of providing the substantial emission reductions that we need in order to achieve the air quality goals described in the rulemaking. Our analysis of these technologies, described in detail in chapter 3 of the RIA, revealed that all of the technologies which offer promise of substantial reductions of NO_x and PM emissions are highly sulfur sensitive. While there are technologies available which are less sensitive to sulfur, such as lean NO_x catalysts and diesel oxidation catalysts, the emission reductions allowed through the application of these technologies are minimal. We have great confidence in the capabilities and ingenuity of engine and emission control designers to solve engineering hurdles which limit current success with technologies. However absent substantive information to suggest that less sulfur sensitive technologies are capable of substantial emission reductions, it would be irresponsible of us to assume that engineers can develop new sulfur insensitive technologies. Given the substantial need for reductions in emissions from diesel engines (see chapter 2 of the RIA), and our analysis which shows that the most promising technologies that can deliver the needed emission reductions are all very sulfur sensitive, we have concluded that setting a 15 ppm cap on sulfur in diesel fuel and setting technology forcing emission standards based upon the technologies that low sulfur diesel fuel enables is the best way to ensure that our air quality goals are met in the future.

(E) The control technologies that will be used to comply with the rule should be evaluated further to determine their long term durability.

(1) Successful industry experience with the aftertreatment systems is limited to vehicles operating to 100K miles and even at this limited operation, severe problems are encountered with respect to catalyst plugging and increased fuel consumption. EPA should give long term durability of the new technologies a more thorough review before implementing the proposed standards.

Letters:

DaimlerChrysler (IV-D-344) **p. 7-8**

(2) Transit bus diesel engines currently have a life expectancy of 300,000 miles. Transit agencies would like EPA to require that all emission-related devices have the same warranty life expectancy.

Letters:

American Public Transportation Association (IV-D-275) **p. 4**

(3) EPA has not addressed the significant aftermarket and replacement parts issues surrounding the widespread use of after-treatment devices on HDEs. Given the multiple rebuilds, high mileage accumulation rates, and long life spans of HD trucks, it is unlikely that aftertreatment systems will function effectively for the full life of the truck. Because HDEs are generally operated significantly beyond the original warranty period, truckers will not receive the same consumer protection absent an EPA program or policy to facilitate aftermarket catalyst devices. EPA may not be justified in claiming full life emission reductions absent some assurance that catalyst devices will continue to operate for the full life or will be replaced as necessary with devices that are fully effective.

Letters:

American Petroleum Institute (IV-D-343) **p. 39-40**
Marathon Ashland Petroleum (IV-D-261) **p. 34**

Response to Comment 3.2.1(E):

See response to comments 3.2.1 (C) and (J).

We are not modifying the warranty provisions in this rulemaking. However, we are making a change to the allowable maintenance regulations. This change will require that manufacturers either design their new exhaust emission control devices to not normally need repair or replacement during the full useful life, or pay for scheduled repair or replacement that is required by the manufacturer to ensure continued emission performance throughout the useful life of the engine. While, in effect, this will not necessarily require manufacturers to pay for an occasional failure, it will require them to pay for any repairs that would be expected to be so frequent as to require scheduled repair of the devices.

We believe that our rebuild regulations contained in §86.004-40 adequately address concerns about engines not being rebuilt correctly. Those regulations require that someone rebuilding an engine must have "a reasonable technical basis" for believing that the rebuilt engine is equivalent (with respect to emissions) to an appropriate certified configuration. Moreover, we believe that the anti-tampering provisions of section 203(a)(3) will effectively prohibit the use of inadequate replacement parts for emission controls. For these reasons, as well as for the reasons described in Response 3.2.1(E)(2), we believe that the emission reductions projected here are appropriate. Regarding replacement parts that may be installed on engines after their full useful life, EPA has existing aftermarket part certification regulations that allow part suppliers and purchasers to determine whether the part will continue to allow satisfactory emission performance. EPA may consider amending these regulations in the future to address unique concerns that may arise on engines certified to the Phase 2 standards.

(F) The conditions required for regeneration of NO_x or SO_x adsorbers conflict with the conditions required for the regeneration of particulate filters.

(1) Adsorber regenerations require low (zero) oxygen partial pressures, a supplement of reductant (for NO_x adsorbers), low space velocities, and moderated temperatures. However, the regeneration of particulate filters and DOCs require high temperatures, high oxygen partial pressures, high NO2 concentrations and moderate space velocities. It is not practical to combine the regeneration of particulate filters or NO_x adsorbers with the regeneration of sulfur traps. Commenter provides significant discussion on this issue including a detailed discussion on how the control systems need to be configured as a whole given their individual limitations. Commenter concludes that the system of aftertreatment devices required to simultaneously reduce PM, remove the remaining sulfur, reduce NO_x and prevent slip is more complex than EPA estimates and notes that EPA has failed to address these trap/adsorber systems issues in its own analysis.

<u>Letters:</u>

Cummins, Inc. (IV-D-231) **p. 18-19**

<u>Response to Comment 3.2.1(F):</u>

While it is true that the conditions for NO_x adsorber regeneration and CDPF regeneration are different (primarily that for NO_x adsorber regeneration low oxygen content is desirable, while for CDPF regeneration high oxygen and NO concentrations are desirable) it is erroneous to assume that this will prevent NO_x adsorbers and CDPFs from being integrated into a single system. NO_x adsorbers and CDPFs can work in a single system because the NO_x regeneration function is a discontinuous event which occurs for only a fraction of the time (a brief period of low oxygen content operation). The bulk of emission control system operation can therefore occur under oxygen rich conditions which favor CDPF regeneration. Further, there are real synergies that make the integration of these technologies into a single system desirable as shown in the testing at NVFEL and in the DNPR system being developed by Toyota. For a complete description of these synergies please refer to our response to comment 3.2.1(C) and to the RIA.

(G) PM trap oxidizers can be effective at controlling PM emissions but there are some technological issues associated with this type of control that need to be resolved.

(1) Commenter provides a detailed discussion of PM trap technology along with data and various pictures and diagrams that illustrate the limitations associated with this type of control. Commenter notes that NO2-based PM oxidation (CRT) is the most promising method so far for filter regeneration but this method requires an expensive catalyst and requires the use of fuel with an extremely low sulfur content in order to prevent contamination of the oxidation catalyst. Commenter provides discussion on the problem of filter plugging due to oil ashes and of fuel additives and the associated reductions in fuel efficiency after a certain amount of engine use. Commenter notes that because of these limitations, they (DaimlerChrysler) have revised the specifications for trap oxidizers (from 100 mbar to 200 mbar admissible exhaust back pressure) and that EPA's fuel specifications must be consistent with these changes.

Letters:

DaimlerChrysler (IV-D-344) **p. 10-12**

(2) Commenter provides a detailed description of PM trap technology and discussion on the issue of lubricating oil ash in diesel particulate filters. These filters typically require maintenance to remove accumulated ash after about 100,000 kilometers of vehicle operation. The frequency of this maintenance will depend on the size and type of the filter, the quality of the lubricating oil, lubricating oil consumption, and the sulfur level in the diesel fuel. The less sulfur present in the diesel fuel may allow for the use of lubricating oil formulations that contain less calcium which is a significant contributor to ash build-up in diesel particulate filters. Other lubricating oil reformulations that would also reduce the ash content could be used to further decrease ash accumulation in diesel particulate filters. Filter cleaning is very simple and quick and methods currently exist for the safe cleaning and proper disposal of accumulated ash. The backpressure of the filter system returns to normal after cleaning.

Letters:

Manufacturers of Emission Controls Association (IV-D-267) **p. 4**

(3) Commenter provides a detailed discussion on the feasibility of diesel particulate filters and notes that the filter regeneration will need to overcome numerous technical challenges and limitations. Commenter notes that an active regeneration system will be required for instances where exhaust temperature is below 675 degrees F for significant periods of time and that the following devices either have not been developed or are not currently available: a durable delta-pressure sensor, an exhaust mass air flow sensor

(MAF), a reliable variable position exhaust valve system, a wide range NO_x/Oxygen sensor, EGR systems capable of compensating for high backpressure swings, a reliable and feasible heat addition source, and a robust and comprehensive control algorithm. In light of these concerns, EPA has failed to appreciate the need for a failsafe active DPF regeneration system and without this component, failure of the control technology will occur.

Letters:

Cummins, Inc. (IV-D-231) **p. 11-12**

(4) PM trap technology actually forms larger numbers of ultra-fine particulates and therefore, may not be the appropriate solution to EPA's defined problem. Commenter cites to data from AVL/CONCAWE to support their assertion.

Letters:

American Petroleum Institute (IV-D-343) **p. 14-15**
Marathon Ashland Petroleum (IV-D-261) **p. 13**

(5) EPA's conclusions regarding the in-use application of PM traps are based on extrapolations from field experiences associated with the operation of advanced particulate filters on heavy-heavy duty diesel applications to light-heavy and light-duty diesel vehicles. The extrapolation is based on EPA's observation that the lower operating temperatures of light-heavy and light-duty diesel vehicles will require lower diesel fuel sulfur levels in order to facilitate PM trap regeneration. These observations ignore two important facts: that there are no field data on light-heavy and light-duty diesel engines to support a sulfur level below 50 ppm and that field data on retrofit installations of the catalyzed particulate trap on existing vehicle/engines technology are not relevant to a rulemaking that is targeted at "new" or "advanced" technology that will be meeting more stringent emissions standards in the 2007 model year.

Letters:

American Petroleum Institute (IV-D-343) **p. 26**
Marathon Ashland Petroleum (IV-D-261) **p. 19**

Response to Comment 3.2.1(G):

We agree that the most promising technology for controlling PM emissions is catalyzed diesel particulate filters which oxidize NO to NO_2 to promote filter regeneration, such as the CRT technology mentioned in the comment. Further we agree that these types of technology are highly sulfur sensitive as detailed in chapter 3 of the RIA and do have some cost associated with their application as detailed in chapter 5 of the RIA. Catalyzed diesel particulate filters (CDPFs) can provide substantial PM and NMHC reductions in a cost effective and durable manner provided that they are operated on diesel fuel with sulfur content at or below 15 ppm.

The commenters raise concerns, in spite of the substantial positive experience with this technology in Europe where thousands have been applied successfully as detailed in Chapter III of the final RIA contained in the docket, that the technology may not be reliable under certain cold ambient conditions and would require the application of some form of active filter regeneration. Further, the commenter suggests that active systems to regenerate the PM filter can not be devised or are too complicated to be applied. We disagree with the assessment of the commenter and, as detailed extensively in chapter III of the RIA, have concluded that diesel particulate filters will function as required throughout the life of a heavy-duty diesel vehicle provided that diesel fuel with sulfur content at or below 15 ppm is used. We have reached this conclusion based on the extensive experience in Europe on retrofit technologies which shows that catalyzed diesel particulate filters are reliable without the use of active regeneration technologies provided that low sulfur diesel fuel is used. This experience includes more than 3,000 vehicles in Sweden where the winter ambient conditions are quite severe. Of course engine or vehicle manufacturers could choose to apply active regeneration should they desire, however based on the extensive retrofit experience with CDPFs we do not believe that this will be necessary.

The comments expressed about CDPF maintenance are consistent with our understanding of the technology as described in Chapters 3 and 5 of the RIA. However, while the commenter notes that current retrofit applications perform maintenance of the CDPFs on 100,000 km intervals, we have estimated that future CDPFs will be able to extend that interval substantially for the very reasons outlined in the comment. It is our understanding that the engine manufacturers and the engine lubricating oil suppliers are already discussing potential changes to engine oil formulations for 2007 in anticipation of the Phase 2 fuel sulfur level and CDPF based emission standards.

The assertion in the comment that CDPFs will require an active regeneration system for instances where the exhaust temperature is below 675°F (357° C) for significant periods of time is contradicted by the substantial experience with retrofit CDPFs in Europe. SAE paper 970182 “Experience with a New Particulate Trap Technology in Europe,” documents real in-use operation with the CDPF technology. Figures 5.2 and 5.3 in the paper document the exhaust temperatures typically seen by a garbage truck in Hannover and a city bus in Paderborn equipped with the CDPF technology. In both instances the vast majority of the vehicle operation occurs with exhaust temperatures well below 350°C. In spite of these low temperatures the CDPFs on these vehicles regenerated passively in the retrofit applications. This was accomplished without the need for the additional hardware mentioned in the comment. The paper concludes with “To date (the paper was published in 1997), some 1800 vehicles with a wide variety of application have been equipped with this technology in Europe and operational experience has confirmed the stable and low back-pressure characteristic predicted for a system which is continuously regenerating above 250°C”.

Lastly, PM trap technology <u>in combination with ultra low sulfur diesel fuel</u> has been shown to greatly reduce the numbers of ultrafine particulate matter (see Chapter 3, section A2b of the RIA). Sub-50 nm diameter ultrafine particulate matter is composed chiefly of semi-volatile compounds, primarily organic compounds nucleated onto sulfuric acid aerosol. The paper cited in the comment makes the correct assumption that passing higher sulfur content fuels over a catalyzed trap produces sulfate PM (chiefly sulfuric acid). This is one of the reasons that the use of PM trap technology requires the use of ultra-low sulfur diesel.

Fundamental to the use of CDPFs is the need for the low sulfur diesel fuel mandated by this program. To understand the role that sulfur plays in CDPF feasibility please refer to the responses to issue 3.3.1 and to the RIA associated with this rulemaking.

(H) EPA should also address the ultra-fine particles that are generated by modern,

clean burning diesel engines since these are capable of being suspended in the air for up to a week, are absorbed into the lungs very efficiently, and are associated with the onset of asthma.

(1) This commenter added that the only method that has been found to control ultra-fine particles in diesel engine exhaust from a modern, clean burning engine is a particulate trap with an oxidation catalyst to remove what is called "soluble organics fraction" and also noted that the reduction of these ultra-fine particles cannot be achieved without the availability and use of very low-sulfur fuel.

Letters:

Stead, Craig (IV-F- 116) **p. 115**

Response to Comment 3.2.1(H):

This is functionally the same as control of PM emissions using a CDPF. Please see Chapter 3, section A2b of the RIA and the response to comment 3.2.1(G).

(I) Disagrees with EPA's proposal to limit allowable repairs or replacement of filter elements in particulate traps or trap oxidizer systems and related components.

(1) Under EPA's current proposal, the only allowable maintenance for filter elements in particulate traps or trap oxidizer systems and related components would be cleaning and adjustment of the filter element [cites to Section 86.007-25(b)(4)(iii)]. These proposed restrictions are a significant departure from current allowable maintenance procedures, which allow the adjustment, cleaning, repair, or replacement of critical emissions-related components at 100,000 miles (or 3,000 hours of use) and at 100,000 mile/3,000 hour intervals thereafter for light HDDEs – or at 150,000 (or 4,500 hour) intervals for medium and heavy HDDEs. Commenter provides additional detailed discussion on expected deterioration of the emissions control equipment, the risks of not allowing such repairs, and asserts that EPA has failed to consider the difference between HDDE owners and LDV owners in terms of maintenance when it proposes such limitations.

Letters:

DaimlerChrysler (IV-D-344) **p. 13-14**
Engine Manufacturers Association (IV-D-251) **p. 71-72**

(2) EPA's proposed limitations on maintenance and repair could have an adverse effect on the development of new technologies. Engine manufacturers already have strong incentives to minimize required maintenance and placing restrictions on allowable maintenance will only restrict the use of promising emission control technologies that may not be able to meet the allowable maintenance requirements.

Letters:

DaimlerChrysler (IV-D-344) **p. 14**

Engine Manufacturers Association (IV-D-251) p. 72

Response to Comment 3.2.1(I):

Our existing regulations contain provisions that limit the amount of maintenance to emission-related components that the manufacturer is allowed to conduct during durability testing (or specify in the maintenance instructions that it gives to operators). We believe that, with very low fuel sulfur levels, these technologies will be very durable in use and will last the full useful life with little or no scheduled maintenance other than cleaning. The durability of these technologies is described in more detail in the RIA.

As the commenters noted, we are modifying these provisions for traps and adsorbers. The old regulations would have allowed a manufacturer to specify something as drastic as replacement of the adsorber catalyst bed or the trap filter after as little as 100,000-150,000 miles if there merely was a "reasonable likelihood" that the maintenance would get done. However, because the new emission control technologies will reduce emissions by 90 percent or more, even 10 percent non-compliance of the maintenance specifications by a vehicle owner could result in very large emission increases. Thus, to ensure that no manufacturer underdesigns their adsorbers or traps (compared to the level of durability that is achievable), we are requiring that these technologies be designed to last for the full useful life of the engine unless the manufacturer is willing to pay for the maintenance. More specifically, the final regulations state that scheduled replacement of the PM filter element, NO_x adsorber, or other catalyst module bed is not allowed during the useful life, unless the manufacturer can show that the replacement will in fact occur and pays for the replacement. Otherwise, only cleaning and adjustment will be allowed as scheduled maintenance. We believe that this revised requirement will ensure that manufacturers make every effort to design durable emission controls, and that if it were necessary to schedule maintenance to the exhaust emission control devices, the maintenance would be performed for virtually all engines. We do believe this requirement will promote the development of improved technologies rather than have an adverse impact on their development as suggested by the commenter.

(J) EPA's conclusions regarding the feasibility of NO_x adsorber technology are not supported by data in the public record, nor has the technology been sufficiently proven in the field.

(1) Adsorber performance regardless of the sulfur level falls significantly short of what is needed to meet EPA's proposed standards. The technology fails in issues relating to durability, low temperature performance, high temperature performance, not-to-exceed standards, regeneration, desulfation cycles, tampering and driveability. The technology is in such an early state of development that there is no substantive scientific evidence that they can meet the proposed NO_x standards at any sulfur level. No data are available for EPA to draw such broad conclusions regarding the technology as to require a 15 ppm sulfur cap in the hope that the technology will work. Cites a study by Engine, Fuel and Emissions Engineering, Inc. (EF&EE) "Selective Catalytic Reduction and NO_x Adsorption Catalyst Technologies for Heavy-Duty Diesel Vehicles," Aug. 2000, which concludes that the feasibility of NO_x adsorbers has yet to be established. EPA provides no basis for its projection that the durability of the technology will be such as to meet the standards throughout the useful life of the vehicles. In fact, the DECSE study reports that regardless of sulfur level, NO_x adsorbers lose 50% of their effectiveness

after a mere 250 hours of service accumulation. Nor does EPA provide any basis for its conclusions that improvements can be made to optimize the adsorber technology to function at lower exhaust temperatures. Similarly, EPA's expectation of improved NO_x performance at higher temperatures is unfounded, and EPA provides no information on the type of chemistry modifications required, nor the timeframe or cost of such modifications. Moreover, EPA had yet to finalize the NTE standards before it concluded that NO_x adsorber performance will be within the NTE, which action is highly inappropriate and gives the public no basis upon which to evaluate EPA's assessment. Nor has EPA provided any meaningful evidence that the obstacles it identifies in NO_x adsorber technology will or can be overcome and at what cost. EPA must address the issue of tampering with NO_x regeneration and desulfation controls, as it has addressed the issue in regard to SCR. And EPA must address the issue of driveability impacts resulting from NO_x adsorber regeneration and desulfation cycles.

Letters:

American Petroleum Institute (IV-D-343) **p. 31-36**
Marathon Ashland Petroleum (IV-D-261) **p. 25-31, 92-93**

(2) Commenter provides significant discussion and data regarding the effectiveness of NO_x adsorption technology. NO_x adsorbers are extremely sensitive to any amount of sulfur in the exhaust stream (see Issue 3.3.2). There has been no successful demonstration of a NO_x adsorber which can be desulfurized periodically and maintain sufficient activity to meet the NO_x emission reduction requirements for the full useful life of a HDE and there has been no demonstration of a regenerable sulfur trap that can survive to full useful life (see Issue 3.3.5). In addition to the issue of sulfur sensitivity, current catalyst formulations do not have the capability to provide sufficient NO_x conversion over the entire range of engine operating conditions. Commenter provides data and analysis that show NO_x conversion at various exhaust temperatures using several catalyst formulations and the percentage of NO_x reduction obtained during the various modes of the EURO test cycle. Commenter asserts that numerous technical challenges will need to be addressed adding that a reductant delivery system with the required atomization capabilities in the limited space available remains a significant system integration problem; that the durability of a reductant delivery system has not been proven; that a low range NO_x sensor, sulfur trap, and comprehensive control algorithms are not available; and that the cost, weight and size of the control system will present additional logistical problems and implementation issues. Commenter concludes that the observed efficiencies will not allow meeting the proposed level of NO_x emissions on the standard tests and are far from obtainable on the proposed SST, particularly under expanded ambient conditions.

Letters:

Cummins, Inc. (IV-D-231) **p. 12-16**
Marathon Ashland Petroleum (IV-D-261) **p. 24-25, 92-93**

(3) Commenter cites to a study done for API by AVL List GmbH, which indicates

that the NO_x adsorber has not been demonstrated to enable HDDEs to meet EPA's proposed NO_x emission standards at any sulfur level, including near zero.

Letters:

Mercatus Center at GMU (IV-D-219) **p. 13-14**

Response to Comment 3.2.1(J):

The majority of the issues raised here are addressed in responses to comments 3.2.1(C), 3.2.1(F), 3.2.1(M), 3.2.1(N), and 3.2.1(O).

With regards to the issues raised on low temperature and high temperature performance of the NO_x adsorber technology we disagree with the commenters' assessment of the available information on NO_x adsorber performance. A substantial portion of the RIA discussion on NO_x adsorbers (Chapter III.A.3.b.iv) focuses on this very issue, defining both the constraints on performance at low and high temperatures, and the effect of these constraints on the feasibility of the standards. The RIA shows that these constraints can be understood and that while they limit NO_x adsorber performance on the margins, the NO_x adsorber catalyst can enable the Phase 2 NO_x standards. Testing at NVFEL shows that NO_x adsorbers can meet both the steady-state SET standard and the transient FTP standard. Further as noted in the RIA, NO_x adsorber developers are known to be working on means to increase the upper temperature limit of the NO_x adsorber catalyst.

Heavy-duty diesel engines rarely operate continuously under high load steady-state conditions (the highest exhaust temperatures) but instead normally operate under steady moderate loads (highway cruise) or transiently with periods of light, moderate and heavy loads. The lower and upper temperature limits of the technology are based upon the steady-state performance of the NO_x adsorber in a test cell. Transient testing of the NO_x adsorber catalyst done at NVFEL and described in the RIA shows that transient operation tends to average out the lowest and highest temperatures to more moderate temperatures where the NO_x adsorber performs better. This is because of the thermal inertia of the emission control system itself. Thermal inertia describes that fact that when transitioning from operation at moderate temperatures to low temperatures the catalyst temperature will remain higher than the inlet exhaust temperature until the catalyst cools down. Similarly when transitioning from moderate exhaust temperature operation to high temperature exhaust operation the catalyst temperature will lag the exhaust temperature, meaning that the catalyst will remain somewhat cooler. Since typical engine operation is somewhere between these extremes, average NO_x reductions can be higher under transient conditions than what would be predicted from continuous steady-state NO_x reduction levels. In fact, that is exactly what was observed in emission testing at NVFEL. Based upon observed engine-out emission rates over the transient FTP test cycle and observed steady-state NO_x conversion efficiencies, an estimate of the transient FTP NO_x reduction was made. The estimated reduction level was 84 percent. When an actual transient FTP was completed, the real emission reduction level was 93 percent. This difference was most likely due to the thermal inertia of the system. For a more in-depth discussion of high temperature and low temperature performance, as well as a discussion of why even with these limitations NO_x adsorber catalysts are capable of meeting the Phase 2 NO_x standards, please refer to chapter III of the RIA. For a discussion of how these issues effect compliance with the NTE standards please see our response to comments 3.2.1(N) and 3.2.1(O).

The tampering issue is raised by the commenter in context of the significant compliance issues with the urea SCR technology. We think that this comparison is inaccurate and that a better comparison can be made to the closely related three-way catalyst technology. Both the NO_x adsorber and the gasoline three-way catalyst technology employed for the vast majority of light-duty vehicles in the U.S. rely on careful controlled exhaust conditions in order to function properly. These functions are controlled by the vehicles computer without intervention by the user. Since the actions of the emission control system are transparent to the user and because modification of the emission control system requires significant sophistication on the part of the modifier, tampering of these systems is unlikely. This is contrasted with the urea SCR technology which can only work properly when the user remembers to "fill-up" the urea supply tank. Absent urea, SCR based NO_x control is not realized. Since proper operation of the system relies on user intervention the likelihood of "tampering" (including simply failing to add urea either accidently or to avoid paying for urea) is significantly increased.

The assertion by the commenter that there has been no successful demonstration of a NO_x adsorber which can be desulfurized (desulfated) periodically and maintain sufficient activity to meet the NO_x emission reduction requirements for the full useful life of a HDE is misleading. In fact, researchers at Ford have shown that a NO_x adsorber can be desulfated periodically (90 times in their test) while maintaining NO_x conversion efficiencies in excess of 90 percent (SAE 982595). Chapter III of the RIA has a significant section devoted to NO_x adsorber durability. There we show that sulfur in diesel fuel is the primary cause of NO_x adsorber deterioration. Further we show that there are means to remove the sulfur from the NO_x adsorber catalyst (desulfation) while recovering NO_x control effectiveness. We also document that when done incorrectly the desulfation event can lead to thermal degradation of the catalyst. We show the mechanism for this degradation (thermal sintering of the catalytic metals) and means to control this process. The issue of thermal sintering of NO_x adsorber catalyst components is similar to the thermal sintering issues faced by light-duty three-way catalysts for vehicles developed to meet current California LEV and future Federal Tier 2 standards using platinum-rhodium (Pt-Rh) catalysts. Initial designs were marked by unacceptable levels of platinum sintering which limited the effectiveness of Pt-Rh catalysts. This problem was overcome through modifications to the catalyst supports and surface structures that stabilize the precious metals at high temperatures (>900 °C) (Brisely et al.,SAE 1999-01-3627). A similar approach to the stabilization of NO_x adsorber catalyst components should reduce thermal sintering of components during desulfation. Further, by controlling the maximum temperature experienced during desulfation the amount of thermal degradation can be controlled to acceptable levels. This appears to be the reason for the good results reported in SAE 982595, mentioned above. We believe for the reasons mentioned above, that the best way to ensure long term NO_x adsorber durability is to decrease the fuel sulfur level as much as possible in order to decrease the number and frequency of NO_x adsorber desulfation events. From the data presented in the RIA, we can conclude that NO_x adsorbers will be durable over the life of heavy-duty diesel engines.

The study done for API by AVL referenced in the comment provides the basis for the comments raised and addressed in 3.2.1(M).

The commenters raise concerns that the NO_x regeneration (and presumably the desulfation event) may cause unacceptable driveability issues. We agree with the commenters that maintaining acceptable driveability is an important constraint on the design of any emission control system. If, during regeneration events, torque fluctuations were noted that were large enough to cause a change in engine/vehicle speed this would be problematic. While we agree that this is an important consideration, we disagree with the implication in the comment that these issues can not be addressed. To the contrary research programs are already showing that this issue can be addressed. In DOE's Diesel Emission Control Sulfur Effects (DECSE) program work was done on NO_x adsorber regeneration (DECSE "Phase I"). There the researchers showed that torque variation can be limited during NO_x regeneration concluding that "the minimal torque fluctuations observed indicate that rich/lean modulation strategies would not significantly impact driveability." Further, positive test results in DECSE Phase II, lead the researchers to conclude, "The desulfurization (desulfation) procedure developed has the potential to meet in-service engine operating conditions and acceptable driveability conditions." The DECSE work shows clearly that this issue can be addressed. For additional information on the DECSE work please refer to chapter III of the RIA or to the numerous DECSE reports contained in EPA docket A-99-06.

For the dual leg approach to NO_x adsorber regeneration, where the exhaust flow is partitioned and where the reductant (diesel fuel) is added to the exhaust, driveability issues are not expected to be problematic. This is because the dual leg approach does not require changes to base engine operation to work. For the NVFEL testing described in chapter III of the RIA, the engine used for testing was a current production heavy-duty diesel engine. No changes to the engine's combustion system or the engine's electronic control system were made that would be expected to change driveability in a noticeable way. Yet NO_x reductions in excess of 90 percent were noted in the testing.

(K) The use of diesel oxidation catalysts (DOC) is complicated when used in conjunction with other aftertreatment devices since DOC must be placed at the end of the system components.

(1) The application of DOCs presents numerous challenges. During the regeneration of one of the two NO_x adsorbers, the effluent from the regenerating adsorber is oxygen free and DOCs cannot oxidize in an oxygen free environment. The streams from both paths are joined upstream of the DOC and the stream from the nonadsorber regeneration side provides the oxygen to oxidize the products. Without proper mixing of the two streams, the proposed NMHC standard will not be achievable. DOCs require high exhaust gas inlet temperatures in order to function properly but when used in conjunction with other devices, the exhaust gas temperature entering the DOC will be at their lowest values. This presents a challenge since the DOCs ability to function is jeopardized under low ambient conditions.

<u>Letters:</u>

Cummins, Inc. (IV-D-231) **p. 16**

<u>Response to Comment 3.2.1(K):</u>

The comment presupposes that these functions will not be integrated. In fact the integration of catalyst monoliths, each having somewhat different function, in series in one catalyst housing is very common in current light-duty gasoline vehicle applications in the United States. Toyota has demonstrated a flow-switching capability within a single catalyst housing, and the capability to integrate both catalyzed diesel particulate filter and NO_x adsorber catalyst functions into a single wall-flow monolith device (see document number IV-E-31 in the docket for this final rule). Chapter III.A discusses integration of catalyzed diesel particulate filters and multiple NO_x adsorbers into one housing, and discusses reduction of thermal inertia through use of an integrated approach to the exhaust emission control system. Document number IV-G-98 in docket A-99-06 describes catalyst systems already developed for the light-duty market that mount an additional monolith in the catalyst cone (see presentation titled, "Gasoline-Powered Emission Control Systems: Advanced Technologies for ULEV and SULEV," page 27 of item IV-G-98), which is a logical approach to integrating a DOC (if necessary) into the emissions control system in a manner that conserves heat while still positioning the DOC downstream of where the regenerating and adsorbing flows converge.

(L) EGR systems are capable of significantly reducing NO_x emissions, but there are some technological issues that need to be resolved that will prevent the effective use of this technology by 2007.

(1) Exhaust gas recirculation systems are currently under development and could be capable of significantly reducing NO_x emissions. However, development work to date (as completed by Daimler along with cooler suppliers) has shown that cooler performance decreases rapidly after only a few hours of service, which negatively impacts the EGR system's ability to reduce NO_x. According to cooler suppliers, this phenomenon is of physical origin and cannot be solved technically. Increased soot and excessive engine wear increase in engines that use EGR systems and as a result, HDDEs equipped with EGR systems must also be fitted with changed charge-cycle systems as well as other modifications. Commenter provides additional detailed discussion and data regarding the limitations associated with EGR technology and asserts that there is nothing in the record to suggest that this technology will be available for introduction by 2007.

Letters:

DaimlerChrysler (IV-D-344) **p. 12-13**

Response to Comment 3.2.1(L):

We disagree with these comments. First, these comments raise concerns regarding the technical feasibility of EGR equipped HDDEs, and their ability to achieve both a 2.5 g/bhp-hr NMHC+NO_x level and a 0.01 g/bhp-hr PM level, without the use of CDPFs. These issues were dealt within in the context of the Phase 1 rule, and are not at issue in this rule. In the Phase 1 rule, we demonstrated the technological feasibility of the 2004 standards (2.5 g/bhp-hr NMHC+NO_x and 0.1 g/bhp-hr PM), which was based on the use of HDDEs using cooled EGR systems, without the need for CDPFs. The commenter suggests that EGR equipped HDDEs will have PM emissions far in excess of the 0.10 g/bhp PM level, and therefore the CDPFs will not be able to achieve the 2007 0.01 g/bhp-hr PM standard because there won't be sufficient NO_2 to oxidize the PM. Specifically, the commenter suggest it requires 10 times the mass of NOX to oxidize a given mass of PM. As discussed above, we have already demonstrated in the Phase 1 rule that an EGR equipped HDDE can achieve both a 2.5 g/bhp-hr NMHC+NO_x standard and a 0.10 g/bhp-hr PM standard. We have estimated that the NO_x emission rate will be on the order of 2.2 to 2.3 g/bhp-hr NO_x. Therefore, there will be more than the 10 times NO_x/PM mass ratio the commenter suggests is needed for CDPFs to achieve the PM standard promulgated in this rule.

(M) Advanced after-treatment systems together with highly reduced fuel sulfur content could be required in addition to cooled exhaust gas recirculation (EGR) and other diesel engine technologies to meet the proposed diesel engine standards.

(1) Commenter provides as supporting documentation, a report and presentation entitled "Evaluation of Future Diesel Engine Technologies" as submitted by Paul Zelenka and Wolfgang Cartellieri of AVL List BmbH, Graz, Austria, to the NPRA at their 2000 annual meeting. This report outlines the technologies that could be used to meet the standards and the issues associated with use and implementation.

Letters:

National Petrochemical & Refiners Association (IV-D-26) **p. 1-23**

Response to Comment 3.2.1(M):

The report summarized here lists technologies which AVL feels are most likely to be used in order to meet a presumed HD 2007 emission standard. The report did not address the use of a NO_x adsorber catalyst in order to meet the standard because AVL presupposed that a NO_x adsorber catalyst would be unable to provide the required NO_x reductions. As documented by the test programs completed by DOE and EPA (in our RIA), this assumption is erroneous as NO_x adsorbers have been shown to be more than 90 percent effective in controlling NO_x emissions over the regulated test procedures.

AVL additionally listed several statements, suppositions and conclusions about the NO_x storage catalyst (NO_x adsorber) that bear addressing here.

1. *Fundamental research and application work primarily concentrating on LDV engines is ongoing at AVL and other places.* - AVL apparently does not feel that there is a theoretical flaw with the technology since it is already working on applications (presumably for the EURO IV LDV standards). Their concerns for Heavy Duty vehicles appear to be based upon engineering hurdles and not on theoretical limits of the technology.

2. *Desorption at rich conditions without any disadvantages (soot increase, secondary emissions, driveability etc.) is being developed by the use of some kind of homogeneous diesel combustion.* - Here AVL suggests yet another means of NO_x adsorber regeneration unanticipated by EPA in its analysis (the RIA identifies two methods for NO_x adsorber regeneration, in-cylinder post injection and in-exhaust dual leg systems). That engineers will continue to find new and novel ways to develop the exhaust conditions needed for NO_x adsorber regeneration seems to be self evident from AVL's statement.

3. *Main obstacle to be overcome is desulphurization (*desulfation*) of stored sulfates. This requires temperatures in the range of 450 to 700 °C, which are hardly achievable during sufficient long period in daily use. At these high temperatures catalyst ageing is promoted impairing system durability.* - AVL reaches the same conclusion that EPA has about the primary issues with NO_x adsorber durability. First that sulfur poisons the NO_x adsorber catalyst. Secondly that desulfation is possible but only at elevated temperatures (although we disagree with AVL that these conditions can not be met in daily use). And lastly that elevated temperatures promote catalyst aging (thermal degradation).

However, we depart from AVL's conclusions on two points. The high exhaust temperatures can in fact be generated for desulfation in a manner that has the potential to meet in-service engine operating conditions and acceptable driveability conditions as shown by the DOE DECSE Phase II work documented in the RIA. Second, we document in the RIA that although thermal degradation is a serious problem, it can be managed. Please see our responses to issues 3.2.1(C) and 3.2.1(J).

4. *For high load operation being typical for heavy-duty diesel engines lean-rich switching inevitably produces heavy smoke peaks because of lack of oxygen at these conditions. The higher the load, the more frequent will be the need for regeneration of the adsorber (due to the higher NO_x mass flow rates and limited NO_x storage capacity at reasonable adsorber size). Upon switching to rich conditions more frequently also the fuel consumption penalty will be higher, and the thermal load of engine components (piston, cylinder head, valves, exhaust system incl. catalyst) will also increase dramatically with HD diesel engines at high engine loads.* - This appears to be AVL's primary reason for concluding that NO_x adsorbers will not be viable for heavy-duty diesels in the 2007 timeframe. The concerns they raise here appear to assume that the rich engine operation is accomplished via a late cycle in-cylinder injection event which could potentially cause the concerns raised here. We disagree with AVL's conclusion here, not in that they have not raised important issues, but in that they have failed to look to potential remedies which are clearly available. The concerns with increased smoke (PM) can be addressed as shown in the NVFEL testing through the application of a CDPF, which is already needed to meet the Phase 2 PM standard. As to the thermal loading concern, this is clearly not an issue for a split catalyst (dual leg) system such as the one described in the RIA. It is also unlikely to be a concern for the homogenous diesel combustion approach suggest by AVL. Lastly, we should note that DOE is already doing late cycle injection based NO_x regeneration and NO_x adsorber desulfation in their Phase II DECSE work and have not reported issues or problems with thermal loading. Rather they conclude about the more severe desulfation cycle that "The desulfurization (desulfation) procedure developed has the potential to meet in-service engine operating conditions and acceptable driveability conditions".

In contrast to AVL's assertion that NO_x adsorbers can not be applied successfully to heavy-duty diesel engines in the timeframe of this rulemaking is a wide range of comments received by EPA that say clearly that NO_x adsorbers can be applied in that timeframe. Some examples of those comments are:

1. *The Department* (the U.S. Department of Energy) *is confident that, assuming a reasonable rate of technology development before 2006, diesel fuel sulfur levels averaging 10 ppm or less will enable emission control devices* (NO_x adsorbers and CDPFs) *to operate effectively over the full useful vehicle life and, therefore, allow the vehicles/engines to meet the future standards* (the Phase 2 standards)." - letter from DOE to Bob Perciascepe 6 September 2000, EPA Docket A-99-06 Item IV-G-28.

2. *... the technological challenges posed by the proposed 2007 HDD standards are achievable.* .. *with the surety of specific standards at a known date, along with a concerted effort by the engine manufacturers and the emission control technology industry, once again we will "make it happen" with technology and integrated systems that meet the standards and are durable.* letter from Martin Lassen - Johnson Matthey Catalytic Systems division 19 October 2000, EPA Docket A-99-06 Item IV-G-55.

3. *We believe all NO_x adsorber development issues have been identified and the technology is proceeding according to schedule.* Letter from John Mooney Director, Technology Development and Business Systems Engelhard Corporation to Margo Oge, U.S. EPA 3 October 2000, EPA Docket A-99-06 Item IV-G-38.

EPA's own laboratory testing program (documented in the RIA) indicates that the NO_x adsorber technology has already made large technological leaps and apparently could be implemented in the relatively near future.

The AVL report does substantiate our assertion that low pressure loop EGR may be a desirable technology given low sulfur diesel fuel and the use of CDPFs. AVL estimates that the use of low pressure loop EGR enabled by this rulemaking would result in a three percent improvement in fuel economy when compared to the more conventional high pressure loop solution (EPA made no estimate of this potential savings, although we agree that this savings may be possible). Further AVL substantiates our conclusion that the application of CDPFs will as stated by AVL "reduce the number of nano-particles in the exhaust to a negligible level."

We disagree with AVL's conclusion that the Urea SCR technology is the only means to meet the Phase 2 NO_x standards. While we agree with their technical assessment that the technology can be further developed to deliver effective NO_x control, we have concluded as explained in issue 3.2.1(C) that a successful program based on the widespread use of SCR is questionable for the 2007 timeframe.

(N) The proposed supplemental emission requirements and tests (SERTs) are not technologically feasible and should not be adopted for Model Year 2007 and later engines.

(1) The SERTs are not mere add-on tests to ensure compliance with the proposed standards but constitute separate and more stringent emission control standards in and of themselves. EPA has failed to provide analysis that the SERTs (which were developed on the basis of retarded timing (finalized to apply to EGR) and are now proposed for implementation with aftertreatment), are technologically feasible with respect to the proposed NO_x, NMHC, PM, and formaldehyde standards. In this context, EPA has failed to meet its statutory mandate. (See also Issue 7.4.3 and Issue 12.2.) In addition, EPA should fully analyze the impacts of the use of the aftertreatment technology that is necessary for meeting the proposed 2007 standards on engine manufacturers' ability to comply with the now-finalized SERTs. EPA has failed to analyze the aftertreatment impact on the FTP and has not addressed the issue in the context of the supplemental emission requirements.

<u>Letters:</u>

Cummins, Inc. (IV-D-231) **p. 21-28**
Detroit Diesel Corporation (IV-D-276) **p. 23-26**
Engine Manufacturers Association (IV-D-251) **p. 57-58**

<u>**Response to Comment 3.2.1(N)(1):**</u>

Commenters suggest we have not met our statutory requirements regarding the NTE and the SET tests. We disagree with this comment. As discussed in Chapter 3 of the RIA for this final rule, we examined the technological feasibility of the supplemental standards, and we have concluded they are technologically feasible and otherwise appropriate by model year 2007. We highlight the key issues and data contained in the RIA below.

With respect to the supplemental emission test (SET) requirements, we have demonstrated in our laboratory that the NOx, NMHC, and PM standards can be achieved with the combination of CDPFs and NOx adsorbers. Chapter 3 of the RIA contains a detailed discussion of the PM reduction capabilities of CDPFs, and includes a discussion of data which shows that CDPF equipped HDDEs can achieve a PM level of 0.01 g/bhp-hr when operated on 15 ppm fuel (see specifically Chapter III(A)(2)(a) of the RIA, and the discussion surrounding Figure III-A.2. and Table III-A.1.). Based on available data, Table III-A.1. of the RIA shows that a HDDE equipped with a CDPF can achieve a PM emission rate over the SET test of 0.009 g/bhp-hr, which would meet the SET PM standard promulgated today, i.e., 1.0 x FTP standard. In the RIA, Tables III.A.-7 through III.A.-10 shows NOx and HC emission data over the SET from our NVFEL test program for a HDDE equipped with both a CDPF and a NOx adsorber using a single-bed test arrangement. This data shows NOx reductions from four different adsorbers of greater than 90 percent, and HC emissions for three of the four adsorbers are below the 0.14 g/bhp-hr NMHC SET standard contained in this rule (i.e., the SET standard is 1.0 x FTP standard). Table III-A.2 of the RIA shows test data from our NVFEL test program using a dual bed NOx adsorber system. This data also shows a 90 percent reduction in NOx emissions is achievable using a NOx adsorber, though HC emissions were reduced only a small amount to a level of 0.27 g/bhp-hr. As discussed in Chapter 3 of the RIA, these HC emissions could be reduced significantly beyond this level with an optimized clean-up diesel oxidation catalysts, as well as with an optimized NOx adsorber regeneration method, to a level sufficient to meet the SET NMHC standard. The Phase 1 rule established an SET NOx standard of 2.5 g/bhp-hr NMHC+NOx (1.0 x 2004 FTP standard). We estimate that 2.2 to 2.3 g/bhp-hr of these emissions will be NOx, therefore, an emission reduction on the order of 90 percent or more will be required to achieve the SET standard promulgated in this rule. Considering the level of reductions we have already demonstrated and the lead time available to engine manufacturers to optimize these control technologies, the SET standards are feasible by model year 2007. (See chapter 3 of the RIA for a detailed discussion of the feasibility of the SET standards)

Regarding the feasibility of the NTE standard, in response to comments and other information available since the proposal, we have changed the NTE standard in this final rule from the proposal in order to address technological issues associated with the anticipated use of exhaust emission control devices such as CDPFs and NOx adsorbers, as discussed here. First, we have finalized an NTE emission standard of 1.5 x FTP standard, which is slightly higher than the 1.25 x FTP standard we proposed. For PM emissions, the NTE requirement, unlike the HD FTP or SET standard, is not a composite test (i.e., the 20 minute transient HD FTP cycle or the 13-steady-state SET modes). In fact, a number of the individual modes within the SET test fall within the NTE engine control zone. As discussed in Chapter 3 of the RIA, CDPFs are very efficient at capturing elemental carbon PM (>95 percent), but sulfate-make under certain operating conditions may exceed the FTP or SET standard, which is part of the reason the PM NTE standard is greater than the FTP and SET PM standards. If carbon PM, generated by HDDEs were the only contributor to PM (i.e., particulate sulfate generation was zero), then a PM NTE standard on the order of 1.0 x FTP standard could very well be considered feasible. However, as discussed in the RIA, CDPFs themselves generate PM from the sulfur in the fuel. Even at the low diesel fuel sulfur levels which will be available as a result of the diesel fuel sulfur requirements established in this rule, particulate sulfate generation will be significant. The DECSE test program discussed in the RIA, in addition to testing CDPFs and reporting data from the SET test, also reported PM performance results at two individual steady-state modes, the peak-torque condition and a "road-load" condition. The peak-torque test mode produces very high exhaust gas temperature (and would therefore be representative of the highest sulfate particulate generating conditions) and the road-load condition is intended to be representative of a typical HD diesel engine line-haul cruise operation (75 percent load, Euro B speed). A linear fit of the DECSE PM emission results for the road-load and peak-torque conditions between the three ppm sulfur test fuel and the 30 ppm sulfur test fuel point shows that the two CDPFs which were tested produced an 88-94 percent or greater reduction at a linear interpolated sulfur level of seven ppm (near the expected in-use average) and an 83-90 percent reduction at a linear interpolated sulfur level of 15 ppm (capped level), for both test operating points. For both CDPFs, the road-load condition resulted in lower sulfate make and higher overall PM reduction than the peak-torque condition. Based on this information, under very high particulate sulfate formation conditions, at 15 ppm sulfur a CDPF can produce at least an 83 percent reduction, and at the expected refinery average sulfur level of seven ppm, when operated at very high sulfate conversion engine conditions a CDPF can produce at least an 88 percent reduction. It should be noted that a prolonged steady-state test condition at the peak-torque mode for a HDDE is representative of the highest exhaust gas temperature producing engine operating conditions. The DECSE testing conditions for these two steady-state points prescribed a five minute warm-up and a 20 minute sample collection, for a total of 25 minutes of operation at peak-torque. The peak-torque test data described above could be considered representative of the worst case particulate sulfate generating conditions. The data show that even under these test conditions, an 83 percent reduction would be sufficient to comply with the NTE provisions, even considering PM sulfate make, when tested on 15 ppm sulfur fuel. Under the Phase 1 rule, a HDDE could emit PM emissions subject to the NTE requirements as high as 0.13 g/bhp-hr (1.25 x 0.10 g/bhp-hr). An 83 percent reduction from this engine would result in a PM emission rate of 0.022 g/bhp-hr, which would comply with the 2007 NTE PM standards contained in this final rule.[70]

Under the Phase 1 HDDE provisions (which includes the Phase 1 FTP standards and the 2007 NTE provisions as they apply to the Phase 1 FTP standards), emission "carve-out" zones of the NTE control zone were defined. These carve-out zones are areas within the defined NTE control zone which are excluded from meeting the NTE standards for specific emissions. The Phase 1 rule defined two types of carve-out zones, one which applied to all regulated emissions (gaseous emissions and PM), and one carve-out zone which only applied to PM. The PM only carve-out zone was specified to exclude low load, high speed engine operation from the NTE requirements. During these conditions, HDDEs not equipped with CDPFs can produce higher PM emission rates, and it was decided within the Phase 1 rule to exclude HDDEs from complying with the PM NTE requirements when operated within the defined PM carve-out zones. With the application of CDPFs to HDDEs, these PM only carve-out zones are not needed. As discussed previously, CDPFs are very effective at reducing engine-out PM. During the recent NVFEL test program which evaluated the effectiveness of diesel CDPFs on low sulfur diesel fuel, we included one steady-state test point which was within the Phase 1 rule's PM carve-out zone. Specifically, the test point was 228 ft-lbs torque and 2,415 rpm (listed as Mode 6 in Figure III.A-6 of the RIA), which places the test condition near the center of the Phase 1 rule's PM carve-out zone for this engine. At

[70] The PM NTE standard contained in this final rule is 1.5 x FTP standard, or 1.5 x 0.01 g/bhp-hr. 40 CFR 86.007-11(a)(4)(v) specifies that the rounding procedures in ASTM E29-90 should be applied to the NTE emission standard, therefore, the NTE standard is rounded to the same number of significant digits as the FTP standard, i.e., 1.5 x 0.01g/bhp-hr is rounded to 0.02 g/bhp-hr. An engine with a measured NTE PM emission rate of 0.022 g/bhp-hr would also be rounded using ASTM rounding provisions, and would be rounded to the same number of significant digits as the standard, so 0.022 g/bhp-hr would round to 0.02 g/bhp-hr, and would meet the NTE PM standard.

this operating condition, one of the CDPFs reduced engine-out PM by more than 95 percent, from 0.068 g/bhp-hr to 0.003 g/bhp-hr, the second CDPF produced similar results. Based on the high PM reduction capability of CDPFs when operated on low sulfur diesel fuel, and their demonstrated ability to achieve >90 percent reductions when operated inside the Phase 1 PM carve-out zones, we have eliminated the PM-only carve-out zones from the NTE requirements.

The PM NTE requirements apply not only during standard laboratory conditions, but also during the expanded ambient temperature, humidity, and altitude limits defined in the regulations. We believe the NTE PM standard is technologically feasible across this range of ambient conditions. As discussed above, CDPFs are mechanical filtration devices, and ambient temperature changes will have minimal effect on CDPF performance. Ambient altitude will also have minimal, if any, effects on CDPF filtration efficiencies, and ambient humidity should have no effect on CDPF performance. As discussed above, particulate sulfate make is sensitive to high exhaust gas temperatures, however, at sea-level conditions, the NTE requirements apply up to ambient temperatures which are only 14°F greater than standard test cell conditions (100°F under the NTE, versus 86°F for HD FTP laboratory conditions). At an altitude of 5,500 feet above sea-level, the NTE applies only up to an ambient temperature within the range of standard laboratory conditions (i.e., 86°F). These small or non-existent differences in ambient temperature should have little effect on the sulfate make of CDPFs, and as discussed above, even when tested under at an engine operating test mode representative of the highest particulate sulfate generating conditions (25 minutes at peak-torque operation) with 15 ppm sulfur diesel fuel, we predict the engine would comply with the PM NTE standard. Based on the available test data and the expected impact of the expanded, but constrained, ambient conditions under which engines must comply with the NTE, we conclude that the PM NTE standard is technologically feasible by 2007, provided low sulfur diesel fuel (<15 ppm) is available.

Regarding the feasibility of the NTE NOx standard, under the Phase 1HDDE rule, NTE emission requirements for NMHC+NOx specify the NTE standard as 1.25 x FTP standard. The Phase 1 FTP standard for NMHC+NOx is 2.5 g/bhp-hr, therefore the Phase 1 NMHC+NOx NTE standard is 3.1 g/bhp-hr. As discussed in the Phase 1 final rule, we would expect the break-down between NMHC and NOx emissions for the Phase 1 NTE standard to be mostly NOx emissions, on the order of 3.0 g/bhp-hr NOx, with the remainder being NMHC. In this rule, we have promulgated the Phase 2 engine NOx NTE standard as 1.5 x FTP standard, i.e., 1.5 x 0.20 g/bhp-hr, which is 0.30 g/bhp-hr NOx. Therefore, a 90 percent reduction in NOx emissions is necessary from Phase 1 engines in order to achieve the Phase 2 NTE NOx standard in this final rule. As discussed here and in the RIA for this rule, this 90 percent reduction is technologically feasible by model year 2007 across the range of engine operating conditions and ambient conditions subject to the NTE standards specified in the regulations. Also as discussed below, some modifications to the NTE provisions to address technical issues which arise from the application of advanced NOx catalyst systems have been included in this final rule. Section III.A.3.b.v.c of the RIA ("NVFEL's NOx Adsorber Evaluation Program"), contains a description of the NOx adsorber evaluation test program run by our EPA laboratory. Included in that section is test data on four different NOx adsorbers for which extensive steady-state mapping was performed in order to calculate the SET and AVL composites (See Figures III.A-7 through III.A-10 of the RIA). Several of the test modes presented in these figures are not within the NTE NOx control zone, and would not be subject to the NTE standard. The following modes listed in these four figures are within the NTE NOx control zone, EPA modes 6 - 13, 15, 17, 19, 20. For all of the adsorbers, efficiencies of 90 percent or greater were achieved across the majority of the NTE zone. The region of the NTE zone for which efficiencies less than 90 percent were achieved were concentrated on or near the torque curve (EPA modes 8, 9, 15 and 17) with the exception of

Adsorber D, for which EPA modes 6 and 7 achieved 87 percent and 89 percent NOx reduction respectively. However, Adsorber D was able to achieve NOx reductions greater than 90 percent along the torque curve. The test modes along the torque curve represent the highest exhaust gas temperature conditions for this test engine, on the order of 500°C. As discussed in Section III.A.3.b.iv.c of the RIA, 500°C is near the current upper temperature limit of the peak NOx reduction efficiency range for NOx adsorbers, therefore it is not unexpected that the NOx reductions along the torque curve for the test engine are not as high as in other regions of the NTE zone. We would expect manufacturers to choose a NOx adsorber formulation which matches the exhaust gas temperature operating range of the engine. In addition, the steady-state mode data in section III.A.3.b.v.c of the RIA were collected under stabilized conditions. In reality, actual in-use operation of a heavy-duty diesel vehicle would likely not see periods of sustained operation along the torque curve, and therefore the likelihood the NOx adsorber bed itself would achieve temperatures in excess of 500°C would be diminished. Regardless, as discussed in Section III.A.3.b.iv.a & c of the RIA, we expect incremental improvements in the high temperature NOx reduction capabilities of NOx adsorbers between now and model year 2007 will be achieved through improvements in NOx adsorber formulations. As discussed above, only small improvements in the current characteristics are necessary in order to achieve 90 percent NOx reductions or greater across the NTE control zone. Considering the available lead time, we expect these improvements will occur and enable the NTE to be achieved.

As discussed in section III.A.3.b.vi.a, the use of advanced NOx reduction catalyst systems on HDDEs will present cold-start challenges for HDDEs similar to what light-duty gasoline manufacturers have faced in the past, due to the light-off characteristics of the NOx adsorber. We have previously discussed the tools available to HDDE manufacturers to overcome these challenges in order to achieve the Phase 2 FTP NOx standard. The majority of engine operation which occurs within the NTE control zone will occur at exhaust gas temperatures well above the light-off requirement of the NOx adsorbers. Figures III.A-7 through III.A-10 in section III.A.3.b.v.c of the RIA ("NVFEL's NOx Adsorber Evaluation Program") show that all test modes which are within the NTE control zone have exhaust gas temperatures greater than 300°C which, as discussed in section III.A.3.b.iv of the RIA, is well within the peak NOx reduction efficiency range of current generation NOx adsorbers. However, though the NTE does not include engine start-up conditions, it is conceivable that a HDDE vehicle which has not been warmed up could be started and very quickly be operated under conditions which are subject to the NTE standard; for example, within a minute or less of vehicle operation after the vehicle has left an idle state. The NTE regulations specify a minimum emissions sampling period of 30 seconds. Conceivably the vehicle emissions could be measured against the NTE provisions during that first minute of operation, and in all likelihood it would not meet the NTE NOx standard set in this final rule. Given that the FTP standards will require control of cold-start emissions, manufacturers will be required to pay close attention to cold start to comply with the FTP. As discussed above, operation with the NTE will be at exhaust gas temperatures within the optimum NOx reduction operating window of the NOx adsorbers, that is, even under cold ambient conditions, NTE engine operation will generally occur at exhaust gas temperatures greater than 300°C. In addition, as discussed in Chapter 3 of the RIA, a NOx adsorber is capable of adsorbing NOx at lower exhaust gas temperatures, on the order of 100°C, but they have not been shown to be able to reduce the stored NOx at this low temperature. Figures III.A-7 through II.A.-10 of the RIA all show NOx emission reductions on the order of 70 - 80 percent are achieved at temperatures as low as 250°C. Therefore, we have established a low temperature exhaust gas threshold of 250°C, below which specified the NTE NOx and NMHC requirements do not apply.

The minimum emissions sample time established under the Phase 1 rule for NTE testing is 30 seconds. This testing requirement was premised on the use of Phase 1 HDDE emission control technology such as EGR and fuel injection timing. These emission control devices tend to produce brake-specific mass emission rates of exhaust pollutants which do not have periodic, orders of magnitude changes in brake-specific emission rates within the NTE control zone when averaged over a 30 second sample time. However, this is not the case for the NOx adsorber catalysts. As discussed throughout this Chapter, NOx adsorbers require active regeneration events, which can produce near zero mass emission rates during the adsorption phase, followed by relatively large spikes in NOx and HC emissions during the regeneration phase. This is illustrated in Figure III.A-11 of the RIA, which shows that engine out NOx under steady-state conditions on the order of 640 ±15 ppm, which is fairly continuous. However, the NOx emissions downstream of the NOx adsorber are both much lower and are characterized by periodic, orders of magnitude changes in emissions. The NOx concentration downstream of the adsorber shows periods of near zero ppm NOx lasting approximately 10 seconds, followed by a NOx peak with a maximum concentration of approximately 40 ppm, with the spike lasting approximately four seconds. A similar phenomenon can be seen in Figure III.A-11 of the RIA for hydrocarbon emissions. Because of this unique periodic nature of the NOx adsorber system, we have modified the NTE sample time provisions in the regulations, to ensure that the emission spikes described above are not measured in isolation during NTE testing. The regulations specify that for any emission control system which requires discreet regeneration events, if a regeneration event occurs within the emissions sample, the emissions averaging time must be at least as long at the time between regenerations events (i.e., a regeneration period), multiplied by the number of full regeneration events within the sample period. This provision to account for regeneration events ensures that the unique operation of the NOx adsorber system will not cause an inappropriate exceedance of the NTE limits.

The NTE requirements apply not only during laboratory conditions applicable to the transient FTP and the SET tests, but also under the wider range of ambient conditions for altitude, temperature and humidity specified in the regulations. These expanded conditions will have minimal impact on the emission control systems expected to be used to meet the NTE NOx standard contained in this final rule. Under the Phase 1 rule, NTE emissions under the expanded NTE testing conditions can be as high as 3.1 g/bhp-hr NMHC+NOx (1.25 x 2004 FTP standard). Therefore, we assume here that engines in the 2007 time frame are capable of achieving 3.1 g/bhp-hr NMHC+NOx over the NTE without the use of the NOx control devices needed to achieve the standards contained in this rule. Thus, we analyze the impact of the NTE expanded testing conditions on the NOx adsorber, not on the base engine which is capable of achieving the Phase 1 NTE requirements. In general, it can be said that the performance of the NOx adsorbers are only effected by the exhaust gas stream to which the adsorbers are exposed. Therefore, the impact of ambient humidity, temperature, and altitude will only effect the performance of the adsorber to the extent these ambient conditions change the exhaust gas conditions (i.e., exhaust gas temperature and gas constituents). The ambient humidity conditions subject to the NTE requirement will have minimal, if any, impact on the performance of the NOx adsorbers. The exhaust gas itself, independent of the ambient humidity, contains a very high concentration of water vapor, and the impact of the ambient humidity on top of the products of dry air and fuel combustion are minimal. The effect of altitude on NOx adsorber performance should also be minimal, if any. The NTE test procedure regulations specify an upper bound on NTE testing for altitude at 5,500 feet above sea-level. The Phase 1 regulations require compliance with an NTE NMHC+NOx limit of 1.25 x the Phase 1 FTP standard up to this altitude. As discussed above, a 90 percent reduction in NOx emissions from the Phase 1 technology engines is, therefore, necessary to comply with the NTE standard established in this rule.

The decrease in atmospheric pressure at 5,500 feet should have minimal impact on the NOx adsorber performance. Increasing altitude can decrease the air-fuel ratio for HDDEs which can in turn increase exhaust gas temperatures; however, as discussed in the Phase 1 final rule, Phase 1 technology HDDEs can be designed to target air-fuel ratios at altitude which will maintain appropriate exhaust gas temperatures, as well as maintain engine-out PM levels near the 0.1 g/bhp-hr level and NOx emissions can be maintained within the Phase 1 NTE standard (1.25 x 2.5 g/bhp-hr NMHC+NOx), within the ambient conditions specified by the NTE test procedure. Finally, the NTE regulations specify ambient temperatures which are broader than the FTP temperature range of 68-86°F. The NTE test procedure specifies no lower ambient temperature bounds. However, as discussed above, we have limited NTE requirements on NOx (and HC) for engines equipped with NOx (and/or HC) catalysts to include only engine operation with exhaust gas temperatures greater than 250°C. Therefore, low ambient temperatures will not present any difficulties for NTE NOx compliance. The NTE also applies under ambient temperatures which are higher than the FTP laboratory conditions. The NTE applies up to a temperature of 100°F at sea-level, and up to 86°F at 5,500 feet above sea-level. At altitudes in between, the upper NTE ambient temperature requirement is a linear fit between these two conditions. At 5,500 feet, the NTE ambient temperature requirement is the same as the upper end of the FTP temperature range (86°F), and therefore will have no impact on the performance of the NOx adsorbers, considering that majority of the test data described throughout this chapter was collected under laboratory conditions. The NTE upper temperature limits at sea-level is 100°F, which is 14°F. (7.7°C) greater than the FTP range. This increase is relatively minor, and while it will increase the exhaust gas temperature, in practice the increase should be passed through the engine to the exhaust gas, and the exhaust gas would be on the order of 8°C higher. Within the exhaust gas temperature range for a HDDE during NTE operation, an 8°C increase is very small. As discussed in detail in Chapter 3 of the RIA, we expect manufacturer to choose an adsorber formulation which is matched to a particular engine design, and we would expect the small increase in exhaust gas temperature which can occur from the expanded ambient temperature requirements for the NTE will be taken into account by the manufacturer when designing the complete emission control system.

As discussed in the RIA, we have demonstrated that reductions in NMHC emissions are possible useing both CDPFs and NOx adsorber, in combination with a clean-up diesel oxidation catalysts. Considering the 0.2 to 0.3 g/bhp-hr HC emission levels of todays HDDEs, we anticipate that 2007 technology HDDEs equipped with CDPFs, NOx adsorbers, and a clean-up DOC, will be capable of achieving the NTE NMHC standard promulgated in this final rule (0.21 g/bhp-hr, i.e. 1.5 x 0.14 g/bhp-hr), provided the following constraints are placed on NTE NMHC testing. The minimum emission sample time provisions for the NTE test have been changed to reflect the potential for short-duration high HC emissions which can occur following a regeneration event, as described above for NTE NOx emissions. This change to the NTE minimum sample time approach will address any feasibility concerns which could arise because of the short-term increase in HC emissions immediately following a regeneration event, by increasing the sample time to include the time period until the next regeneration. In addition, the NMHC NTE provisions do not apply until the hydrocarbon emission control device (e.g., DOC) has achieved a warmed up exhaust gas temperature of at least 250°C on the outlet of the device. As discussed above, this same provision applies to the NOx NTE standard. With these additional constraints placed on NTE testing, we conclude the NTE standard for NMHC can be achieved by model year 2007.

Regarding the comments on an NTE formaldehyde standard, we have not established an NTE formaldehyde standard in this rule. Please see response to comment 3.1.1(G) for more detail on this issue.

(2) EPA has not specifically addressed expanded ambient conditions in the proposed rule. However, based on EPA's statements that the just-finalized

SERTs also would be applicable to HDEs under the proposed rule, it is assumed that the SERTs include requirements for expanded ambient conditions. Commenters provided significant discussion, data and analysis on this issue with respect to the technological feasibility of aftertreatment at low ambient temperatures and at high altitude conditions, as well as the need to protect the aftertreatment system at extreme ambient temperatures. Commenters also note that EPA has not given adequate consideration to the impact of combining the required technologies into one emissions control system at FTP conditions or with the new SERTs at expanded ambient conditions and provide additional discussion on this issue.

Letters:

Cummins, Inc. (IV-D-231) **p. 22-25**
Engine Manufacturers Association (IV-D-251) **p. 64-66**

Response to Comment 3.2.1(N)(2):

We disagree with the comment that we have not addressed the feasibility of the supplemental emission requirements over the expanded ambient conditions. First, it should be noted that the SET test procedure is a laboratory based tested, applicable to the same conditions which apply to the pre-existing NTE standard. Therefore, any comments regarding the “expanded ambient conditions” are not relevant to the SET standard. With respect to the NTE requirements, as discussed in response to comment 3.2.1(N)(1) above and in more detail in Chapter 3 of the RIA, we have considered the effects of ambient temperature and altitude as they apply to the NTE test procedures, and as discussed above we have concluded the NTE standard is technologically feasible over the range of ambient conditions which during which the NTE standard is applicable.

The commenters suggest that exhaust emission control devices are effected by exhaust gas temperature, and they raise a concern with the impact of low ambient temperatures on NTE performance. As discussed in response to comment 3.2.1(N)(1) above, we have considered this impact in our feasibility analysis, and we have addressed it by placing a constraint on NTE compliance, i.e., the regulations specify that for NTE NOx and NMHC compliance, HDDEs do not need to comply with the NTE requirements when the exhaust gas temperature on the outlet side of the aftertreatement device(s) is less than 250 degrees Celsius.

The commenters raise concerns regarding compliance with the NTE PM standard at altitude. EMA’s comments includes PM data on electronically controlled and mechanically controlled HDDEs manufactured between 1980 and 1995, which indicates PM emissions increase with altitude. This data is not relevant to the 2007 technology engines. First, no mechanical engines are produced today for on-highway HDDEs. Second, there is no indication that manufacturers attempted to meet PM standards at altitude for any of the data provided, so the data does not show that engines can’t comply with the PM standard at altitude. Finally, these engines were not equipped with CDPFs. In this rule, we have discussed the large reductions in PM emissions which can be achieved with the use of CDPFs, and as discussed in response to comment 3.2.1(N)(1) and in Chapter 3 of the RIA, we have considered the impact of altitude on the emission performance of Phase 2 technology engines, and we have concluded the PM NTE standards are technologically feasible by model year 2007.

With regard to the comment on the need to protect the exhaust emission control system at extreme ambient temperatures, the commenter does not suggest what “extreme” is. The NTE requirements, under the NTE ambient operation conditions option 2 in the regulations, apply at ambient temperatures up to 100 deg. F at sea-level, and at 86 deg. F at 5,500 feet above sea-level. We consider these ambient temperatures to be typical, especially during high ozone days when emissions control is critical, rather than “extreme”, as suggested by the commenter. As discussed in response to comment 3.2.1(N)(1) above and in the RIA, the NTE is achievable within these bounds. For temperatures above these levels, the manufacturers will of course have the right to apply to the Agency for auxiliary emission control devices to protect the engine/vehicle from damage, which could include protection of the exhaust emission control device from extreme exhaust gas temperatures. In addition, within the temperature/altitude bounds described above and defined in the regulations, the NTE only applies “under conditions which can reasonably be expected to be encountered in normal vehicle operation and use” (see 40 CFR 86.1370(a)). Therefore, manufacturers would also be allowed to receive AECDs for engine/vehicle protection during abnormal and/or extreme vehicle operation, provided they can demonstrate to the Agency’s satisfaction that such vehicle operation should not be subject to the NTE standard.

We disagree with the comment we have not given adequate consideration to the combination of the required technologies with respect to their ability to achieve the FTP standards or the supplemental emission requirements (NTE and SET). Such analysis has been performed, and there is a detailed discussion in Chapter 3 of the RIA (see specifically the discussion under section (A)(3)(b)(iii) of Chapter 3 of the RIA, and the text discussion Figure III-A.4 of Chapter 3), as well as a discussion with respect to the NTE and SET standards in response to comment 3.2.1(N)(1) above.

(3) EPA has not analyzed the impact of the SERTs on the proposed formaldehyde standard. The SERTs only add additional uncertainty about the need for and appropriate limits of a possible formaldehyde standard and EPA should not finalize a standard until an appropriate technological feasibility analysis is completed that would address these issues.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 67**

Response to Comment 3.2.1(N)(3):

Regarding the comments on an NTE formaldehyde standard, we have not established an NTE formaldehyde standard in this rule. However, we expect significant formaldehyde control over the NTE operation just as we do during FTP operation.

(4) Supplemental testing data collected with respect to the 2004 emission standards does not support the feasibility of the proposed standards. When evaluating the 2004 data, it is important to consider the context in which the supplemental testing requirements were met. The techniques that could be employed to meet the NTE requirements and reduce emissions well below the 2004 standards are not available under the 2007 standards. The low 2007 standards do not allow substantial operation well below the FTP-based standards and there is little or no margin to accommodate variability in the overall efficiency of the engine emission control system. The 2007 HD diesel engine standards are just 10 percent of the 2004 standards. Therefore, the 25 percent variability allowance under the 2007 standards is equivalent to a

mere 2.5 percent of the 2004 standards. It is extremely unlikely that these engines could maintain emissions under various conditions within such a small range. To the extent that the supplemental testing data for the 2004 standards is relevant, it suggests that the standards cannot be met.

Letters:

General Motors Corp. and Isuzu Motors America, Inc.(IV-D-256) **p. 50-51**

Response to Comment 3.2.1(N)(4):

The commenters present a detailed discussion of why data from 2004 technology HDDEs does not demonstrate the feasibility of the 2007 NTE standards contained in this rule. As discussed in response to comment 3.2.1(N)(1) above, and in more detail in the RIA, we have not relied solely on data from 2004 technology HDDEs in making our determination the 2007 NTE standards for Phase 2 engines are technologically feasible. As discussed in response to comment 3.2.1(N)(1) and in the RIA, we have analyzed data from NO_x adsorbers and CDPFs, which are clearly not the emission control technology which will be used to achieved the 2004 HDDEs standards. As discussed in detail in the Phase 1 rule, we expect the 2004 HDDE standards will be achieved primarily through the use of cooled EGR.

(O) The proposed NTE limits are not technologically feasible.

(1) The proposed NTE zone establishes a 1.25 factor over the base standard. However, this does not provide any additional flexibility because of measurement inaccuracy and rounding procedures. A 0.25 g/bhp-hr standard that must be met over all points of the engine operating map is not technologically feasible. In addition, for the proposed PM standard, the NTE limit and the standard on the FTP are essentially the same which does not make any sense and EPA has failed to show that such an NTE standard is technologically feasible. The NTE is fundamentally inconsistent with the FTP and therefore, violates the testing provisions of the CAA. Slight changes in the efficiency of the emission control system that are acceptable when attempting to meet the "2004" standards, would have ten times the percentage effect on emissions from a "2007" technology engine. Therefore, a 3 percent decrease in converter efficiency that is barely noticed under the 2004 standards could easily cause emissions to increase over 125 percent of the 2007 standards, resulting in an NTE violation. Without data correlating the NTE emission limits with the standard FTP transient test protocol, it is not even clear how stringent the NTE limits are, or whether they are technically feasible. EPA should eliminate the NTE requirements from its proposed rule or modify the supplemental testing requirements in a way that renders them technologically feasible and cost effective for manufacturers. Commenters provided significant discussion on this issue describing in detail why the NTE limits are not feasible.

Letters:

Cummins, Inc. (IV-D-231) **p. 23-26**
Engine Manufacturers Association (IV-D-251) **p. 59**
General Motors Corp. and Isuzu Motors America, Inc.(IV-D-256) **p. 56-60**
International Truck & Engine Corp.(IV-D-87) **p. 1-2**, (IV-D-257) **p. 20-23**

Response to Comment 3.2.1(O)(1):

We agree with the comment that an NTE standard of 1.25 x FTP standard in the context of the Phase 2 2007 FTP standards for NOx, NMHC, and PM is not appropriate, and in this final rule we have established an NTE standard of 1.5 x FTP standard. The technological feasibility basis for this decision is discussed in response to comment 3.2.1(N) above, as well as in the RIA for this final rule.

The commenters raise concerns regarding the appropriateness of an NTE level of 1.25 x FTP standard due to emission measurement procedures and mathematical rounding issues. Regarding emission measurement procedures, EMA provides no detail regarding the comment, other than stating that "The 'headroom' purportedly made available by the NTE limits is meaningless because of measurement inaccuracy." EMA also mentions the NTE limit cannot be discerned from the FTP standard due to measurement resolution issues for NOx, though no data is provided. As we discuss in response to comments under issue 7.4.5(A), emission measurement equipment is currently available which is capable of accurately measuring the low emission levels required by these standards. Please see our responses to the comments under issue 7.4.5(A). Regarding the comment on rounding, we have incorporated standard ASTM rounding procedures into the NTE regulations, and these provisions make it clear that the NTE standard does not round down to the FTP standard. Specifically, the NTE standard of 1.5 x FTP standard results in an NTE standard of 0.30 g/bhp-hr NOx, 0.21 g/bhp-hr NMHC, and 0.02 g/bhp-hr PM, all of which are numerically higher than the FTP standard.

Regarding the comment that the NTE is fundamentally inconsistent with the FTP and therefore, violates the testing provisions of the CAA, we disagree with this comment. International's comments along this line implies that the NTE violates the CAA's testing provisions because the NTE does not test compliance with the FTP. This comment is not logical. The NTE emission standard is a standard in and of itself, and it does not rely on the FTP test procedure for determining compliance with the NTE standard. The regulations define test procedures for NTE testing which are separate and distinct from the FTP standard, and the purpose of the NTE test procedure is to determine compliance with the NTE standard, not to determine compliance with the FTP standard. The CAA does not restrict the Agency from setting separate and distinct standards and test procedures applicable to HDDEs. For example, the Agency has had smoke standards for a number of years which have their own emission test procedure which is distinct and separate from the FTP test procedure.

Regarding the comments from General Motors/Isuzu on 2004 vs. 2007 NTE requirements and conversion efficiencies, the relevance of this discussion to the 2007 NTE standards is unclear. First, the 2004 standards are based on the feasibility of EGR technology, not on exhaust emission control technology. Second, with respect to the feasibility of the 2007 NTE standards, as discussed in response to comment 3.2.1(N) above and in the RIA, we have considered the application of exhaust emission control devices (e.g., NOx adsorbers and CDPFs) to HDDEs, and we have made a number of changes to the proposal which address the feasibility issues for model year 2007. In the Chapter 3 of the RIA, we discuss the data available regarding NOx conversion efficiencies which NOx adsorbers are capable of producing across the NTE engine control zone. Considering the near 90 percent or greater NOx reduction capabilities across the NTE engine, the NTE standard of 1.5 x FTP standard is achievable by model year 2007.

Regarding the comment on the need for the Agency to correlate the NTE standard to the FTP standard in order to determine the stringency and feasibility of the NTE standard, the intent of this comment is unclear. As discussed in the proposal and in this final rule, the Agency has evaluated all of the proposed requirements and as promulgated in this final rule the requirements are appropriate under the Agency's authority under the Clean Air Act. In this final rule we have established separate FTP and NTE standards which we have determined are technologically feasible by model year 2007 and are otherwise appropriate under the Clean Air Act. The commenter suggested that without information regarding how the pre-existing FTP correlates to the NTE, it is not possible to know how stringent the NTE is, or if the NTE is feasible. We disagree with these comments. The issue of whether or not the NTE is more or less stringent than the pre-existing FTP is not relevant to the Agency's standard setting process. Based on the information presented in this final rulemaking we have determined the NTE standards are feasible and appropriate for model year 2007. The issue of how the NTE compares in stringency to the pre-existing FTP, or how the NTE correlates to the pre-existing FTP is not relevant to the critical question the Agency must answer - which is whether or not the NTE, FTP, and the SET requirements contained in this final rule are technologically feasible and otherwise appropriate under the CAA by model year 2007, and the Agency has determined that the answer to this critical question is yes for each of these test procedures and standards.

Regarding the comment that EPA should eliminate the NTE requirements from its proposed rule or modify the supplemental testing requirements in a way that renders them technologically feasible and cost effective for manufacturers. We agree with the comment that the NTE requirements should be technologically feasible. As discussed in response to comment 3.2.1(N) above, we have made a number of changes in this final rule which make the NTE feasible by model year 2007. Regarding the comment that the NTE must be cost-effective, please see response to comment 5.10(D).

(2) The proposed "NTE deficiencies" will not be as helpful as EPA expects and cannot be used as a substitute for establishing the technological feasibility of the proposed NTE limits. These provisions would give little help to engine manufacturers in attempting to comply with the NTE limits alone and would give no help with the other supplemental emission requirements. The time frame in which manufacturers would be allowed to apply for and obtain deficiencies is very limiting. In addition, these provisions could lead to an uneven playing field in the industry. One of the commenters notes that these provisions should not be used as a substitute for conducting a thorough analysis of the technological feasibility of the NTE zone and limits.

Letters:

Cummins, Inc. (IV-D-231) **p. 25**
Engine Manufacturers Association (IV-D-251) **p. 60-61**

Response to Comment 3.2.1(O)(2):

Regarding NTE deficiencies, as discussed in response to comment 3.2.1(N) above, and in more detail in the RIA, we have determined the feasibility of the NTE standards based on the data available and our analysis of this data, and we have not considered the availability or the in-availability of NTE deficiencies in making this determination. However, the availability of deficiencies can only help manufacturers in attempting to meet the NTE requirements when they are initially implemented.

Regarding the comment that the NTE deficiencies will not be as helpful as the Agency expects, the NTE deficiencies are an option available to engine manufacturers, not a requirement. Manufacturers who do not believe they are helpful can ignore this optional regulatory provision. However, during conversations with several engine manufacturers during the course of this rulemaking, many manufacturers stated the deficiencies would be helpful, and in fact presented verbal arguments for why the deficiencies should not be limited to model years 2007 through 2009.[71] Based on the input of these manufacturers we have decided to extend the availability of the NTE deficiencies from the proposed 2007 -2009 time frame to 2007 - 2012. This extension is appropriate because, considering the phase-in of the NOx standard, manufacturers may be introducing new Phase 2 engine technology equipped engines beginning in 2010. However, we have limited the number of deficiencies for 2010 - 2012 to three per engine family, because of the long lead time available.

Regarding the comments on level playing field, the EPA NTE deficiency allowance are equally available to all manufacturers. The NTE deficiencies are only an allowance for minor deviations from the NTE requirements. The NTE deficiency provisions will allow a manufacturer to apply for relief from the NTE emission requirements under limited conditions. EPA expects that manufacturers should have the necessary functioning emission control hardware in place to comply with the NTE, especially given the lead time afforded to the NTE requirements in this final rule. Nonetheless, we recognize that there may be situations where a deficiency(ies) is necessary and appropriate. Deficiencies will be approved on an engine model basis, for a single model year, though a manufacturer may request a deficiency for all models and/or horsepower ratings within an engine family, if appropriate. These limitations are intended to prevent a manufacturer from using the deficiency allowance as a means to avoid compliance or delay implementation of any emission control hardware or to compromise the overall effectiveness of the NTE emission requirements. Given these constraints, and the limited nature of the NTE deficiency provision, we do not believe competitiveness between engine manufacturers will be an issue. Manufacturers must comply with the FTP and the SET, and they are expected to comply with the NTE, and therefore we expect any NTE deficiencies to be minor, and certainly to have minor implications, if any, on engine cost and performance. The Agency's light-duty on-board diagnostics deficiency provisions have been implemented for a number of years, and no light-duty vehicle manufacturer has raised concerns regarding level-playing field or competitive issues.

(3) The NTE provisions were originally developed based on manufacturer data and experience from "old" engine technology, which used retarded injection timing as the primary emission control. EPA has failed to provide any analysis of the technological feasibility of the proposed shape, size and limitations of the NTE zone as well as the "carve-out" area of the zone as applied to the aftertreatment technology.

<u>Letters:</u>

Cummins, Inc. (IV-D-231) **p. 24**
Engine Manufacturers Association (IV-D-251) **p. 61**

<u>**Response to Comment 3.2.1(O)(3):**</u>

---

[71] EPA meeting with the Engine Manufacturers Association, December 1, 2000, EPA Air Docket A-99-06, Docket Item IV-E-46.

In the RIA for this rule, and as discussed in response to comment 3.2.1(N) above, we have analyzed the available data and determined the NTE standard promulgated in this rule is technologically feasible in the context of the engine and emission control systems we expect to be produced to meet these standards. Included in this analysis was the limitations of the expected control technologies (e.g., CDPFs and NOx adsorbers). In response to technical issues associated with the application of these technologies to HDDEs, we in-fact have made a number of changes to the NTE requirements, including the carve-out zones. Specifically: we have eliminated the PM carve-out zone (as discussed in response to comment 3.2.1(N)); we have set the NTE standard at 1.5 x FTP standard; we have changed the minimum NTE sample time approach (as discussed in response to comment 3.2.1(N)), we have provided a minimum exhaust gas temperature requirement for NOx and NMHC NTE compliance ((as discussed in response to comment 3.2.1(N)).

(4) The stringency of the NTE requirements is impacted by the definition of defeat device, which is different in the current rules, in the 2004 NPRM, the 2004 final rule, and in the consent decrees. Engine manufacturers have not yet had the opportunity to assess the differing impacts on stringency of those different definitions. One commenter (EMA) adds in this context that EPA should retain the current definition of defeat device and refers to their comments on this issue as submitted in response to the 1999 Feasibility Review (2004 rule), p. 17-18. This commenter added that if EPA does not retain its existing definition, then at a minimum it must provide clearly understandable direction to manufacturers and should not prohibit the necessary use of auxiliary emission control devices (AECDs) to address engine operating conditions. Another commenter noted that EPA will need to fully recognize that continuous modulation of the emission control system is absolutely required for compliance, and does not automatically represent a defeat device. (See also Issue 3.1.1.)

Letters:

Cummins, Inc. (IV-D-231) **p. 27**
Engine Manufacturers Association (IV-D-251) **p. 61, 65-66**

Response to Comment 3.2.1(O)(4):

See our response to comment 3.1.1(E).

(5) The NTE limits are not suited to diesel engines employing catalysts. Commenter cites to their letter submitted in response to the "2004" rule in which they provided detailed discussion regarding why the NTE limits are not suited to gasoline engines employing catalysts and notes that the problems associated with applying NTE limits to gasoline HD engines are also applicable to diesel engines that will employ advanced catalyst based NO_x and PM emission control systems. The catalyst itself is not a dynamic system with active control and moving parts that can respond to the changes in engine operating conditions. Rather, under some conditions, such as high-power, high-speed operation, the flow through the catalyst will necessarily be higher than at other times. Under an NTE limit, a manufacturer of HD engines must work to reduce emissions during these high emitting operating conditions at the expense of controls during other operating modes. Because the advanced diesel engine will require catalyst using precious metals, it may

also be subject to the need for protected circuits and will also experience varied exhaust gas residence times in the catalyst under different load conditions.

Letters:

General Motors Corp. and Isuzu Motors America, Inc.(IV-D-256) **p. 59-60**

Response to Comment 3.2.1(O)(5):

We disagree with these comments. The commenter incorrectly applies their knowledge of gasoline 3-way catalysts technology to HD diesel technology. We do not respond to their comments here regarding the appropriateness of an NTE approach for HD gasoline engines, as we did not propose any NTE for HD gasoline, and this final rule contains no NTE requirements for HD gasoline.

The commenter states the NTE approach is not suitable for HD diesels with aftertreatment devices, based on several issues associated with HD gasoline engines. First, the commenter states the catalyst is not a dynamic device. While not a mechanical device with operating points, this statement in other ways is incorrect as it applies to HD diesels. In Chapter 3 of the RIA, we discuss in detail the technology of NOx adsorbers, which is in fact an active device, which will require active regeneration and de-sulfation events. With respect to CDPFs, we have demonstrated in Chapter 3 of the RIA, and as discussed in response to comment 3.2.1(N), we have demonstrated the PM NTE standard is technologically feasible by model year 2007. The commenter suggests there will be a need for engine protection and aftertreatment protection within the NTE requirements. We disagree with this statement. The NTE requirements apply during normal engine operation and during typical ambient conditions which are widely experienced by HDDEs. Manufacturers will still be able to apply for AECDs for engine protection during truly extreme or abnormal engine/vehicle operation and extreme ambient conditions, i.e., conditions not subject to the NTE standard. The commenter discusses HD gasoline catalysts data and calibration techniques, including engine enrichment and concerns regarding high CO and NMHC emissions, as well as the need to protect catalysts with precious metals from extremely high temperatures. This data is not relevant to HD diesel engines equipped with CDPFs and NOx adsorbers. As discussed in the RIA, HD diesel engines under heavy-load have exhaust gas temperatures in the 500 - 600 deg. Celsius . However, HD gasoline engines, with enrichment protection strategies, can easily have exhaust gas temperatures under high load in the 850 - 900 deg. Celsius range. Clearly data which may be relevant to HD gasoline engine/catalyst systems regarding high exhaust gas temperatures and the need for catalyst protection strategies can not be compared to HD diesel engines.

We also disagree with the comments regarding the design of the catalyst system to accommodate the NTE due to high-power, high-speed operation, and that such a design is at the expense of other operating modes. The HD diesel FTP includes operation under high-power, high-speed conditions, and the SET contains a number of high-load and high-speed test modes. A manufacturer who designs a system to pass the HD diesel FTP and the SET must already design the system to operate under these conditions. In addition, the NTE standard is higher than the FTP and the SET standard, which therefore decreases the need to focus only on the NTE standard, and appropriately requires manufacturers to focus on robust hardware and calibration strategies which will control emissions over both the FTP and the supplemental requirements (NTE and SET).

(6) The ambient conditions over which the NTE requirements apply are essentially unbounded, which is a major deficiency in the formulation of the rule. The undefined correction factors are intended to take account of the natural effects of ambient temperature on the mechanisms of NO_x and particulate production inside the engine and are not intended to account for the changing performance, or physical limits to operation, of engine emission control systems such as cooled EGR or exhaust aftertreatment. With future low emission technologies, no simple relationship exists between the ambient conditions and the emissions output of the engine. In determining correction factors, relying on manufacturers to use 'good engineering judgment' is too vague and would present a barrier to ensuring a "level playing field" for all manufacturers. EPA should clarify on what basis correction factors are defined for engines having complex emission control systems.

Letters:

Cummins, Inc. (IV-D-231) **p. 25-26**

Response to Comment 3.2.1(O)(6):

We disagree with this comment. The NTE ambient conditions in fact our bounded. The regulations specify two ambient operating conditions during which the engine is subject to the NTE provisions, see 40 CFR 86.007-11(a)(4)(ii). Under Option 2 in the regulations, the NTE does not apply above 5,500 feet above-sea level, and the NTE does not apply above a defined temperature at each elevation below 5,501 feet above-sea level. The commenter states that this is a major deficiency with the rule, yet this contradicts the commenters supplemental comments, which indicate they support the NTE provisions with respect to 2004 technology engines (see EPA docket A-99-06, docket item IV-G-94, which states "Manufacturers would have supported inclusion in the 2004 rule of the supplemental tests proposed to take effect in 2007"). With regard to the comments regarding the NTE provisions for humidity and temperature, these are optional provisions, and there is no requirement for manufacturers to use correction factors. We do not believe it is appropriate to establish correction factors for the industry as a whole, as the standards will not take effect until model year 2007 and it is likely manufacturers will employ different combinations of hardware can control strategies in order to comply with the standards, and these variations may make a single set of correction factors for the industry inappropriate.

(P) The supplemental steady-state requirements are not technologically feasible.

(1) Even though EPA presents the supplemental steady state (SSS) requirements as an addition only of "test procedures," the SSS emission requirements as proposed by EPA would create a new and unnecessary standard for HDDEs.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 61**

Response to Comment 3.2.1(P)(1):

We disagree with the comment that the supplemental emission test standard (SET, the 13-mode steady-state test) is unnecessary. The commenter provides little discussion to support this statement, but rather they refer to their comments on the Phase 1 rule, in which the commenter states the SET and the NTE appear to have the same purpose, and therefore the SET should be eliminated. We disagree with these statements. The SET has a purpose distinct from the NTE. The SET is a steady-state test, consisting of 13 specific modes, and 4 of the 13 modes fall outside of the NTE control zone. The emission standard for the SET is 1.0 times the engine's FEL or the emission standard, compared to the NTE standard of 1.5 times the FEL or the emission standard. The NTE is designed as a cap on emissions at any time, where as the SET is a test of average emissions over various steady-state operating conditions. Thus, the emission levels that must be met under the SET is lower than the level to meet the NTE. These differences clearly indicate the SET and the NTE do not cover the same type of engine operation for the same purpose. The NTE and SET, in combination with the pre-existing transient FTP, are necessary to provide EPA with assurance that appropriate emission control is occurring across the broad range of operation which heavy-duty diesel engines encounter

(2) The supplemental steady-state test (Euro-III test) and emission limits are infeasible. The supplemental SS test is not correlated with the FTP and EPA has not developed a method of comparing the relative stringency of the two tests. Therefore, it is not possible to determine the stringency of the proposed standards or whether those standards are feasible. (See also Issue 7.4.3.)

Letters:

General Motors Corp. and Isuzu Motors America, Inc.(IV-D-256) **p. 60-61**

Response to Comment 3.2.1(P)(2):

Regarding the comment that the SET standard is infeasible, please see the response to comment 3.2.1(N). Regarding the comment that the SET is not correlated to the pre-existing FTP, and therefore it is not possible to determine the stringency of the SET standard, this comment is not relevant. As discussed in response to comment 3.2.1(O)(1) regarding a similar comment on the NTE, the issue of whether or not the SET is more or less stringent than the pre-existing FTP is not relevant to the Agency's standard setting process. Based on the information presented in this final rulemaking we have determined the SET standards are feasible and appropriate for model year 2007. The issue of how the SET compares in stringency to the pre-existing FTP, or how the SET correlates to the pre-existing FTP is not relevant to the critical question the Agency must answer - which is whether or not the SET requirements contained in this final rule are technologically feasible and otherwise appropriate under the CAA by model year 2007, and the Agency has determined that the answer to this critical question is "Yes."

(Q) The proposed closed crankcase requirement will lead to a loss of engine performance and an overall increase in emissions.

(1) Commenter notes that the engines used in the DECSE study, on which EPA relies, were not equipped with closed crankcase control and contrary to EPA's assertions, 15 ppm sulfur diesel fuel does not make the standard "feasible." To address this issue, a 5 ppm cap on sulfur fuel is essential, since there will be an increased engine oil sulfur contribution as a result of the closed breather requirement.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 13**

(2) EPA's suggestion that breather gas can be routed to the exhaust system upstream of the aftertreatment systems is impractical. Exhaust back pressure is on the order of 2-4 inches of mercury under fully loaded operating conditions whereas crankcase pressure is normally kept to a few inches of water. Routing breather gas to the exhaust would result in increased pressurization of the crankcase and exhaust gas flow in and out of the crankcase with changing speed and load conditions. Higher crankcase pressure effects piston ring seating and dynamics, influencing in-cylinder oil control and piston ring and liner wear. Exhaust flow into the crankcase will result in sooting of the oil and a need for more frequent oil changes. Therefore, routing the breather gas to the engine intake is the only practical solution but in this case, oil vapor carried over with the breather gas can form harmful deposits on the turbocharger compressor and the engine intake system, foul the heat transfer surfaces of the charge air cooler, and place an additional sulfur and ash burden on the exhaust aftertreatment system. Deposits can cause a loss of engine performance and increased emissions and fouling of the charge air cooler will result in loss of charge cooling effectiveness leading directly to increases in NO_x and PM emissions. Commenter provides additional discussion on this issue and concludes that a requirement to close the breather system will lead to increased emissions over the engine's lifetime and that the proposed emission standards are not feasible with this added requirement.

Letters:

Detroit Diesel Corporation (IV-D-276) **p. 21-23**

Response to Comment 3.2.1(Q):

The commenters assert that the data we have analyzed, derived from open crankcase systems, does not apply when determining the feasibility of the Phase 2 standards with closed crankcase systems. We disagree. We anticipate that the heavy-duty diesel engine manufacturers will be able to close the crankcase using one of two methods, the first, by using closed crankcase filtration systems. We are aware of at least two companies which produce closed crankcase filtration systems for the heavy-duty diesel market today, as described in more detail below.[72, 73] Second, the blow-by gases could be routed directly into the exhaust system upstream of the emission control equipment. Finally, if the manufacturer chooses not to close the crankcase, the manufacturer must add the emission from the open crankcase ventilation system to the emissions from the engine downstream of any emission control equipment, e.g., the open-crankcase emissions would be added into the FTP emission results. Thus, the regulatory provision has been written such that if adequate

---

[72] "Crankcase Emissions & Closed Crankcase Filtration", presented by Marty Barris, Donaldson Corporation, Society of Automotive Engineers TOPTEC, September, 2000, copy available in EPA Air Docket A-99-06.

[73] "Advances In The Control of Crankcase Emissions From Diesel Engines", G. Dickson & K. Edge, Diesel Progress, Nov. 1995, copy available in EPA Air Docket A-99-06.

control can be had without "closing" the crankcase then the crankcase can remain "open." (Please see our response to Issue 3.1.1(N).)

As noted in Chapter III of the RIA, there may be a need to remove, clean, and reverse CDPFs at regular intervals to remove ash build-up resulting from engine oil. Small amounts of oil can enter the exhaust via the combustion chamber (past the pistons rings and valve seals), and via the crankcase ventilation system. This can lead to ash build-up, primarily as a result of the metallic oil additives used to provide pH control. This pH control is necessary, in part, to neutralize sulfuric acid produced as a byproduct of burning fuel containing sulfur. However, with reduced fuel sulfur, these oil additives could be reduced, thereby reducing the rate of ash build-up and lengthening any potential cleaning intervals. The use of oil additives which are less prone to ash formation would also extend periodic maintenance intervals. The combination of low sulfur fuel and oil additives with reduced ash formation will reduce the need for periodic maintenance to at least those specified in CFR 86.004-25 (100,000 miles or 3,000 hours for light heavy-duty vehicles, and 150,000 miles or 4,500 hours for medium- and heavy-duty engines). Periodic maintenance would consist of reversing the CDPF and/or washing it out with compressed air or water. Consequently, we conclude that CDPFs will be able to meet the required emission life with minimal maintenance.

We expect that, in order to meet the stringent tailpipe emission standards set in this rule, manufacturers will choose to utilize closed crankcase approaches. Closed crankcase filtration systems work by separating oil and particulate matter from the blow-by gases through single or dual stage filtration approaches, routing the blow-by gases into the engine's intake manifold and returning the filtered oil to the oil sump. As we note in Chapter III of the RIA, closed crankcases are required for new heavy-duty diesel vehicles in Europe starting in 2000. Oil separation efficiencies in excess of 80 percent have been demonstrated with production ready prototypes of two stage filtration systems after more than 500 hours of testing.[74, 75] By eliminating 80 percent or more of the oil that would normally be vented to the atmosphere, the system works to reduce oil consumption and to eliminate concerns over fouling of the intake system when the gases are routed through the turbocharger. Mercedes-Benz currently utilizes this type of system on virtually all of its heavy-duty diesel engines sold in Europe, and Mercedes-Benz has certified at least one on-highway HDDE in the U.S. equipped with such a system since at least 1999.[76] Many of these closed crankcase ventilation systems include a replaceable filter element which is serviced on a fixed interval. Since this is the approach we think that industry is most likely to take we have accounted for the cost of this maintenance in the cost estimates described in chapter V of the RIA.

An alternative approach could be to route the blow-by gases into the exhaust system upstream of the CDPF which would be expected to effectively trap and oxidize the engine oil and diesel PM. One commenter argues that such an approach will not work given the pressure differential between the crankcase and the exhaust system upstream of the CDPF. We disagree that such an approach will not work. We believe that the system could be designed to circulate crankcase gases into the exhaust stream during pulses generating

[74] Letter from Marty Barris, Donaldson Corporation, to Byron Bunker US EPA, March 2000. EPA Air Docket A-99-06.

[75] "Crankcase Emissions & Closed Crankcase Filtration", presented by Marty Barris, Donaldson Corporation, Society of Automotive Engineers TOPTEC, September, 2000, copy available in EPA Air Docket A-99-06.

[76] "Documentation of Closed Crankcase Systems for Model Year 1999 Daimler-Benz On-highway Heavy-duty Diesel Engine Family", EPA Memorandum, Byron Bunker, available in EPA Air Docket A-99-06.

vacuum in the exhaust. We also believe that a venturi system, like those sometimes used in EGR system to facilitate EGR flow, could be used to generate a low pressure capable of facilitating crankcase gas flow. We agree that this approach may require the use of low sulfur engine oil to ensure that oil carried in the blow-by gases does not compromise the performance of the sulfur-sensitive emission control equipment as discussed in Chapter III section 5 of the RIA.

Please see the comment summarized as Issue 3.2.1(R) for the opinion of the Manufacturers of Emissions Control Association regarding closed crankcase control systems. (See docket item IV-D-334.)

(R) It is feasible to control crankcase emissions in the range of 80 to 90 percent.

(1) Commenter provides data generated on crankcase emissions and crankcase emission control. Commenter notes that in June 2000, tests were conducted on the crankcase blow-by emissions from two popular HD on-road diesel engines. The resulting data based on blow-by physical and chemical analysis show that controlling crankcase emissions significantly below current levels is feasible. Filtration system technology exists that is capable of collecting and coalescing 80 to 90 percent of the blow-by aerosol with which it is challenged. A closed crankcase filtration system removes 100 percent of the blow-by PM normally emitted into the atmosphere.

<u>Letters:</u>

Manufacturers of Emissions Controls Association (IV-D-334) **p. 1-4**

<u>Response to Comment 3.2.1(R):</u>

We concur with this comment.

(S) An H2S catalyst will be required to minimize odor in the exhaust.

(1) An H2S catalyst will be required in order to convert the H2S in the exhaust downstream of the NO_x, SO_x and DPF components to prevent odor associated with H2S. These devices are used extensively in the light duty industry but at much lower sulfur quantities. However, this device will add cost, space needs, weight and complexity to an already overburdened system.

<u>Letters:</u>

Cummins, Inc. (IV-D-231) **p. 16**

<u>Response to Comment 3.2.1(S):</u>

The formation of H_2S comes from the lean-rich cycling of the NO_x adsorber catalyst. SO_2 from combustion of fuel sulfur is efficiently oxidized to SO_3 over platinum when oxidizing conditions are present in the exhaust. The SO_3 reacts with the NO_x storage components on NO_x adsorber catalysts to form stable metallic sulfates. The sulfates must be periodically released since they occupy sites that can be used for NO_x storage. This is accomplished similar to NO_x regeneration (rich operation - reducing conditions) except that it must be done at a higher temperature. Sulfate released under such conditions could be reduced to H_2S. This can be minimized or virtually eliminated by:

1. Reducing the amount of ceria used
2. Changing the crystal structure of the ceria through thermal treatment to reduce its retention of sulfur oxides (Lox et al.).
3. Using a metallic scavenger, such as Nickel, copper, or manganese (Golunski and Roth, Dettling et al.)
4. Use of a DOC function in the integrated system as described in the response to comment 3.2.1(K) and in Chapter 3A of the RIA.

Formation of H_2S is also an issue with spark-ignition gasoline engines that use three-way catalysts. It is typically controlled via the use of nickel scavenging. Nickel binds sulfur under reducing conditions, subsequently releasing it as SO_2 under oxidizing conditions. Three-way catalysts containing nickel have demonstrated greater than 95% suppression of H_2S (Dettling et al.).

We agree that during a desulfation event it may be possible that a NO_x adsorber or a SO_x adsorber will release sulfur as hydrogen sulfide, H2S (see full description of this phenomena in RIA Chapter III). Given this possibility, we have included the cost of a downstream oxidation catalyst designed to oxidize the undesirable H2S emissions to more desirable SO2 emissions. While the catalyst will increase the size and weight of the system to some extent, we disagree with the assertion that this will add further complexity to the emission control system. To the contrary, by providing a downstream oxidation function which can clean up hydrocarbon (HC) and H_2S emissions, which may occur during some specific operating conditions such as NO_x adsorber regeneration and NO_x adsorber desulfation, the overall emission system can be made to be more robust and less complex. This is because the clean up function allows for less precise control of the NO_x regeneration and desulfation events since any fugitive emissions can be cleaned up by the downstream oxidation catalyst.

References:

Dettling, J., Hwang, H., Pudick, S., Tauster, S., “Control of H_2S Emissions from High-Tech TWC Converters”, SAE Technical Paper Series, No. 900506, 1990.

Lox, E., Engler, B., Koberstein, E., “Development of Scavenger-Free Three-Way Automotive Emission Control Catalysts with Reduced Hydrogen Sulfide Formation”, SAE Technical Paper Series, No. 890795, 1989.

Golunski, S., Roth, S., “Identifying the Functions of Nickel in the Attenuation of H_2S Emissions from Three-Way Catalysts”, 1991 Catalysis Today 9:105-112.

(T) The PM standard may not be feasible since the technology capable of meeting the standard has yet to become commercially available.

(1) Real world experience with PM traps that use precious metal catalysts has yet to move beyond field trials. Commenter acknowledges the supporting documentation offered by EPA to conclude that this technology can be used to meet the standards but notes that conclusions regarding its ability to enable manufacturers to meet the proposed PM standard cannot be based on a limited number of field tests. The fact that this technology is not yet commercially available and has not been tested on a wider scale in the real

world, leads to considerable uncertainty regarding whether the PM standard can in fact be met.

Letters:

Mercatus Center at GMU (IV-D-219) **p. 15**

Response to Comment 3.2.1(T):

See our response to comment 3.2.1(C).

(U) The NO_x adsorber will be an effective tool for reducing emissions since development issues have been identified and the technology is proceeding according to schedule.

(1) Commenter notes that the status of the NO_x adsorber technology has come into question in the context of this proposed rule and that any concerns regarding the technology can be addressed. Samples of current NO_x adsorber development have shown excellent performance results. The development paths leading toward product optimization have been identified and there are no technical barriers that cannot be addressed in the time frame proposed by EPA.

Letters

Engelhard Corporation (IV-G-38), **p.1**

Response to Comment 3.2.1(U):

EPA concurs with this comment.

Issue 3.2.2: Gasoline Engine & Vehicle Exhaust Standards

(A) The gasoline engine and vehicle standards are technically feasible.

(1) One commenter asserted that gasoline-powered highway engines will be able to achieve the proposed emissions standards within the suggested time-period using advanced emission control strategies now being employed on passenger cars and light duty trucks. Recent advances in thermal durability of three-way catalyst technology will assist in using this technology for heavy-duty vehicles with higher catalyst temperatures than typical lighter vehicles.

Letters:

Manufacturers of Emission Controls Association (IV-D-267) **p. 3, 10-11**, (IV-F-26, 116) **p. 47** (IV-F-117) **p. 89** (IV-F-191) **p. 120**

Response to Comment 3.2.2(A):

EPA concurs with this comment.

(B) The proposed 2007 HDG standards will be feasible only if a gasoline sulfur

standard that is more stringent than the Tier 2 standard is imposed and implemented.

(1) Since EPA has proposed standards for HDG engines and vehicles in 2007 that are similar to and in some cases more stringent than, the standards adopted by California under the LEV II program, an ultra low sulfur fuel is necessary. The availability of only 80 ppm sulfur gasoline causes the proposed 2007 HDG standards to be significantly more stringent than the California LEV II standards. One commenter noted that EPA should adopt the California Phase III reformulated gasoline fuel standards nationwide with a sulfur cap of 30 ppm to be effective no later than mid-2006. Another recommended that EPA impose a 5 ppm sulfur standard for gasoline nationwide by mid-2006, since this level is currently under consideration in California and would lead to significant additional NO_x reductions. (See also Issue 9.)

<u>Letters:</u>

DaimlerChrysler (IV-D-284) **p. 9**
Engine Manufacturers Association (IV-D-251) **p. 49**
Ford Motor Company (IV-D-293) **p. 2**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 37-38**

<u>Response to Comment 3.2.2(B):</u>

EPA disagrees with these comments. First, the standards being finalized for heavy-duty gasoline vehicles are equivalent to the California LEV-II LEV levels, with the exception of the PM standard (0.02 g/mi for these final standards and 0.12 g/mi for LEV-II LEVs). The LEV-II PM standard was set with non-PM trap equipped diesel vehicles in mind and should not represent a problem for gasoline vehicles.

We know that gasoline sulfur has a negative impact on gasoline vehicle emission controls. Gasoline vehicles depend on the catalytic converter to reduce emissions of HC, CO, and NO_x. Sulfur and sulfur compounds attach or “adsorb” to the precious metal catalysts that are required to convert these emissions. Sulfur also blocks sites on the catalyst designed to store oxygen that are necessary to optimize NO_x emissions conversions. While the amount of sulfur contamination can vary depending on the metals used in the catalyst and other aspects of the design and operation of the vehicle, some level of sulfur contamination will occur in any catalyst. In fact, in our Tier 2 final rule we stated that, “We now believe that there are not (and will not be in the foreseeable future) emission control devices available for gasoline-powered vehicles that can meet the proposed Tier 2 emission standards that would not be significantly impaired by gasoline with sulfur levels common today.” (See 65 FR 6729, February 10, 2000.) In our Tier 2 rule, we concluded that a 30 ppm average and 80 ppm cap are necessary and appropriate to enable the emissions reductions needed from Tier 2 vehicles. We stated our belief that Tier 2 vehicles that operate on gasoline will, on average over their long-term operation, have to use fuel with sulfur levels no greater than 30 ppm to avoid significant impairment of their emissions control systems. Furthermore, we noted that short-term operation on gasoline with sulfur levels higher than 80 ppm will have a significant adverse effect on the desired emission performance and will significantly impair the emissions control system. The vast majority of test data we reviewed during the Tier 2 rulemaking process showed that sulfur has a negative impact on catalyst operation even at these low levels. Most of the data from test programs that looked at the emissions impacts of various sulfur levels tested a minimum sulfur level of approximately 30 ppm. However, while there was little data demonstrating the emissions impact of even lower sulfur levels, we concluded that sulfur levels below 30 ppm are not necessary to allow manufacturers to meet the Tier 2 standards, since we were able to demonstrate compliance with the standards using 30 ppm gasoline.

These reasons served as the basis for our decision to control the gasoline sulfur level in order to enable the Tier 2 standards. The Phase 2 gasoline emission standards are consistent with the upper bins of our final light-duty Tier 2 standards (i.e., those final bins that few Tier 2 vehicles will be able to utilize due to the NO_x averaging requirement). This gasoline sulfur control results in heavy-duty gasoline vehicles being fueled by the same low sulfur gasoline required for Tier 2 vehicles, thereby enabling the Phase 2 heavy-duty gasoline standards. We believe this because the same basic technology will be used on both light-duty and heavy-duty gasoline vehicles -- the three-way catalyst. The three-way catalyst and the precious metals used in the three-way catalyst are adversely affected by sulfur in the same ways regardless of vehicle size. Therefore, the emission standards in both our Tier 2 rule and our Phase 2 heavy-duty rule can and will be met using the 30 ppm average/80 ppm cap sulfur gasoline required by the Tier 2 rule.

Further, in a letter from Tom Cackette, California ARB, to Margo Oge, EPA, dated February 8, 1999, Mr. Cackette expresses the ARB opinion that compliance with the LEV II standards will not require a further reformulation of their current cleaner burning gasoline (i.e., the Phase II gasoline having a sulfur specification of 30 ppm average, 80 ppm cap, which is equivalent to the Tier 2 gasoline specification). (See Air Docket A-99-06, docket item IV-G-97) Mr. Cackette also explains that, while the ARB is planning to revisit its reformulated gasoline specifications, it was doing so “with the objective of lowering emissions from all on-road, catalyst-equipped vehicles, and not because we believe it is necessary to allow future compliance with the LEV II standards.” In conclusion, Mr. Cackette states that any fuel changes would not provide evidence that they “believe the feasibility of LEV II requires a cleaner gasoline” and, in fact, their “belief is that it does not.”

(C) EPA's proposed NO_x standard for HDG engines is not technologically feasible.

(1) EPA has provided little basis or analysis for the technological feasibility of the proposed NO_x standard for HDG engines, which is not feasible. The technology that engine manufacturers are developing in order to meet the Tier 2 gasoline engine standards cannot be assumed to be sufficient to achieve the levels of reductions sought for heavy duty gasoline engines in 2007. One commenter noted that EPA cannot assume that the same standard is appropriate for HD gasoline engines as may be appropriate for HD diesel engines. Because of the deterioration realities of gasoline engine aftertreatment technology, engine manufacturers must design gasoline engine and aftertreatment systems to achieve emissions performance at least 50% below the standard in order to ensure that in-use engines will comply with the standard for their full useful life. As an alternative to EPA's proposal, these commenters suggests that EPA adopt a combined NMHC and NO_x standard of 1.0 g/bhp-hr.

<u>Letters:</u>

Engine Manufacturers Association (IV-D-251) **p. 50**
Ford Motor Company (IV-D-293) **p. 3-7**

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 38-40**

(2) The proposed standards do not recognize differences in vehicle weight, usage, and duty cycles. HD Otto cycle vehicles, with their wide and varied usage in the field, experience a wide range of load duty cycles from light to very heavy. Mandating a single emission standard for all HD gasoline engines is costly and inefficient and such standards do not comply with CAA 202(a)(3), which requires that EPA establish standards based on certain characteristics (i.e. weight, horsepower, type of fuel, and other factors) within specific classes or categories of vehicles or engines. In addition, EPA has failed to justify its proposal to require emissions from incomplete vehicles to meet more stringent standards than those proposed for complete vehicles. It is arbitrary and capricious to mandate standards that vary in stringency without any discussion or justification for the disparity. Commenter provides significant discussion on this issue and notes several differences between incomplete and complete vehicles, and vehicles less than and greater than 14,000 GVWR, such as catalyst configuration, catalyst washcoat durability, higher in-use temperatures for higher GVWR vehicles, and secondary air and exhaust gas recirculation effectiveness on the HD gasoline engine cycle as opposed to the chassis cycle. This commenter recommends that EPA address these issues and finalize the following two sets of combined NO_x + NMHC standards for HD gasoline engines: 1.0 g/bhp-hr for HD gasoline engines greater than 14,000 GVWR and 0.8 g/bhp-hr for HD gasoline engines and incomplete vehicles less than or equal to 14,000 GVWR.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 51**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 40-42**

(3) Catalyst efficiency/durability is the only significant control for tailpipe emissions on HDG engines. However, during the FTP and during in-use operation, very high exhaust gas temperatures are generated, which adversely impact the durability of the catalyst. In the context of these concerns, the assumption that a 6 g/bhp-hr engine-out NO_x level can be achieved is overly optimistic. To achieve this level, NO_x efficiency will need to be maintained at 98.3 percent over 120,000 miles and if engine-out levels are higher, then NO_x efficiencies will need to be maintained at an even higher level. Regardless of the engine-out level, this type of conversion efficiency capability and durability is simply not available and is not expected to be available in the near future. EPA has suggested that new catalyst technologies have the ability to withstand 1100 degrees C, which may be true on a limited basis but catalysts are not capable of operating at these temperatures for any extended period of time. Thermal degradation is not the only means of reducing catalyst efficiency. There are chemical effects, such as phosphorous, lead, zinc, sulfur and manganese, which also degrade catalyst performance. EPA has not presented data demonstrating that the level of catalyst performance needed to meet the proposed standard is feasible, or will be feasible over the useful life for the majority of commercial trucks in-use.

Letters:

Ford Motor Company (IV-D-293) **p. 6**

(4) Current "light duty" technology cannot be applied directly to incomplete HDG vehicles with the assumption that the proposed emission levels will be achieved. Higher levels of hardware capability need to be invented to overcome conditions that light duty components are not subjected to (i.e. high temperatures for long periods of time).

Letters:

Ford Motor Company (IV-D-293) **p. 6-7**

Response to Comment 3.2.2(C):

All of these comments question the ability of heavy-duty gasoline engines to meet the Phase 2 standards of 0.2 g/bhp-hr NO_x and 0.14 g/bhp-hr NMHC. Commenters note that EPA should not assume that emission standards appropriate for diesel engines are necessarily appropriate for gasoline engines, basing that statement on the deterioration realities of gasoline aftertreatment devices versus the deterioration realities of diesel aftertreatment devices. However, the useful life of a HD gasoline engine is 120,000 miles, which compares very favorably (from the gasoline engine manufacturer's viewpoint) to the useful life of a heavy HD diesel engine at 435,000 miles. We do not believe it would be appropriate for gasoline engines to have a higher standard than diesel engines, particularly given the relatively low useful life of the gasoline engine. It is important to note that most HD gasoline engines are placed in incomplete vehicles in the 10,000 to 14,000 pound range, a weight range within which diesel engines have a 110,000 mile useful life. Nonetheless, the same types of diesel exhaust emission control devices will be placed on the lighter diesel engines as on the heavier diesel engines with useful lives of 435,000 miles.

Regarding the feasibility of the Phase 2 standards for HD gasoline engines, as discussed in Chapter III of the RIA, we believe the standards are feasible. Our Tier 2 standards and the California LEV-II standards will require that catalysts deliver 95 to 99 percent conversion efficiencies over a 120,000 mile useful life. This is being accomplished through close-coupling of catalysts, improved precious metal dispersion, and through control of precious metal sintering from the high temperatures experienced in the close-coupled location. So, catalyst efficiency in and of itself should not be an issue. That leaves two primary elements to meeting the Phase 2 standards:

- Reducing engine-out emissions to the point where 95 to 99 percent catalyst efficiency results in compliance; and,
- Maintaining 95 to 99 percent catalyst efficiency during 120,000 miles of operation in a heavy-duty vehicle.

As for engine-out levels, while the typical current gasoline engine has engine-out NO_x emissions of roughly 9 to 10 g/bhp-hr, we believe that engine-out NO_x emissions can be reduced to the 6 to 8 g/bhp-hr level using EGR. In fact, it could be argued that engine-out NO_x emissions could be reduced to the 5 g/bhp-hr range using very aggressive EGR strategies. In comparison, current diesel engines have engine-out NO_x levels in the 4 to 5 g/bhp-hr range, with that level falling to the 2 to 2.3 g/bhp-hr range in the 2004 timeframe through use of EGR. However, applying EGR in an effort to deliver <4 to 5 g/bhp-hr engine-out NO_x on a HD gasoline engine would result, as commenters correctly note, in dramatically reduced power from the engine.

Nonetheless, current HD gasoline engines either use no EGR at all, or the EGR rates are relatively low (~5%), or the conditions under which EGR is active are severely restricted, on the order of five to 10 percent. By using approximately 7 to 15 % EGR, engine-out NO_x levels can be driven down to the 6 to 8 g/bhp-hr range without considerable loss in power and performance. Through improved cold start strategies and heat managed exhaust, along with improved catalyst designs through better precious metal dispersion, a 99 percent catalyst efficiency can be achieved. This would deliver tailpipe NO_x levels of 0.06 to 0.08 g/bhp-hr. Such a NO_x level would allow for substantial deterioration and compliance headroom with a full three times the 0.06 level (i.e., 0.18 g) still falling below the 0.20 g NO_x standard.

Similar arguments can be made regarding NMHC emissions. Typical current engine-out NMHC levels are 1.5 to 2.0 g/bhp-hr NMHC.. Through improved cold start strategies and heat managed exhaust, along with improved catalyst designs through better precious metal dispersion, a 99 percent catalyst efficiency can be achieved. This would deliver tailpipe NMHC levels of approximately 0.02 g/bhp-hr. As for NO_x, such a NMHC level would allow for substantial deterioration and compliance headroom with a full three times the 0.02 level (i.e., 0.06 g) still falling well below the 0.14 g NMHC standard. It should also be pointed out that the cold-start portion of the heavy-duty FTP is weighted considerably less than the light-duty FTP75.

However, commenters have expressed considerable concern with regard to durability and catalyst deterioration. A 99 percent catalyst efficiency that deteriorates to 95 percent efficiency after 120,000 miles would result in tailpipe NO_x levels of 0.30 to 0.40 g -- exceeding the standard. As argued in our light-duty Tier 2 rule, recent advances in catalyst technology will reduce the amount of deterioration experienced by gasoline three-way catalysts. The commenter appears to imply that the catalyst would need to sustain 1100 °C temperatures. Such high temperatures would be extremely unlikely. Engine calibration (spark timing, enrichment strategy) is sufficient to maintain exhaust temperatures below 850 to 900 °C even under extreme conditions. Furthermore, it is likely that sustained 1100 °C exhaust temperatures would result in catastrophic failure of engine components. If the manufacturers' engine calibration allowed sustained operation of this sort without intervention, it would likely lead to a considerable warranty issue for the manufacturer, so this does not appear to be likely.

As noted above, precious metal dispersion becomes more advanced every year providing improvements in conversion efficiencies. Also, precious metal sintering from high temperatures is being minimized through recent advances in stabilization of both precious metal and oxygen storage components. Initial designs meant to address thermal sintering that resulted from close coupling of catalysts were marked by a switch away from Pt-Rh catalysts in favor of more thermally durable Pd-only and Pd-Rh catalysts. Concerns over the cost of Pd in the world market has lead to the development of advanced Pt-Rh three-way catalysts that are considerably more durable and are now roughly equivalent in performance to advanced Pd-Rh designs (Brisely et al.). This was accomplished through modifications to the catalyst supports and surface structures that stabilize the precious metals at high temperatures (>900 °C), allowing their use in severe-duty under-floor configurations. For our analysis, we have assumed a Pd focused approach to address thermal sintering, although the recent advances noted here suggest that similar or better results will be possible from Pt based designs for all but the most close-coupled catalyst position. Given current precious metal prices, our cost analysis would not be affected by either outcome because the precious metal prices we used for Pt and Pd are essentially equivalent ($13.25/gram of Pt; $12.54/gram of Pd). We have also assumed that fully 50 percent of the gasoline engine fleet will move toward close-coupled catalyst systems, where none were assumed for the Phase 1 standards. Lastly, we have assumed a rather large increase in both the catalyst system volumes and the precious metal loadings for HD gasoline engines. This results in roughly a 20 percent increase in the amount of precious metals that will be used in three-way catalysts for HD gasoline engines. This increase in precious metals, the recent advances in precious metal dispersions, and the recent advances in catalyst durability noted here, along with the Tier 2 gasoline in place well before 2008, will enable the Phase 2 gasoline engine standards.

We disagree with the comment that the Phase 2 standards do not comply with CAA 202(a)(3). That section, under paragraph (a)(3)(A)(ii), states that, "In establishing classes or categories of vehicles or engines for purposes of regulations under this paragraph, the Administrator may base such classes or categories on gross vehicle weight, horsepower, type of fuel used, or other appropriate factors." This does not *require* the Administrator to promulgate different standards for different classes or weights. In this case, since the standards promulgated are equally appropriate for gasoline and diesel engines, there was no reason to distinguish between them especially given the fact that both gasoline and diesel engines are used for vehicle applications affected by this rule. Thus, there are environmental reasons for not allowing either engine type to have a less stringent standard.

Another commenter argued that we had failed to justify our proposal to require emissions from incomplete vehicles (i.e., gasoline engines) to meet more stringent standards than those proposed for complete vehicles. Commenters stated their belief that we had been arbitrary and capricious in mandating standards that vary in stringency without justification for the disparity. We believe we had provided very good reasoning for this in our proposal, and rebut consistently here. The gasoline engine standards have been chosen to provide a fuel-neutral program for HD engines. This way, all HD engine certified systems meet the same set of standards regardless of the fuel used. This approach is consistent with our approach taken under Tier 2 and, ironically, is consistent with public comments received in response to the Phase 1 proposal arguing that diesel engines should be required to meet the same emission standards as gasoline engines (which were lower for Phase 1 engines). These levels, in considering both gasoline and diesel engines, were chosen to satisfy our CAA requirement to set standards which reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors. (See CAA 202(a)(3).) Further, we consider the gasoline vehicle standards to be roughly equivalent in stringency to the gasoline engine standards and expect engines complying with either standard will use the same emission control technologies. We are providing the most effective program that can be delivered, while also delivering a program with attractive synergy to both the Tier 2 and California LEV-II programs by going forth with the vehicle standards we have chosen. Therefore, we disagree that we have been arbitrary and capricious.

(D) EPA has not demonstrated that lower NO_x levels can be achieved for HDG engines without significant tradeoffs, including reduced emission component durability, engine performance, and fuel consumption.

(1) There will be interactions between some technology items that will reduce the effectiveness of others. In general, catalyst systems with high conversion efficiencies and durability, well beyond what is available today, will be needed to meet the proposed standards. There are several concerns that should be addressed by EPA in considering the potential interactions and emission reductions associated with the anticipated control technologies.

Letters:

Ford Motor Company (IV-D-293) **p. 3**

Response to Comment 3.2.2(D)(1):

See our responses to comments 3.2.2(D)(2), (3), (4), (5), and (6).

(2) The use of EGR technology at wide-open throttle reduces total power output, and depending on the amount of EGR being delivered and the specific engine knock limit, the decrease in wide-open throttle power output with EGR can be as much as 15%. In this case, manufacturers would need to increase the displacement of the engine to gain back the power lost, which would decrease expected reductions in tailpipe emissions. In addition, larger engines would result in an overall loss in fuel economy at part throttle operation.

Letters:

Ford Motor Company (IV-D-293) **p. 4**

Response to Comment 3.2.2(D)(2):

While the decrease in power may be as much as 15% at wide open throttle (WOT), it is not necessary to have EGR engaged at all at WOT conditions to achieve NO_x emissions well below the standard. During testing at EPA-NVFEL of a 6.8L, 260 h.p. V-10 HDG engine over the FTP cycle, only 20 seconds of operation (~1.7% of the cycle) occurred at WOT. Approximately 30 seconds of operation (~ 2.5% of the cycle) exceeded 90% throttle position, and approximately 90% of the cycle time was spent below 70% throttle position. Many light-duty spark ignition engine calibrations restrict EGR above approximately 70% throttle position. It appears to be clear that such a strategy can be used with HD gasoline engines while still complying with the NO_x standard with a considerable compliance margin.

(3) Using large percentages of EGR cannot be done without contributing to combustion instability. High EGR rates require significant changes to engine architecture to enable sufficient intake charge motion to allow stable combustion without having a negative impact on HC emissions. Fast burn combustion chamber design can improve this situation but at the expense of increased NO_x emissions. High levels of EGR also contribute to intake charge air heating.

Letters:

Ford Motor Company (IV-D-293) **p. 4**

Response to Comment 3.2.2(D)(3):

Large percentages of EGR will not be required to meet the standard with a considerable compliance margin. Testing at EPA-NVFEL with a 1998 5.4L V8 spark ignition engine confirmed that engine out NO_x emissions can be reduced by half or more over a broad range of operating conditions using 5 to 14% EGR (SAE Technical Paper 2000-01-1957). This is below an EGR level where combustion instability becomes an issue, and this was confirmed via measurement of pre-catalyst CO and HC emissions, which were unchanged from the additional EGR.

(4) Multi-valve engine technology could provide additional HC and NO_x control but the tradeoff is a greater crevice area (valve seat area) compared with a two-valve engine, which creates higher engine-out HC levels. Basic engine, brake- specific engine-out NO_x levels also increase as the Break Mean Effective Pressure (BMEP) of the engine increases. These tradeoffs reduce the benefits of multi-valve technology.

Letters:

Ford Motor Company (IV-D-293) **p. 5**

Response to Comment 3.2.2(D)(4):

Other manufacturers have relied heavily on multi-valve technology with good results. All current certified California ULEV and proposed SULEV light-duty vehicles use this technology. Obviously, there are trade-offs that push different manufacturers in different directions. One light-duty manufacturer offers a number of engines with two intake valves and one exhaust valve per cylinder to reduce exhaust port heat rejection and improve catalyst light-off. The use of or lack of multi-valve technology will not be the primary factor in the ability of a HDG engine manufacturer to meet the heavy-duty exhaust emission standards.

(5) The use of better atomization (air assisted) fuel injections to improve combustion as a way of reducing base-engine emission levels could have a negative impact at operating conditions other than warm up depending on the exhaust constituent being considered. HC levels may be reduced during warm up, but that will come at the expense of increase NO_x levels due to the improved combustion (higher cylinder pressures and temperatures).

Letters:

Ford Motor Company (IV-D-293) **p. 5**

Response to Comment 3.2.2(D)(5):

The manufacturer did not supply sufficient data to compare the trade-off of NO_x with air-assisted injection, or supply data on the effects of EGR, spark timing, and other engine control parameters on this trade-off. It is possible that the trade-offs versus NO_x emissions could be a net benefit.

(6) It is possible to develop a calibration with lower engine out NO_x. However, this would not represent the best calibration "optimization/balance," and would result in severely "de-tuning" the engine to achieve reduced NO_x levels. This would create a number of problems, including reduced powertrain performance, increased fuel consumption, and greater heat generation (resulting in reduced durability of emission components).

Letters:

Ford Motor Company (IV-D-293) **p. 5**

<u>Response to Comment 3.2.2(D)(6):</u>

This is not necessarily the case. Use of moderate EGR rates at part load conditions actually improves fuel efficiency by forcing a larger throttle opening and reducing pumping losses (Nakajima et al., Heywood et al., McDonald and Jones). WOT performance will not need to change to meet the standards (see our response to comment 3.2.2 (D)(2)). The sophistication of currently available engine control systems allows a much greater degree of flexibility in the control of EGR, spark timing, and other parameters than previously possible. Careful calibration of these engine control parameters will be sufficient to manage exhaust heat, driveability, torque output, and engine durability.

Issue 3.2.3: Evaporative Standards

(A) The technologies and strategies EPA assumes for evaporative control may not be appropriate.

(1) The evaporative control strategies for light duty vehicles fail to translate directly to the larger vehicles due to factors such as more injectors in the engine (10 vs. 4 to 8) and a significantly larger fuel tank. Developing a canister that is large enough to trap evaporative emissions from a large tank and that can still be purged effectively presents a significant engineering challenge. It is possible that additional hardware to trap bleed emissions will be necessary and new, unique purge strategies will have to developed.

<u>Letters:</u>

Ford Motor Company (IV-D-293) **p. 10**

<u>Response to Comment 3.2.3(A):</u>

EPA disagrees that evaporative control strategies for light-duty vehicles fail to translate directly to the larger vehicles. While it may be necessary to incorporate a larger evaporative emission canister or different purge strategies for heavy-duty vehicles, the same basic technologies and approaches can be used for both light- and heavy-duty. Further, the fact that most heavy-duty vehicles are certifying today with emission levels at or below the Phase 2 evaporative emission standards suggests that evaporative emissions can be effectively controlled on these larger vehicles. Nonetheless, we agree that there may be some changes made to heavy-duty vehicles to improve upon evaporative emissions compliance margins, but only those with the largest fuel tanks and out-dated materials. As a result, and as noted in Chapter V of the RIA and in our response to comment 5.5, we have increased our final estimated cost of compliance, relative to the proposed cost, in the context of the Phase 2 evaporative emission standards.

Issue 3.3: Sulfur Impact

Issue 3.3.1: Sulfur's Effect on PM Trap

(A) Particulate filter technology could be effective at reducing PM emissions to low levels, provided the sulfur level in the fuel is greatly reduced.

(1) Commenters provided discussion on the diesel particulate filter, or continuously regenerative trap (CRT) technology, and why low sulfur fuel is important. Engine manufacturers expect that the use of advanced catalysts in particulate filter systems will increase the sulfate conversion rate of emission control systems to 40% or more, depending on engine operating conditions and that this increase would represent a significant portion of the PM emissions from HDDEs and vehicles. Sulfur in the fuel can inhibit the NO to NO2 conversion process causing regeneration light-off temperature to increase outside the normal exhaust temperature range leaving the filter susceptible to plugging. This issue is particularly critical for applications that generally operate at lighter loads and lower speeds and exhaust temperatures. One commenter noted that it has been demonstrated that one measure of the regeneration temperature, called the "balance point temperature" is increased by 20 to 30 degrees C when going from 3 ppm to 30 ppm sulfur diesel. Ultra-low sulfur fuel (and the resulting lower regeneration temperature) is required to enable the effective use of particulate filter technology. Some commenters refer to the "DECSE" program and study as supporting documentation. One commenter (International) noted that they have conducted a demonstration of a CPF system on a school bus using a HDDE and a 3 ppm fuel. In this case, PM levels were reduced to below 0.01 g/bhp-hr, NMHC emissions were reduced below measurable levels, and CO emissions were reduced by more than 90 percent. Another commenter noted that operating experience with filter technology in Europe with less than 10 ppm sulfur diesel fuel has demonstrated that proper filter regeneration will occur even when vehicles are operated in areas such as Sweden, where low seasonal ambient temperatures are similar to those found in the northern U.S. One commenter provided the DOE report "Impact of Diesel Fuel Sulfur on CIDI Engine Emission Control Technology," August 2000, which includes test data and supporting information that illustrates the adverse impact of higher sulfur levels on catalyzed diesel particle filters and continuously regenerating diesel particle filters.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 3-4**
CA Trucking Association (IV-D-309) **p. 7**
DaimlerChrysler (IV-D-344) **p. +24-27**
Detroit Diesel Corporation (IV-D-276) **p. 1-5**
Engine Manufacturers Association (IV-D-251) **p. 9-10**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 46, 48**
International Truck & Engine Corp. (IV-D-257) **p. 6**
Mack Trucks (IV-D-324) **p. 3**
Manufacturers of Emission Controls Association (IV-D-267) **p. 7-8**
U.S. Department of Energy (IV-G-28) **p. 2-3, Att. 2**
UAW (IV-D-215) **p. 4**

(2) EPA should not rely on the argument that a 15 ppm sulfur cap is not needed to meet EPA's proposed PM standard since catalyst-based diesel particulate filter technology has operated in limited engine applications where sulfur levels have exceeded 15 ppm. This argument is misplaced for two reasons.

First, particulate filter technology was applied in limited situations only after a careful assessment of the engine operating conditions and a conclusion was made that the technology could successfully operate in those situations. One cannot conclude based on these studies that particulate filter technology could be applied to all the highway diesel HDEs covered by EPA's proposed rule with various engine performance parameters, usage patterns, and ambient conditions. Second, in these limited situations, the design control target was nowhere close to EPA's proposed standard.

Letters:

Manufacturers of Emission Controls Association (IV-D-267) **p. 8**

(3) Continuously regenerating PM traps (CRT) use a catalyst to reduce the regeneration temperature, allowing regeneration to occur during normal operation. However, the reliance on a catalyst requires that fuel contaminants such as sulfur be eliminated from the diesel fuel and therefore, near-zero sulfur diesel will be necessary to ensure that the application of PM trap technology is successful. Engine operation under sustained low temperature conditions will also increase the difficulty of PM trap regeneration and under these conditions, it is quite possible that regeneration will be prevented given the combination of 15 ppm sulfur fuel and sustained low temperature operation.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 46**

(4) Diesel particulate filter (DPF) technology has very high filtration efficiency but requires periodic regeneration since exhaust back pressure increases with particulate loading. Sulfur has a detrimental effect on this type of particulate filter. Sulfate forms in the oxidation catalyst which is located upstream of the DPF, which increases the back pressure requiring regeneration and has an adverse effect on fuel consumption. In steady state conditions at speeds higher than 100-120 kph, the SO3 remains as a gas, which allows it to pass through the DPF and condense downstream forming secondary particles. However, this could be prevented by using diesel fuels with a sulfur content less than 50 ppm. In addition, when regeneration occurs, sulfate stored in the filter is decomposed and partially converted to SO2. If a catalytic device is placed downstream of the filter, the SO2 is oxidized to SO3, which can react with water to form white smoke. This only occurs when fuels with more than 30 ppm sulfur are used.

Letters:

DaimlerChrysler (IV-D-344) **p. 23**

Response to Comment 3.3.1(A):

We agree with the commenters assessment that catalyzed diesel particulate filters (CDPFs) can be highly effective at controlling particulate matter (PM) emissions provided they are operated on low sulfur diesel fuel. We further agree with the commenters that the main issues with regard to sulfur in diesel fuel and CDPFs are the formation of sulfate PM from sulfur in diesel fuel and CDPF regeneration (durability).

The commenters correctly note that sulfur in diesel fuel forms sulfur dioxide in the exhaust which can be oxidized across the CDPF further to form sulfuric acid which condenses in the atmosphere (and in the CFR test procedure) to form sulfate PM. Further the commenters are correct to note that the fraction of the total PM made up from sulfate PM increases significantly when the CDPF technology is applied to control the elemental carbon and soluble organic fraction (SOF) portions of diesel PM. The formation of sulfate PM as noted by several of the commenters is such that with fuel sulfur levels greater than 15 ppm the Phase 2 PM standards are not attainable. While some commenters suggest that even lower fuel sulfur levels are needed in order to ensure compliance with the Phase 2 PM standard, data from the DECSE program presented in the draft RIA for the NPRM shows that the Phase 2 PM standard can, in fact, be met with a fuel sulfur cap of 15 ppm. The ability of CDPFs to meet the specific supplemental standards is addressed in our response to comments 3.2.1 (N), (O) and (P).

The commenters also provide substantial information, similar to that described by EPA in the draft RIA from the NPRM, that shows CDPFs may not regenerate when operated on fuel with anything but very low fuel sulfur levels. CDPFs “trap” (filter) solid particles in the exhaust, primarily elemental carbon along with hydrocarbons which are adsorbed onto the surface of the particle. The trapped PM will quickly clog the CDPF causing it to fail unless the trapped PM is removed, typically by oxidation of the PM to form carbon dioxide (CO_2) and water (H_2O). CDPFs rely on the formation of a strong oxidant, nitrogen dioxide (NO_2), in order to ensure that CDPF regeneration occurs under normal operating conditions. The needed NO2 is formed by oxidation of NO in the diesel exhaust across a platinum based oxidation catalyst. The platinum catalyst can exist either in front of the filter portion of the CDPF on its own flow through catalyst substrate, or can be applied to the surface of the filter portion of the CDPF directly. Sulfur in the exhaust poisons these platinum catalysts, no matter their location, inhibiting the formation of NO2 as noted by the commenters. This inhibition of NO2 leads to an eventual failure of the CDPF unless fuel sulfur levels are very low as noted by the commenters.

As shown clearly in the draft RIA from the NPRM and from the data provided by the commenters, there is an overwhelming body of evidence that shows that sulfur from the fuel poisons the CDPF leading to failure to form NO2 and subsequently leading to failure of the CDPF. The commenters point out data from both controlled experimental data such as from the DECSE report that demonstrates clearly that sulfur inhibits CDPF regeneration as measured by the balance point temperature and real world retrofit applications such as the substantial fleet experience in regions that already have low sulfur diesel fuel. The fact that there is substantial laboratory data to show the mechanism by which sulfur poisons the CDPF and substantial field experience with CDPFs on different fuel sulfur levels that shows increased frequency of failures with increasing fuel sulfur levels means that the commenters were able to come to a consensus on the problems with sulfur and CDPF regeneration.

We agree with the commenters who suggest that even lower fuel sulfur levels (below the 15 ppm cap we are mandating) would provide even lower PM emission levels and somewhat improved CDPF regeneration. However, we disagree with the suggestion that lower levels are required in order to meet the Phase 2 PM standard or to ensure reliable CDPF regeneration. Analysis of the DECSE data referenced by the commenters and the additional data summarized in the draft RIA, shows that fuel with a 15 ppm sulfur cap enables the Phase 2 PM standard. Further the extensive successful CDPF field experience chronicled in the RIA and in the comments on fuel with a sulfur cap of 10 ppm, and given

International's commitment to produce a CDPF equipped diesel bus in markets where 15 ppm can be made available (as described in their comments summarized here), makes us confident that CDPFs will regenerate reliable when operated on the mandated fuel under this program which is expected to have an in-use average level between seven and 10 ppm.

We agree with the commenter about the danger in assuming that because a single vehicle or fleet of vehicles equipped with CDPFs has been able to operate on higher than 15 ppm sulfur fuel that all CDPF equipped heavy-duty vehicles will be able to operate on high sulfur fuel. As noted by the commenter since the engine operating conditions determine the amount of heat available for regeneration, and since for limited vehicles this heat level can be significantly higher than would be expected on average for all vehicles, some carefully chosen CDPF equipped vehicles can operate on sulfur levels higher than 15 ppm. Of course as noted by the commenter, these vehicles when operated on higher than 15 ppm sulfur fuel will be unable to meet the PM emission standards set in this rulemaking due to sulfate PM formation. Most importantly we agree with the commenter that demonstration of CDPF durability when operating on fuel with a sulfur level above 15 ppm on a limited cross-section of vehicle types and narrowly constrained operating conditions can not be the basis for demonstrating the general performance of CDPF technology on higher fuel sulfur levels across other vehicle types and the wide range of operating conditions normally expected in use. This is especially true when there are known mechanisms by which fuel sulfur inhibits CDPF regeneration and when there is conflicting data that shows failures of some vehicles when operated on fuel sulfur levels higher than 15 ppm.

(B) Under the oil industry proposal of 50 ppm, PM traps are likely to suffer high failure rates, leaving oxidation catalysts that yield only a 20 percent PM reduction as the most likely PM after-treatment technology.

(1) Although some PM traps (including the most promising continuously regenerating traps) can operate at 50 ppm, trap clogging and failure is a serious problem at this level due to the formation of sulfate PM. Fuel economy also suffers, as a result of increased regeneration needs. This would be difficult--if not impossible--for engine, aftertreatment, and/or vehicle manufacturers and/or sellers to warrant such a trap for the full useful life of the vehicle, and fuel economy-sensitive vehicle users might not welcome the technology. Consequently, in the event EPA adopts a 50 ppm sulfur cap, manufacturers and sellers would be likely to opt for the less effective oxidation catalyst, rendering the proposed 0.01 g/bhp-hr PM standard unachievable.

Letters:

Natural Resources Defense Council (IV-D-168) **p. 4**

Response to Comment 3.3.1(B):

We agree with the issues raised by the commenter, who makes clear why setting a 50 ppm diesel fuel sulfur cap would be unacceptable.

(C) EPA has not accounted for the fact that the continuously regenerating trap, on which EPA primarily relies, may not regenerate itself in cold climates if diesel fuel at 15 ppm sulfur is used.

(1) Commenter cites to the RIA (p. III-26) and notes that EPA fails to recognize that the typical sulfur level of the diesel fuel in Sweden is 3 ppm, with few samples exceeding a 5 ppm level. EPA admits that 50 ppm does not work in colder climates and does not present any evidence that a 15 ppm cap is sufficient for proper operation of continuously regenerating particulate traps in cold ambient conditions.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 13-14**

Response to Comment 3.3.1(C):

The commenter raises concerns that the exceptionally good results with 10 ppm sulfur diesel fuel, even in extremely cold climates like Sweden's, may not necessarily indicate that similarly good results (in terms of CDPF regeneration) are ensured in the U.S. with the 15 ppm sulfur cap mandated by EPA (with an expected in-use average of seven to 10 ppm). While we do not have data with a fine enough resolution to differentiate the small difference between 10 ppm and 15 ppm sulfur caps, we can apply engineering judgement to the question. Our own engineering judgement augmented by the submissions from the various catalyst development companies leads us to believe that a 15 ppm fuel sulfur cap will allow for reliable regeneration of the CDPF even under the harsh winter conditions experienced in portions of the U.S. and Canada. We received comments on this rulemaking from the Manufacturers of Emission Control Association (MECA) and several of its members including the two largest CDPF manufacturers, Johnson Matthey and Englehard Corporation indicating that a 15 ppm fuel sulfur level (with a lower in use average) would allow them to develop CDPF systems which would be reliable in-use. Please see EPA docket A-99-06 items IV-F-100, IV-F-188, and II-G-80.

(D) EPA data on PM Traps provide no evidence to correlate trap failures to sulfur content.

(1) The Johnson-Matthey letter notes a handful of particulate trap failures on its systems in Finland and Denmark, using 50 ppm and 200 ppm fuel, respectively, while there were no failures in Sweden using 10 ppm fuel. The letter attributes the lack of failures to low sulfur fuel. This conclusion is questionable, however, because Johnson-Matthey provided absolutely no data to positively correlate failures to diesel fuel sulfur levels. The failures could be attributable to engine malfunction, their state of maintenance, or the type of lubricants used. Andrew Walker of Johnson-Matthey noted during the February SAE International Congress that many of the PM trap failures were caused by the fact that the vehicles were not driven over duty cycles that were conducive to efficient trap operation. The lack of trap failures in Sweden is more likely attributable to the fact that the Mk1 fuel used there has fewer of the heavier diesel components that PM traps usually remove. This light-duty work of the PM traps in Sweden is a more likely explanation for the lack of failures than is the sulfur content of the fuels.

Letters:

American Petroleum Institute (IV-D-343) **p. 28-29**
Marathon Ashland Petroleum (IV-D-261) **p. 21-22**

(2) EPA's claim that DPFs require low sulfur fuel ignores the success of the retrofit applications of this technology at sulfur levels higher than 50 ppm. EPA's concern about sulfate formation during the use of an NO oxidation function to promote DPF soot burn-off ignores the fact that sulfate formation is greatest at high exhaust temperatures. A DPF system would meet the proposed PM standards over the urban HD transient cycle with 50 ppm fuel. The currently available emission data clearly show that EPA's proposed FTP PM standards can be achieved with current trap designs and a 50 ppm fuel. Commenters cite to data from MECA, EF&EE, Sierra Research and Engelhard to support their position on this issue (see Attachments 2, 3, and 4 to API letter).

Letters:

American Petroleum Institute (IV-D-343) **p. 11, 25-26**
ExxonMobil (IV-D-228) **p. 7-8**
Marathon Ashland Petroleum (IV-D-261) **p. 19, 93**

(3) EPA inappropriately relied on the DECSE report, in that no effort was made to test DPF systems that were optimized to minimize sulfate formation. Modest exhaust heating would address concerns about the low temperature durability of DPF systems with 50 ppm fuels that were raised in the NPRM. The heating would improve DPF performance and would reduce the need for DPF oxidation activity thereby lowering sulfate formation.

Letters:

ExxonMobil (IV-D-228) **p. 8**

Response to Comment 3.3.1(D):

The comments summarized suggest that fuel with a 50 ppm cap, 30 ppm average could enable the CDPF technology to both function reliably (regenerate) and to control PM emissions to meet the Phase 2 PM standard. The comments are contrasted by the substantial comments we received saying that an in-use average below 15 ppm was required in order to ensure reliable CDPF regeneration not to mention the comments suggesting that even 15 ppm was not low enough (issue 3.3.1.(C)). We disagree with the commenters suggestion that 50 ppm sulfur fuel would enable the CDPF technology.

The commenters reach their conclusion by failing to recognize the inherent trade-offs between encouraging CDPF regeneration while suppressing sulfate PM formation and by looking past the lessons learned from the substantial fleet experience in Europe.

The formation of NO2 across a platinum oxidation catalyst is fundamental to the regeneration of the CDPF as discussed at length in the RIA and in response 3.3.1(A). Unfortunately the same oxidation function serves to oxidize sulfur in the exhaust (originally from sulfur in the fuel) to sulfuric acid which condenses to form sulfate PM. The formation rates of NO2 and sulfate PM across a platinum oxidation catalyst both increase with temperature, with sulfate formation rates typically higher than NO2 formation rates at all but the lowest temperatures (see figure 10 in SAE 890404). This chemical phenomena sets up a paradox which has frustrated emission control development engineers for more than a decade. Actions designed to improve CDPF regeneration such as higher catalyst loadings, higher exhaust temperatures, insulating the catalyst and including all of the ones suggested by the commenters inherently increase the formation of sulfate PM. Actions intended to suppress the formation of sulfate PM such as moving the catalyst further from the engine, lowering catalyst loadings, and including all of the ones suggested by the commenters all suppress the formation of NO2 leading to poor CDPF regeneration and in most cases failure of the CDPF. The commenters ignore this paradox when they suggest that the results from the DECSE program are misleading because the PM formation rates noted in DECSE could be decreased through mechanisms designed to suppress sulfate formation, but which will certainly also suppress NO2 formation and CDPF regeneration. The simple fact is the only way to ensure both CDPF regeneration and low PM emissions is to use a highly catalyzed CDPF with very low sulfur diesel fuel.

The commenters also raise questions about our reliance on field experience in setting the fuel sulfur level. That experience documented in the RIA bears summarizing here. The experience gained in field tests in regions where low sulfur fuel is already available helps to clarify the need for very low sulfur diesel fuel. In Sweden and some European city centers where below 10 ppm diesel fuel sulfur is readily available, more than 3,000 CDPFs have been introduced into retrofit applications without a single failure. This success on 10 ppm sulfur fuel is all the more impressive as some of these units have been in operation for more than six years. The field experience in areas where sulfur is capped at 50 ppm has been less definitive. In regions without extended periods of cold ambient conditions (such as the United Kingdom) field tests on 50 ppm cap sulfur fuel have been positive, with no reported durability issues (although PM emissions would certainly be above the Phase 2 PM standard). These good results in the UK are contrasted with field tests in Finland where colder winter conditions are sometimes encountered (similar to many northern regions of the United States). The testing in Finland revealed a failure rate of 10 percent (14 failures in the test program) when operated on fuel with a sulfur cap of 50 ppm. This 10 percent failure rate has been attributed to insufficient CDPF regeneration due to fuel sulfur in combination with low ambient temperatures. Other possible reasons for the high failure rate in Finland when contrasted with the Swedish experience appear to be unlikely. The Finnish and Swedish fleets were substantially similar, with both fleets consisting of transit buses powered by Volvo and Scania engines in the 10 to 11 liter range. Further, the buses were operated in city areas and none of the vehicles were operated in northern extremes such as north of the Arctic Circle. As the ambient conditions in Sweden are expected to be no less harsh than those in Finland, and since the vehicles and engines were substantially similar, we believe the increased failure rates noted here are due to the higher fuel sulfur level in a 50 ppm cap fuel versus a 10 ppm cap fuel. Testing on an even higher fuel sulfur level of 200 ppm was conducted in Denmark on a fleet of 9 vehicles. In less than six months, all of the vehicles in the Danish fleet had failed due to plugging of the CDPFs. We believe that this real world testing clearly indicates that increasing diesel fuel sulfur levels limit CDPF regeneration, leading to plugging of the CDPF even at fuel sulfur levels as low as 50 ppm.

The commenters suggest that other factors contribute to failures experienced in some fleets when operated on higher fuel sulfur levels (higher than 10 ppm) in spite of the fact that there are clear mechanistic reasons that show higher sulfur levels lead to lower CDPF regeneration (see comments and our response in 3.3.1(A)). We disagree with the commenters assertion that other factors were more important because of the substantial similarities between the fleets operated in each of the regions mentioned here and because there is a clear mechanistic description (suppressed NO2 formation) that explains the higher failure rates experienced with higher fuel sulfur levels.

The commenters also suggest that the Phase 2 FTP PM standard might be able to be met with a CDPF equipped engine operated on 50 ppm sulfur diesel fuel. This comment highlights the very reason we feel it is appropriate to set standards that both control emissions under some typical transient operations and control emissions under extended near steady-state operation as typified by much of heavy duty vehicle operation and the SET procedure. The FTP test does not capture the extended loaded operation which can characterize some heavy-duty vehicle driving and because of this it does not capture the potentially significant sulfate PM emissions from some CDPF equipped vehicles. The FTP hot start test lasts for only 20 minutes and does not operate continuously under conditions which would be representative of on highway driving for a heavy-duty truck. For these reasons temperatures are relatively low over the FTP, suppressing sulfate PM formation. Where we to set a 50 ppm fuel sulfur limit as suggested by the commenter, the real PM emissions realized from the in-use vehicle fleet would be substantially higher than what is predicted from the FTP test procedure alone. It is only by testing compliance against both the FTP procedure and the SET procedure that we ensure the emission reductions sought by this program. Further, even if our air quality needs weren't as great as they are, and we were able to accept a higher PM emissions rate in-use, the simple fact is that 50 ppm cap fuel will not ensure reliable CDPF operation for all of the vehicles in the fleet. Experience shows that some CDPF equipped vehicles when operated on 50 ppm cap fuel fail due to poor CDPF regeneration due to sulfur in the fuel.

Please refer also to issues 3.3.1 (A-C and E).

(E) Johnson-Matthey data show no significant effect of sulfur content on temperature requirements for trap regeneration.

(1) Relying on charts included in the Johnson-Matthey letter cited in the NPRM, commenters assert that the data do not suggest there exists a significant difference in NO_x conversion efficiency for particulate traps operated on diesel fuel containing 10 ppm, 30 ppm, or 50 ppm sulfur.

Letters:

American Petroleum Institute (IV-D-343) **p. 27-28**
Marathon Ashland Petroleum (IV-D-261) **p. 20-21**

(2) Based upon findings of the DOE DECSE program, Johnson-Matthey claim that a PM trap cannot be used with fuel of 50 ppm sulfur because the catalytic process used to promote particulate combustion in the exhaust also preferentially oxidizes fuel sulfur to sulfate. API claims that the DECSE report is not a relevant basis on which to support a rulemaking that focuses on future engines and aftertreatment technology because the engine used in the DECSE program did not represent future technology. It was calibrated to meet the 1998 NO_x standards of 4.0 g-bhp-hr, and the engine and PM trap were not optimized to function as an integrated "system." Moreover, the DECSE program used the steady-state OICA cycle, which creates engine temperatures significantly higher than the HD transient FTP cycle. The temperature difference could explain the high conversion rates of sulfur to sulfate. API questions EPA's rationale of setting emissions standards based on the driving cycle that exhibits the highest sensitivity to sulfur content. Also, the location of the traps in the test cell configuration could have lead to elevated exhaust temperatures and sulfate concentrations. Regardless, a systems approach to engine and aftertreatment devices could lower the conversion rates of sulfur.

Letters:

American Petroleum Institute (IV-D-343) **p. 27-28**

Response to Comment 3.3.1(E):

The data mentioned in the comment from Johnson Matthey shows the affect of sulfur on the NO to NO2 oxidation rate across a platinum catalyst. The data can be somewhat confusing to understand and the results can vary somewhat depending upon the test sequence order and the length of time allowed for the results to stabilize. This is because the data represents the amount of NO oxidation inhibition caused by cumulative sulfur poisoning of the platinum catalyst. The importance of test order and test duration can be best explained by a hypothetical example. If the NO oxidation rate of a fresh (no sulfur poisoning yet) catalyst is measured at a single temperature with 50 ppm sulfur fuel over time the NO oxidation rate will decrease. The NO oxidation rate at 100 hours will be substantially lower than it was after 1 hour. The length of time allowed for stabilization at any one temperature and one fuel sulfur level can be easily understood to change the results due to the different amounts of accumulated sulfur poisoning of the catalyst. Similarly the test order can be understood to have an effect on the results. If after extended exposure to 50 ppm sulfur fuel the same catalyst is then exposed to 10 ppm sulfur fuel, the NO oxidation rate would be expected to remain low. This is because the sulfur poisoning has already occurred before the fuel switch. Operating on lower sulfur fuels can not change this fact. Therefore, the sequence of fuel sulfur levels in the testing is important.

For the previously mentioned reasons the test results mentioned in the comment must be viewed in the context of how they were tested and can not necessarily be used to determine the exact degree of inhibition at one sulfur level or the amount of difference between two sulfur levels. However, the results can be understood to show that the lower the sulfur level, the less the amount of sulfur the catalyst is exposed to, the lower the degree of sulfur poisoning and thus the less NO inhibition due to sulfur. Whether or not the differences are “significant” can not be determined from this testing. The significance of the difference between various sulfur levels is determined by whether or not the inhibition of NO oxidation is large enough to suppress CDPF regeneration causing CDPF failure. The DECSE balance point data described in issue 3.3.1(A) clearly shows that the CDPF regeneration is significantly inhibited at fuel sulfur levels as low as 30 ppm. The extensive European field experience discussed in the RIA and in issue 3.3.1(D) shows that the degree of CDPF regeneration suppression caused by operation on 50 ppm cap fuel can be enough to cause CDPF failures.

To state more clearly: the Johnson Matthey data mentioned in the comment shows that there is a mechanistic cause for NO oxidation inhibition due to sulfur poisoning of the platinum catalyst. The DECSE balance point temperature results described in comments summarized in 3.3.1(A) show that NO oxidation inhibition due to sulfur even at levels as low as 30 ppm can suppress CDPF regeneration. Finally, real world experience in Europe on 50 ppm cap fuel shows that for some vehicles this degree of NO oxidation inhibition is enough to cause CDPF failures. For these reasons, we have concluded that a fuel sulfur level of 50 ppm is not an appropriate level for a CDPF based PM control program.

See also the responses to comments 3.3.1(A) through (D).

(F) EPA has failed to address techniques other than sulfur reduction for managing PM control.

(1) There exist other means, such as insulation of exhaust piping, to manage the effects of cold temperature ambient conditions on the efficiency of catalyzed PM filter traps, rather than lowering sulfur content of fuels as suggested in the Johnson-Matthey letter. Another technique to lower the creation of sulfate even with higher sulfur fuels would be to use EGR and variable turbo controls to elevate exhaust temperatures at lower loads.

Letters:

American Petroleum Institute (IV-D-343) **p. 29-31**
Marathon Ashland Petroleum (IV-D-261) **p. 22**

(2) EPA has failed to consider recent research to develop sulfur resistant PM trap schemes, including Sierra Research report on "Future Diesel-Fueled Engine Emission Control Technologies and Their Implications for Diesel Fuel Properties--A Review," Aug. 18, 1999; and AVL List Paper presented at NPRA Annual Meeting, March 2000. Commenter also noted developments by Steyr Nutzfahrzueg Ag of a SO catalyst which cut diesel HC emissions by over 90%, oxidized CO by over 70%, and reduced cold start emissions. Compared to oxy-cats, it avoided oxidation of SO2 to SO3, did not cause PM increases, and will not oxidize NO to NO2, and the catalyst is resistant to sulfur. Commenter cites a report by K. Richter, "Hydrocarbon Sorption and Oxidation Catalyst for HDE," Society of Automotive Engineers, Paper #1999-01-3560. Commenter also notes new metallic additives to decrease PM emissions and reduce control technology's sensitivity to sulfur. Renault and PSA/Peugeot-Citroen are employing such additives with success. Commenter cites O. Salvat et al, "Passenger Car Serial Application of a Particulate Filter System on a Common Rail Direct Injection Engine, SAE, Paper #2000-01-0473.

Letters:

American Petroleum Institute (IV-D-343) **p. 29-31**
Marathon Ashland Petroleum (IV-D-261) **p. 22-23**

Response to Comment 3.3.1(F):

The commenters raise two separate issues with regards to allowing less sulfur sensitive technologies to meet the Phase 2 PM standard. The first suggestion is that CDPF sulfur sensitivity can be decreased by the application of “other means” such as insulation of exhaust piping or different engine management techniques in order to raise exhaust temperatures. This issue is addressed fully in response to comment 3.3.1(D).

The second suggestion raised here is that there are some less sulfur sensitive technologies which could be applied as alternatives to the CDPF technology in order to control PM emissions. The non-filter based technologies suggested in the comment, such as new diesel oxidation catalyst technologies and new hydrocarbon adsorber technologies, do not offer the amount of control necessary in order to meet our significant air quality concerns. These technologies provide minimal control of the bulk of diesel PM (the elemental carbon portion i.e., the black soot) and thus typically offer less than 30 percent reductions in total PM. CDPFs operated on low sulfur diesel fuel provide total PM reductions in excess of 90 percent. Without control of all of the constituents of diesel PM (soot, hydrocarbons, and sulfate) we can not realize the substantial reductions that are needed to meet the Phase 2 PM standards.

The other set of alternative technologies are diesel particulate filters (DPFs) which promote the oxidation of diesel PM with fuel additives in conjunction with active fuel heaters such as the PSA system mentioned by the commenter. The fuel additive catalysts mentioned here do reduce the temperature at which the oxidation of trapped PM in the DPF can occur. For CDPF regeneration without precious metals, temperatures of around 650°C must be obtained. At such high temperatures, elemental carbon will burn provided sufficient oxygen is present. However, diesel engines rarely if ever operate with such high exhaust temperatures. For example, exhaust temperatures on the HDE Federal Test Procedure cycle typically range from 100°C to 450°C. The fuel additive technologies mentioned in the comment can reduce the temperature at which the carbon is oxidized to approximately 450°C. Precious metal CDPFs use platinum to oxidize NO in the exhaust to NO_2, which is capable of oxidizing carbon at temperatures as low as 250°C to 300°C. The difference between the 450°C temperature for the additive based technologies and the 250°C temperature for the CDPF technology is important because for much of diesel engine operation exhaust temperatures are below 450° C. For example since exhaust temperatures are typically below 450°C during the HD FTP test procedure, a fuel additive based DPF system would not be expected to regenerate over the test.

PSA attempts to overcome the problem of inadequate exhaust temperatures (even with the fuel additive) by adding excess fuel to the exhaust which then is oxidized over a diesel oxidation catalyst raising the exhaust temperature high enough to promote PM oxidation with the fuel additive. Using this approach PSA claims that PM emissions are reduced by as much as 60%. The use of fuel additives and supplemental exhaust heat in order to ensure regeneration leads to increased fuel consumption and increased system maintenance. The fuel additive produces a metallic ash which is collected in the filter and which must be cleansed from the filter every 50,000 miles. Further the additional fuel used to promote PM oxidation is not directly offset by other savings through the application of this technology.

While such a technology might work in some applications, we do not believe that a technology solution that requires the use of an additional fuel additive, increases maintenance cost over that for a CDPF, and provides only two-thirds of the benefits of the CDPF is an acceptable approach for a national heavy-duty diesel emission control program.

We are unaware of viable technology solutions to the substantial air quality problems of the diesel engine that can be applied without reducing diesel fuel sulfur levels substantially. Please see our response to comment 3.2.1(D).

Issue 3.3.2: Sulfur's Effect on NO_x Adsorbers

(A) NO_x adsorbers are extremely sensitive to the presence of sulfur in diesel fuel.

(1) The sulfate formed during the combustion process will block the storage sites in the adsorbers needed for effective NO_x adsorption. This will have a negative influence on the reduction of NO_x emissions but will also cause an increase in the fuel consumption of the engine. NO_x adsorbers are likely to require near-zero sulfur levels since their ability to effectively store NO_x is extremely sensitive to the presence of any fuel sulfur. Some commenters provided significant discussion and data regarding the reduction in the NO_x

conversion rate with higher sulfur fuel and the fuel economy impacts of operating the catalyst at higher temperatures as necessary for effective desulfating. At sulfur levels above the proposed 15 ppm cap, companies developing NO_x adsorber technology question the ability to commercialize systems that would be effective for the extended useful life of HDDEs. One commenter cites to the "ACEA Data of the Sulfur Effect on Advanced Emission Control Technologies" study, which shows that near zero sulfur levels are required to enable advanced aftertreatment technologies to enter the market. Others referred to the DECSE program and study as supporting documentation. One commenter provided the DOE report "Impact of Diesel Fuel Sulfur on CIDI Engine Emission Control Technology," August 2000, which includes test data and supporting information that illustrates the impact of higher sulfur levels on NO_x adsorbtion technologies.

Letters:

CA Trucking Association (IV-D-309) **p. 7**
Cummins, Inc. (IV-D-231) **p. 12**
DaimlerChrysler (IV-D-344) **p. 4, 8, +18-21**
Detroit Diesel Corporation (IV-D-276) **p. 1-5**
Engine Manufacturers Association (IV-D-251) **p. 10-11**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 47-48**
International Truck & Engine Corp. (IV-D-257) **p. 6**
Mack Trucks (IV-D-324) **p. 3**
Manufacturers of Emission Controls Association (IV-D-267) **p. 8**
U.S. Department of Energy (IV-G-28) **p. 2-3, Att. 2**
UAW (IV-D-215) **p. 4-5**

Response to Comment 3.3.2(A):

We agree with the commenters who note that sulfur from diesel fuel poisons the NO_x adsorber catalyst by blocking the storage sites in the adsorber. Further we agree with the commenters that the lower the fuel sulfur level the better for the NO_x adsorber catalyst. However, we disagree with the assertion by some commenters, that average fuel sulfur levels below the seven to 10 ppm level expected from our 15 ppm fuel sulfur cap will be necessary in order to make NO_x adsorbers feasible over the life of a heavy-duty vehicle. Please refer to our responses also on issues 3.2.1(A,C,D,J,M).

Issue 3.3.3: Effects of Lubricating Oil Sulfur

(A) EPA must address the sulfur content in lube oils to avoid problems with emission control equipment.

(1) The metallic ash content of lube oils may cause plugging of particulate traps which must then be removed and the ash blown off every 100,000 to 150,000 kilometers. The proposed voluntary low-sulfur lube program in the rule may undermine the significant financial investments in the new technologies. European Automobile Manufacturers Association recommend certain balances of sulfated ash for new technology engines.

Letters:

DaimlerChrysler (IV-F-186)

(2) EPA has not considered the effect of engine oil sulfur contamination. Industry sources predict engine oil sulfur contamination will be a major factor under the proposed sulfur standard. Various scientists predict such contamination may represent sulfur levels of 10 to 20 ppm in engine exhaust gases (cites to Prof. David Kettleman, University of Minnesota, Diesel Fuel News, 10/18/99). EPA cannot require ultra-low sulfur standards absent consideration of real world effect of engine oil contamination on sulfur sensitive emission reduction devices.

Letters:

National Alternative Fuels Foundation (IV-D-214) **p. 16**

Response to Comment 3.3.3(A):

The comments summarized here raise two concerns with the lubricating oils used in diesel engines equipped with CDPFs and NO_x adsorbers,

1) Metallic ash from engine oil can lead to CDPF plugging

2) Sulfur in engine oil can contribute to poisoning of CDPFs and NO_x adsorbers just as sulfur in fuel can.

While we agree with the commenters that these are important issues which must be considered, we disagree with the commenters on the magnitude of the problems raised by these issues and the appropriate means to address these issues.

Metallic ash from lubricating oil is captured by the filtering mechanism of the CDPF and can eventually accumulate in the CDPF causing increased backpressure and a need to clean the ash from the CDPF as described in the RIA and in the comment. The rate of ash accumulation and thus the interval at which a cleaning event will need to occur is determined by the quantity of metallic additives in the lubricating oils and the engine oil consumption rate. As described in the RIA we expect that there will be a need to clean the accumulated ash from CDPFs at regular intervals and have therefore estimated a cost for this cleaning. Further, we expect that the oil industry and the engine manufacturers will work together (in fact already are as noted in comment summary 3.3.3(B)) in order to define the best oil formulation consistent with the emission control systems being developed to meet the Phase 2 standards. We believe that industry working together to develop new oil formulations as needed to address all of the needs of the engine/vehicle systems is the best way to address this issue.

Sulfur in engine oil can also contribute to sulfur in the exhaust which poisons the function of both CDPFs and NO_x adsorbers. Current engine lubricating oils have sulfur contents which can range from 2,500 ppm to as high as 8,000 ppm by weight. Since engine oil is consumed by heavy-duty diesel engines in normal operation, it is important to account for the contribution of oil derived sulfur. The approach that we used in the RIA to give a straightforward comparison of this effect is to express the sulfur consumed by the engine as an equivalent fuel sulfur level. Using this approach in the RIA we showed that the fuel equivalent amount of sulfur expected from engine oil was approximately one ppm. We also showed in the RIA why estimates of this fuel equivalent sulfur levels made for vehicles with open crankcase ventilation systems can be misleading. Given the relatively low amount of oil derived sulfur expected to enter the exhaust system as described in the RIA we do not feel that it is necessary to set a sulfur limit on engine oil. However, we believe that the use of low sulfur diesel fuel may allow for engine oil formulations to be developed with a lower sulfur content. As we mentioned previously the engine manufacturers and the oil industry are already working together to address these issues. Therefore we think it is both inappropriate and more importantly unnecessary for us to set standards for engine lubricating oils.

(B) EPA has failed to address the need for low sulfur/low ash lube oil.

(1) Presently, fully formulated HDDE oils contain between 0.3 and 0.8 percent sulfur. With ultra low sulfur fuel, the lube oil sulfur contribution becomes more significant. Commenter provides additional discussion on this issue noting that the formulation of lube oil requires a delicate balance of components to serve the multiple and often conflicting demands of routine engine operation. Current research is underway on this issue through a cooperative effort between engine manufacturers, DOE, emission control system suppliers and the petroleum industry. EPA should participate in these efforts. Commenter does not recommend any specific requirements for lube oil but notes that EPA should assess whether the requisite changes to lube oil to reduce the sulfur and ash content will occur voluntarily and, if not, then specifications should be set.

<u>Letters:</u>

Cummins, Inc. (IV-D-231) **p. 45**

<u>Response to Comment 3.3.3(B):</u>

See response to comment 3.3.3(A).

(C) Since engine lubricating oils containing sulfur do not contribute to exhaust sulfur, there should be no requirement to reformulate the product.

(1) Commenter (Motor and Equipment Manufacturers Association and Automotive Chemical Manufacturers Council) notes that given that lubricating oils do not contribute to exhaust sulfur and that EPA's proposed rule requires that the crankcase be closed and that crankcase ventilation systems be put in place by engine manufacturers, it is unnecessary to require lubricating oil manufacturers to reformulate their products at this time. Additional investigation by EPA is necessary before any reformulation measures are adopted.

<u>Letters</u>

Motor and Equipment Manufacturers Association (IV-D-258), **p. 9**

<u>Response to Comment 3.3.3(C):</u>

While we agree with the commenter that reformulating engine oils in order to accommodate new exhaust emission control technologies, such as NO_x adsorbers and CDPFs, are not required, we do believe that it may be beneficial to reformulate engine oils giving consideration to the changes brought on by the application of the emission control technologies and low sulfur diesel fuel. See also response to comment 3.3.3(A).

Issue 3.3.4: Other After-treatment Technology

(A) Some of the aftertreatment systems that are currently under development contain an oxidation catalyst, which is likely to produce a high amount of additional particulates in the presence of high sulfur fuel.

(1) The oxidation catalyst in aftertreatment systems will oxidize carbon monoxide and SO2 converting it to SO4, which, as a result, produces a high amount of additional particulates if high sulfur fuel is used. This could limit the introduction of otherwise beneficial aftertreatment systems. If a 15 ppm sulfur fuel is used, the sulfur contribution is minimal for engines without aftertreatment systems. However, when an oxidation catalyst is used, the conversion rate can drastically increase to between 30% and 100% depending on the efficiency of the catalytic converter. Commenter provides additional data to support their assertion and asserts that a sulfur cap of 5 ppm is necessary for future HDDEs to be reliably certified to a 0.01 g/bhp-hr PM standard.

Letters:

DaimlerChrysler (IV-D-344) **p. 3-4, +15-16**

(2) Even though EPA has indicated in the RIA that oxidation catalyst technology is not sufficient to achieve the necessary levels of PM reductions, if ultra low sulfur fuel is available nationwide, this technology can be more efficient and can be retrofitted to existing engines to allow substantial emissions benefits. Oxidation catalysts also can be very durable with little or no deterioration in effectiveness over time. Commenter refers to the "DECSE" program and study as supporting documentation.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 9-10**

Response to Comment 3.3.4(A):

We recognize the impact of fuel sulfur on particulate generation over oxidizing systems. The feasibility of the PM standard using highly oxidizing exhaust emission controls such as CDPFs containing precious metals is discussed in Chapter III of the RIA, section (A)(2). Precious metal CDPFs behave similarly with respect to SO_2 oxidation to the DOCs discussed by the commenter. Some incorporate a precious metal DOC upstream of the wall-flow filter media, others incorporate the DOC function onto the surface of the filter media. The data summarized in table III.A-1 of the final RIA show that the 0.01 standard can be met using such a device with a 15 ppm sulfur diesel fuel based on data from the DECSE Program.

As for retrofits using DOCs, even with increased efficiency, DOC technology alone is not sufficient to meet the PM standards**.** DOCs remove gas-phase semi-volatile organic compounds, with little or no interaction with elemental carbon PM. These contribute to PM emissions after they are cooled via dilution with air and either adsorb to elemental carbon PM or form a nucleated organic aerosol. As mentioned in Chapter III of the RIA, section (A)(2), semi-volatile organic compounds comprise only 10 to 30 % of total PM mass. Even with an efficiency of 100% and no formation of sulfate PM, DOC technology would at best only provide ~30% reduction in PM emissions. This would not be sufficient to meet the new PM standard; however, PM emissions below the pre-2007 PM standard of 0.10 g/bhp-hr could be achieved. But, a retrofit program incorporating a DOC would be enhanced through the availability of low sulfur fuel.

Reference:
Diesel Emission Control Sulfur Effects (DECSE) Program - Phase II Interim Data Report No. 4, Diesel Particulate Filters-Final Report, January 2000, Table C1, www.ott.doe.gov/decse.

(B) The NO_x reduction capability of $DeNO_x$ (lean-NO_x) catalyst loading is limited by the presence of sulfur in the fuel.

(1) Very low sulfur levels are necessary to maximize the effectiveness of $deNO_x$ catalysts. Even though EPA has determined that use of lean-NO_x catalyst technology will not achieve the necessary levels of NO_x reduction, it is a technology that could potentially be retrofitted to existing engines to achieve substantial NO_x reductions if ultra low sulfur fuel is available nationwide. Commenter refers to the "DECSE" program and study as supporting documentation.

<u>Letters:</u>

Engine Manufacturers Association (IV-D-251) **p. 10**

(2) $DeNO_x$ passive catalysts show high sulfur sensitivity in terms of NO_x conversion efficiency. When the catalyst is operated with sulfur free fuel, the optimal operating temperature is lower and therefore, is better suited to modern exhaust temperatures. Even a switch from zero to 10 ppm sulfur content lowers the conversion efficiency by approximately 25 percent. The relatively low NO_x conversion efficiency of $DeNO_x$ passive catalysts give limited prospects for its use in the long term but could be used as an interim solution for some applications, such as passenger cars and light duty commercial vehicles.

<u>Letters:</u>

DaimlerChrysler (IV-D-344) **p. 17-18 (att.)**

<u>Response to Comment 3.3.4(B):</u>

As noted by the commenters, reducing fuel sulfur levels is beneficial to many types of exhaust emission controls in addition to those that are likely to be used to meet the new standards. These controls include $deNO_x$ catalysts, SCR, non-thermal plasma, and DOCs. These benefits were not directly accounted for in the rulemaking, but are acknowledged by EPA.

(C) Low-sulfur diesel fuel would be required for the application of the non-thermal plasma assisted catalyst.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

UAW (IV-D-215) **p. 5**

Response to Comment 3.3.4(C):

See our response to comment 3.3.4(B).

Issue 3.3.5: Developments in Sulfur Tolerance

(A) Sulfur traps remain a possibility to protect advanced aftertreatment systems but may not be feasible or commercially viable by 2007.

(1) Sulfur traps remain in the research stage and the question remains as to how the trap would be emptied and how to dispose of the effluent.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 11-12**

(2) Sulfur traps could potentially mitigate the need for ultra-low sulfur diesel fuel but this technology is unproven and there is currently no practical onboard system that has been demonstrated to be effective.

Letters:

U.S. Department of Energy (IV-G-28) **p. 2**

Response to Comment 3.3.5(A):

SO_x traps (or SO_x adsorbers) are catalyst systems designed to store sulfur compounds under lean operating conditions and then to release the stored sulfur emissions periodically as SO2. The catalytic compounds and processes are essentially the same as for NO_x adsorbers, although some ratios of storage compounds may change in order to promote an easier release of the sulfur compounds. The NO_x adsorber technology that we believe will be applied in order to meet the Phase 2 NO_x standards is itself a SO_x adsorber. It will store sulfur under lean operating conditions and then release the sulfur during periodic desulfation events. In this way the NO_x adsorber technology is expected to be able to manage diesel fuel sulfur levels that are on average below 15 ppm. However, as we explain further in responses to comments 3.2.1(C), (J), and (M), these desulfation events cause some thermal degradation of the NO_x adsorber catalyst making it impossible to meet the Phase 2 NO_x standard over the useful life of a heavy-duty vehicle on fuel sulfur levels higher than 15 ppm. This type of integrated SO_x trap / NO_x adsorber (or more simply a NO_x adsorber capable of periodic desulfation events) will be possible by 2007 provided the development steps outlined in the RIA are met. Primary among these are the availability of diesel fuel with an average sulfur level less than 15 ppm and the development of control systems capable of providing the necessary conditions for NO_x adsorber desulfation (similar to those already demonstrated in the DECSE Phase II work described in the RIA).

There are two other approaches to SO_x traps that have more ambitious goals for sulfur control. These are:

1) "sacrificial" SO_x traps that store sulfur and are periodically replaced (disposable)

2) regenerating SO_x traps with by-pass architectures (by-pass SO_x traps)

With regards to both of these approaches we agree with the commenters that while these approaches are theoretically capable of controlling sulfur, they will not be available, effective or practical for application in order to meet the Phase 2 standards.

Disposable SO_x traps would work to control sulfur by adsorbing sulfur compounds onto the surface of the SO_x trap under all conditions (again these are simply sulfur optimized NO_x adsorbers) and then would never release the stored sulfur while installed on a vehicle. Periodically these devices would need to be replaced in order to control sulfur. As described in more detail in the RIA, we have two reasons why we believe that this approach will only be possible if fuel sulfur levels are well below 15 ppm. Primary among these reasons is SO_x trap size. We estimate in the RIA that in order to allow a heavy heavy-duty vehicle to operate on a one year service interval using this approach and 50 ppm sulfur diesel fuel, the SO_x trap would need to have a volume of 710 liters! Typical heavy heavy-duty diesel engines themselves have a displacement of normally only 10-15 liters. A means to package this kind of system on a heavy-duty vehicle appears to be impossible. Further as explained in the RIA, this approach can only provide some sulfur protection. Inevitably some amount of sulfur would get past the device requiring that the downstream components be somewhat sulfur tolerant. The downstream NO_x adsorber would need to be capable of periodic desulfation events itself. Therefore we agree with the commenters that SO_x traps applied in this manner would not be practical or available in the timeframe of the Phase 2 standards.

We agree with the commenters that regenerating SO_x traps with by-pass architectures as suggested by other commenters in issues 3.3.5(D), (E), and (F), are not practical and add unnecessary system constraints while failing to provide fully effective sulfur control. This concept is overly complex essentially requiring the application of redundant NO_x adsorber systems. One called a “sulfur trap” and installed in front of a downstream “primary” NO_x controlling NO_x adsorber. The up-front NO_x adsorber/sulfur trap would store sulfur under most conditions while providing a periodic means to release the stored sulfur and then by-pass it around the remaining sulfur sensitive emission control technologies. There are several fundamental issues with this approach for which we do not see satisfactory solutions. If the SO_x trap stores NO_x under lean conditions (it most likely would at some exhaust temperatures), it would the face the problem of “NO_x poisoning”, NO_x filling the intended sulfur storage sites, forcing frequent NO_x purge cycles. One potential “solution” to this would be to perform a NO_x regeneration of both the up-front SO_x trap and the primary downstream NO_x adsorber at the same time and on a frequent basis (before the upfront SO_x trap was full of NO_x). Unfortunately the NO_x regeneration is not capable of fully removing the stored sulfur and would cause some sulfur release that could then poison the downstream NO_x adsorber. Therefore this solution would not work. The only approach put forth that would seem to have any potential to theoretically address this problem is to reverse flow through the primary NO_x adsorber and the up-front SO_x trap/NO_x adsorber every NO_x regeneration event. In order to make this approach work a system similar to that described in the comments provided by Cummins Engine Company (docket A-99-06 item IV-D-231) would be necessary. As noted by Cummins in their comments, this approach is unacceptably complex and cannot be expected to work over the full useful life of a heavy-duty vehicle. Further, as noted in the preceding discussion of the disposable SO_x trap, SO_x traps do allow some sulfur past causing gradual poisoning of the downstream emission control components. Therefore, this approach may only delay the inevitable.

For all of the reasons given above, we agree with the comments summarized here and echoed in summary 3.3.5(B) that SO_x traps do not offer a practical on-board means to control sulfur from diesel fuel.

(B) Sulfur traps are not a viable substitute for significantly reducing the level of sulfur in diesel fuel.

(1) At sulfur levels higher than EPA's proposed standard, the technology would add a considerable measure of complexity to the NO_x control system. A SO_x trap would require its own regeneration system and likely would require a by-pass to protect the downstream NO_x control unless it were 100% effective. The size of the SO_x trap would also be a consideration because even at levels of 50 ppm sulfur it would quickly become saturated. Regenerating the SO_x trap would also have adverse impacts on fuel economy and may produce other undesirable emission by-products.

Letters:

Manufacturers of Emission Controls Association (IV-D-267) **p. 8-9**

Response to Comment 3.3.5(B):

See our response to comment 3.3.5(A).

(C) If sulfate formation is a problem for integrated SCR/DPF, a sulfur trap could be added between the DPF and the SCR.

(1) NO_x traps capture sulfur oxides and absorb essentially all the sulfate downstream of the DPF. The NO_x/SO_x trap would release sulfur in the form of SO2 during regeneration thereby eliminating the sulfate PM issue. While the SO_x trap system is not proven technology, the developments required are similar to that required for the NO_x adsorber system.

Letters:

ExxonMobil (IV-D-228) **p. 9**

Response to Comment 3.3.5(C):

We agree with the commenter that it is possible to store sulfur emissions (SO_x) under lean conditions on a SO_x trap (or a NO_x adsorber for that matter) and then to release the stored sulfur compounds under rich operating conditions. Further, we agree that if the sulfur compounds released under rich conditions were able to be emitted as SO2, then this approach could significantly reduce sulfate PM emissions. This possibility is one advantage that NO_x adsorbers and SO_x traps have over systems such as Urea SCR which do not store sulfur under lean conditions and instead oxidize sulfur compounds forming sulfate PM which is emitted into the atmosphere.

However, we disagree with implication that this approach could be used to allow a

Compact SCR (Urea SCR) based control system (including a CDPF) to meet the Phase 2 PM standard. Our concern about this conclusion is based upon the fact that we do not believe that a practical SO_x trap can be developed in order to control sulfur at levels above 15 ppm. Our analysis in the chapter III of the RIA shows that either the SO_x trap must be unacceptably large or must be desulfated periodically in order to maintain acceptable sulfur capture efficiency. The use of a sulfur storage catalyst that is periodically desulfated is the same as using a NO_x adsorber. Therefore, since a NO_x adsorber system would be required in order to allow a compact SCR based system to meet the Phase 2 PM standard, we wonder why someone would choose to use the compact SCR system. Further, as we explain in the RIA, the SO_x/NO_x adsorber (trap) would need 15 ppm in order to allow it to continue to function well over the full useful life of a heavy-duty vehicle. Please refer also to our response to comment 3.3.5(A).

(D) Sulfur trap devices will be necessary since the NO_x adsorber cannot tolerate any sulfur from the fuel or engine lube oil. However, there are some technical feasibility issues associated with this technology that are unresolved.

(1) SO_x trap devices will be essential for ensuring that the NO_x adsorber technology is not exposed to any sulfur. However, the technological and logistical issues associated with an emission control system that incorporates a particulate trap, SO_x trap and NO_x adsorption system have not been completely resolved. The rejuvenation of a sulfur trap may require cleaning or replacement by the operator. The cost of such a sulfur trap will likely be between \$500 and \$1,000 per vehicle.

Letters:

Cummins, Inc. (IV-D-231) **p. 9-10**
Marathon Ashland Petroleum (IV-D-261) **p. 74**

Response to Comment 3.3.5(D):

See our response to comment 3.3.5(A).

(E) EPA has not considered a viable sulfur trap technology that protects diesel aftertreatment systems from all engine exhaust sulfur emissions.

(1) The poisoning of sulfur-sensitive emission reduction devices may be solved without the removal of fuel sulfur by using a device known as the Protection of Aftertreatment Systems from Sulfur (PASS) system. This system prevents sulfur from reaching sulfur-sensitive emission reduction devices, allowing these devices to operate at peak efficiency. Commenter provides additional data and technical discussion regarding the PASS system design and notes that the development and confirmation testing will be completed later this year (2000). As further documentation supporting the development status of this technology, commenter provides a copy of a preproposal to the Southwest Research Institute.

Letters:

National Alternative Fuels Foundation (IV-D-214) **p. 4, 18-21**

Response to Comment 3.3.5(E):

We are aware of the PASS concept mentioned in the comment and believe that it is substantially similar to the by-pass regeneration approach discussed in response to issue 3.3.5(A). The PASS concept employs multiple SOx traps that work to by-pass the emission control equipment such as a NOx adsorber or CDPF. It contains two SOx traps, an upfront “lean” SOx trap that stores sulfur under lean operating conditions and a downstream “rich” SOx trap that exists in parallel with the primary emission control equipment and stores sulfur under rich conditions. The system is designed such that the main emission control equipment is taken “off-line” occasionally to allow for the SOx traps to be purged. There is no explanation of how emissions are controlled when the emission control technology is off-line. Further as described in response to issue 3.3.5(A) such an approach is unnecessarily complicated while only providing partial protection of the sulfur sensitive emission control technologies. SOx traps do allow some sulfur past causing gradual poisoning of the downstream emission control components. Therefore, this approach only delays the inevitable. For all of the reasons listed there we do not feel that the PASS concept could be effectively applied for all heavy-duty vehicles as would be required for a national program.

(F) Rapid advancement in SO_x traps will allow for the use of NO_x adsorber systems on higher sulfur fuel.

(1) There are promising new developments in SO_x traps that can be periodically regenerated. Diesel engine systems have been tested that combine a SO_x trap with a NO_x trap (cites to J.E. Parks, et al "Sulfur-Resistant NO_x Sorbate Catalyst for Increasing Longevity in Diesel Exhaust", Society of Automotive Engineers Paper Number 2000-01-1012, February 2000). While EF&EE expressed serious concerns about whether NO_x adsorber systems are feasible on any sulfur level, they have stated that 30 ppm average/50 ppm cap fuel would be as feasible as 15 ppm cap fuel due to rapid advancement in SO_x traps.

Letters:

American Petroleum Institute (IV-D-343) **p. 39, 69-70**
Marathon Ashland Petroleum (IV-D-261) **p. 33-34**

Response to Comment 3.3.5(F):

See our response to comment 3.3.5(A).

Issue 3.4: Fuel Economy Impacts

(A) A 15 ppm sulfur content will result in a loss of fuel economy. Thus additional volumes of diesel will be needed to match the energy content of current diesel consumption.

(1) Refiners are likely to cut the heaviest portion of the diesel fuel fraction from the ultra low sulfur diesel fuel. Because of its relatively higher BTU content, heavier material increases fuel economy but contains sulfur compounds that are more difficult to remove. This necessary strategy will result in lower production volumes and reduced fuel economy.

Letters:

National Petrochemical & Refiners Association (IV-D-218) **p. 2, 9**
Western Independent Refiners Association (IV-D-273) **p. 3**

Response to Comment 3.4(A):

EPA assessed the techniques by which refiners might comply with the new sulfur cap. Cutting out the heaviest portion of the diesel fuel fraction from the material to be processed into ultra low sulfur diesel fuel would reduce the cost of hydrotreating. However, it would also decrease the volume of highway diesel fuel produced, decreasing revenues. Also, the refiner would then have to sell the heavier material. As summarized in Chapters IV and V of the Final RIA, the markets for this heavier material would quickly become saturated with product if refiners followed this route, and the prices available for this material would drop precipitously. Thus, we do not expect refiners to consider this a viable compliance technique. However, the desulfurization process itself does tend to increase fuel volume and reduce fuel density. Overall, there is a small decrease (on the order of 1%) in the total amount of energy leaving the hydrotreater, though some gasoline and LPG is produced. The refiner can then decrease his overall gasoline to distillate ratio elsewhere in the refinery to recover this small loss in diesel fuel energy.

The decrease in fuel density does mean that fuel economy will decrease slightly. EPA included this cost in its refining costs by requiring its modeled refineries to produce the same amount of energy in the form of diesel fuel as was produced prior to the rule. In other words, refiners were assumed to produce and distribute slightly more volume of diesel fuel after the new rule than before.

(B) The use of particulate filters will not have a significant impact on fuel economy.

(1) Fuel economy impacts will vary somewhat with the filter designs, applications and operating modes. However, recent studies show a small effect. Commenter cites to the DECSE program which found a fuel economy impact of 1 to 2 percent, and to the ARCO EC Diesel program, which retrofitted a variety of vehicles and found no significant impact on fuel economy as a result of using filter technology.

Letters:

Manufacturers of Emission Controls Association (IV-D-267) **p. 5**

Response to Comment 3.4(B):

We agree with the commenter that based on the ARCO EC diesel program and other test programs, the fuel economy impact of CDPFs will be small, if there are any at all.

(C) NO_x adsorbers will have an adverse impact on fuel economy.

(1) The higher the sulfur levels, the more frequent and intense the desulfurization phase resulting in adverse impacts on fuel economy. There may be some opportunities to off-set some of the fuel economy impacts of NO_x adsorber technology. If the technology can function at very high efficiencies, then in certain driving modes, the engines can be calibrated to achieve a fuel

economy improvement with the associated increase in engine-out NO_x emissions being controlled by the adsorber. This and other types of systems development will continue over the next six years to improve the effectiveness of NO_x adsorbers and minimize its impact on fuel economy.

Letters:

Manufacturers of Emission Controls Association (IV-D-267) **p. 5-6**

(2) NO_x adsorber catalyst regeneration will cause a fuel penalty between 4 and 9 percent depending on engine duty cycle and NO_x reduction targets. Modal fuel penalty values range from 5.5 percent at the higher exhaust temperatures to 16 percent at the lower exhaust temperature. One commenter noted that DECSE targeted a 4 percent fuel economy penalty and went over this level in some tests, and that Cummins and Volkswagon have reported fuel economy losses of up to 7 percent. This commenter adds that EPA's proposed vehicle system will have a fuel economy penalty of 5 percent, which will cost the consumer an additional 5 cpg, and that in contrast, the SCR/CDPF system would lead to a minimal fuel economy penalty resulting in only a 1 cpg cost to the consumer.

Letters:

American Petroleum Institute (IV-D-343) **p. 69, 74**
Cummins, Inc. (IV-D-231) **p. 14**
Marathon Ashland Petroleum (IV-D-261) **p. 3, 30**

Response to Comment 3.4(C):

There are two issues with regard to NO_x adsorbers and fuel economy which are raised in the comments summarized here:

(A) Desulfation events consume fuel, so higher fuel sulfur levels lead to higher fuel use and
(B) NO_x adsorbers use diesel fuel as a reductant therefore fuel consumption levels will be inherently higher (much higher according to some commenters).

NO_x adsorbers will have to undergo a periodic desulfation event in order to remove sulfur which has poisoned the catalyst in order to maintain high NO_x conversion efficiencies. The desulfation event requires controlled operation under hot and net fuel rich exhaust conditions. These conditions, which are not part of a normal diesel engine operating cycle, can be created through the addition of excess fuel to the exhaust. This addition of excess fuel causes an increase in fuel consumption. Since the frequency of this desulfation event is based upon the sulfur level in the fuel (higher fuel sulfur levels require more frequent desulfation events) increasing the fuel sulfur level inherently leads to higher fuel consumption levels. We agree with the commenter that higher fuel sulfur levels lead to increased fuel consumption and we believe that this is one more reason why the fuel sulfur level should be as low as possible.

While NO_x adsorbers, as noted by the commenters, require non-power producing consumption of diesel fuel in order to function properly and, therefore, have an impact on fuel economy, they are not unique among NO_x control technologies in this way. In fact NO_x

adsorbers are likely to have a very favorable NO_x to fuel economy trade-off when compared to other NO_x control technologies like cooled EGR and injection timing retard that have historically been used to control NO_x emissions. Today, most diesel engines rely on injection timing control (retarding injection timing) in order to meet the 4.0 g/bhp-hr NO_x emission standard. For 2004 model year compliance, we expect that engine manufacturers will use a combination of cooled EGR and injection timing control to meet the 2.0 g/bhp-hr NO_x standard. Because of the more favorable fuel economy trade-off for NO_x control with EGR when compared to timing control, we can forecast that less reliance on timing control will be needed in 2004. Therefore, fuel economy will not be changed even at this lower NO_x level.

NO_x adsorbers have a significantly more favorable NO_x to fuel economy trade-off when compared to cooled EGR or timing retard alone, or even when compared to cooled EGR and timing retard together.[77] Current NO_x adsorber data from NVFEL show greater than 90 percent reduction in NO_x emissions over the SET and FTP, while only increasing fuel consumption by a very reasonable two percent as documented in the RIA. Further the data show that, for significant portions of the engine's typical operating range, NO_x control in excess of 98 percent is possible even with engine-out emissions as high as 5 g/bhp-hr.[78] Further at this point in the development of the NO_x adsorber technology it would be premature to expect no further improvement in fuel economy with the application of the NO_x adsorber. Therefore, we expect manufacturers to take full advantage of the NO_x control capabilities of the NO_x adsorber and project that they will decrease reliance on technologies with a less favorable emissions to fuel economy trade-off, especially injection timing retard, when operating at conditions where the NO_x adsorber performance is significantly greater than 90 percent. We have therefore predicted that the fuel economy impact currently associated with NO_x control from timing retard would be decreased by at least three percent. In other words, through the application of advanced NO_x emission control technologies, which are enabled by the use of low sulfur diesel fuel, we expect the NO_x trade-off with fuel economy to continue to improve significantly when compared to today's technologies. This will result in both much lower NO_x emissions, and potentially overall improvements in fuel economy. Improvements could easily offset the fuel consumption of the NO_x adsorber itself and, in addition, the one percent fuel economy loss projected to result from the application of PM filters. Consequently, we have projected no fuel economy penalty will result from this rule.

Therefore we disagree with the commenter's assertion that the application of NO_x adsorbers will lead to a significant increase in fuel consumption.

(D) Fuel sulfur levels need to be very low to avoid adverse impacts on fuel economy.

(1) NO_x adsorber sulfur regeneration can consume significant amounts of fuel unless the fuel sulfur levels are very low. As sulfur levels increase above 15 ppm, the fuel economy penalty doubles with each doubling of the sulfur level. At 15 ppm the fuel economy penalty is 1% and at 30 ppm the penalty is 2%.

---

[77] Zelenka, P. et al, *Cooled EGR - A Key Technology for Future Efficient HD Diesels,* SAE 980190, Society of Automotive Engineers 1998. Figure 2 from this paper gives a graphical representation of how new technologies (including exhaust emission control technologies) can shift the trade-off between NO_x emissions and fuel economy.

[78] Memorandum from Charles Schenk to Air Docket A-99-06, dated October 30, 2000.

Letters:

CA Trucking Association (IV-D-309) **p. 7**

Response to Comment 3.4(D):

We agree with the commenter that higher fuel sulfur levels lead to higher fuel consumption for NO_x adsorber desulfation. See our response to comment 3.4(C).

(E) The oil industry's 50 ppm sulfur limit would have a negative effect on the fuel economy of the nation's trucks and buses.

(1) For example, NO_x adsorbers are expected to consume diesel fuel as they cleanse themselves of stored sulfates. Also, PM trap regeneration is inhibited by diesel fuel's sulfur--leading to increased PM loading, increased exhaust backpressure, and decreased fuel economy.

Letters:

Natural Resources Defense Council (IV-D-168) **p. 4**

Response to Comment 3.4(E):

We agree with the commenter that fuel sulfur levels at 50 ppm sulfur as proposed by some in the industry would lead to increased fuel consumption due to increased frequency of desulfation and due to increased average CDPF backpressure when compared to a 15 ppm fuel sulfur cap. This is one reason why we feel that 15 ppm sulfur cap is the right level. See also our response to comment 3.4(C).

(F) There are intake air restrictions for diesel engines that may have an impact on the effectiveness of various control technologies and fuel consumption.

(1) Diesel engines are operated with excess air, which leads to a low gas temperature in the cylinder in comparison to operation at the stoichiometric air/fuel ratio. This ensures a thermal load for the engines components that is necessary for the high specific performance of diesel engines. Operation at an excess air ratio of 1.0 is not typical for a diesel engine and will impose an excessive thermal load on engine components close to the combustion chamber. The application of the NO_x adsorber catalyst technology to HDDEs requires the excess air ratio to be between 0.9 and 1.0 for denitration of the adsorber catalyst and reduction of NO_x. Commenter provides additional discussion and data to illustrate the relationship between the excess air ratio, NO_x controls and fuel consumption.

Letters:

DaimlerChrysler (IV-D-344) **p. 8-9**

(2) A considerable increase of PM is observed when the excess air ratio is changed from 1.9 to 1.5, which poses a problem for HDDEs as those engines increase fuel consumption with a decreasing excess air ratio. Commenter provides discussion and data to illustrate this correlation.

Letters:

DaimlerChrysler (IV-D-344) **p. 9**

(3) The intake air restriction for diesel engines is critical for turbo-charger behavior since it can cause the turbo-charger's speed to drop. Turbocharged engines are very susceptible to the effects of a change in the excess air ratio. This issue has not been adequately addressed by EPA in the proposed rule.

Letters:

DaimlerChrysler (IV-D-344) **p. 9**

Response to Comment 3.4(F):

The commenter correctly points out that there are considerable challenges to operating heavy-duty diesel engines at an excess air ratio of 0.9 to 1.0. These are among the primary reasons (along with fuel economy considerations) that EPA took a different approach to NO_x adsorber regeneration during its laboratory evaluation. Using a dual-bed or multiple-bed approach with direct-exhaust fuel injection for adsorber regeneration provides the necessary reducing environment for NO_x desorption without the need for reducing the engine's excess air ratio. Restriction of excess air ratio for regeneration is also an unlikely means of regeneration of the NO_x adsorber for a heavy-duty diesel application since the fuel economy penalty is considerably higher than using a dual-bed or multiple-bed NO_x adsorber approach. Please refer to chapter III of the RIA for a detailed discussion of dual-bed and multiple-bed NO_x adsorber catalysts.

(G) The proposed standards will lead to an overall loss of fuel economy.

(1) The new emission control systems will add weight, complexity, and operational constraints that will prevent achieving the same fuel economy in the absence of these components. SCR systems will require a sizeable urea tank, NO_x adsorber systems will require frequent rich air-to-fuel ratio excursions, and the PM trap will also require additional components and catalysts. Even if advance engine controls compensate to a certain degree for the loss in fuel economy, a net loss will still occur.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 76**

Response to Comment 3.4(G):

We disagree with the assertion of the commenter that overall the fuel economy of new vehicles will decrease relative to today's level due to the application of new emission control technologies. The commenter does acknowledge that the application of new more efficient control technologies can offset fuel economy changes, but suggests that in spite of this fact, the fuel consumption for engines will increase. The conclusion the commenter reaches appears to be based upon the same assumptions made by in the comments summarized in 3.4(C). Specifically that NO_x adsorbers will require an increase in fuel consumption between four and 10 percent. We disagree with that assumption. The theoretical fuel consumption need for NO_x adsorbers is less than one percent (see docket A-

99-06 item IV-D-267) and testing at NVFEL has shown that actual fuel consumption levels can be less than two percent, even given a five gram/bhp-hr engine out NO_x emission level. We believe it is more appropriate to assume that NO_x adsorbers will consume fuel at a rate of one to two percent of the total fuel consumption and that the net fuel economy impacts of all changes in the vehicle will be zero.

We expect manufacturers to take full advantage of the NO_x control capabilities of the NO_x adsorber and project that they will decrease reliance on technologies with a less favorable emissions to fuel economy trade-off, especially injection timing retard, when operating at conditions where the NO_x adsorber performance is significantly greater than 90 percent. We have therefore predicted that the fuel economy impact currently associated with NO_x control from timing retard would be decreased by at least three percent. In other words, through the application of advanced NO_x emission control technologies, which are enabled by the use of low sulfur diesel fuel, we expect the NO_x trade-off with fuel economy to continue to improve significantly when compared to today's technologies. This will result in both much lower NO_x emissions, and potentially overall improvements in fuel economy. Improvements could easily offset the fuel consumption of the NO_x adsorber itself and, in addition, the one percent fuel economy loss projected to result from the application of PM filters. Consequently, we disagree with the comment raised here and continue to believe that, no fuel economy penalty will result from this rule.

Issue 3.5: Other Technology (inc. SCR)

(A) SCR technology is currently being developed for commercial application and will be available for some vehicles in the near future.

(1) SCR technology is capable of achieving significant NO_x reductions and is also capable of reducing HC emissions and PM. On-road demonstrations of SCR have established excellent NO_x reduction performance after over 325,000 miles of vehicle operation with over 6 million miles of accumulated commercial fleet operation.

Letters:

Manufacturers of Emission Controls Association (IV-D-267) **p. 6**, (IV-F-187)

(B) EPA should consider SCR as a control technology for HDDEs since this NO_x reduction process is the only way to reduce effectively NO_x emissions through exhaust gas aftertreatment and ensure the positive characteristics of diesel engine operation.

(1) SCR as a NO_x reduction process is well known and has proven success in the area of stationary source air emissions reduction technology. This system could also be applied to HDDEs and even though it will require the availability of an additional substance for engine operation (NH3 in the form of urea), it is capable of reducing NO_x emissions, ensuring the positive operational characteristics of diesel engines and meeting the fuel efficiency limitations under consideration. With SCR, a conversion efficiency of 80% can be achieved. However, SCR as an aftertreatment technology is still under development and further research is necessary.

Letters:

DaimlerChrysler (IV-D-344) **p. 10**

(C) EPA should not completely dismiss SCR as a NO_x control technology, which is the technology of choice in Europe and like the CDPF has been tested and proven on thousands of European diesel vehicles using 50 ppm and higher sulfur diesel fuel.

(1) SCR technology easily achieves NO_x levels of 0.5 gm/bhp-hr and EPA has noted in the RIA that this technology may be capable of meeting the proposed 0.2 g/bhp-hr standard by 2007. SCR can be used immediately and does not need a four year phase-in or a technology review. SCR's ability to be operating in 100% of 2007 new diesel vehicles allows SCR technology to generate more early NO_x emission reduction benefits than EPA's proposal.

Letters:

American Petroleum Institute (IV-D-343) **p. 11**
Marathon Ashland Petroleum (IV-D-57) **p. 2**

(2) Heavy duty engine SCR is relatively insensitive to diesel sulfur levels but the compact SCR technology to be used in smaller vehicles is reportedly somewhat sulfur sensitive. However, the compact SCR technology incorporates platinum-based oxidation catalysts, which are very similar to current gasoline oxidation catalysts, which can successfully operate at sulfur levels up to 80 ppm. This technology would be capable of meeting the 0.5 g/bhp-hr standard for the life of the vehicle given a 50 ppm sulfur level in diesel fuel.

Letters:

Marathon Ashland Petroleum (IV-D-57) **p. 2**

(3) EPA should not ignore a proven, ready-to-go technology, such as SCR, in favor of a totally unproven technology such as NO_x adsorbers. EPA should quantify the risks associated with SCR and should calculate the risk-corrected expected benefits of each technology path. This would demonstrate that the NO_x adsorber technology, even if given a very optimistic risk factor of 50%, plus its 15 ppm diesel requirement, is too risky and has a much lower expected benefit value. Commenter notes that an SCR/CDPF system could be a viable alternative to EPA's proposed control strategy.

Letters:

Marathon Ashland Petroleum (IV-D-57) **p. 2-3**, (IV-D-261) **p. 3, 17**

(4) Engine Fuel and Emissions Engineering, Inc. concluded that SCR should be capable of controlling NO_x to the required levels without the use of precious metal catalysts that could hinder the ability of the system to meet the proposed PM standards, and without the use of a downstream catalyst for ammonia slip. SCR systems may even reduce PM emissions by a small amount. Moreover, the life cycle costs for SCR technology are lower than the

costs for NO_x adsorber systems, even accounting for the cost of urea. The urea infrastructure is not an issue because if commercial demand exists, truck stops and distributors will carry it. Tampering concerns with SCR technology also exist with NO_x adsorber technology; but may be easily overcome through urea sensors which could limit engine power or retard injection timing, creating a severe disincentive to not filling the urea tank. A urea dispenser could automatically fill the tank at refueling and would require no additional operator effort. Dismissal of SCR due to tampering and maintenance concerns would also require dismissal of the other NO_x control technologies that are the basis of the proposed rule. One commenter notes that EPA's concern that 50 ppm would poison the NO to NO2 function is unfounded in that the modest poisoning is not expected to have a significant effect on SCR performance. Commenter further notes that the exhaust heating required for SCR is less than the heating required for NO_x adsorbers. Commenter cites to a report, "Selective Catalytic Reduction Technology for Heavy-Duty Diesel Vehicles," prepared for API by Engine Fuel and Emissions Engineering, Inc., to support its assertion that SCR has considerable lifecycle cost advantage over NO_x adsorber systems, and can tolerate higher sulfur fuels.

Letters:

American Petroleum Institute (IV-D-343) **p. 37-39**
ExxonMobil (IV-D-228) **p. 6-7, 9**
Marathon Ashland Petroleum (IV-D-261) **p. 31-33**

(D) EPA should be cautious regarding SCR technology because it is a sensitive technology and would require substantial infrastructure investment to ensure the availability and use of urea.

(1) SCR requires extremely careful control that is difficult to achieve in the real world, particularly with mobile engines. SCR technology that uses an oxidation catalyst for NO_x reduction requires the same low sulfur levels as NO_x adsorber technology. Even though other SCR designs are less sulfur sensitive, the use of low sulfur fuel increases their reduction efficiency and allows for optimization of the engine/emission control technology system. [see also Point (E)]

Letters:

American Lung Association (IV-D-270) **p. 21**, (IV-F-181)
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 47**
NESCAUM (IV-D-315) **p. 10**
Natural Resources Defense Council (IV-D-168) **p. 4**
STAPPA/ALAPCO (IV-D-295) **p. 11**

(2) Creating a urea infrastructure throughout the country to make this technology viable for distance haulers is far too costly and difficult.

Letters:

Mack Trucks (IV-D-324) **p. 3**

STAPPA/ALAPCO (IV-D-295) **p. 11**

(3) Ammonia and other toxics are associated with SCR, which means its use may create more problems than it solves.

Letters:

STAPPA/ALAPCO (IV-D-295) **p. 11**

(4) SCRs have demonstrated significant reductions under certain steady state conditions where control systems have adequate time to determine the correct amount of urea solution injection to achieve maximum NO_x control while avoiding ammonia slip. However, with heavy duty engines in on-highway applications, there are rapid and wide swings in both speed and load. It is unclear whether under these varying conditions, the significant reductions needed to comply can be achieved with available sensor, actuators, and control technologies. Commenter provides significant discussion on this technology including issues associated with temperature limitations/thermal lag and chemical lag, and notes that before this technology is widely used to meet the standards, EPA will need to ensure that urea SCR systems can achieve the requisite NO_x reductions over these wide swings in speed and load.

Letters:

Cummins, Inc. (IV-D-231) **p. 16-18**

(5) In achieving 90 percent NO_x reduction, the matching of urea and NO_x flow rate will have to be controlled very precisely. Excess injection will result in ammonia slip and excess urea consumption, while under injection will result in not meeting the desired NO_x targets. The sensitivity of the system is aggravated by the fact that current NO_x sensor accuracy is only about +/- 5 percent, which is about half the proposed NO_x standard and the durability of these sensors is reduced after 125,000 miles. In addition to these concerns, urea solutions are subject to freezing so heating systems will be required for urea storage and delivery systems. EPA needs to analyze trap/urea SCR systems and determine if they are a viable alternative.

Letters:

Cummins, Inc. (IV-D-231) **p. 19-20**

(6) The SCR systems in Europe are not performing as well as originally expected and might not provide NO_x reductions necessary to meet the more stringent U.S. standards. In addition, transient operation makes it very difficult to achieve the optimum urea concentrations, which lead to secondary emissions (NH3, N2O, NH4NO3, etc.) and degradation of catalyst durability. SCR would also require an average sulfur level of less than 10 ppm to achieve acceptable deterioration rates. Given these limitations as well as the need for a national urea distribution network, a final rule should not incorporate the assumption that SCR systems will work, particularly with higher sulfur fuels.

Letters:

U.S. Department of Energy (IV-G-28) **p. 2**

Response to Comments 3.5(A), (B), (C) and (D):

EPA acknowledges that Compact SCR (Urea SCR systems utilizing an up-front platinum catalyst to promote oxidation of NO to NO2) can enable high NO_x reductions. High-efficiency compact-SCR requires very low fuel sulfur levels similar to those set forth in this rulemaking in order to enable significant NO_x reductions. Further, compact SCR will require a 15 ppm fuel sulfur cap when applied in conjunction with a CDPF to meet the Phase 2 PM standard. Please see Chapter III of the RIA for further discussion of the fuel sulfur level requirements of this technology. See also comment 3.5(E). EPA acknowledges the reservations about SCR expressed by some of the commenters. Although there may be centrally-fueled fleet applications that may be suitable for the use of SCR, we have concluded that it would be impossible to ensure widespread compliance under an SCR program where an entirely new fluid would need to be added in order to ensure proper emission control system function. The infrastructure for delivering urea at the diesel fuel pump would need to be in place for these devices to be feasible in the marketplace; and before development of the infrastructure could begin, the industry would have to decide upon a standardized method of delivery for the urea supply. In addition to this, there would need to be adequate safeguards in place to ensure the urea is used throughout the life of the vehicle since, given the added cost of urea and the fact that urea depletion would not normally affect driveability, there would be an incentive not to refill the urea tank. This could lead to considerable uncertainties regarding the effectiveness of SCR, even if EPA were to promulgate the regulations that likely would be needed to require the regular replenishment of urea. A further discussion of compliance issues and SCR is presented in the response to comment 3.2.1(C).

(E) The use of SCR in diesel engines would require very low sulfur fuel since the control system will need to be used along with precious metal oxidation catalysts.

(1) The application of SCR to diesel vehicles will require a systems approach that includes design modifications to the vehicle and engine, very low sulfur fuel, reductant (urea, ammonia) delivery, and catalyst design. Unlike diesel engines in a stationary application which operate over a relatively narrow temperature range, diesel engines in mobile sources operate transiently over a broad range of operating conditions. As a result they require precious metal oxidation catalysts to lower the system's operating temperatures and to control ammonia slip. The precious metal catalysts require very low sulfur fuel. Thus, the successful use of SCR would require very low sulfur diesel fuel and the development of an infrastructure for the appropriate production, shipping, handling, and storage of urea.

Letters:

DaimlerChrysler (IV-D-344) **p. +21-22**
Detroit Diesel Corporation (IV-D-276) **p. 4**
Engine Manufacturers Association (IV-D-251) **p. 11**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 47**
Mack Trucks (IV-D-324) **p. 3**

STAPPA/ALAPCO (IV-D-295) **p. 11**

(2) SCR uses an oxidation catalyst to facilitate NO_x reduction to achieve high control efficiencies and requires the same low sulfur levels as the NO_x adsorber technology. This type of SCR, sometimes referred to as "Compact SCR" typically requires a small volume of SCR catalyst resulting in a more compact unit which in turn facilitates its installation on heavy duty vehicles with limited space availability. Other SCR technology designs are less sensitive to sulfur but very low sulfur fuel allows these technologies to achieve the highest NO_x reductions and fuel economy improvements. In addition, SCR systems often have an oxidation catalyst downstream of the SCR catalyst to control any ammonia emissions and these will form sulfate as a result of the sulfur in fuel, which would make the PM NTE standard unachievable with sulfur levels above 15 ppm.

<u>Letters:</u>

Manufacturers of Emission Controls Association (IV-D-267) **p. 9**, (IV-F-26, 116) **p. 47** (IV-F-117) **p. 89** (IV-F-191) **p. 120**
UAW (IV-D-215) **p. 4-5**

<u>Response to Comment 3.5(E):</u>

As noted by the commenters, reducing fuel sulfur levels is beneficial to many types of exhaust emission controls in addition to those that are likely to be used to meet the new standards. These controls include deNO_x catalysts, SCR, non-thermal plasma, and DOCs. These benefits were not directly accounted for in the rulemaking, but are acknowledged by EPA.

(F) Recently, catalysts have been developed that may be more resistant to sulfur than present SCR catalyst technology.

(1) Apyron has developed a revolutionary catalyst technology for NO_x destruction that overcomes issues associated with present commercial SCR technology (e.g. cost, disposal, sulfur poisoning, and ammonia slip) and field trials for this technology are scheduled for late 2000. However, even though this technology may be more resistant to sulfur than present SCR catalyst technology, the use of ultra low sulfur fuels will still be beneficial and will enhance the effectiveness of NO_x destruction.

<u>Letters:</u>

Apyron Technologies, Inc. (IV-D-227) **p. 1**

(2) The ARIS 2000 urea SCR technology has demonstrated emission levels at or near the 2007 proposed limits. The ARIS prototypes have achieved NO_x of 0.6 g/bhp-hr and whatever sulfur level EPA ultimately selects, this technology will find broad application to new engines based on its emission reduction capabilities and fuel economy benefits. The technology is available for use in new or retrofit applications with current sulfur levels.

<u>Letters:</u>

Clean Diesel Technologies, Inc. (IV-D-157) **p. 1**

(3) Bimetallic fuel borne catalyst (FBC) from Clean Diesel Technologies is used at low dose rates in the fuel to reduce engine-out emissions, improve fuel economy and lower the temperature at which soot collected in a filter is oxidized. Unlike heavily precatalyzed filters, or systems that rely solely on the upstream generation of NO_2 for the oxidation of soot, the FBC/filter systems are more tolerant of higher sulfur fuels in the 50 to 350 ppm range. Nearly 200 vehicles in Asia and Europe are operating filters using the platinum/cerium FBC with fuel sulfur levels at or above 50 ppm. Engine and vehicle testing has confirmed soot oxidation at temperatures as low as 280 to 300 C when using fuel treated with the FBC. Commenter provides additional discussion on this technology and notes that PM can be reduced by 80 to 90 percent and NO_x can be reduced by 17 to 20 percent with no fuel economy penalty.

Letters:

Clean Diesel Technologies, Inc. (IV-D-157) **p. 1-3**

Response to Comment 3.5(F):

The commenters did not provide data to substantiate claims with respect to sulfur tolerance and the technology does not appear address sulfate PM issues related to SCR as described in Chapter III of the RIA. Furthermore, EPA has strong reservations about the general applicability of SCR as a NO_x control (please see the responses to Issues 3.2.1C, and 3.5 A, B, C and D).

The commenter did not provide detailed data on the soot oxidation temperatures. It is not clear if the temperatures reported are the minimum temperatures at which any soot oxidation takes place, or if the temperatures are balance point temperatures (where the soot deposition rate is roughly equivalent to the soot oxidation rate, ie., sustainably self-cleaning). It is also not mentioned if the particulate filter used with the additive was catalyzed or non-catalyzed. Lower balance point temperatures (~250 °C) and higher PM removal efficiencies (>90%) are achievable with the CDPFs, as described in chapter III of the RIA. The additive discussed is similar to the technology used by PSA with non-catalyzed diesel particulate filters. Experience with these additives and a non-catalyzed diesel particulate filter shows a balance point temperature of approximately 450 °C, which is too high for sustainable regeneration for many heavy-duty applications, particularly medium-heavy and light-heavy-duty applications. Fuel-borne catalyst additive use with diesel particulate filters is discussed in further detail in the response to comment 3.3.1F.

EPA is also concerned about the potential health effects of fuel additives and, therefore, has established a fuel additive registration program that requires extensive testing to ensure no adverse health implications from such additives.

(G) EPA should consider advocating an approach that would use fuel additives along with particulate or sulfur trap technologies for controlling NO_x, PM, and other emissions.

(1) EPA should consider advocating the copper additive/trap approach for

controlling PM emissions. Metallic additives in diesel fuel facilitate the combustion of diesel particulate. In combination with a ceramic filter, or trap, the emissions of particulate can be controlled to whatever level desired, depending on the porosity of the trap. Commenter cites to Society of Automotive Engineers (SAE) papers 901609and 930131 and the references therein as supporting documentation that this methodology could be an effective PM reduction strategy. There is no need to modify diesel fuel composition in order to achieve EPA's proposed PM emission reduction goals since that approach would be extremely costly and since the copper additive/trap technology has been demonstrated to be a successful and cost-effective strategy. With this approach, PM emissions are easily controlled and NO_x can be subsequently managed by standard exhaust gas recirculation techniques. Commenter provides significant discussion on this issue and provides as attachments additional discussion on the benefits and feasibility of a DPF/fuel additive system, a letter from EPA to Dr. Mark Levin (Lubrizol Corp) that outlines the acceptability of the proposed use of a copper additive in diesel fuel, and a comprehensive analysis of the effects of airborne copper on the environment.

Letters:

TJ Pakamist Ltd. (IV-D-113) **p. all**

(2) As an alternative technology, EPA should consider the inclusion of a new alternative fuel additive technology with the diesel fuel, which would improve combustion and reduce NO_x, PM, and toxic emissions. This approach could be used with existing fuels along with sulfur trap technology and would obviate the necessity of reducing sulfur levels along with complicated aftertreatment systems. The alternative fuel additive technology is the combination of a non-toxic oxygenate and a non-toxic proprietary co-additive. A oxygen/metallic combination along with conventional diesel leads to an enhanced combustion process, which is immune to the negative combustion attributes of sulfur. Commenter provides additional data and analysis to support their position on this issue. Commenter notes that development and confirmation testing will be completed later this year (2000). As further documentation supporting the development status of this technology, commenter provides a copy of their preproposal to the Southwest Research Institute.

Letters:

National Alternative Fuels Foundation (IV-D-214) **p. 1-4, 16-18**

Response to Comment 3.5(G):

With regards to the copper additive technology, the commenter references SAE paper number 930131, which shows that the initiation of soot burn-off occurs at temperatures of approximately 360 °C or higher, and a PM reduction efficiency of 80 to 90 %. The temperature reported was the temperature for initiation of soot oxidation, not balance point temperature (temperature at which soot accumulation and oxidation rates are equivalent, ie., sustainable soot burn off). Precious metal-based CDPFs have demonstrated balance point temperatures (~250 °C) that are considerably lower than even the initial soot oxidation temperature of the copper additized fuel/non-catalyzed particulate filter combination proposed by the commenter.

The copper additive discussed is similar to the technology used by PSA with non-catalyzed diesel particulate filters. Experience with these additives and a non-catalyzed diesel particulate filter shows a balance point temperature of approximately 450 °C, which is too high for sustainable regeneration for many heavy-duty applications, particularly medium-heavy and light-heavy-duty applications. The CDPF with low sulfur diesel fuel has also demonstrated higher PM removal efficiencies (>90%) than the strategy proposed by the commenter (for a further description of CDPF technology, please see chapter III of the RIA). Fuel-borne catalyst additive use with diesel particulate filters is discussed in further detail in the response to Issue 3.3.1F. The commenter also states that sufficient NOx control can be obtained through combustion modification. We disagree with that assertion because experimental and theoretical evidence shows that there is a lower limit of NOx emissions based on the kinetics of stable diesel combustion of approximately 1.5 g/bhp-hr (Flynn et al., SAE Technical Paper 2000-01-1177).

With regards to the “new alternative fuel additive” the commenter provides virtually no data to substantiate claims of meeting the Tier 2 standards using combustion-enhanced fuels. One figure submitted by the commenter shows NOx emissions and fuel economy. No details of the testing were given, but from the fuel economy (15-19 mpg), it is assumed that the application that the data was provided for was either light-duty or light-heavy-duty. If light-duty, the minimal data submitted shows emissions that are more than 30 times the NOx standard of the highest fully-phased in Tier 2 certification bin, and more than 4 times the highest current LDT4 Tier 1 diesel NOx standard. If the application tested were light-heavy duty, the data would suggest approximately 5 g/bhp-hr for the additized engine, which is above the 1998 HD on-highway NOx standard. Thus, this presents no information showing that the technology discussed can meet the standards promulgated in this rule; therefore, it does not obviate the need for low sulfur diesel fuel to meet the standards.

Please refer to our responses to Issue 3.3.1(F) and 3.5(F) for more discussion on fuel additives and additive/trap systems.

EPA is also concerned about the potential health effects of fuel additives and, therefore, has established a fuel additive registration program that requires extensive testing to ensure no adverse health implications from such additives.

As for those comments regarding fuel additives in conjunction with sulfur trap technology, please refer to our responses to Issue 3.3.5.

(H) EPA should consider the new diesel emission purification system - DPNR.

(1) DPNR (Diesel Particulate - NO_x Reduction System) can simultaneously and continuously reduce PM and NO_x in diesel exhaust gas based on Toyota's NO_x storage reduction three-way catalyst technology. DPNR features a newly developed fine porous ceramic filter coated with a NO_x storage reduction three-way catalyst which was designed for use with lean-burn gasoline engines. PM is oxidized by active oxygen released in the NO_x storage process and by excess oxygen in exhaust gas. When the engine momentarily switches to stoichiometric (rich) operation, PM is also oxidized by active oxygen released in the process of reducing the stored NO_x. DPNR shows a conversion efficiency of greater-than-80 percent in both PM and NO_x in the initial stage of operation, compared to the permitted level of exhaust

emission from a 2-ton diesel truck under 1998 Japanese regulation limits. DPNR requires fuel with low sulfur content to maintain a high conversion efficiency and is not suited for retrofitting onto in-use vehicles since it requires the precise control of injected fuel quantity realized by a common rail fuel injection system. *[NOTE: This comment was submitted as a press release with information on Toyota's DPNR system (no cover letter was attached) - there is no indication that this comment was in fact submitted by Toyota].*

Letters

Toyota (IV-G-36), **p. 1**

Response to Comment 3.5(H):

The summarized item is actually a press release by Toyota Motor Corporation describing their new Diesel Particulate NO_x Reduction (DPNR) technology, slated for introduction in 2003. The technology is an integrated catalyzed diesel particulate filter (CDPF) and a NO_x adsorber in a single compact system. Toyota claims an 80 percent reduction in both PM and NO_x for this system. We are aware of Toyota's technology claims and of Toyota's intention to manufacture this product for the 2003 model year (four model years before the Phase 2 standards begin to go into effect). We describe the system further in chapter 3 of the RIA because we believe that it represents one possible approach to meeting the Phase 2 standards given additional time for refinement. The fact that Toyota intends to sell a system in 2003, which many commenters suggested was impossible to even consider by 2007, shows how rapidly these advanced emission control technologies are developing.

Issue 3.6: Other Issues - Engine and Vehicle Standards

(A) EPA should adopt rules that would reduce currently unregulated hazardous air pollutants that are found in diesel exhaust.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Natural Resources Defense Council (IV-F-75, 191) **p. 68**

Response to Comment 3.6(A):

We believe that the Phase 2 standards will result in considerable reductions in unregulated pollutants from diesel exhaust. For example, even though we are not finalizing a new formaldehyde standard, we believe that the new hydrocarbon standard will result in lower formaldehyde emissions from Phase 2 diesel engines than from current or Phase 2 diesel engines. Additionally, other toxic hydrocarbons are expected to be reduced in conjunction with the lower NMHC standard being set for Phase 2 engines. Please refer to our response to Issue 2.2(H)(3) for more information regarding gaseous air toxics and, in general, our responses to Issues 2.2 and 2.3 for more detailed discussion of air quality and unregulated pollutants.

(B) EPA should also address the relationship between cetane and NO_x emissions, and should impose additional standards as necessary.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

NY DEC (IV-F-52)

Response to Comment 3.6(B):

As described in the NPRM, currently available information on the effect of changes in cetane number on NO_x emissions suggests that the effects will be quite small. In addition it does not appear that higher cetane levels are necessary to enable the aftertreatment that we are focusing on in this rulemaking to operate efficiently. For these reasons we have chosen not to place any new controls on cetane number at this time. See also our responses to comments under Issue 4.6(A) and 4.6(B). However, we are continuing to evaluate the effects of diesel fuel properties on emissions, and may propose new standards in the future as we deem them appropriate.

(C) Evaluate emissions based on a vehicle-mile, rather than a brake-horsepower basis.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

Transportation Techniques (IV-F-191) **p. 246**

Response to Comment 3.6(C):

Engine standards are stated in terms of grams per unit of work rather than grams per mile. Therefore, engine emission standards need not increase with weight because heavier engines do not necessarily emit more per unit of work produced. Vehicle standards are stated in terms of grams per mile driven. In contrast to engines, heavier vehicles, due to their greater mass, tend to emit more per mile due to the increased load placed on the engine which requires the engine to do more work to travel each mile.

For engine certification, it is most appropriate to state emission standards on a gram per unit work basis because no vehicle exists during the test. Further, a single engine model may be installed in many different vehicles designed to do different amounts of work. Testing every possible vehicle would increase cost substantially and would result in different g/mile emission rates for each vehicle. In the Phase 1 rule (See 65 FR 59896, October 6, 2000.), we have required that all complete gasoline vehicles up to 14,000 pounds be chassis certified (certified as vehicles) which carries with it a g/mile emission standard. We have carefully considered the possibility of allowing or even requiring heavy-duty diesels to certify in the same way but have not done so in this rule due to concerns that the industry may find it very difficult to adjust to this substantial testing revision in the time frame necessary for this rule. However, we are allowing heavy-duty diesels under 14,000 pounds to chassis certify as an option.

(D) EPA must consider engine deterioration and failure of control devices, which may increase projected emissions substantially.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

Union of Concerned Scientists (IV-F-165)

Response to Comment 3.6(D):

With respect to engine deterioration, the primary effect of deterioration is on PM emissions. Preliminary data from EPA-funded work shows that even PM emissions deterioration that increases engine-out PM emissions by 60% or more has little or no effect on post-CDPF PM emissions (see memo to Docket A-99-06, item IV-B-17). This is understandable since the efficiency of the CDPF is over 90%, and the majority of the PM emissions with CDPF usage is due to sulfate-make, not break-through. In fact, the CDPF data referred to in Chapter III of the RIA (in-house EPA data, data from the DECSE program, and particle size/number data referred to in section A(2)(b)) shows that the actual PM capture efficiency (not including sulfate-make) is upwards of 98%. As long as low sulfur fuel is used and the CDPF remains intact, fairly high engine out PM emissions deterioration (even 2 or 3X current regulated levels) should not raise in-use PM emissions above the standard. With respect to the durability of emissions control devices, EPA agrees that such devices must be durable. The engine manufacturers are required to meet the emissions standards at the full useful life of the engine. Please see the responses to Issues 3.2.1 (C), (J), and (M) for a further discussion of issues related to the durability of exhaust emission control systems.

(E) EPA should establish a workable voluntary retrofit program.

(1) Commenter notes that there are numerous issues that EPA should take into consideration in pursuing retrofit opportunities. These include the implementation of a voluntary retrofit program with incentives, consistency across States, qualifying retrofits, uniform testing and certification protocols, uniform baseline emission rates, calculation of SIP credits, warranties, liability, and other relevant issues.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 73-74**
NYC DEP (IV-D-209) **p. 3**

Response to Comment 3.6(E):

See our responses to comments 3.1.5(C), 3.1.5(E), and 3.3.4(A).

(F) EPA should encourage the implementation of non-fuel control strategies such as HDDE retrofit programs which could provide greater reductions and would be less disruptive than State-imposed diesel sulfur levels.

(1) A mandatory retrofit program for certain older vehicles could provide enormous emissions benefits in a very cost-effective manner with 30/50 ppm sulfur fuel. Existing in-use engines emit anywhere from 0.1 - 0.6 g/bhp-hr of PM. Reductions in PM from retrofitting these older engines would result in much greater mass of PM reduced as compared to an approach that involves imposing a 15 pm sulfur standard for diesel fuel. *[see also 3.1.5(E)]*

Letters:

American Petroleum Institute (IV-D-343) **p. 6, 83**

Response to Comment 3.6(F):

A mandatory retrofit program is well beyond the scope of this rule which serves to set new emission standards for new diesel engines beginning in the 2007 model year. Please refer to our response to comment 3.1.5(E) regarding our belief that a 30/50 ppm fuel program would not deliver a viable nationwide program for PM control from diesel engines, even on a retrofit basis. We acknowledge that catalyzed PM traps appear to work acceptably on some applications in mild to warm climates. However, Chapter III of the RIA makes clear that catalyzed PM traps will not work properly on all diesel applications in all climates with a 30/50 ppm fuel program. For that reason, a 30/50 ppm fuel program would only enable PM retrofits consisting of limited use of catalyzed PM traps and extensive use of DOCs. As we note in our response to comment 3.3.4(A), DOCs remove gas-phase semi-volatile organic compounds, but remove little or no elemental carbon PM. As mentioned in Chapter III of the RIA, section A.2, semi-volatile organic compounds comprise only 10 to 30 percent of total PM mass. Achieving such reductions in addition to the reductions achieved via the Phase 2 standards is attractive but, as stated, outside the scope of this rule.

(G) EPA should more fully address issues related to its proposed NO_x and NMHC standards in the context of alternative fueled engines.

(1) EPA has provided little analysis of the technological feasibility of its proposed standards for alternative-fueled engines. Each type of alternative-fueled engine presents unique issues of technological feasibility and this is particularly true for NO_x adsorbers as natural gas and propane may not be effective reductants. The proposed NMHC level would also be difficult to achieve as well as to demonstrate, for natural gas and propane engines. EPA must specifically analyze the feasibility of achieving its proposed NO_x and NMHC standards for alternative-fueled engines, including natural gas and propane.

Letters:

Cummins, Inc. (IV-D-231) **p. 20-21**

(2) The proposed emission standards create a dilemma for suppliers of natural gas fueled engines. If EPA's proposed standards are finalized, and diesel engines can meet those limits, manufacturers of natural gas fueled engines will need to make a commercial decision regarding the continued viability of natural gas fueled engines since they are typically a more expensive alternative. A possible result would be the withdrawal of natural gas engines from the market.

Letters:

Detroit Diesel Corporation (IV-D-276) **p. 11-12**

Response to Comment 3.6(G):

The Phase 2 standards are meant to be fuel-neutral standards. We have argued that the standards are technologically feasible with the lead time provided for diesel and gasoline fueled engines. These types of engines overwhelmingly dominate the heavy-duty fleet. The standards were not set with the intention of promoting one fuel over the other. Similarly, the standards were not set with the intention of providing room for alternative fueled engines to find a role in the market. We believe that those wanting to produce alternative fueled engines in the 2007 and later time frame will be able to comply with the Phase 2 standards provided sufficient engineering development is put into achieving that compliance. If a decision is made to leave the alternative fueled heavy-duty market, we do not believe it will be because of technological infeasibility of the Phase 2 standards but because manufacturers make the business decision not to pursue a role in that market. Further, we disagree that we *must* specifically analyze the feasibility of achieving our proposed standards for alternative fueled engines. In contrast, we must analyze the feasibility of achieving our proposed standards giving appropriate consideration to cost, energy, and safety. This we have done.

(H) Does not support any option that will apply relaxed emission standards for any geographic areas because there are environmental concerns in national parks across the nation.

(1) A uniform standard is important for national parks' air quality across the nation. There are 140 NPS units in 27 States in various areas of the country that are located in ozone (1-hr or 8-hr) nonattainment areas, based on 1997-99 data. In addition, ongoing research shows the need to reduce nitrogen deposition in areas that may be in attainment. For instance, Denver-area NO_x emissions, one of the key pollutants that would be reduced by the proposal, are a major concern for Rocky Mountain National Park in terms of nitrogen and ammonium deposition and episodic acidification. In addition, in this same area, the reduced sulfur dioxide emissions from low sulfur fuel would assist Class I areas in the region improve visibility. The same types of benefits would occur in other areas that do not face ozone concerns, such as Utah, Arizona, and other western States.

Letters:

National Park Service (IV-D-180) **p. 3**

Response to Comment 3.6(H):

The final Phase 2 engine standards will apply equally nationwide, with the exception of U.S. Territories. There are special fuel provisions for Alaska, but those do not affect the implementation of Phase 2 engine standards. Please refer to our responses to Issues 6.6 and 6.7 for more discussion on how our program will be implemented in Alaska and U.S. Territories, respectively.

Issue 3.7: Technology Reassessment

Issue 3.7.1: NO_x Control Technology Reassessment

(A) Expressed opposition to a mid-term technology review.

(1) Commenters noted that such a review is unnecessary given the high degree

of certainty that the availability of clean fuels will enable rapid development of effective NO_x control technologies.

Letters:

American Lung Association (IV-D-270) **p. 26-27**
City of Chicago (IV-D-240) **p. 6**
Flowers, Bobbie (IV-G-67)
GA Public Interest Research Group (IV-F-117) **p. 43**
Kotgal, Kalpana (IV-F-192) **p. 17**
STAPPA/ALAPCO (IV-D-295) **p. 2, 14**
U.S. PIRG (IV-F-71, 190) **p. 185** (IV-F- 192) **p. 134**

(2) One commenter noted that if a technology review is included as part of the proposed rule, EPA should limit such a review to the proposed NO_x standard only.

Letters:

Kotgal, Kalpana (IV-F-192) **p. 17**

(3) Commenters noted that if EPA determines a technology review is warranted, EPA must ensure that it allows equally for the strengthening as for the relaxation of emission standards.

Letters:

Natural Resources Defense Council (IV-D-168) **p. 8**, (IV-F-75)
U.S. PIRG (IV-F-71), (IV-F-190) **p. 185**)

(4) EPA should not use a future technology review as a substitute for a thorough analysis of the technological feasibility of the proposed standards. Such a review would effectively prevent engine manufacturers from fully developing and investing resources toward achieving the standards that are finally adopted, because those standards may change in the future.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 53**

(5) EPA's proposal for a technology review indicates the uncertainty that adsorber technology can achieve the proposed NO_x reductions. Rather than rushing to finalize the rule by the end of the year, EPA should take the time to obtain all the information it needs to justify the NO_x standard, and get the rule right the first time. If EPA determines to include a technology review, API expects a lead time of at least 4 years from the review.

Letters:

American Petroleum Institute (IV-D-343) **p. 68**
ExxonMobil (IV-D-228) **p. 21**
Marathon Ashland Petroleum (IV-D-261) **p. 72**

(6) A technology review to assess the progress that emission control device manufacturers have made towards fulfilling their assurances to EPA is worthless, at least from the point of view of the diesel fuel refining and marketing industry. If EPA finds that it has erred in relying on the representations of these manufacturers that their devices will be commercially viable in 2007, the refining industry will have already expended billion of dollars towards achieving a 15 ppm diesel fuel. Commenters conclude that such a review would create uncertainty regarding the regulations and would be too late to influence the investment decisions of refiners and engine manufacturers.

<u>Letters:</u>

Chevron (IV-D-247) **p. *2**
Society of Independent Gasoline Marketers of America (IV-D-328) **p. 3**

(7) Making the rule contingent on a technology review is a large disincentive for manufacturers to develop emission control technologies.

<u>Letters:</u>

Chicago DEP/Chicago Metro Mayors Caucus Clean Air (IV-D-335) **p. 5-6**
City of Chicago (IV-D-240) **p. 5**

(B) Expressed support for a technology review prior to full implementation of the rule to evaluate the status of newly developing emission reduction technology (i.e. NO_x adsorber technology) and to ensure that the development of the technology is on schedule and available for meeting the proposed standards.

(1) Commenters provided no further supporting information or detailed analysis.

<u>Letters:</u>

International Truck & Engine Corp. (IV-F-34)

(2) EPA should conduct a comprehensive technology review prior to finalizing the rule because the rule relies on NO_x adsorber technology that is still in its research phase and has not been demonstrated to meet all aspects of performance required for full-scale application and commercialization. One commenter (DOE) specifically suggested the 2003 time frame to conduct the reassessment. By this time, more data will be available on the operation of diesel NO_x control technology and its sulfur sensitivity. This commenter added that the review should be a multi-agency effort, with an opportunity for non-federal organizations and the public to participate.

<u>Letters:</u>

NY DEC (IV-D-239) **p. 3**
National Petrochemical & Refiners Association (IV-D-218) **p. 1, 13, 14**
U.S. Department of Energy (IV-G-28) **p. 6-7**

(3) An engine technology review is reasonable only in the context of a 50 ppm

sulfur cap and ABT program.

Letters:

Phillips Petroleum Company (IV-D-250) **p. 4**

(4) EPA has not conducted sufficient tests to ensure that the new ultra-low sulfur content diesel fuel will work efficiently with the new emission reduction technologies and to determine whether the unproven technology will actually reduce emissions to desired levels.

Letters:

Food Marketing Institute (IV-D-283) **p. 3-4**

(5) EPA should conduct more analysis of the science and technology that would support the achievement of the proposed emission standards. An independent panel should be convened to evaluate the many unknowns associated with achieving the proposed standards, particularly those related to NO_x emissions. This panel could also develop data to more accurately predict the costs and benefits of the proposed rule to the transit industry.

Letters:

American Public Transportation Association (IV-D-275) **p. 2**

(C) Expressed support for a periodic technology progress report and review designed to ensure that emission reduction goals are being achieved without compromising engine driveability, reliability, durability, and fuel economy performance.

(1) Commenter provides no further supporting information or detailed analysis.

Letters:

National Automobile Dealers Association (IV-D-280) **p. 2**

Response to Comment 3.7.1(A), (B) and (C):

As discussed in section III.H of the preamble, we believe that a review of NO_x adsorber technology is appropriate. In fact, we have committed to conducting a series of biennial reviews. For each review, we will collect and analyze information from engine manufacturers, NO_x adsorber manufacturers, our own testing, and other sources. At the end of each review cycle, we will release (and post on the Web) a report discussing the status of the technology and any implications on the heavy-duty engine emission control program. We will release the first report by December 31, 2002, and subsequent reports at the end of each second year through December 31, 2008.

We recognize that not all commenters will agree with our decision to conduct these reviews. In fact, some comments suggested that no such review should occur due to the high degree of certainty that the availability of clean fuels will enable rapid development of effective NO_x control technologies. We fully agree that knowledge of clean fuel availability will result in rapid development of NO_x control technology. However, we also acknowledge the engineering challenges that remain before NO_x adsorber technology can be implemented to achieve the Phase 2 standards.

Some comments noted that any NO_x technology review should allow for the strengthening of the standards as well as possibly relaxing them. We agree with this comment and have not placed any limitation on the review that might constrain such strengthening if warranted and cost effective.

As for comments regarding EPA using such a review in place of conducting a thorough analysis of the technological feasibility of the standards, we do not believe that is what we are doing. On the contrary, we have extensively analyzed the technological feasibility of the standards and have presented that analysis in Section III of the preamble, Chapter III of the RIA, and throughout our responses to Issues 3.2 and 3.3. Further, we do not believe that conducting these reviews will prevent engine manufacturers from fully developing and investing resources toward achieving the final standards because of the possibility that those standards may change. Instead, we believe these reviews encourage investment so that manufacturers may play a role in shaping the progress demonstrated in each review and their outcome.

We do not agree that our decision to conduct these reviews illustrates our uncertainty that adsorber technology can achieve the proposed NO_x reductions. On the contrary, our testing demonstrates that NO_x adsorbers can achieve the necessary NO_x reductions over both the FTP and the SET. Please refer to Chapter III of the RIA for more detail on our test data. However, as noted above, we acknowledge that engineering challenges remain in the area of durability and desulfation. Therefore, we would not characterize the decision to conduct these reviews as uncertainty, but rather as a chance to work cooperatively with all stakeholders to address the engineering challenges that remain. As for leadtime available following the review, more than four years will still remain following the first review in 2002.

Some commenters expressed concern that a review of the NO_x technology would create uncertainty regarding the regulations and would be too late to influence the investment decisions of refiners and engine manufacturers. The concern here appears to be that the review might indicate that NO_x adsorbers will not work, meaning the fuel will not be needed, meaning that investments toward compliance would be stranded. Such an outcome is not a serious possibility. We do not consider the NO_x technology review to be one of determining whether or not we will have NO_x control technology on diesel engines by 2007. Instead, the review will address the engineering challenges that remain and serve to determine if minor revisions to the program are indeed necessary -- are the standards still the right standards; are the regeneration testing provisions still appropriate; etc. Therefore, investments made by refiners and engine manufacturers will in no way be stranded investments because 15 ppm fuel will be needed and NO_x control technology will be implemented regardless of the outcome of the reviews.

One commenter suggested convening an independent panel to evaluate the many unknowns associated with achieving the proposed standards. We consider our review process to serve that function. While we are not an independent panel, we fully expect all stakeholders to be involved in the process and that it will be, to the extent feasible, a joint effort among the many stakeholders.

Issue 3.7.2: Diesel Fuel Sulfur Reassessment

(A) Supports a thorough technology review prior to finalizing the proposed rule.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

National Petrochemical & Refiners Association (IV-D-218) **p. 1**

(2) EPA has not provided any data that demonstrates how the low sulfur fuel can be delivered to markets without significant sulfur increases. EPA has identified potential interfaces where substantial contamination with higher sulfur-content fuels could occur, but does not identify measures that will ensure that contamination will not occur. Since very small quantities of higher sulfur content residuals could have a significant adverse effect on the reliability of shipments of the ultra-low sulfur fuel. Clearly more work will be necessary over the next few years to resolve these issues.

Letters:

U.S. Department of Energy (IV-G-28) **p. 7**

(3) Supports a review of the fuel standard since it could result in a devastating impact to diesel fuel supplies. Commenter specifically notes that there should be a review of the potential impacts to the jet fuel market.

Letters

National Petrochemical & Refiners Association (IV-G-31), **p. 1**

(B) Opposes a review of the fuel standards.

(1) Commenter provides no further supporting information or detailed analysis.

Letters:

ExxonMobil (IV-D-228) **p. 21**

(2) Reference to a technology review of the fuel standards either in the final rule or the preamble, will lead to additional uncertainty upon the part of refiners and would create a major disincentive to make the investments needed to comply.

Letters:

American Petroleum Institute (IV-D-343) **p. 68**
Marathon Ashland Petroleum (IV-D-261) **p. 72**

Response to Comment 3.7.2(A) and (B):

Some commenters requested that EPA conduct a formal review of the feasibility of the 15 ppm sulfur cap at some specified date in the future soon enough to modify the standard if necessary and before refiners were committed to their significant capital investments. Other commenters argued against such a review.

Commenters supporting a formal technology review cited uncertainties in 1) the ability of refiners to produce fuel meeting the 15 ppm standard, and 2) the ability of the distribution system to maintain compliance with this standard during transport. They also cite the high cost of compliance and are concerned about the possibility of refiners leaving the highway diesel fuel market, resulting in market shortages. Commenters arguing against such a review are primarily concerned that such a review adds to the uncertainty facing refiners. They are concerned that a review would discourage refiners from investing early to meet the standard and possibly that the results of such a review would come after many refiners had already invested in technology to meet the final standard.

EPA does not believe that a review in this area is necessary. We agree with ExxonMobil and API that it would add to the uncertainty facing refiners and would discourage early investment. We also do not believe that the concerns raised by commenters supporting a review are serious enough to merit a formal review. For example, our assessments of desulfurization technology in Chapters IV and V of the Final RIA indicate clearly that meeting the 15 ppm standard is feasible. Uncertainty exists regarding the severity of hydrotreating which will be necessary in each refinery, but the leadtime available is more than sufficient to resolve these uncertainties and allow each refiner to develop a cost effective strategy for his refineries. Likewise, the steps which will be necessary to transport 15 ppm diesel fuel in order to maintain its quality are described in these same chapters of the Final RIA. No new technology is necessary in this case, just more careful execution of current best practices. Thus, there does not appear to be any basis in this area for a formal technology review. Finally, a detailed discussion of the diesel fuel supply issue is presented in Chapter V of the Final RIA. There, we indicate that 1) the availability of technology at reasonable cost, 2) the difficulty of selling highway diesel fuel in other markets, and 3) the ability of refiners producing nonroad diesel fuel to produce highway diesel fuel meeting the 15 ppm standard, and 4) the temporary compliance option all come together to support the conclusion that supplies of highway diesel fuel will be more than adequate with the implementation of this rule.

Issue 3.7.3: Role of Non-conformance Penalties

(A) EPA should draft rules that would establish appropriate nonconformance penalties for engine and vehicle manufacturers.

(1) EPA should establish nonconformance penalties (NCPs) as part of this rulemaking. EPA's proposed new standards and requirements will be technology-forcing and almost certainly will result in the inability of some engine manufacturers and/or engine families to comply with the standards. NCPs are essential to ensure that manufacturers are able to participate in the market and meet customer needs. The size of the penalties should be established using the same cost estimates used to establish the cost of the proposed regulation.

<u>Letters:</u>

Engine Manufacturers Association (IV-D-251) **p. 54**
International Truck & Engine Corp. (IV-D-257) **p. 31**

<u>**Response to Comment 3.7.3(A):**</u>

We are not establishing NCPs for the new standards at this time. In order for us to establish NCPs for a specific standard, we would have to find that: 1) substantial work will be required to meet the standard for which the NCP is offered; and 2) there is likely to be a "technological laggard" (i.e., a manufacturer that cannot meet the standard because of technological (not economic) difficulties and, without NCPs, might be forced from the marketplace). According to the CAA (Section 206(g)), such NCPs "shall remove any competitive disadvantage to manufacturers whose engines or vehicles achieve the required degree of emission reduction." At this time, we cannot conclude that NCPs will be needed. While we believe that substantial work will be required to meet the 2007 standards, we currently have no information indicating that a technological laggard is likely to exist. Recognizing that it may have been difficult for manufacturers to comment on these criteria at this early stage of development, when implementation of these standards is still more than six years away, it may be appropriate to reconsider NCPs in a future action.

ISSUE 4: DIESEL FUEL STANDARDS

Issue 4.1: Level of Diesel Fuel Sulfur Standard

(A) Expressed support for at least a 15 ppm diesel fuel sulfur standard as necessary to achieve the proposed engine and vehicle standards.

(1) Many commenters provided no further supporting information or detailed analysis. [See further detail for some of these commenters summarized under Issue 4.1, Point (D).] Approximately 13,700 private citizen commenters made this statement.

<u>Letters:</u>

20/20 Vision (IV-F-58)
Acoff, Jeffrey, et. al. (IV-G-11)
Alliance of Automobile Manufacturers (IV-F-59, 190) **p. 114** (IV-F-117) **p.168** (IV-G-50)
American Lung Association of Colorado (IV-D-54)
American Lung Association of Los Angeles (IV-D-47)
American Lung Association (IV-F-72, 161, 164, 181, 191) **p. 146**
American Lung Association of CT (IV-D-63) **p. 1**
American Lung Association of Metropolitan Chicago (IV-D-237) **p. 1**
American Lung Association of NJ (IV-D-224) **p. 1**
American Lung Association of OR (IV-D-165) **p. 1**
American Lung Association of Orange County (CA) (IV-D-176) **p. 1**
American Lung Association of SD (IV-D-31) **p. 1**
American Lung Association of TN (IV-D-19) **p. 1**
American Lung Association of VA (IV-D-205) **p. 1**
Appalachian Office of Justice & Peace (IV-D-99) **p. 1**
Arab Community Center for Economic and Social Services (IV-D-112)
Asamoah, Nikiya (IV-D-09)
Bagnarol-Reyes, Carolina, et. al. (IV-G-24)
Bay Area Air Quality Management District (IV-D-139) **p. 1**
Beeman, Nora, et. al. (IV-G-09)
Boulder County Clean Air Consortium (IV-D-35) **p. 1**
Braun, Carl and Norma (IV-D-69)
CA Air Pollution Control Officers' Association (IV-D-109) **p. 1**
CA Air Resources Board (IV-D-203) **p. 4**, (IV-F-190) **p. 13**
CA PIRG (IV-F- 190) **p. 175** (IV-F-190) **p. 280**
CA Trucking Association (IV-F-109) **p. 65** (IV-F- 116) **p. 150** (IV-F- 192) **p. 34**
CO Public Interest Research Group (IV-F-191) **p. 219**
CT Coalition for Environmental Justice (IV-D-131) **p. 2**
CT DEP (IV-F-49)
Caesar, M. (IV-D-339)
Carson Forest Watch (IV-D-106)
Cassara, Bob (IV-F-65)
Center for Environmental Health (IV-D-89) **p. 1**
Center for Neighborhood Technology (IV-F-11)
Chicagoland Transportation and Air Quality Commission (IV-F-10)
Chuang, Henry (IV-F- 117) **p. 265**
Chung, Payton, et. al. (IV-D-133)

Kotgal, Kalpana (IV-F-192) **p. 17**
L.A. County Bicycle Coalition (IV-F- 190) **p. 131**
La Grange Park (IV-D-39) **p. 1**
Landfall Productions, Inc. (IV-D-27)
League of Women Voters of Louisiana (IV-D-199) **p. 1**
League of Women Voters of New Orleans (IV-D-210) **p. 1**
Legal Environmental Assistance Foundation (IV-D-126) **p. 1**
Levy, David (IV-F-37)
Lichtman, Elijah (IV-D-08)
Lind, Karen, et. al. (IV-D-121)
Little Village Environmental Justice Organization (IV-F-192) **p. 147**
MO Coalition for the Environment (IV-D-235) **p. 1**
Manufacturers of Emissions Controls Association (IV-F-187)
Mathews, Erik, et al (IV-D-24) **p. 1**
Mayor and citizens of Fort Collins, CO (IV-F-191) **p. 211**
Mayor of Denver (IV-F- 191) **p. 152**
Mayor of Glendale, CO (IV-F-191) **p. 177**
Metropolitan Atlanta Rapid Transit Authority (IV-F-117) **p. 122**
Metropolitan Washington Air Quality Committee (IV-D-34) **p. 2**
Mexican-American Community Foundation (IV-F-179)
Montgomery, Jack, et. al. (IV-D-78)
NJ PIRG (IV-F-116) **p. 314**
NY Assembly - Health Committee (IV-F-38)
NY PIRG (IV-F-116) **p. 244**
NY State Assembly (IV-D-266) **p. 1**, (IV-F-53)
NY State Senator (IV-F-50)
NYC Council (IV-F-80)
NYC DEP (IV-D-159) **p. 1**
NYC Environmental Justice Alliance (IV-F-116) **p. 317**
National Park Service (IV-F-191) **p. 108**
Natural Resources Defense Council (IV-D-168) **p. 3**, (IV-F-75, 191) **p. 68**
Nerode, Gregory, et. al. (IV-D-04)
OR Toxics Alliance (IV-D-175) **p. 1**
Ozone Transport Commission (IV-D-249) **p. 2**, (IV-F-55)
PA DEP (IV-D-100) **p. 2**
Packard, Josh (IV-G-54)
Pandey, Stacey (IV-F-117) **p. 274**
Pecoraro, Elizabeth (IV-F-117) **p. 117**
Private citizen (IV-D-12)
Rhubert, Pamela J. (IV-D-15) **p. 1**
Richards, Donna and Bill, et. al. (IV-G-19)
Riggles, Ruth, et. al. (IV-D-102)
Robin, Susan (IV-D-302)
Rock, Steve, et. al. (IV-G-22)
Rodriguez, Dolores, et. al. (IV-D-91)
Rutherford, Jolene, et. al. (IV-D-347)
SC Dept. of Health and Environmental Control (IV-D-143) **p. 1**
STAPPA/ALAPCO (IV-D-140) **p. 1**, (IV-F-32, 78)
Schmitz, Randy, et. al. (IV-D-46)
Sierra Club, GA Chapter (IV-D-348) **p. 1**
Sierra Club, PA Chapter (IV-D-53)
Smith, Bryan R., et. al. (IV-D-105)

Smith, Curt, et. al. (IV-D-49)
Smith, Maria (IV-D-72)
Southern Queens Park Association, Inc. (IV-D-36) **p. 1**
Stead, Craig (IV-F- 116) **p. 115**
TN Environmental Council (IV-F- 117) **p. 154**)
The Mountaineers (IV-D-184) **p. 1**
Tosco (IV-D-84), (IV-F-157)
Tri-State Transportation Campaign (IV-F-116) **p. 359**
Tseng, Joyce, et. al. (IV-D-03)
U.S. PIRG (IV-F-71, 190) **p. 185**(IV-F- 192) **p. 134** (F-IV- 191) **p.142**
Union of Concerned Scientists (IV-F-165)
Unity Center (IV-D-75) **p. 1**
Varsbergs, Krista, et. al. (IV-D-38)
Village of Burr Ridge (IV-D-316) **p. 1**
WI DNR (IV-D-291) **p. 1**, (IV-F-25)
Washington Regional Network (IV-D-18) **p. 1**
West Harlem Environmental Action/Envr Justice Network (IV-F-76)
Western Independent Refineries Association (IV-F-190) **p. 144**)
Wilderness Society (IV-F-117) **p. 217**
Williams, Mary, et. al. (IV-D-122)
Zweig, Robert (IV-D-30)

(2) Commenters noted that the availability of 15 ppm diesel also will facilitate the retrofit of existing highway and nonroad diesel vehicles with particulate traps.

Letters:

American Lung Association (IV-D-270) **p. 22-26**
Engine Manufacturers Association (IV-F-174)
NESCAUM (IV-D-315) **p. 9-10**, (IV-F-63)
OH Environmental Council (IV-D-130) **p. 1**
STAPPA/ALAPCO (IV-D-295) **p. 2,13-14**

(3) Commenters noted that there is existing data from the DECSE report that indicates that a 15 ppm level is required in order to meet the proposed 0.01 PM standard. As sulfur levels increase above 15 ppm, it becomes increasingly difficult, and quickly impossible, to meet the NTE limits for the entire engine speed and load map. This is because of sulfate formation (as documented in the DECSE report) and the increasing temperature at which regeneration occurs. One of the commenters stated that an increase from 3 to 30 ppm fuel can increase the temperature by 20 to 30 degrees Centigrade.

Response to Comments 4.1(A)(1)-(3):

Generally, these comments provide added justification and support for the low sulfur diesel fuel program. As described in the preamble to the final rule, we are establishing a comprehensive national control program that will regulate the heavy-duty vehicle and its fuel as a single system. As part of this program, new emission standards will begin to take effect in model year 2007, and will apply to heavy-duty highway engines and vehicles, including those fueled by alternative fuels, unless otherwise specified in the regulations. These standards are based on the use of high-efficiency catalytic exhaust emission control devices or comparably effective advanced technologies. Similar high-efficiency NOx exhaust emission control technology has been quite successful in gasoline direct injection engines that operate with an exhaust composition similar to diesel exhaust.

However, as discussed in Section III of the preamble and Chapter III of the RIA, application of this technology to diesels has some additional engineering challenges. In that section we discuss the current status of this technology. Because this technology is damaged by sulfur, we are also requiring low sulfur diesel fuel containing no more than 15 ppm sulfur by mid-2006. The program provides substantial flexibility for refiners, especially small refiners, and for manufacturers of engines and vehicles. These options will ensure that there is widespread availability and supply of the low sulfur diesel fuel from the very beginning of the program, and will provide engine manufacturers with the lead time needed to efficiently phase-in the exhaust emission control technology that will be used to achieve the emissions benefits of the new standards. As noted by one of the commenters, while not a part of today's rulemaking, the widespread availability of low sulfur diesel fuel may have the side benefit of stimulating the retrofit of existing vehicles and nonroad equipment with exhaust emission control technology.

Letters:

DaimlerChrysler (IV-F-186)
Environmental Law & Policy Center of the Midwest (IV-F-6)
Johnson Matthey (IV-F-117) **p. 94**
Manufacturers of Emission Controls Association (IV-F-26, 116) **p. 47** (IV-F-117) **p. 89** (IV-F-191) **p. 120**
South Coast Air Quality Management District (IV-F-185)

(4) The maintenance cost associated with a sulfur standard higher than 15 ppm would place the cost burden on truck owners when the fuel spoils the emissions control equipment.

Letters:

CA Trucking Association (IV-D-309) **p. 6**

Response to Comment 4.1(A)(4):

We have not analyzed the cost of the additional maintenance that would be required in order to apply advanced aftertreatment systems on vehicles using fuel with a sulfur content higher than 15 ppm, primarily because we do not believe that the systems would function properly on higher fuel sulfur levels. We do agree with the commenter's suggestion that higher fuel sulfur levels can have undesirable effects on emission control equipment and that this might lead to additional maintenance costs.

(5) Although an even lower cap may prove to be necessary, it is crucial that the final rule include a fully effective, nationwide cap of no higher than 15 ppm by mid-2006. Exposure to higher sulfur content fuel will compromise the performance of, if not render ineffective or destroy, emission control equipment that will be introduced to meet the 2007 emission standards.

Letters:

American Lung Association (IV-D-270) **p. 19**

CA Air Resources Board (IV-D-203) **p. 5**
CT DEP (IV-D-142) **p. 1**
Chicago DEP/Chicago Metropolitan Mayors Caucus Clean Ai (IV-D-335) **p. 4**
Environmental Defense (IV-D-346) **p. 9**
Environmental Law and Policy Center (IV-D-331) **p. 4**
IL Environmental Protection Agency (IV-D-193) **p. 1**
International Center for Technology Assessment (IV-D-313) **p. 2-3**
MI Environmental Council (IV-D-290) **p. 1**
NC DENR (IV-D-151) **p. 1**
NH DES (IV-D-150) **p. 1**
NY DEC (IV-D-138) **p. 1**
STAPPA/ALAPCO (IV-D-295) **p. 2, 10-11**
Southwest Air Pollution Control Authority (IV-D-149) **p. 1**
Stuckey, Stephanie (IV-D-182) **p. 1**
TX Natural Resource Conservation Commission (IV-G-3) **p. 1**
Transportation Alternatives (IV-D-332) **p. 1**
Udall, Mark (IV-D-173) **p. 1**
Vigo County Air Pollution Control (IV-D-137) **p. 1**
WA Department of Ecology (IV-D-141) **p. 1**
WI DNR (IV-D-144) **p. 1**

(6) EPA's low sulfur standard will help facilitate the development and use of alternative fuel technologies as well as various NO_x and PM control devices.

Letters:

CA Transit Association (IV-G-14) **p. 1**
NJ Transit (IV-G-4) **p. 1**

(7) CARB has also proposed a sulfur content standard of no greater than 15 ppm and EPA should maintain this aspect of its proposal. If a higher standard is set, the cost of diesel to California agencies would greatly increase, as suppliers would be faced with having to refine a much smaller quantity of this fuel for a relatively small California market.

Letters:

CA Transit Association (IV-G-14) **p. 1**

(8) In mandating a 15 ppm cap, the durability of the catalyst in meeting performance requirements for NO_x destruction will be significantly enhanced.

Letters:

Apyron Technologies, Inc. (IV-D-227) **p. 1**

Response to Comments 4.1(A)(5)-(8):

See Response to Comments 4.1(A)(1)-(3), above.

(B) It is reasonable and appropriate for EPA to impose the 15 ppm sulfur standard based on the assumption that sulfur-sensitive technologies (i.e. NO_x adsorbers)

will be readily available within the time frame proposed.

(1) Commenter specifically cites to the API letter from R. Cavaney to Carol Browner, dated April 26, 2000, and asserts that the refining industry's argument is misleading (i.e. that there is no evidence to suggest that NO_x adsorber technology for HDDEs would be available and viable for 2007 and that as a result, the proposed sulfur standard should not be imposed). The data currently show that the availability of NO_x adsorber technology is dependent on the availability of ultra-low sulfur fuel and is a viable control technology within the time frame proposed.

Letters:

International Truck & Engine Corp. (IV-D-257) **p. 8**

Response to Comment 4.1(B):

Generally, this comment provides added justification and support for the low sulfur diesel fuel program. Refer to the Response to Comments 4.1(A)(1)-(3) above.

(C) The proposed sulfur level must be required nationwide to reduce the chance that higher sulfur fuels will damage sulfur-sensitive control technologies.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Air Pollution Control District (IV-D-55) **p. 1**
Alliance of Automobile Manufacturers (IV-F-59, 190) **p. 114** (IV-F-117) **p. 168**
Coalition on the Environment and Jewish Life (IV-F-184)
Engine Manufacturers Association (IV-F-117) **p. 39** (IV-F-191) **p. 39**)
Environmental Health Coalition (IV-D-286) **p. 1**
Environmental Health Watch (IV-D-212) **p. 1**
Fogel, Judy (IV-F-190) **p. 68**
Grand Canyon Trust (IV-D-317) **p. 1**
Hoosier Environmental Council (IV-D-281) **p. 1**
Institute for Global Solutions (IV-F-175)
International Truck & Engine Corp. (IV-F-117) **p. 109**
Interstate Claims (IV-F-190) **p. 66**
La Grange Park (IV-D-39) **p. 1**
Levy, David (IV-F-37)
Lu, Rong (IV-F-162)
NC Waste Awareness and Reduction Network (IV-D-51) **p. 1**
Natural Resources Defense Council (IV-D-168) **p. 5**, (IV-F-75, 190) **p. 98**
Ozone Transport Commission (IV-D-249) **p. 2**
Regional Air Pollution Control Agency (IV-D-103) **p. 1**
STAPPA/ALAPCO (IV-D-295) **p. 10**
Sierra Club, Lone Star Chapter (IV-D-287) **p. 2**
Sierra Club, PA Chapter (IV-D-204) **p. 1**
Tosco (IV-D-304) **p. 2**

(2) California, Sacramento and the South Coast will not meet their attainment

dates unless a national diesel fuel sulfur standard is imposed. Without a universal diesel fuel sulfur standard, the trucking industry will be facing regulations that interfere with operation and will put California truckers at a competitive disadvantage. This commenter added that a national standard will ensure adequate supply and reasonable prices at the pump and that truckers will pay the cost in the form of reduced fuel economy if a fuel sulfur standard above 15 ppm is imposed. Similarly, commenters in the Midwest, particularly Chicago, noted that due to the volume of interstate truck traffic, a national standard is necessary for that region to meet its NAAQS.

Letters:

CA Air Pollution Control Officers' Association (IV-D-109) **p. 1**
CA Natural Gas Vehicle Coalition (IV-F- 190) **p. 135**
CA Trucking Association (IV-D-309) **p. 6-7**, (IV-F-190) **p. 38** (IV-F-116) **p. 150**
Caucus Clean Ai (IV-D-335) **p. 3**
L.A. City Council (IV-F-176)

(3) Commenters in California expressed support for nationwide application of the rule in order to level the playing field for California's trucking fuel costs.

Letters:

CA Natural Gas Vehicle Coalition (IV-F- 190) **p. 135**
CA Trucking Association (IV-F-190) **p. 65**
City of Los Angeles Environmental Quality and Waste Man (IV-F-190) **p. 95**
Jack Jones Trucking, Inc. (IV-F-190) **p. 58**
Natural Resources Defense Council (IV-F-190) **p. 98**
Onyx Environmental Services (Gavendi) (IV-F-190) **p. 62**
Quikway Trucking Company (IV-F-190) **p. 60**

(4) Commenters noted that without a national standard, states may advocate the use of boutique fuels to meet their NAAQS, and boutique fuels will make it very difficult for the trans-state and national carriers.

Letters:

Interstate Claims (IV-F-190) **p. 66**
Swift Transportation (IV-F-190) **p. 59**

(5) Regional standards would result in clogged aftertreatment technologies, forcing high maintenance costs and decreased fuel economy and performance.

Letters:

American Lung Association (IV-D-270) **p. 19**
Engine Manufacturers Association (IV-F-174)
Onyx Environmental Services (Gavendi) (IV-F-190) **p. 62**
Phillips Petroleum Company (IV-D-250) **p. 6**

(6) Implementation of a single national low sulfur diesel fuel would eliminate most misfueling concerns, the need for a vehicle labeling mandate and awkward and expensive nozzle and inlet restricter requirements, and the need for a separate distribution, storage, and retail system. A single national standard will also result in significant emissions benefits for engines designed to meet those standards as well as for nonroad diesel engines. A single national sulfur standard would also facilitate the retrofitting of existing engines and would enable the introduction of clean and efficient advanced light duty diesels.

Letters:

National Automobile Dealers Association (IV-D-280) **p. 3**

(7) Without a national standard, the potential exists for having different fuel standards in different parts of the country. It would not be practical to allow two types of diesel fuel in the market. This would significantly delay the benefits of the proposed rule by making the lower sulfur fuel more expensive to produce and distribute.

Letters:

Children's Environmental Health Network (IV-D-244) **p. 3**
Swift Transportation Company (IV-D-263) **p. 1**

(8) Implementation of low-sulfur fuel nationwide would allow for the effective application of emission control technologies to diesel vehicles, would help prevent misfueling and the impaired functioning and failure of pollution control devices due to use of higher sulfur fuel, and would help ensure a reliable, stable supply of clean diesel fuels throughout the U.S. A nationwide standard would also provide an incentive for improvements in the performance of HDVs currently in use.

Letters:

NYC DEP (IV-D-209) **p. 2**
UAW (IV-D-215) **p. 4-6**

(9) Application of the diesel standards only in nonattainment areas would result in urban sprawl as industries flee nonattainment areas.

Letters:

City of Chicago (IV-D-240) **p. 4**

(10) A uniform fuel standard is important for national parks' air quality across the nation. There are 140 NPS units in 27 States in various areas of the country that are located in ozone (1-hr or 8-hr) nonattainment areas, based on 1997-99 data.

Letters:

National Park Service (IV-D-180) **p. 3**

(11) Low sulfur fuel across the nation is important to encourage the use of new technologies, such as direct fuel injection or fuel cells, in production vehicles because these technologies will require low sulfur fuel.

Letters:

National Park Service (IV-D-180) **p. 4-5**

Response to Comment 4.1(C)(1)-(11):

We believe it is necessary that highway diesel fuel must be available nationwide and year-round which meets the 15 ppm sulfur limit. To relax this requirement would jeopardize many of the environmental benefits of the program. Although the NO_x reduction impact on ozone tends to be concentrated in the warmest summer months, PM and air toxics benefits are realized year-round. Moreover, the exhaust emission control devices require low-sulfur diesel fuel year-round. The use of highway diesel fuel with a sulfur content greater than 15 ppm could damage the emission control technology of 2007 and later model year vehicles and engines. Once vehicles are equipped with the new exhaust emission control devices, they can only be fueled with the low-sulfur fuel. This precludes any consideration of a seasonal program. In addition, because diesel vehicles travel across the country transporting goods from region to region and state to state, low-sulfur diesel fuel will have to be available nationwide. The health effects associated with diesel PM emissions are not area-specific, nor are the adverse effects of high sulfur diesel on engines with exhaust emission control. For these reasons, we do not believe that any regional or seasonal exemptions from the requirements of the low sulfur diesel fuel program are practical. We have incorporated some transitional provisions at the start of the program which will allow for the continued production of limited amounts of 500ppm highway diesel fuel. These provisions, however, have been designed in a way so as not to undermine the availability of 15ppm diesel fuel nationwide for the new vehicles that are required to use it.

(D) Specifically expressed opposition to the refining industry's proposal to cap diesel sulfur at 50 ppm because that degree of desulfurization will not allow car/engine manufacturers to achieve the proposed emission reductions.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Congress of the United States (IV-D-294) **p. 4**
Environmental Law & Policy Center of the Midwest (IV-F-6)
Sherman, Scott (IV-F-190) **p. 87**

Response to Comments 4.1(D)(1):

See our Response to Comments 4.2(B), (C), and (D), below.

(2) Commenters asserted that sulfur is a poison that blocks the use of after-treatment technology by rendering the hardware inoperable at higher sulfur levels and that a very low level of sulfur in diesel fuel is critical for the future development of effective after-treatment technologies. Some added that only

very low sulfur fuel will permit catalyst-based control strategies to be optimized for maximum emission reduction efficiencies.

Letters:

Alliance of Automobile Manufacturers (IV-F-9)
American Truck Dealers Line Representative Committee (IV-F-191) **p. 126**
CA Trucking Association (IV-D-309) **p. 6-7**
DaimlerChrysler (IV-F-15, 116) **p. 292** (IV-F-117) **p. 96** (IV-F- 191) **p. 173**
Engine Manufacturers Association (IV-F-33, 116) **p. 43** (IV-F-, 117) **p. 39** (IV-F-191) **p. 39**
GA Public Interest Research Group (IV-F-117) **p. 43**
Manufacturers of Emission Controls Association (IV-F-26, 117) **p. 89** (IV-F-191) **p. 120**
Natural Resources Defense Council (IV-D-168) **p. 3**, (IV-F-75, 190) **p. 98** (IV-F- 191) **p. 68**
STAPPA/ALAPCO (IV-F-32, 117) **p. 29** (IV-F-191) **p. 32**
U.S. PIRG (IV-F-71)
Union of Concerned Scientists (IV-F-165)
WI DNR (IV-F-25)

Response to Comments 4.1(D)(2):

See our Response to Comments 4.2(B), (C), and (D).

(3) At 50 ppm, the reliability and durability of the filter technology will be compromised.

Letters:

Environmental Defense (IV-D-346) **p. 10**
Environmental Law and Policy Center (IV-D-331) **p. 4**
Manufacturers of Emission Controls Association (IV-F-26, 116) **p. 47** (IV-F-117) **p. 89** (IV-F-191) **p. 120**

Response to Comments 4.1(D)(3):

See our Response to Comments 4.2(B), (C), and (D).

(4) One commenter added that any work currently underway for the NO_x adsorber technology will cease if a 50 ppm sulfur standard is imposed since the feasibility and effectiveness of this technology is dependent upon a very low-sulfur fuel. Others noted generally that levels higher than the proposed 15 ppm sulfur cap could derail the deployment of NO_x reduction technologies that are necessary to meet the proposed standards.

Letters:

DaimlerChrysler (IV-D-284) **p. 5**
Kotgal, Kalpana (IV-F-192) **p. 17**
Manufacturers of Emission Controls Association (IV-F-26, 116) **p. 47** (IV-F-117) **p. 89** (IV-F-191) **p. 120**

Response to Comments 4.1(D)(4):

See our Response to Comments 4.2(B), (C), and (D).

(5) The use of a NO_x adsorber with 50 ppm fuel is only about 20 percent efficient but with 15 ppm fuel, the adsorber becomes 90 percent efficient.

Letters:

International Truck & Engine Corp. (IV-F-27, 34, 117) **p. 109** (IV-F-191) **p. 99**

Response to Comments 4.1(D)(5):

We have not estimated the NO_x reduction efficiency of a NO_x adsorber when operated on 50 ppm sulfur diesel fuel, because we do not believe that the technology would function properly over its full useful life if operated on 50 ppm sulfur fuel. We do agree with the commenter, that diesel fuel sulfur levels higher than 15 ppm will lead to a significant decrease in NO_x adsorber efficiency. In addition, higher sulfur diesel fuel would adversely impact engine fuel economy if the adsorber had to be desulfated frequently enough to maintain the NO_x performance (refer to Section 3.F of the preamble or Chapter III.A.7 of the RIA for more information).

(6) Diesel fuel at 50 ppm will reduce the durability and longevity of diesel engines.

Letters:

International Truck & Engine Corp. (IV-F-27, 34, 117) **p. 109** (IV-F-191) **p. 99**

Response to Comments 4.1(D)(6):

See our Response to Comments 4.2(B), (C), and (D).

(7) European countries are using different formulations ranging from 10 ppm (Sweden) to 50 ppm (Finland) sulfur. Data have demonstrated that no failures in emission control technology was found in the lowest sulfur levels but, in areas with higher diesel fuel sulfur content near 50 ppm, the failure rate was 10% for areas with cold temperatures similar to the U.S. One commenter also cites to examples in California to support their assertion that the emission control technologies are effective only with sulfur levels below 15 ppm. Higher levels of sulfur in the fuel (25-50 ppm) result in additional ash buildup, primarily as a result of the metallic oil additives used to neutralize sulfuric acid produced as a byproduct of burning fuel that contains sulfur.

Letters:

CA Trucking Association (IV-D-309) **p. 6-7**
Manufacturers of Emission Controls Association (IV-F-26, 116) **p. 47** (IV-F-117) **p. 89** (IV-F-191) **p. 120**

(8) Like Sweden, Germany has put in place measures to achieve a 10 ppm low sulfur diesel fuel level by January 1, 2003. Germany is pressing the

European Parliament to follow its lead by 2005. In both Germany and Japan, progress toward producing low sulfur diesel has been based on joint agreements between the vehicle manufacturers and the oil makers. Another commenter also cited German government statement in a recent petition to the EC in support of low sulfur fuel.

Letters:

American Lung Association (IV-D-270) **p. 21-22**
Environmental Defense (IV-D-346) **p. 11**

Response to Comments 4.1(D)(7) and (8):

As discussed in chapter III of the RIA, we have incorporated data and information from around the world in our analysis of the need for a 15ppm sulfur cap. Generally, these comments provide added justification and support for the low sulfur diesel fuel program. While actions taken abroad may serve to support the validity of our final rule, our standards must be based on their own merits.

(E) The 15 ppm fuel sulfur standard as proposed is far too stringent and costly.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

Ergon & Lion Oil Co. (IV-F-117) **p. 183**
Placid Refining Company, LLC (IV-D-230) **p. 1**

Response to Comment 4.1(E)(1):

See our Response to Comments 4.2(B), (C), and (D), below.

(2) Many of these commenters expressed support for the refining industry's proposal to reduce sulfur levels in diesel fuel to 50 ppm instead of the 15 ppm level as proposed by EPA. Some noted that a 50 ppm standard would cost half as much as EPA's proposed 15 ppm fuel sulfur standard, but still would result in significant environmental benefits. These commenters argued that the additional capital cost to reach a 15 ppm sulfur level in diesel fuel is not worth the incremental environmental benefit that would be achieved. Some also noted that the prohibitively high costs of the retrofit will force many refiners to forego the highway diesel market, resulting in supply reductions and price volatility. One commenter suggested that EPA should set the standard at a level that is within the capability of every refinery, rather than that which might be achievable in an average refinery. Another commenter specifically noted that EPA should withdraw the rule unless a 50 ppm cap is finalized as the diesel fuel standard. A commenter claims that the sulfur levels required by the proposal have not been produced in large quantities and will be particularly difficult because of the relatively high-sulfur petroleum feedstocks typically available in the U.S.

Letters:

Agricultural Retailers Association, et. al. (IV-D-148) **p. 1**
Agricultural organizations as a group (IV-D-265) **p. 2**
American Bus Association (IV-D-330) **p. 3**
American Farm Bureau Federation (IV-F-5)
American Petroleum Institute (IV-D-343) **p. 41-42**, (IV-F-16)
CA Trucking Association (IV-F-190) **p. 38**
CO Petroleum Association (IV-D-323) **p. 3**
Cenex Harvest States Cooperatives (IV-D-232) **p. 1, 12**, (IV-F- 191) **p. 102**
Citgo Corporation (IV-D-314) **p. 7**
Coal Operators & Associates, Inc. (IV-D-64) **p. 1**
Cooperative Refining, LLC (IV-D-300) **p. 2-3**
Countrymark Cooperative (IV-D-333) **p. 2-6**, (IV-F-30, 117) **p. 74** (IV-F-191) **p. 184**
Equiva Services (IV-D-226) **p. 3**
Ergon & Lion Oil Co. (IV-F-117) **p. 183**
ExxonMobil (IV-D-228) **p. 2, 5**, (IV-F-800)
Farmland Industries (IV-F-29)
Food Marketing Institute (IV-D-283) **p. 2**
ID Barley Commission (IV-D-312) **p. 1-2**
Independent Fuel Terminal Operators Association (IV-D-217) **p. 3-4**
Johnson Petroleum, Inc. (IV-D-17) **p. 1**
Kentuckians for Better Transportation (IV-D-16) **p. 1**
Koch Industries (IV-D-307) **p. 7-9**
MN Chamber of Commerce (IV-D-28) **p. 1**
Marathon Ashland Petroleum (IV-D-261) **p. 7, 19, 55**, (IV-F-74)
NATSO (IV-D-246) **p. 8**, (IV-F-17)
NE Farm Bureau Federation (IV-D-153) **p. 1**
NY Assoc. of Service Stations & Repair Shops (IV-F-45)
National Association of Convenience Stores (IV-F- 191) **p. 168**
National Council of Farmer Cooperatives (IV-D-351) **p. 3**
National Grain and Feed Association (IV-D-301) **p. 1**
National Petrochemical & Refiners Assoc./CITGO (IV-F- 117) **p. 101**
National Petrochemical & Refiners Association (IV-D-218) **p. 2, 17, 15, 19**, (IV-F-31, 44)
National Ready Mixed Concrete Association (IV-D-271) **p. 2**
PA Association of Milk Dealers (IV-D-23) **p. 1**
Perfection Oil Company (IV-D-41) **p. 1**
Phillips Petroleum Company (IV-D-250) **p. 3**
Remster, John (IV-F-28)
Society of Independent Gasoline Marketers of America (IV-D-328) **p. 1,3-5**
U.S. Chamber of Commerce (IV-D-329) **p. 1, 4**
Ultramar Diamond Shamrock Corporation (IV-F-191) **p. 136**
WY Refining Company (IV-F-191) **p. 58**
Welsh, Inc. (IV-D-22) **p. 1**
Western Independent Refineries Association (IV-F-190) **p. 144**)

<u>Response to Comment 4.1(E)(2):</u>

As discussed in Chapter III of the RIA, we do not believe that the diesel aftertreatment technology would function properly over its full useful life if operated on diesel fuel with a sulfur concentration higher than 15 ppm. As discussed in detail in Section V of the preamble and Chapters VI and VII of the RIA, we believe that the low sulfur diesel fuel program we have designed is cost-effective. Furthermore, we project that the monetized benefits of the program will exceed the costs by a wide margin.

In Chapter V of the RIA, we discussed our cost analysis for every domestic refinery to produce 15 ppm sulfur diesel fuel. In this analysis, we accounted for the variety of crude oil feedstocks typically available in the U.S., some of which are very sour (i.e., they contain a relatively high sulfur content). Specifically, we used this information to project the requisite size reactor and hydrogen consumption for each refinery. We concluded that the 15 ppm sulfur standard is reasonable and appropriate. Specifically, we project the average refining cost will be 4.3 cents per gallon after 2010. The maximum cost for any refinery is only projected to be five to seven cents per gallon depending on a given refinery's PADD location and allowing for the market to realign itself for production of highway vs. off-highway diesel fuel. In addition, we concluded that refiners that exit the highway diesel market would face a much lower value for their diesel fuel if the supply of nonroad diesel fuel exceeds its projected demand. Thus, we believe most refiners will choose to invest in new equipment or revamp old hydrotreating equipment to produce 15 ppm sulfur fuel. Based on all information available to us, we project that 20 percent of diesel fuel production will come from grassroots units and 80 percent from revamped units. In Issue 8.1.1, we address the refining industry's ability to recover the costs associated with the low sulfur diesel fuel program. In essence, cost recovery will depend upon overall supply and demand for highway diesel fuel which cannot be predicted without uncertainty. At the same time, no evidence was presented which indicates that the industry will not be able to recoup the projected costs. We have established the need and emission benefits anticipated by the vehicle and engine emission reductions enabled by highway diesel fuel capped at 15 ppm. Both the preamble and the RIA make this case. Additional discussion of issues considering the need and benefits of this rule are included under Issue 2 of this document.

We did not analyze the benefits of a 50 ppm sulfur cap program. As described in the RIA, we have concluded that our standards are not feasible with a sulfur level of 50 ppm. See our responses to Issue 3.3.1 and Issue 5.10(C)(11).

We reviewed the report by UOP noted by the commenter as well as other reports by UOP and studies (including confidential business information) provided by UOP to the National Petroleum Council (NPC) and MathPro Inc. Our evaluation of these UOP materials is reflected in our refinery cost analysis.

(3) One commenter noted that according to a recent study (not specified), the most advanced vehicle emissions reduction technology known to be effective reduces emissions about the same with diesel fuel at either 50 ppm or 15 ppm.

<u>Letters:</u>

American Petroleum Institute (IV-F-42,182, 117) **p. 161** (IV-F-191) **p. 114**

(4) Commenters argued that a 50 ppm cap would enable diesel engines to meet the proposed PM standards and also achieve significant NO_x reductions.

<u>Letters:</u>

American Petroleum Institute (IV-F-16, 42, 182, 117) **p. 161** (IV-F-191) **p.**

114
Marathon Ashland Petroleum (IV-D-261) **p. 19**, (IV-F-74)
National Petrochemical & Refiners Assoc./CITGO (IV-F-117) **p. 101**
National Petrochemical & Refiners Association (IV-F-31, 44)

Response to Comments 4.1(E)(3) and (4):

See our Response to Comments 4.2(B), (C), and (D), below.

(5) In considering the viability and potential benefits of 50 ppm sulfur fuel, EPA has ignored viable aftertreatment technology such as SCR, and has overstated the sulfur sensitivity of other technology. A 30/50 specification would result in virtually identical emissions reductions as those projected by EPA for a 15 ppm cap. The cost effectiveness of a 30/50 specification is clearly better than that of EPA's proposal. Commenter provides additional data and discussion on this issue including comparative projections to 2030.

Letters:

American Petroleum Institute (IV-D-343) **p. 11, 51-52**
Marathon Ashland Petroleum (IV-D-261) **p. 54-55**

Response to Comment 4.1(E)(5):

As described in more detail in our responses to comments 2.4(G), 3.2.1(J), and 3.5(A) through (D) and the RIA, we do not believe that Urea SCR will be capable of achieving the standards finalized today with a 50ppm sulfur cap on diesel fuel as the commenter suggests. Furthermore, we do not believe that Urea SCR will be a generally available technology in the 2007 timeframe due to the significant compliance issues associated with the technology.

(6) Commenters noted that the small differences in ambient concentrations of diesel exhaust resulting from a 50 ppm versus a 15 ppm sulfur cap will have no significant health benefits.

Letters:

American Petroleum Institute (IV-D-343) **p. 12**
Marathon Ashland Petroleum (IV-D-261) **p. 7, 55**

Response to Comment 4.1(E)(6):

We did not analyze the health benefits associated with a diesel fuel sulfur cap higher than 15 ppm. However, as documented in our proposal, the level of emission reductions expected by this rule can only be achieved by diesel fuel capped at 15 ppm. Feasible emission reductions with a 50 ppm fuel would be much less and by extension, the health benefits would be correspondingly less. For the reasons discussed in Section III of the preamble and Chapter III of the RIA, we do not believe that the diesel aftertreatment technology would function properly over its full useful life if operated on 50 ppm sulfur fuel. The technology, which requires low sulfur diesel fuel (with no more than 15 ppm sulfur), will be needed by new engines and vehicles for them to meet the emission standards which take effect in 2007. Without these standards, the important air quality benefits of the program would not be achieved. As described in the preamble, our 15 ppm diesel sulfur program and the associated engine standards do not go too far as evidenced by the fact that there will still be some concerns with ozone and PM ambient concentrations even after our program is implemented.

(7) One commenter referenced all supporting information and documentation that it has already submitted to EPA during the development stages of this proposed rule and notes that EPA should take all of this information into serious consideration.

Letters:

American Petroleum Institute (IV-F-182, 117) **p. 161**

Response to Comment 4.1(E)(7):

See our Response to Comments 4.2(B), (C), and (D), below.

(8) The costs of imposing a 15 ppm standard will be excessive in relation to the environmental benefits, and this standard as proposed will result in higher fuel prices and fuel shortages.

Letters:

American Petroleum Institute (IV-F-16)
Cenex Harvest States Cooperatives (IV-F- 191) **p. 102** (IV-F-191) **p. 232**
Conoco (IV-F- 191) **p. 154**
Cooperative Refining, LLC (IV-D-300) **p. 2**
Countrymark Cooperative (IV-F-30)
Gary-Williams Energy Corporation (IV-F-43)
NY Assoc. of Service Stations & Repair Shops (IV-F-45)
National Petrochemical & Refiners Association (IV-F-44)
Paramount Petroleum Corp. (IV-F-190) **p. 168**)
Petroleum Marketers Association of America (IV-F-67)
Ports Petroleum Co, Inc. (IV-F- 117) **p. 190**
Society of Independent Gasoline Marketers of America (IV-F- 191) **p. 196**
U.S. Oil & Refining Co. (IV-F-190) **p. 159**
Western Independent Refiners Association (IV-D-273) **p. 2-3**

(9) Commenters state that EPA has underestimated the refinery processing changes needed to produce 15 ppm sulfur diesel fuel, since EPA's estimates are based on refining technology and catalyst vendors who underestimate reactor severity and the catalyst activity necessary to make low-sulfur fuel. Specifically, the hydrogen consumption required to hydrotreat typical diesel stocks containing 20-40% light catalytic cycle oil, and achieve 5-10 ppm sulfur, is on the order of several hundred standard cubic feet per barrel more than estimated by the vendor. MathPro's predictions for production of very low sulfur diesel are based on confidential, overly optimistic catalyst performance estimates by the catalyst vendors, and in reality will cost twice EPA's estimate of 4.0 cents per gallon. Moreover, the costs of desulfurizing nonroad diesel could add to those cost estimates.

Letters:

American Petroleum Institute (IV-D-343) **p. 41-42**
Marathon Ashland Petroleum (IV-D-261) **p. 37-38, 94**

Response to Comments 4.1(E)(8) and (9):

Our responses to comments on price spikes and shortages are covered in Issue 8.1.1, below. Regarding the technology, hydrogen, and nonroad issues, the commenters did not present any technical information along with their comments. We considered all available information on these issues in our refining cost analysis which is described in detail in Chapter V of the RIA. As discussed in Issue 5.10 and in chapter VII of the RIA, our analysis of the benefits of this rulemaking conclude that the economic benefits overwhelm the costs.

(10) Commenters asserted generally that EPA has based the proposed fuel sulfur standard on engine and vehicle standards that are arbitrary and potentially unattainable.

Letters:

Citgo Corporation (IV-D-314) **p. 5**
Countrymark Cooperative (IV-D-333) **p. 6**
National Petrochemical & Refiners Assoc./CITGO (IV-F-117) **p. 101**
National Petrochemical & Refiners Association (IV-F-31, 44)
Swain, Edward (IV-D-162) **p. 1-2**

Response to Comment 4.1(E)(10):

See our Response to Comments 4.2(B), (C), and (D), below.

(11) Commenter notes that manufacturers are unable to meet the proposed NO_x standard with fuel containing zero sulfur; therefore, EPA cannot justify a 15 ppm standard as a basis for enabling NO_x adsorbers.

Letters:

ExxonMobil (IV-D-228) **p. 6**

Response to Comment 4.1(E)(11):

As described in more detail in Chapter III of the RIA and in our response to comment 3.2.1(C), we project that the diesel aftertreatment technology will be generally available and effective, contingent upon the availability of 15 ppm sulfur diesel fuel.

(12) Commenters proposed a 30 ppm sulfur content (some of which indicated this should be an average) as a balance struck between refinery issues and control technology issues. Below a 25 ppm standard, production and retrofitting costs increase dramatically, while production decreases. A 30 ppm standard has no measurable impact on fuel economy or the ability of technology to meet the proposed emission standards.

Letters:

Equiva Services (IV-D-226) **p. 3**
Kern Oil & Refining Co. (IV-D-310) **p. 2, 4-5**, (IV-F-173)
Paramount Petroleum Corp. (IV-F-190) **p. 168**
U.S. Oil & Refining Co. (IV-F-190) **p. 159**
Western Independent Refineries Association (IV-F-190) **p. 144**

Response to Comment 4.1(E)(12):

See our Response to Comments 4.2(B), (C), and (D), below.

(13) One commenter suggested that if engine manufacturers can meet the proposed emissions limits with today's control technologies, EPA should challenge them to develop controls which function on fuels with 30 ppm sulfur content.

Letters:

U.S. Oil & Refining Co. (IV-F-190) **p. 159**

Response to Comment 4.1(E)(13):

We have set the emission standards based upon the substantial air quality need for emission reductions, primarily NOx and PM. These reductions can be achieved through the enablement of advanced emission control technologies which are necessary to meet the phase 2 standards for heavy-duty highway engines and vehicles. More discussion on this issue can be found above in our response to issue 3.2.1(D), 4.2(B)-(D), and section III.F. of the preamble. See also responses to comments under Issue 8.1 regarding impacts on small refiners in particular.

(14) One commenter supported a 25 ppm standard, which would result in no differences in NO_x emissions when compared to a 15 ppm standard. The commenter noted that the slightly reduced PM benefits with the higher sulfur option can easily be compensated by reducing nonroad diesel fuel sulfur levels.

Letters:

Chevron (IV-D-247) **p. *2, 1, 3**

Response to Comment 4.1(E)(14):

See our response to comment 4.1(E)(6).

(15) The 15 ppm standard is subject to legal challenge because the SBREFA process did not focus upon a 15 ppm goal and therefore did not meet the requirements of Section 609.

Letters:

Western Independent Refineries Association (IV-D-273) **p. 4-8**, (IV-F-190) **p.**

144

Response to Comment 4.1(E)(15):

The SBREFA process was conducted prior to the selection of any specific sulfur standard. However, the stated expectation throughout the SBREFA process was that the sulfur standard would fall between 5ppm and 50ppm. Since the final 15ppm standard is less stringent than the most stringent level considered in the SBREFA process, we do not believe that the commenters legal arguments are valid. See response to Issue 12.1(A).

(16) The cost of applying the appropriate technologies to meet the proposed 15 ppm sulfur cap for diesel fuel remains controversial, particularly since it is likely to be very high. The refining industry has indicated that they will need to make major new investments to meet the standard and that several of these companies will not be able to recover their costs and as a result will decide not to make the necessary investment. EPA has assumed that refiners will be able to meet the standard through retrofitting existing facilities, which may not be the case. EPA should consider the refining industry's proposal to cap sulfur at 50 ppm since it may be more cost-effective.

Letters:

Mercatus Center at GMU (IV-D-219) **p. 15-16, 32-33**

(17) Commenter provides supplemental documentation establishing that the 15 ppm standard is prohibitively expensive and that the quality of crude oil is on the decline. Commenter suggests EPA contact UOP and obtain a copy of "Diesel Fuel Specifications and Demand for the 21st Century."

Letters:

Swain, Edward (IV-D-162) **p. 5-49**

Response to Comments 4.1(E)(16) and (17):

See our response to comment 4.1(E)(2).

(18) EPA's proposal does not make a convincing case that it is feasible for refiners to produce 15 ppm diesel in the quantities needed nationwide and added that these concerns are heightened in the west since there is a greater reliance on small refiners and since large quantities of highway diesel are used. New diesel standards will require most of the distillate pool in the west to meet the 15 ppm standard and to supply this demand, western refiners will be forced to treat cracked diesel stocks, which are the most difficult and expensive streams to treat. Western refiners also have fewer outlets such as home heating oil for off-specification product.

Letters

Western Governors' Association (IV-G-41), **p. 2**

Response to Comments 4.1(E)(18):

We believe that the low sulfur diesel fuel program, which includes a temporary compliance option, hardship provisions, and flexibility for Rocky Mountain refiners, will ensure that low sulfur diesel fuel will be in sufficient supply and widely available in 2006. We agree with the commenters that refineries supplying fuel to the Geographic Phase-in Area (GPA) tend to be disproportionately challenged compared to other refiners with respect to capital formation, the availability of engineering and construction resources, and the isolated nature of many of the markets. Moreover, the introduction of low sulfur highway diesel fuel in June 2006 overlaps with the conclusion of the interim low sulfur gasoline standards for GPA refiners.

As described in the preamble, we have concluded that it is appropriate to grant additional flexibility to refiners that supply gasoline to the GPA while also meeting the low sulfur diesel standards. Additional flexibility for GPA refiners will allow them to spread out their capital investments for producing low sulfur gasoline and highway diesel fuel. In light of the above, we are modifying the GPA gasoline program while still achieving significant environmental benefits. We expect this provision will have little or no long-term impact on the environmental benefits of the Tier 2/Gasoline Sulfur program, while providing for considerable near-term implementation flexibility and improved feasibility of the highway diesel fuel program.

GPA refiners that produce both gasoline and highway diesel fuel and are subject to the Tier 2/Gasoline Sulfur program may choose to stagger their desulfurization investments for the two fuels. Refiners that comply with the low sulfur diesel fuel standard by June 1, 2006 for all of their highway diesel fuel production may receive a two-year extension of their interim GPA gasoline standards for 2006, that is until December 31, 2008. In addition to allowing refiners the opportunity to spread out their desulfurization investments, we believe this provision will encourage the production of 15 ppm diesel fuel by some refiners in and near the GPA, which will further help to ensure the new fuel is widely available for new vehicles throughout the area. See also responses to comments under Issue 8.1 regarding the ability of refiners to provide adequate supply of 15 ppm sulfur diesel fuel.

(F) EPA should set the sulfur standard at a level that would not adversely affect the supply of diesel fuel. (See related comments under Issue 8.1.1.)

(1) EPA should set a sulfur standard only after ensuring that this standard would not reduce diesel fuel supplies. Commenters do not specifically recommend any particular sulfur level but note that considerations associated with the need to supply consumers with diesel fuel at a reasonable cost supports the adoption of a higher sulfur standard.

Letters:

New England Fuel Institute (IV-D-296) **p. 1-3**
Reusable Industrial Packaging Association (IV-D-129) **p. 1**

Response to 4.1(F):

See response to 4.1(E)(8) and (9).

(G) It is unreasonable for EPA to propose a 15 ppm diesel fuel sulfur standard that will require substantial capital investment, based on control technologies that have not been field tested or proven.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Cenex Harvest States Cooperatives (IV-F- 191) **p. 232**
Independent Fuel Terminal Operators Association (IV-D-32) **p. 2-3**
Marathon Ashland Petroleum (IV-F-74)

(2) Preliminary tests sponsored by both the industry and the government demonstrate that after-treatment technologies have not cut emissions to desired levels regardless of the sulfur content of fuels.

Letters:

American Petroleum Institute (IV-F-16, 42, 182, 117) **p. 161** (IV-F-191) **p. 114**
Marathon Ashland Petroleum (IV-D-261) **p. 2**

(3) EPA is requiring the addition of aftermarket treatment devices that are not necessarily being developed by the engine manufacturers. The engine manufacturers will pay the price if the aftermarket devices are not able to meet the standard and subsequently, consumers, farmers, and retailers will pay higher prices for vehicles as a result. The commenter specifically suggests that EPA withdraw the rule and reconsider the technological advancements they are requiring as well as the resulting costs to the consumer.

Letters:

Agricultural Retailers Association (IV-D-178) **p. 3-4**
North American Equipment Dealers Association (IV-D-194) **p. 3-4**

(4) Commenter believes that small refiners should have an ongoing exemption until the aftertreatment technologies (and the ability of the fuel distribution system to deliver 15 ppm fuel) have been proven. See Issue 8.5.2, Point (G).

Letters:

Murphy Oil Corporation (IV-D-274) **p. 10-11**

(5) EPA has not provided any legitimate basis for a 15 ppm standard as opposed to a 30 or 50 ppm standard.

Letters:

Murphy Oil Corporation (IV-D-274) **p. 12**

(6) EPA has justified the need for the deep reductions in diesel sulfur content based on control technologies that have yet to be proven to be technologically feasible in the field or even commercially viable. In this regard, EPA's proposal is too ambitious. The proposed sulfur level may have an adverse

impact on fuel prices and supplies, which would affect businesses that rely on diesel vehicles.

Letters:

AL Farmers Federation (IV-D-206) **p. 1**
Coal Operators & Associates, Inc. (IV-D-64) **p. 1**
ExxonMobil (IV-D-228) **p. 1**
IN Builders Association (IV-D-208) **p. 1**
IN Retail Council (IV-D-211) **p. 1-2**
KS Cooperative Council (IV-D-187) **p. 1**
MD Farm Bureau (IV-D-192) **p. 1**
MFA Oil Company (IV-G-16) **p. 1**
MI Petroleum Assoc./MI Assoc. of Convenience Stores (IV-D-202) **p. 1**
Mid-Atlantic Petroleum Distributors' Association (IV-D-124) **p. 1**
OH Trucking Association (IV-D-190) **p. 1**
Service Station Dealers of America (IV-D-253) **p. 1**
VA Aggregates Association (IV-D-177) **p. 1**
VA Agribusiness Council (IV-G-1) **p. 1**
VA Trucking Association (IV-D-191) **p. 1**
WI Motor Carriers Association (IV-D-189) **p. 1**

(7) EPA has failed to show that engine and emission control technologies will be in place by 2007 that can deliver the greater than 90 percent emission reductions driving the need for ultra-low sulfur diesel fuel. For example, EPA notes that SCR could be adapted for use in vehicles yet admits that significant challenges remain for compact SCR systems. EPA cannot make the case that SCR will be available, proven, and reliable by 2007. Similar problems confront other vehicle emission control technologies such as NO_x adsorbers, sulfur traps, and catalyzed particulate filters. These technologies, while promising, remain uncertain.

Letters:

U.S. Chamber of Commerce (IV-D-329) **p. 4**

Response to Comment 4.1(G)(1)-(7):

We believe the emission control technologies enabled by 15 ppm sulfur diesel fuel will be able to function properly through the useful life of the vehicles and engines and will allow the vehicles and engines to meet the standards being adopted today. For a discussion of and response to these issues the reader is referred to section III of the preamble, Chapter III of the RIA, and issue 3.2.1(C). Specific aspects of comments (G)(2) and (G)(7) were previously discussed in the Response to Comments 4.1(E)(11) and 4.1(E)(5), respectively. For specific aspects of comment (G)(5), see our Response to Comments 4.2(B), (C), and (D)

(H) EPA should adopt a higher fuel sulfur standard to encourage engine manufacturers to develop sulfur-resistant technology and thereby avoid the high costs and adverse environmental consequences of severe hydrodesulfurization.

(1) Small refiners especially will face high costs because they typically run single

refining trains and thus are more sensitive to producing off-spec fuel. Severe hydrodesulfurization requires high energy consumption and contributes significantly to greenhouse gas emissions. The stringent specification also discourages investment in alternative technologies that might be more environmentally friendly.

Letters:

Petro Star Inc. (IV-D-216) **p. 4-5**

Response to Comment 4.1(H):

For a discussion of and response to these issues the reader is referred to the response to comment 4.1(E)(13) and 4.1(G) above. In addition, given the requirements of the new vehicles to be operated on 15ppm fuel or less, higher sulfur levels cannot be used in these new vehicles. However, given the disproportionate impact on small refiners, we are allowing them, among other things, to continue the production of 500ppm sulfur highway diesel fuel for several years as long as the fuel is not sold for use in 2007 and later model year vehicles.

(I) Expressed support for a national fuel sulfur level that is lower than 15 ppm.

(1) Commenters expressed support for a 5 to 10 ppm sulfur diesel fuel and some specifically expressed support for the "sulfur-free" fuel as defined by the Worldwide Fuel Charter (WWFC). Commenters provided significant data and discussion regarding the benefits to NO_x conversion efficiency if sulfur levels are reduced below 15 ppm, and some noted specifically that EPA should finalize a diesel fuel specification that is identical to the WWFC Category 4 requirements (a summary of these requirements is provided by DaimlerChrysler as an attachment to their letter). These commenters note that the WWFC standards would also set limits for fuel cetane and aromatics (see also Issue 4.9), which would preserve a diesel powertrain option for the light-duty passenger vehicle market. One commenter provided a detailed report [AECA Data of the Sulfur Effect on Advanced Emission Control Technologies, July 2000] that summarizes the effects of higher sulfur fuel on aftertreatment technologies and supports the assertion that near-zero sulfur diesel fuel would be the most desirable option. Another commenter provided the DOE report "Impact of Diesel Fuel Sulfur on CIDI Engine Emission Control Technology," August 2000, as supporting documentation. This document includes data and discussion on engine test results, which compare the effectiveness of emission reduction given varying levels of diesel fuel sulfur. Other commenters also provide significant discussion and data regarding the need for ultra low sulfur fuel given the adverse impact to various control technologies and specifically advocate a sulfur cap no higher than 5 ppm. (See also Issues 3.3.1 and 3.3.2.)

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 1-4**, (IV-F-9, 59, 191) **p. 89**
Children's Environmental Health Network (IV-D-244) **p. 2**
Cummins, Inc. (IV-D-231) **p. 42-44**

DaimlerChrysler (IV-D-136) **p. 1**, (IV-D-284) **p. 2-4**, (IV-D-344) **p. 1-5, +all**, (IV-F-15, 167, 116) **p. 292** (IV-F-191) **p. 173**
Detroit Diesel Corporation (IV-D-276) **p. 4-6**
Engine Manufacturers Association (IV-D-166) **p. 1**, (IV-D-251) **p. 8-9, 13-14**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 35-37**
International Truck & Engine Corp. (IV-D-257) **p. 5-7**
Manufacturers of Emission Controls Association (IV-D-267) **p. 3,7-9**
Sullivan, Linda and Thullen, Angela (IV-F-23)
U.S. Department of Energy (IV-G-28) **p. 2-3, Att. 2**
UAW (IV-D-215) **p. 2-5**
Unity & Diversity World Council (IV-F-190) **p. 213**
Volkswagen (IV-D-272) **p. 1-2**

(2) The sulfur level in diesel fuel needs to be lower than 15 ppm in order to allow manufacturers to meet the Tier 2 standards for light duty vehicles (see also Issue 9). One commenter (VW) provides significant discussion on this issue and asserts that EPA has failed to demonstrate that the high efficiencies necessary to comply with the Tier 2 standards can be maintained for the useful life of the technologies with a 15 ppm sulfur diesel fuel. Another commenter noted that there is emerging data from DOE research that supports the view that this "sulfur-free" standard is needed for diesel vehicles to meet the Tier 2 standards.

Letters:

Alliance of Automobile Manufacturers (IV-F-59)
Volkswagen (IV-D-272) **p. +3-4**

(3) EPA needs to go further. The removal of as much sulfur in diesel fuel as possible is essential to maximizing emission reductions because without the removal of essentially all sulfur, advanced NO_x after-treatment devices will not be feasible, advanced PM after-treatment will be poisoned, and engines will be exposed to excessive wear and increased maintenance costs.

Letters:

Alliance of Automobile Manufacturers (IV-F-9)
Association of International Automobile Manufacturers (IV-D-259) **p. 1**
Detroit Diesel Corporation (IV-D-276) **p. 4-6**
Engine Manufacturers Association (IV-D-251) **p. 8-9**, (IV-F-33, 174, 116) **p. 43** (IV-F-117) **p. 39**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 35-37**
International Truck & Engine Corp. (IV-D-257) **p. 5-7**
Mack Trucks (IV-D-324) **p. 3**

(4) Continues to support a 5 ppm sulfur requirement, but believes the emission standards can be achieved with a 15 ppm cap.

Letters:

Manufacturers of Emission Controls Association (IV-F-26, 187, 116) **p. 47** (IV-F-117) **p. 89**

(5) In setting the sulfur cap, EPA should consider what is happening in California and other parts of the world. Europeans are already producing 10 ppm fuel using very modest fiscal incentives; and BP, Amoco, and ARCO announced that they could do so as well. The U.S. should not allow itself to become a "dumping ground" for fuel that cannot meet the specifications in European countries and should set a sulfur cap for diesel that is lower than 15 ppm. One commenter added that EPA has failed to acknowledge that while the Swedish fuel has a specified cap of 10 ppm sulfur, the average sulfur content of Swedish fuel is 2-3 ppm and rarely exceeds 5 ppm. This commenter concludes that there is no assurance that a cap of 10 ppm or 15 ppm is adequate to ensure reliable regeneration and that EPA should impose a 5 ppm cap.

Letters:

Coalition for Clean Air (IV-F-190) **p. 177**
Consumer Policy Institute (IV-D-186) **p. 6**
DaimlerChrysler (IV-D-284) **p. 4-5**
Detroit Diesel Corporation (IV-D-276) **p. 5**

Response to Comments 4.1(I)(1)-(5):

See Response to Comments 4.1(D)(7) and (8).

(6) Commenters urged EPA to adopt the toughest possible standards.

Letters:

10th District PTA (IV-F-190) **p. 262**
Domac, Jacquiline (IV-F- 190) **p. 249**
Environmental Defense (IV-F-169)
Friends of the Children (IV-F-158)
Glendale-La Crescenta Advocates (IV-D-80) **p. 1**
Lu, Rong (IV-F-162)
Mexican-American Legal Defense & Educational Fund (IV-F-160)
Sierra Club (IV-F-159)

(7) Commenters refers to the California Air Resources Board (CARB) report entitled "Proposed Risk Reduction Plan for Diesel-Fueled Engines and Vehicles" dated July 13, 2000 as supporting documentation. This report is a comprehensive plan to reduce diesel PM and refers to the use of a very low sulfur diesel fuel with a cap lower than 15 ppm. Commenter also notes that the South Coast Air Quality Management District (SCAQMD) is in support of reducing sulfur levels for all fuels and that their Proposed Amended Rule 431.2 would cap diesel fuel at 15 ppm by 2006 in the SCAQMD.

Letters:

DaimlerChrysler (IV-D-284) **p. 5-6**

(8) EPA should consider a cap of 5 ppm since lower sulfur fuel will improve the efficiency and durability of advanced technology catalysts and traps. One

commenter added that the additional cost of reducing sulfur to near zero levels to ensure the reliable operation of the advance diesel aftertreatment devices is only a few cents per gallon. (See also Issue 5.8.)

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 35-37**
NESCAUM (IV-D-315) **p. 9**

(9) Supports a 5 ppm sulfur standard and suggested that a phase-in approach of 15 ppm in 2006, 10 ppm in 2007, and 5 ppm in 2008 would both ease the transition and help alleviate problems associated with residual sulfur in the pipelines.

Letters:

Coalition for Clean Air (IV-F-190) **p. 177**

(10) Nationwide controls that eliminate sulfur from diesel fuel would allow for the successful development of control technologies for diesel-powered vehicles and would allow for improvements in the environmental performance of HDVs currently in use. Requirements for very low sulfur diesel fuel in European countries have allowed for the development of exhaust emission control technologies. Once clean diesel fuels are available in the U.S., EPA's proposed HDE and vehicle standards would ensure that public health and environmental benefits from the use of vehicle emission control devices would quickly follow. Requirements for near zero sulfur diesel fuel would allow for the implementation of program to retrofit in-use HDVs with some of the types of aftertreatment devices that will be used on new diesel engines and would also lead to other benefits such as lower emissions of sulfur oxide and sulfate, reduced engine wear, the need for less frequent oil changes, and greater durability of exhaust gas recirculation components.

Letters:

UAW (IV-D-215) **p. 4-6**

Response to Comment 4.1(I)(6)-(10):

In developing the regulations finalized today, the Agency considered a wide range of sulfur levels, including sulfur levels as low as 5ppm as requested by a number of the commenters. However, based on the wide range of information available to us, our analysis of the current state of the exhaust aftertreatment technology, and the expected advancement of that technology between now and when the standards would go into effect, we are confident that a sulfur cap at 15ppm will be sufficient to enable the technology and enable the emission standards to be achieved. The reader is referred to section III.F. of the preamble and chapter III of the RIA, and the response to issue 3.2.1 for a complete discussion of this assessment.

While reducing the sulfur level below 15ppm may provide marginal benefits, the benefits are marginal once the technology has been enabled at the 15 ppm level. However, as the sulfur level is decreased below 15ppm, the feasibility and cost associated with producing and distributing diesel fuel at that sulfur level continues to increase. Consequently, the benefits of reducing the sulfur level below the 15ppm cap where the vehicle emission control technology is enabled would not appear to justify the economic impact.

See also our Response to Comments 4.2(B), (C), and (D).

(J) Opposes possibility of moving to a 5 ppm standard.

(1) This would require near zero sulfur levels at the refinery to avoid downstream contamination, and such levels are neither technically feasible or cost effective, and would require significant distribution/transportation infrastructure changes.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 5**

Response to Comment 4.1(J):

See Response to Comments 4.1(I)(6)-(10), above.

Issue 4.2: Form of Standard (cap and/or average)

(A) Supports a cap on diesel sulfur levels instead of an averaging system.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

Engine Manufacturers Association (IV-F-174)
L.A. County Bicycle Coalition (IV-F- 190) **p. 131**
Natural Resources Defense Council (IV-D-168) **p. 3**

(2) An averaging system would be difficult and impractical to enforce. A fuel sulfur average would represent only a refiner's average and, therefore, cannot be monitored or enforced at the pump. Engine manufacturers and their customers must be assured that fuel meeting the required limitations will always be available nationwide. It is critical that after-treatment technologies not be exposed to higher sulfur fuels, which an averaging system would allow. The potential for irreversible damage to systems such as NO_x adsorbers and catalyzed regenerating particulate filters from higher sulfur fuel underscores the need for a capped, not average, diesel fuel sulfur requirement.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 12-13**
British Petroleum (IV-D-242) **p. 4**
Children's Environmental Health Network (IV-D-244) **p. 2**
Engine Manufacturers Association (IV-D-251) **p. 12-13**, (IV-F-33, 116) **p. 43** (IV-F- 191) **p. 39**
International Truck & Engine Corp. (IV-D-257) **p. 11**

Volkswagen (IV-D-272) **p. +6**

(3) The 15 ppm sulfur cap provides assurance that sensitive emission control technology will not see high levels of sulfur, which would occur if an average of 15 ppm is imposed (or if a higher cap of 80 ppm is imposed). Refiners might choose any number of options to comply with a 15 ppm average, and some of these options could expose current and developing options for aftertreatment technologies to higher levels of sulfur. Even localized pockets of higher sulfur fuel could have a widespread impact on vehicle emissions.

<u>Letters:</u>

DaimlerChrysler (IV-D-284) **p. 2-3**

(4) A sulfur average standard will only place additional burdens and costs on refiners, while providing little benefit.

<u>Letters:</u>

British Petroleum (IV-D-242) **p. 4**

<u>Response to Comment 4.2(A)(1)-(4):</u>

The low sulfur diesel fuel program imposes a 15 ppm cap on the sulfur content of highway diesel fuel. We are finalizing a cap standard on the sulfur content of diesel fuel to protect the vehicle aftertreatment technologies that we expect will be used to meet the 2007 heavy-duty engine and vehicle emission standards. An average standard by itself would not be sufficient to ensure that sulfur levels higher than those that could be tolerated by the exhaust emission control technology would not be used in vehicles for extended periods of time. Given that the cap standard is the limiting factor, we agree that imposing an average standard would only place additional burdens and costs on refiners while providing little benefit.

Although the current 500 ppm sulfur limit requirement for diesel fuel provides no specific program flexibilities for averaging, in the years since that limit was set, motor vehicle fuel regulations have frequently incorporated provisions allowing regulated industries to average regulated parameters around a standard, often with a capped upper limit. In fact this approach was taken in the recently promulgated control of gasoline sulfur levels, in which we adopted a 30 ppm average level with an 80 ppm cap.

Despite the ability of averaging provisions in some programs to increase compliance flexibility and in some cases reduce overall costs while still achieving the environmental objectives, we are not finalizing such provisions in the low sulfur diesel fuel program. Basing the fuel program around an average sulfur level would risk failure in meeting the whole objective of sulfur control (the enablement of sulfur-sensitive emission control technologies) and thereby the environmental objectives of the program, or could require the adoption of a cap so low that the average level would be irrelevant. The exhaust emission control technologies enabled by diesel sulfur control appear to be far more sensitive to and far less forgiving of variations in fuel sulfur level than advanced gasoline technologies for Tier 2 light-duty vehicles. Enough is known about the exhaust emission control technologies to convince us that 15 ppm sulfur represents an enablement threshold level, above which increases in emissions and system failures are likely if not probable.

Imposing an average standard in addition to the cap would require additional product sampling, recordkeeping, and reporting requirements to demonstrate compliance with the standard. Thus, the flexibility of an average standard would not be worth the additional cost and complexity of it, particularly when coupled with a 15 ppm sulfur cap.

(B) Supports a 5 ppm average with a 15 ppm cap.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

Johnson Matthey (IV-F-117) **p. 94**

Response to Comment 4.2(B):

There are five key factors which, when taken together, have lead us to conclude that a sulfur cap of 15 ppm is both necessary to enable the NO_x and PM exhaust emission control technology (and thereby allow the heavy-duty vehicle and engine emission standards to be met), and appropriate, taking into consideration the challenges involved in producing and distributing low sulfur diesel fuel. These factors include the implications that sulfur levels in excess of 15 ppm have on the efficiency, reliability, and fuel economy impacts of the exhaust emission control systems, and the feasibility and costs of producing low sulfur diesel fuel.

The efficiency of emission control technologies at reducing harmful air pollutants is directly impacted by sulfur in diesel fuel. Initial and long term conversion efficiencies for NO_x, NMHC, CO and diesel PM emissions are significantly reduced by catalyst poisoning and catalyst inhibition due to sulfur. NO_x conversion efficiencies with the NO_x adsorber technology in particular are dramatically reduced in a very short time due to sulfur poisoning of the NO_x storage bed. In addition, total PM control efficiency is adversely impacted by the formation of sulfate PM. The formation of sulfate PM is likely to be in excess of the total PM standard, unless diesel fuel sulfur levels are below 15 ppm. Finally, particulate trap regeneration is inhibited at higher diesel fuel sulfur levels. Please refer to issue 3.2.1, 3.3.1, and 3.3.2.

The reliability of the emission control technologies to continue to function as required under all operating conditions for the life of the vehicle is also directly impacted by sulfur in diesel fuel. As discussed in Section III of the preamble and Chapter III of the RIA, sulfur in diesel fuel can prevent proper operation and regeneration of both NO_x and PM control technologies, leading to permanent loss in emission control effectiveness and even catastrophic failure of the systems. We have concluded that diesel fuel with sulfur levels no higher than 15 ppm is necessary to provide a level of reliability for these technologies to allow their introduction into the marketplace.

The sulfur content of diesel fuel will also affect the fuel economy of vehicles equipped with NO_x and PM exhaust emission control technologies. As discussed in detail in Section III of the preamble and Chapter III of the RIA, NO_x adsorbers are expected to consume diesel fuel in order to purge themselves of stored sulfates and maintain efficiency. The amount of sulfur in diesel fuel is directly proportional to the impact on fuel economy. As sulfur levels increase above 15 ppm , the fuel economy impact transitions from negligible to unacceptable levels. Likewise, PM trap regeneration is inhibited by sulfur in diesel fuel. This inhibition leads to increased PM loading in the diesel particulate filter, increased exhaust backpressure, and poorer fuel economy. Thus, for both NO_x and PM technologies, the lower the fuel sulfur level, the better the vehicle fuel economy.

As a result of these factors, we have concluded that 15 ppm represents an upper diesel fuel sulfur boundary that would make these technologies viable. Therefore, the low sulfur diesel fuel program caps diesel fuel sulfur at 15 ppm. In comments received on the proposal, as well as in subsequent meetings and discussions, however, we have frequently heard different points of view on this issue expressed by the vehicle and engine manufacturers, and by oil refiners.

Some vehicle and engine manufacturers have argued for a maximum cap on the sulfur content of diesel fuel of five ppm, believing that this level is necessary. As we discuss in Section III of the preamble and Chapter III of the RIA, however, we believe that a cap of 15 ppm will be sufficient to ensure the reliability of PM exhaust emission control technology and enable it to reach the very high efficiencies needed (over the wide range of vehicle operation and conditions) for engine compliance.

We believe that requiring a cap lower than 15 ppm would not be necessary to enable the exhaust emission control technology to meet the very low NO_x and PM emission standards we are finalizing. A cap lower than 15 ppm would provide little additional emission reduction but would increase the cost. Consequently, requiring a sulfur cap lower than that necessary to enable the exhaust emission control technology to meet the emission standards would be inappropriate.

Conversely, many oil refiners have argued for a higher maximum cap (if any) on the content of sulfur in diesel fuel, typically on the order of 50 ppm. They argue that the cost of reducing the sulfur level below a cap of 50 ppm (and average of 30 ppm) becomes prohibitively high. They further argue that emission control technology for diesel engine exhaust is still in its infancy and will likely develop rapidly over the next several years, to the point where it is much less sulfur sensitive than current technology. As discussed in Section III of the preamble and Chapter III of the RIA, we also believe that the emission control technology will develop rapidly over the coming years, and in particular are projecting that the sensitivity of NO_x adsorber technology to fuel sulfur will improve considerably through the development of techniques to effectively regenerate themselves of stored sulfur compounds. Based on available information and our projections from that information, we believe that a cap higher than 15 ppm sulfur, and in particular a cap as high as 50 ppm would not enable the exhaust emission control technology needed to achieve the emission standards and, furthermore, may severely compromise the reliability of the systems and result in unacceptable fuel economy impacts. In addition, as discussed in the preamble, although we acknowledge that the cost to desulfurize diesel fuel does increase with more stringent sulfur levels, we have concluded that these costs would not be prohibitively high, and maintain that the environmental benefits of the program are sufficient to justify the costs of the program at a sulfur cap level of 15 ppm.

Based on our assessment of the efficiency, reliability, and fuel economy impacts of sulfur on emission control technologies for diesel engine exhaust, and the cost and feasibility factors associated with reducing the sulfur content of diesel fuel, we believe 15 ppm is the appropriate sulfur cap. However, we did analyze in the draft RIA the impacts on technology enablement, costs, and benefits from controlling fuel sulfur to a 15 ppm average level with a 25 ppm cap, as well as from capping fuel sulfur at five ppm and 50 ppm. These levels have been supported by various stakeholders as either necessary (in the case of a five ppm cap) or adequate (in the case of a 50 ppm cap) for enabling high-efficiency diesel exhaust emission controls, and so we believed that assessments of these levels was appropriate. We have concluded in the final rule, however, that sulfur levels above 15 ppm would not enable the high efficiency diesel exhaust emission controls. Furthermore, the emission benefits from the standards being adopted today are substantial and of significant benefitin improving air quality and protecting public health and the environment. For more information on benefits issues, please refer to the responses comments under Issue 2, above.

(C) Supports a 30 ppm average sulfur content.

(1) A 30 ppm average represents a balance between production capabilities and sulfur's impact on control technologies. Averaging enables fuel to meet the emissions standards, but allows for small deviations from refinery process variations, distribution and storage.

Letters:

Equiva Services (IV-D-226) **p. 3**
Phillips Petroleum Company (IV-D-250) **p. 3**
Western Independent Refineries Association (IV-F-190) **p. 144**

Response to Comment 4.2(C):

See Response to Comment 4.2(B), above.

(D) Supports an average sulfur content of 15 ppm in order to enhance overall reliability of diesel fuel supplies.

(1) An average sulfur content of 15 ppm has several advantages: higher probability that some cracked stocks could be included in the highway diesel pool, thereby minimizing the overall loss of volume; longer hydrotreater cycle lengths between catalyst replacement at the refinery; more robust and reliable plant operation; increased flexibility for refiners/blenders; and mitigation of fuel integrity problems expected to occur throughout the distribution system.

Letters:

Chevron (IV-D-247) **p. 2**

Response to Comment 4.2(D):

See Response to Comment 4.2(B), above.

(E) Opposes a sulfur cap.

(1) A sulfur standard based on a cap instead of an average imposes undue stringency on refiners relative to the true sulfur target. With a 15 ppm cap, an additional enforceable average standard would be useless in providing refinery flexibility or reducing emissions.

Letters:

American Petroleum Institute (IV-D-343) **p. 50**
Marathon Ashland Petroleum (IV-D-261) **p. 53-54**

<u>**Response to Comments 4.2(E):**</u>

See our response to comment 4.2(A).

(F) The sulfur standard should be established on an annual average basis.

(1) While use of a per gallon standard makes a program easier to administer, it removes valuable flexibility from the distribution system and adds unnecessary costs. If the EPA is concerned about poisoning of the control devices, the annual average could be coupled with a per gallon cap or maximum.

<u>Letters:</u>

Independent Fuel Terminal Operators Association (IV-D-217), **p. 10-11**

<u>**Response to Comments 4.2(F):**</u>

See our response to comment 4.2(A).

Issue 4.3: Schedule

Issue 4.3.1: Start Date

(A) Support the 2006 deadline as proposed by EPA because this deadline is crucial for ensuring that vehicles with new sulfur-sensitive control technologies will have access to the low-sulfur fuel.

(1) Commenters provided no further supporting information or detailed analysis.

<u>Letters:</u>

American Lung Association (IV-F-72, 181, 191) **p. 146**
Alliance of Automobile Manufacturers (IV_G-50)
Bay Area Air Quality Management District (IV-D-139) **p. 1**
CA Air Resources Board (IV-F-190) **p. 13**
CA PIRG (IV-F- 190) **p. 175**
CT Coalition for Environmental Justice (IV-D-131) **p. 2**
Citizen, physician (IV-F-190) **p. 76**
DE Dept. of Natural Resources & Environmental Control (IV-D-146) **p. 1**
Estler, Danielle (IV-F-21)
GA Department of Natural Resources (IV-D-268) **p. 1**
Institute for Global Solutions (IV-F-175)
International Truck & Engine Corp. (IV-D-257) **p. 11**
L.A. County Bicycle Coalition (IV-F- 190) **p. 131**
League of Women Voters of Louisiana (IV-D-199) **p. 1**
Lu, Rong (IV-F-162)
Manufacturers of Emission Controls Association (IV-F-190) **p. 108**
NY DEC (IV-D-138) **p. 1**
NYC DEP (IV-D-159) **p. 1**
Natural Resources Defense Council (IV-D-168) **p. 6**, (IV-F-75, 191) **p. 68**

Northwest District Association (IV-D-117) **p. 1**
OH Environmental Council (IV-D-130) **p. 1**
STAPPA/ALAPCO (IV-D-140) **p. 1**, (IV-F-32, 78, 117) **p. 29** (IV-F-191) **p. 32**
Tosco (IV-D-84), (IV-F-157)
U.S. PIRG (IV-F-71, 192) **p. 134**
Vigo County Air Pollution Control (IV-D-137) **p. 1**
WA Department of Ecology (IV-D-141) **p. 1**

(2) EPA should maintain the proposed implementation date of 2006 since a start date sooner than this would not leave sufficient time for refiners and retailers to adequately plan for the future.

Letters:

Quikway Trucking Company (IV-F-190) **p. 60**

(3) The lead time provided by the 2006 implementation date for low sulfur diesel offers the refining industry adequate time to comply with the standards.

Letters:

City of Chicago (IV-D-240) **p. 5**
Environmental Defense (IV-D-346) **p. 10**, (IV-F-169)
Metropolitan Washington Air Quality Committee (IV-D-34) **p. 2**
Natural Resources Defense Council (IV-F-190) **p. 98**
Tosco (IV-D-304) **p. 1**

(4) Since fuel sulfur can permanently destroy or disable the aftertreatment technologies projected to be used to meet the proposed emission standards, the diesel fuel sulfur cap should be fully implemented nationwide no later than June 1, 2006. Because it's a matter of equipment failure and not just an issue of a temporary reduction in emission control performance, it is important to ensure that engines designed to meet the proposed standards will never be exposed to fuels with high levels of sulfur. Allowing the deadline to extend beyond June 2006 will threaten the viability of the new emission control equipment and the credibility of the entire emission control program.

Letters:

Detroit Diesel Corporation (IV-D-276) **p. 6-7**

Response to Comment 4.3.1(A)(1)-(4):

In general, these comments provided added support and justification for the leadtime and start date of the low sulfur diesel fuel program. Specifically, beginning June 1, 2006, refiners must begin producing highway diesel fuel that meets a maximum sulfur standard of 15 ppm. All 2007 and later model year diesel-fueled vehicles must be refueled with this new low sulfur diesel fuel.

The low sulfur diesel fuel program includes a combination of flexibilities available to refiners to ensure a smooth transition to low sulfur highway diesel fuel. First, refiners can take advantage of a temporary compliance option, including an averaging, banking and trading component, beginning in June 2006 and lasting through 2009, with credit given for early compliance before June 2006. Under this temporary compliance option, up to 20 percent of highway diesel fuel may continue to be produced at the existing 500 ppm sulfur maximum standard. Highway diesel fuel marketed as complying with the 500 ppm sulfur standard must be segregated from 15 ppm fuel in the distribution system, and may only be used in pre-2007 model year heavy-duty vehicles. Second, we are providing additional hardship provisions for small refiners to minimize their economic burden in complying with the 15 ppm sulfur standard. Third, we are providing additional flexibility to refiners subject to the Geographic Phase-in Area (GPA) provisions of the Tier 2 gasoline sulfur program, which will allow them the option of staggering their gasoline and diesel investments. Finally, we are adopting a general hardship provision for which any refiner may apply on a case-by-case basis under certain conditions. These hardship provisions, coupled with the temporary compliance option, will provide a "safety valve" allowing up to 25 percent of highway diesel fuel produced to remain at 500 ppm for these transitional years to minimize any potential for highway diesel fuel supply problems.

(B) Oppose the 2006 deadline because it is essential that refiners have additional lead time if they must invest in the necessary technology to reduce sulfur levels in diesel fuel.

(1) Some of these commenters noted that refiners will be trying to meet the Tier 2 gasoline sulfur standard at roughly the same time as the diesel sulfur standard if the rule is finalized as proposed and that to address this issue, EPA should delay implementation to no earlier than January 1, 2008. The overlap of the implementation schedules for these standards would demand excessive capital expenditures and would jeopardize the ability of refiners to obtain the proper engineering or technical support as well as the desulfurization equipment necessary to meet the proposed standards. In addition, the uncertainty of the nonroad standards and the MTBE rulemaking may further complicate implementation within the proposed time-frame and a determination of exactly when compliance can be achieved. Commenters urged EPA to delay implementation from 2 to 4 years (2008-2010). One of the commenters also pointed to the NPC report as further support for the need to delay the start date and as documentation of the impact of other requirements such as Tier 2 and MTBE.

Letters:

American Farm Bureau Federation (IV-F-5)
American Petroleum Institute (IV-D-343) **p. 41, 55-58**
CO Petroleum Association (IV-D-323) **p. 3**
Citgo Corporation (IV-D-314) **p. 7**
ExxonMobil (IV-F-105)
Marathon Ashland Petroleum (IV-D-261) **p. 58-61**, (IV-F-74)
National Petrochemical & Refiners Association (IV-D-218) **p. 15**, (IV-F-44)
Sinclair Oil Corporation (IV-D-255) **p. 2-3**

(2) Commenters recommended that EPA delay implementation of the rule until at least 2009 or 2010 to allow for additional compliance flexibility for refiners and to allow for additional time to develop sulfur-tolerant emissions control devices for HDVs. Some of these commenters proposed a delay to 2010 together with a 50 ppm cap and no phase-in. One of the commenters added

that the current proposed time frame would force some refiners to make their investments in the 2001 to 2003 time frame due to the large number of refiners that will need to comply with the standards (which will fill existing fabrication shops and qualified construction companies from 2004 to 2006). One commenter noted that a 2-3 year delay would greatly improve EPA's ability to accurately estimate the investment requirements for very low sulfur diesel and provide a meaningful cost/benefit analysis.

Letters:

Cooperative Refining, LLC (IV-D-300) **p. 3**
Ergon & Lion Oil Co. (IV-F-117) **p. 183**
National Petrochemical & Refiners Association (IV-D-218) **p. 14**
Phillips Petroleum Company (IV-D-250) **p. 3**
Ports Petroleum Co, Inc. (IV-F- 117) **p. 190**
Society of Independent Gasoline Marketers of America (IV-D-328) **p. 1**, (IV-F-191) **p. 196**

(3) The timing will be especially difficult in the West where the proposed 2006 date occurs eight months before final implementation of the 30/80 ppm gasoline standards. In fact, EPA's proposal contradicts the findings EPA made in the gasoline rule that refineries in the West would have difficulty competing for engineering and construction resources. To be consistent with the delay in the gasoline standards for the West, EPA must allow an extended compliance date for diesel fuel as well.

Letters:

Sinclair Oil Corporation (IV-D-255) **p. 3-5**

Response to Comment 4.3.1(B)(1)-(3):

We believe that today's program will provide a sufficient supply of low sulfur diesel fuel for the engines and vehicles that need it beginning in 2007 while allowing the refining industry to spread out its capital investments for producing the clean fuel. Under the program's temporary compliance option, a refinery may produce up to 20 percent of its total highway diesel fuel at the existing highway diesel fuel sulfur standard of 500 ppm, determined on an annual basis. The remaining 80 percent of the highway diesel fuel produced at that refinery during the year must meet a sulfur standard of 15 ppm. As part of this temporary compliance option, a PADD-based averaging, banking, and trading (ABT) program will be available. For example, a refinery could produce more than 80 percent of its highway diesel fuel as low sulfur diesel fuel and generate credits based on the volume of highway diesel fuel produced at 15 ppm that exceeded the 80 percent requirement. Within that same PADD (within the limits explained in the preamble for California, Alaska, Hawaii, and any state with an EPA-approved waiver from the federal program), these credits may be averaged with another refinery owned by that refiner, banked for use in future years, or sold to another refinery.

The low sulfur diesel fuel program offers additional flexibility to refiners who produce gasoline for sale in the GPA. Under this provision, refiners that produce both gasoline and highway diesel fuel and are subject to the Tier 2/Gasoline Sulfur program may choose to stagger their desulfurization investments for the two fuels. Refiners that comply with the low sulfur diesel fuel standard by June 1, 2006 for all of their highway diesel fuel production may receive a three-year extension of their interim GPA gasoline standards for 2006, that is through December 31, 2010. In addition to allowing refiners the opportunity to spread out their desulfurization investments, we believe this provision will encourage the production of 15 ppm diesel fuel by some refiners in and near the GPA, which will further help to ensure the new fuel is widely available for new vehicles throughout the area.

The low sulfur diesel program also contains a menu of small refiner hardship provisions as discussed in section IV of the preamble and Issue 8.5, including a four year delay in compliance with the 15 ppm sulfur standard for diesel fuel, allowance to generate credits for the production of 15 ppm sulfur diesel fuel, and a delay in compliance with the final Tier 2 gasoline sulfur standard in exchange for complying on time with the 15 ppm sulfur diesel fuel requirement.

The low sulfur gasoline program, which phases-in from 2004 through 2006 for most refiners, also offers an ABT program as well as flexibilities for small refiners and refiners who produce gasoline for sale in the GPA. Hence, we believe both low sulfur fuel programs are structured to allow for sufficient lead time and maximum refiner flexibility.

In section IV of the preamble and chapter IV of the RIA, EPA analyzed in detail the combined impacts of both programs together, including the transitional provisions for both programs as described above. The conclusion of the analysis indicated that a start date of June 1, 2006 at the refinery for the diesel program, along with the transitional provisions, allowed for the distribution of capital, engineering, and construction over a sufficient period of time so as to make the burden on the industry reasonable.

In regard to MTBE, we are exploring control options through our authority under the Toxic Substances Control Act (TSCA). On March 20, 2000, Administrator Browner announced the Agency's Advance Notice of Proposed Rulemaking (65 FR 16093, March 24, 2000) under Section 6 of TSCA to control the use of MTBE as a fuel additive. If and when we propose an MTBE control program, we would consider it's impact on the refining industry in the context of all other CAA regulatory impacts, including the low sulfur diesel rule.

(C) Suggested EPA provide tax or other incentives to encourage businesses to implement the proposed rule in advance of the deadline.

(1) Commenters provided no further supporting information or detailed analysis.

<u>Letters:</u>

Chicago DEP/Chicago Metropolitan Mayors Caucus Clean Ai (IV-D-335) **p. 6**
City of Chicago (IV-D-240) **p. 6**
National Biodiesel Board (IV-F-191) **p. 249**
Nolan, Catherine (IV-D-169) **p. 1**
Toltz, Ken (IV-F-191) **p. 215**

(2) EPA should implement financial incentives such as grants or revolving loan programs specifically for the adoption of clean vehicle technologies in advance of the proposed schedule. One commenter added that substantial quantities of ultra low sulfur fuel will be needed at various locations throughout the country beginning in the 2004 timeframe to support these field evaluation programs.

Letters:

City of Los Angeles Environmental Quality and Waste Man (IV-F-190) **p. 95**
Detroit Diesel Corporation (IV-D-276) **p. 7**
NY DEC (IV-D-239) **p. 3**

Response to Comments 4.3.1(C)(1) and (2):

EPA does not have statutory authority to create tax incentives. The approach recommended by the commenters would require an Act of Congress to implement.

(3) The early introduction of ultra low sulfur diesel is necessary if engine manufacturers are to have any possibility of generating credits under the ABT program as proposed. Such incentives could be refinery emission credits, federal or state tax incentives, or other similar, innovative programs.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 31**

(4) Voluntary emission credits programs or other market-based incentives to encourage the early introduction of low-sulfur fuels would allow advanced emissions testing, lower the costs of emissions control equipment, and possibly allow the distribution system a chance to develop experience in handling the new fuel. Any incentive-based opportunities offered by EPA for early introduction of a low sulfur diesel fuel should include biodiesel at a level at least twice the rate of other credits or incentives offered because of the low-sulfur characteristics and other healthy environmental attributes offered by biodiesel.

Letters:

Ag Environmental Products (IV-D-179) **p. 1-2**
National Biodiesel Board (IV-D-288) **p. 4-5**
Griffin Industries (IV-D-221) **p. 2**
MN Soybean Growers Association (IV-D-337) **p. 2**
ND Soybean Growers Association (IV-D-311) **p. 2**
NE Soybean Board (IV-D-195) **p. 1-4**
OH Soybean Association (IV-D-277) **p. 2**
OH Soybean Council (IV-D-278) **p. 2**
West Central (IV-G-40) **p. 1**
World Energy Alternatives (IV-D-336) **p. 2**

Response to Comments 4.3.1(C)(3) and (4):

As discussed in Section IV.A.2.a of the preamble, today's regulation allows refiners and importers to generate early credits (prior to June 1, 2006) under limited circumstances, based on production of low sulfur diesel fuel prior to June 1, 2006.

The early credits program has two sets of provisions: 1) credits generated after May 31, 2005 but before June 1, 2006, and 2) credits generated after May 31, 2001 but before June 1, 2005. For a refiner or importer to generate early credits after May 31, 2005, it must demonstrate that the 15 ppm fuel produced early was segregated in the distribution system and not commingled with current 500 ppm sulfur fuel. Only that volume that the refiner could verify was actually sold as 15 ppm fuel at retail or to centrally-fueled fleets would be eligible for early credits. The program also specifies that early credits can be generated prior to June 1, 2005. In this case, however, the refiner or importer must demonstrate that the fuel meeting the 15 ppm sulfur standard is used in vehicles certified to meet the basic 2007 emission standard for PM (0.01 g/bhp-hr) or in vehicles using retrofit technologies needing equivalent standards approved as part of EPA or state retrofit programs. These provisions for early credits under the fuel regulations are designed to work in harmony with the provisions for early credits under the engine and vehicle regulations.

(D) EPA should consider requiring that low sulfur fuel be available in the marketplace sooner than July 2006.

(1) The July 1, 2006 date for compliance with the sulfur standard is barely adequate to meet new vehicle needs. Manufacturers can introduce a 2007 MY vehicle as early as January 2, 2006 and past experience shows that some vehicles and engines are certified and available as early as this date. A seven year lead time for refiners to comply with the standard is more than adequate and EPA should consider setting the compliance date at January 1, 2006. Commenters provided significant discussion on this issue and noted that an earlier introduction is important not only for meeting the standards in the proposed rule, but also to meet the Tier 2 and 2004 HD rule requirements.

Letters:

DaimlerChrysler (IV-D-284) **p. 4**
Engine Manufacturers Association (IV-D-251) **p. 16-17**

Response to Comment 4.3.1(D)(1):

As described below in Response to Comments 4.3.2, we believe that the September start date for retailers is appropriate. A January 2006 start date would conflict with the distribution of distillate products such as home heating oil whereas a July start date (with a corresponding start date of April/May for refiners) would overlap with the distribution of low RVP gasoline to meet summertime RFG and or conventional gasoline volatility requirements. Retail availability by September 2006 will assure fuel is available for the first introduction of heavy-duty diesel trucks with 2007 model year engines installed, the earliest model year we can mandate the Phase 2 emission standards for these engines; requiring low sulfur fuel substantially earlier, e.g., September 2005, would provide some additional emission benefits and flexibilities for early introduction of Phase 2 engines but we do not believe the burdens placed on the fuel industry to meet such an early date for low sulfur fuel availability is warranted without also being able to mandate engine and vehicle emission standards which require such fuel.

June 1, 2006 start date of the fuel program is appropriate and will not interfere significantly with the introduction of 2007 model year vehicles which historically have not been introduced until January 1 of the same calendar year (i.e., January 1, 2007 for the 2007 model year) and only recently have been introduced as early as July or August of the previous calender year for some models.

We are confident that the program's June 1, 2006 start date and the program's design will provide refiners with the appropriate amount of lead time that they need for producing 15 ppm sulfur highway diesel fuel and avoid excessive interaction with the gasoline sulfur control program. Furthermore, it will allow for sufficient and widespread supply of the low sulfur diesel fuel for the vehicles that will need it beginning with the 2007 model year.

In the period leading up to the introduction of lower sulfur diesel fuels, Tier 2 Interim Standards will be in place (beginning in 2004) for Tier 2 light-duty vehicles that are achievable through the use of currently available and near term engine and exhaust aftertreatment technologies that do not require the use of low sulfur diesel fuel. These technologies include the use of advanced fuel systems (e.g., as electronically controlled, high-pressure common rail fuel systems) and cooled EGR to achieve low engine-out NO_x and PM levels, along with the use of conventional diesel exhaust aftertreatment such as diesel oxidation catalysts and/or near-term NO_x reduction technology such as precious-metal-based lean-NO_x catalysts.

(2) There is a possibility of slippage in the proposed diesel compliance date of July 2006 and exemptions could be granted. This presents a concern since the 2007 HD technology will not meet the emission standards for the required useful life without low sulfur fuel. Any exposure to higher sulfur fuel due to regional exemption or delays will cause emissions control hardware ineffectiveness.

Letters:

DaimlerChrysler (IV-D-284) **p. 4-5**

Response to Comment 4.3.1(D)(2):

No delay in the start of the fuel program is or should be anticipated. Furthermore, the flexibility provisions of the final rule will not interfere with the availability of low sulfur diesel fuel for the vehicles that need it.

(3) Encourages adoption of the earliest possible date for implementation of low sulfur diesel. One commenter stated that 7 to 10 years is too long for those suffering from the adverse health effects of diesel exhaust.

Letters:

Association of International Automobile Manufacturers (IV-D-259) **p. 1**
Environmental Defense (IV-F-169)
IL Environmental Protection Agency (IV-D-193) **p. 1**
NY State Attorney General's Office (IV-D-238) **p. 1**
San Joaquin Valley Air Pollution Control District (IV-D-56) **p. 2**
Sierra Club (IV-F-159)
South Coast Air Quality Management District (IV-D-147) **p. 1**

Response to Comment 4.3.1(D)(3):

The 2007 model year is the earliest date for the introduction of the new engine standards given the lead time and stability provision in the CAA. Since the justification for the fuel standards is to enable the introduction of new 2007 model year engines which meet the standards, there is insufficient justification to introduce the fuel any earlier.

(4) Commenters provided no further supporting information or detailed analysis.

Letters:

American Lung Association (IV-F- 192) **p. 8**
American Lung Association of Metropolitan Chicago (IV-F-13)
Bishop, Mark (IV-F-12)
CA Trucking Association (IV-F-190) **p. 38** (IV-F-192) **p. 34**
CO Environmental Coalition (IV-F- 191) **p. 237**
CO People's Environmental and Economic Network (IV-F-191) **p. 222**
Coalition for Clean Air (IV-F-190) **p. 177**
Communities for a Better Environment (IV-F-190) **p. 129**
Congresswoman Diana DeGette (IV-F-191) **p. 208**
DaimlerChrysler (IV-D-136) **p. 2**
Firestone, Ross (IV-F-4)
Hinds, William (IV-F-190) **p. 202**
International Truck & Engine Corp. (IV-F-180)
Kouba-Cavallo Associates (IV-F-1)
L.A. Dept of Water & Power (IV-F-190) **p. 79**
Mayor and citizens of Fort Collins, CO (IV-F-191) **p. 211**
Nadine Garcia (IV-F-183)
National Biodiesel Board (IV-F-191) **p. 249**
Sherman, Scott (IV-F-190) **p. 87**
South Coast Air Quality Management District (IV-F-185)
Stewart, Jim (IV-F-170)
Wilmington North Neighborhood Association (IV-F-190) **p. 265**

Response to Comment 4.3.1(D)(4):

Refer to Response to Comment 4.3.1(D)(1).

(5) A national fuel standard should be implemented by 2004. One commenter noted that this deadline would help States attain the NAAQS. Other commenters provided significant discussion on the necessity of providing low sulfur diesel by 2004 to allow manufacturers to comply with the Tier 2 standards for light duty diesel vehicles. These commenters note that qualifying light duty diesel vehicles under Tier 2 will depend in part, on a company's ability to produce sufficient vehicles in the lower bins allowing for acceptable fleet averages. One commenter added that the potential growth of light duty diesels could lead to a market share of 9 to 24 percent of the light duty fleet by 2015, which underscores the importance of ensuring the availability of low sulfur diesel for these vehicles in order to ensure compliance with Tier 2 standards. (See also Issue 9.)

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 9-10**
CA Trucking Association (IV-D-309) **p. 3**
Volkswagen (IV-D-272) **p. 1, +5-6**

Response to Comment 4.3.1(D)(5):

Refer to Response to Comment 4.3.1(D)(1).

(E) If the compliance deadline for clean diesel fuel is delayed beyond 2006, then EPA should delay the implementation of the proposed light duty and HD standards until the time at which low sulfur fuel is uniformly available throughout the country.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

DaimlerChrysler (IV-D-284) **p. 5**

Response to Comment 4.3.1(E):

Response to Comment 4.3.1(D)(2).

(F) Recommends a two-year delay in implementation that would require nationwide availability of ultra-low sulfur by mid-2008 to enable advanced-technology emissions control systems beginning with model year 2009.

(1) This delay in timing would free up the necessary engineering and construction resources to accomplish the gasoline-desulfurization projects in the Rockies, prior to the diesel desulfurization projects nationwide. Commenter provides further discussion and figures appended to its letter.

Letters:

Chevron (IV-D-247) **p. 4**

(2) A two year delay would provide adequate time for development of sulfur adsorber technology for diesel fuel. Moreover, innovative diesel fuel desulfurization technology and catalysts are currently being developed; and it is critical that the timeline of the rule allows for the implementation of the best processing technology and investment of capital in the most reasonable advanced technology. Phillips, for example, is actively investigating the potential for S Zorb adsorption technology to distillates to reduce the dependence of desulfurization technology on hydrogen. The rule requires refiners to have new desulfurization units operating by the fourth quarter of 2005, effectively forcing them to invest in conventional hydrotreating technology. New technology units could be built and be operational between 2006 and 2008, but not by 2005. The delay would allow advancement in aftertreatment technologies, and would avoid the need for a technology phase-in by allowing all vehicles to meet the NO_x standard in 2009.

Letters:

Phillips Petroleum Company (IV-D-250) **p. 4-6**

(3) Commenter states that with the supply concerns raised in the NPC report, at

least a two year extension is warranted, which would also allow time to work out the technical issues in desulfurizing diesel fuel to low levels.

Letters:

National Council of Farmer Cooperatives (IV-D-351) **p. 5-6**

(G) Recommends a delay until 2010 for the fuel standards because this timing would only slightly delay the clean air goals and would provide additional time to develop the NO_x and PM after-treatment technologies.

(1) Commenter provides no further supporting information or detailed analysis.

Letters:

Placid Refining Company, LLC (IV-D-230) **p. 5**

Response to 4.3.1(F)(1)-(3) and (G):

The start date of the diesel fuel program is driven by the engines and vehicles that need it to meet the emission standards which take effect beginning in 2007. The standards, in turn, are dictated by the air quality need for NOx and PM control especially. Any delay in the start of the program would result in the loss of tremendous air quality benefits of the program over time and the economic benefit to society that results from those air quality benefits. Based on our analysis of the vehicle/engine technology as discussed in section III of the preamble and chapter III of the RIA we are confident that the standards finalized today will be achievable beginning with the 2007 model year. Furthermore, we have analyzed the impact of this program on refiners across the country in the context of the gasoline sulfur control program and concluded that a June 1, 2006 start date at the refinery provides sufficient lead time, given the various compliance flexibilities that have been incorporated in to the final rule (see section IV of the preamble). Finally, we have analyzed the potential impact on supply of the program as discussed in the response to issue 8.1.1 and chapter IV of the RIA and concluded that the provisions of the final rule would adequately address any supply concerns. Therefore, we do not believe it would be appropriate to delay the start date of the program given the air quality need as well as the many compliance flexibilities that are already available to the regulated entities under today's program. While more time always allows the potential of better, cheaper technology to evolve, the rule already provides more than 5 years of lead time during which this can occur. Furthermore, more time has to be weighed against the environmental losses that would result. Given that the final rule is cost effective in its present form and provides far greater economic benefits through improved air quality than the cost of the program, a delay is not justified. We disagree the comment suggesting the loss in in-use emission benefits and delay in reaching air quality goals that would result from delaying fuel (and emission standards) to 2010 are acceptable and have substantial comment which also argues against the effects of such a delay; see discussion under Issue 2 of this response to comment.

(H) Agrees with EPA statement that the 2006 start date should not be applicable to every refinery and expects that farmer co-ops would be exempt from this start date.

(1) Commenter notes, however, that EPA appears to contradict itself in Section

VI. of the preamble, which indicates that the entire pool of on-road diesel will have to convert in 2006 -- this is inappropriate as farmer co-ops should be given more time and flexibility to comply.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 5-6, 10**

Response to 4.3.1(H):

Farmer cooperative refiners are not exempt from the low sulfur diesel fuel requirements. As discussed in Section IV of the preamble, we concluded that it is not necessary or appropriate to provide separate treatment for farmer cooperative refiners as a class. However, any farmer cooperative refiner that meets the two criteria of the small refiner definition will be considered eligible for the small refiner compliance options, one of which allows for the continued sale of 500 ppm sulfur diesel fuel through May 31, 2010. Any farmer coop covered under GPA provisions of the Tier 2 gasoline program is also eligible for the flexibility provided to GPA refiners under this rulemaking. In addition, farmer coops may choose the temporary compliance flexibility which is available to all refiners. This flexibility will allow refiners to delay full compliance until December 31, 2009. Finally, farmer coops are eligible to apply for hardship waivers. For a discussion regarding impacts on farmer cooperative refiners, please also refer to the responses to comments under Issue 8.1.1(B), in particular.

(I) EPA should postpone implementation of the rule until 2007 to coincide with Alaska's Tier 2 gasoline requirements.

(1) It's more cost efficient to build the desulfurization capacity simultaneously.

Letters:

Williams Energy Services (IV-D-167) **p. 4**, (IV-F- 191) **p. 240**

Response to 4.3.1(I):

See response to comments under Issue 6.6.2.

Unlike the rest of the nation, Alaska is currently exempt from the 500 ppm sulfur standard for highway diesel fuel and dye requirements. Since the beginning of the 500 ppm highway diesel fuel program, we have granted Alaska exemptions from meeting the sulfur standard and dye requirements, because of its unique geographical, meteorological, air quality, and economic factors. Because of these unique factors, we are establishing in today's action an alternative option for implementing the low sulfur fuel program in Alaska.

We are providing the State of Alaska an opportunity to develop an alternative low sulfur transition plan. We intend to facilitate the development of this plan by working in close cooperation with the state and key stakeholders. This plan must ensure that sufficient supplies of low sulfur diesel fuel are available in Alaska to meet the demand of any new 2007 and later model year diesel vehicles. Given that Alaska's demand for highway diesel fuel is very low and only a few new diesel vehicles are introduced in Alaska each year, it may be possible to develop an alternative implementation plan for Alaska in the early years of the program that provides low sulfur diesel only in sufficient quantities to meet the demand of the new diesel vehicles. This provision gives all Alaska refiners, including those that are small, more flexibility during the transition period because they will not have to desulfurize the entire highway diesel volume. Our goal in offering this additional flexibility is to transition Alaska into the low sulfur fuel program in a manner that minimizes costs, while still ensuring that the new vehicles receive the low sulfur fuel they need. We expect that the transition plan will begin to be implemented at the same time as the national program, but the state will have an opportunity to determine what volumes of low sulfur fuel must be supplied, and in what timeframes, in different areas of the state. Consequently, there is sufficient flexibility in our final rule to address the commenter's concern in Alaska without impacting the startup of the entire program. See also discussion under Issue 6.6.

(J) Opposes the 2006 deadline since it is unnecessary and inconsistent with the implementation deadline for HD engine and vehicle standards.

(1) An extremely small percentage of vehicles will require the new low sulfur diesel starting in 2006, given the NO_x phase-in for HD engines and expected fleet turnover rates. EPA should consider full and simultaneous implementation of the standards for both engines/vehicles and diesel fuel. Commenter notes that EPA may not have the authority to require refiners to provide low-sulfur diesel for manufacturers that may choose, but are not required, to produce vehicles that meet Tier 2 standards early.

<u>Letters:</u>

ExxonMobil (IV-D-228) **p. 20-21**
Western Governors' Association (IV-G-41) **p. 1**

<u>Response to 4.3.1(J):</u>

The start date of the fuel program is designed to be in harmony with the start of the vehicle and engine standards as discussed in 4.3.1(D)(1)(4) and (5) above. All new 2007 and later model year vehicles will require the use of low sulfur diesel fuel, since the PM standard is not being phased-in.

Issue 4.3.2: Transition Schedule

(A) The implementation date should be changed to October 1 at the refinery gate and January 1 at retail to coincide with the model year changeover of HDDE.

(1) Implementation timing should be consistent with vehicle introductions that occur in September; advancing the effective date for the heavy-duty low sulfur diesel is an inappropriate mechanism for encouraging the introduction of more light-duty diesel vehicles for fuel economy and policy reasons. In addition, the October 1 refinery deadline that precedes a retail deadline in January, will allow three months of lead time for tank turnover.

<u>Letters:</u>

American Petroleum Institute (IV-D-343) **p. 55**
Marathon Ashland Petroleum (IV-D-261) **p. 58**

(B) Recommends that refinery shipments begin no earlier than June 1, 2006; and that full retail compliance begin by September 1, 2006.

(1) Because each April the refining industry is taxed with the RVP/VOC phasedown, simultaneous phasing in of low sulfur diesel will overextend the industry's capabilities.

Letters:

British Petroleum (IV-D-242) **p. 4**

(C) To minimize supply disruptions, EPA should use a start date of May 1 with a transition schedule through August 1 (and the ability to obtain quick waivers in the early phase of the program).

(1) EPA often uses October or January as start dates, but should avoid those periods because of higher demand on distillate products at that time (heating oil). Then, EPA needs to provide a transition period to allow for adjustments in the distribution chain (May 1 at refinery gate, June 1 at terminals, and August 1 at retail). Then, EPA needs to provide streamlined waiver procedures (within a day), with a waiver fee schedule established. Rural versus urban distinctions should apply for obtaining waivers. This approach will ensure the ability to use non-compliant barrels in the early phase and maintain supply.

Letters:

Hart/IRI Fuels Information Services (IV-D-154) **p. 3-4**

(D) EPA should avoid requiring the distribution system to undergo any changeover to low sulfur diesel during April through June of any given year.

(1) Beginning in April of every year, the gasoline refining and distribution system is severely taxed with the phase-down of gasoline RVP to meet summertime RFG and/or conventional gasoline volatility requirements. The industry is faced with turnover of thousands of storage tanks at a multitude of terminals to assure adequate supply of compliant gasoline by May 1 at the terminals and the implementation of low sulfur fuel at this time would overextend industry's capabilities.

Letters:

American Petroleum Institute (IV-D-343) **p. 55**
Marathon Ashland Petroleum (IV-D-261) **p. 58**

Response to Comments 4.3.2(A)-(D):

As discussed in the preamble, we proposed a set of compliance dates slightly earlier than the dates contained in this final rule. Under the proposal, refiners, terminals and retailers would have had to begin producing low sulfur diesel fuel by April 1, 2006, May 1, 2006 and June 1, 2006, respectively. Several commenters pointed out that the April introduction date for refiners occurred at the same time refiners would be changing over from winter to summer gasoline to comply with Reid Vapor Pressure (RVP) requirements. They recommended that the introduction of low sulfur diesel fuel be delayed for a couple of months to provide refiners and the distribution system the opportunity to focus on the two conversions separately and ensure that each occurs as designed. Commenters also suggested that we extend the time period between the refinery and downstream deadlines to better allow for the time it may take the distribution system to make a complete transition to the 15 ppm sulfur level.

In response to these concerns, today's action provides a few additional months for introduction of the low sulfur diesel fuel compared to the proposal and provides an additional month between the refinery and retail compliance dates, to provide a smoother transition through the distribution system. We believe the additional time provides appropriate relief for the refiners, while still assuring that low sulfur diesel fuel will be available at the retail level no later than September 1, 2006. This schedule will allow manufacturers to introduce 2007 and later model year diesel engines and vehicles as early as September 1, 2006. While a slight delay from the dates of the proposal, the Agency does not believe this delay will place any undue burden on the engine manufacturers. Historically, new heavy-duty vehicle models were introduced on or around January 1 (of the same calendar year as the model year). Only recently, manufacturers have begun introducing some model lines as early as July or August, particularly light heavy-duty vehicles. Delaying the start date further to October 1 at the refinery and January 1, 2007 at the retail level, however, could cause a substantial delay in the introduction of new 2007 model year vehicles relative to today's practices. Therefore, to assure availability and to not discourage the early introduction of engines meeting the 2007 standards, we cannot adopt October 1, 2006 refinery gate and January 1, 2007 retail deadlines for availability of 15 ppm sulfur diesel fuel as recommended by the commenter.

Issue 4.4: Exemptions

(A) Four commenters expressed general opposition to having any areas that are exempt from the low sulfur fuel requirements.

Letters:

DaimlerChrysler (IV-D-284) **p. 6**
Engine Manufacturers Association (IV-D-251) **p. 22-23**
Detroit Diesel Corporation (IV-D-276) **p. 7-8**
National Park Service (IV-D-180) p. 3

Response to Comment 4.4(A)(1) and (2):

Our Response to Comments related to areas that are exempt or excluded from the low sulfur fuel requirements are discussed in Issues 6.6 Alaska and 6.7. U.S. Territories. While we have not adopted any geographic exemption, we have provided for some additional flexibilities for compliance in the GPA and Alaska. We do not believe these flexibilities will result in compromising the air quality of national parks.

Issue 4.5: Fuel Lubricity

(A) The fuel property changes resulting from desulfurization may have an adverse impact on fuel lubricity.

(1) Problems with fuel lubricity and elastomer compatibility occurred in Sweden

and California with the introduction of very low sulfur fuel. In these cases, there were significant reductions of fuel aromatic levels to 10% or less and it is suspected that difficulties with those new fuels were largely a result of the severe aromatic reductions. Commenter refers to their own guidance on producing superior quality diesel and recommended parameters for lubricity and elastomer compatibility (See "EMA Consensus Position: Joint EMA/TMC Pump Grade Specification for Premium Diesel Fuel," FQP1-B, Attachment C).

Letters:

Engine Manufacturers Association (IV-D-251) **p. 28-29**

(2) The exact nature of lubricity impacts associated with refining changes used to meet the 15 ppm limit are uncertain, but the experience of the agricultural community with the initial diesel fuel sulfur rule suggests the impacts may be severe.

Letters:

Murphy Oil Corporation (IV-D-274) **p. 13**

(3) The hydrotreating process needed to reduce sulfur to 15 ppm will produce dramatic reductions in fuel lubricity. One commenter specifically noted that EPA's proposed standard will stress the lubricity of diesel fuel many times more than that required for 500 ppm sulfur diesel fuel implemented in 1993. Lack of lubricity will cause premature equipment breakdown and in some cases, catastrophic failure.

Letters:

Department of Defense (IV-D-298) **p. 2**
Stanadyne Automotive Corporation (IV-D-342) **p. 1-2**

(4) The proposed rule would move the industry to virtually sulfur free fuel, which would remove some of the benefits from the presence of sulfur in diesel, such as lubricity and seal chemistry. Carriers cannot afford to risk operating on low sulfur fuel that may cause operational and maintenance problems for their trucks.

Letters:

American Trucking Association (IV-D-269) **p. 15**

Response to Comment 4.5(A)(1)-(4):

Experience has shown that it is very rare for a naturally high-sulfur fuel to have poor lubricity, although most studies show relatively poor overall correlation between sulfur content and lubricity. Considerable research remains to be performed for a better understanding of the fuel components most responsible for lubricity. Consequently, we are uncertain about the potential impacts of the 15 ppm sulfur standard on fuel lubricity. There is evidence that the typical process used to remove sulfur from diesel fuel -- hydrotreating -- can impact lubricity depending on the severity of the treatment process and characteristics of the crude.

Because refiners will likely rely on hydrotreating to achieve the proposed sulfur limit, there may be reductions in the concentration of those components of diesel fuel which contribute to adequate lubricity. As a result, we believe that the lubricity of some batches of fuel may be reduced compared to today's levels. We have assumed in our cost analysis that industry will add lubricity additives to diesel fuel to address any lubricity concern, much as they are doing today both in the U.S. and abroad.

As discussed in the comments presented in section 4.5(B) below, there are a number of options for addressing potential lubricity concerns. Performance enhancing additives such as might be needed here are often developed in cooperative efforts between engine manufacturers, fuel refiners, and additive manufacturers. The need to consider the use of additives to enhance lubricity is recognized now, more than five years before fuel meeting the requirements of today's rule will be required. Thus, there appears to be adequate lead time to assess potential impacts on the current vehicle fleet as well as new technology vehicles that are under development and to develop an industry-consensus lubricity standard if one is necessary.

(B) There are various strategies that can be used to mitigate the problem of poor lubricity.

(1) Lubricity concerns are easily mitigated through additization or by blending with higher lubricity components. One commenter (DoD) noted that use of JP-8 has helped address concerns associated with lubricity since it contains a corrosion inhibitor/lubricity enhancer additive that provides some lubricity protection.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 5**
Cummins, Inc. (IV-D-231) **p. 44**
Department of Defense (IV-D-298) **p. 2**
Engine Manufacturers Association (IV-D-251) **p. 29**

(2) EPA should consider the use of a low blend of biodiesel into the entire U.S. diesel pool to address concerns associated with lubricity. This approach would eliminate the inherent variability associated with the use of other additives and whether sufficient additive was used to make the fuel fully lubricious. Commenters noted that biodiesel significantly enhances engine lubricity, even at very low blends such as one-half to two percent. [See also comments on this issue below under Point (D)].

Letters:

Ag Environmental Products (IV-D-179) **p. 1**
Griffin Industries (IV-D-221) **p. 1-2**
MN Soybean Growers Association (IV-D-337) **p. 1**
ND Soybean Growers Association (IV-D-311) **p. 1**
NE Soybean Board (IV-D-195) **p. 4**
National Biodiesel Board (IV-D-288) **p. 2**, (IV-F-191) **p. 249**
OH Soybean Association (IV-D-277) **p. 1**
OH Soybean Council (IV-D-278) **p. 1**
Stanadyne Automotive Corporation (IV-D-342) **p. 3**

West Central (IV-G-40) **p. 1**
World Energy Alternatives (IV-D-336) **p. 1**

<u>Response to Comments 4.5(B)(1) and (2)</u>:

We agree that blending small amounts of lubricity-enhancing additives increases the lubricity of poor-lubricity fuels to acceptable levels. These additives are available in today's market, are effective, and are in widespread use around the world. For example, in the U.S., we understand that refiners are treating diesel fuel with lubricity additives on a batch to batch basis, when poor lubricity fuel is expected. Other examples include Sweden, Canada, and the U.S. military. Since 1991, the use of lubricity additives in Sweden's 10 ppm sulfur Class I fuel and 50 ppm sulfur Class II fuel has resulted in acceptable equipment durability. Since 1997, Canada has required that its 500 ppm sulfur diesel fuel not meeting a minimum lubricity be treated with lubricity additives. The U.S. military has found that the traditional corrosion inhibitor additives that it uses in its fuels have been effective in reducing fuel system component wear. Similarly, it appears that blending small amounts of biodiesel may also be effective in increasing the lubricity of poor- lubricity fuels to acceptable levels. While the commenter suggested EPA require the use of biodiesel in diesel fuel to address lubricity concerns, as discussed in the response to next comment, we have not elected to set a lubricity standard for this rule, and will leave it up to the industry to determine the best way of addressing diesel fuel lubricity. The use of lubricity additives is not expected harm the emissions control technology that we anticipate will be used to meet the vehicle emission requirements under today's rule.

(3) Lubricity is not an issue for low-sulfur diesel fuel when it is incorporated into the PuriNO$_x$ fuel emulsion. This additive compensates for lubricity deficiencies in the diesel fuel.

<u>Letters:</u>

Lubrizol Corporation (IV-G-49) **p. 6**

<u>Response to Comments 4.5(B)(3):</u>

We have decided to not establish a lubricity standard in today's action, but have included a 0.2 cents per gallon cost in our calculations for the economic impact to account for the potential increased use of lubricity additives. We believe the best approach is to allow the industry and the market to address the lubricity issue in the most economical manner, while avoiding an additional regulatory scheme. A voluntary approach should provide adequate customer protection from engine failures due to low lubricity, while providing the maximum flexibility for the industry. This approach will be a continuation of current industry practices for diesel fuel produced to meet the current Federal and California 500 ppm sulfur diesel fuel specifications, and benefits from the considerable experience gained since 1993. It will also include any new specifications and test procedures that we expect will be adopted by the American Society for Testing and Materials (ASTM) regarding lubricity of highway diesel fuel quality.

We do not believe that an EPA regulation for lubricity is appropriate at this time for several reasons. First, the expertise and mechanism for a lubricity standard already exist in the industry. According to the comments, the industry has been working on a lubricity specification for ASTM D-975, and low cost remedies for poor lubricity have already been proven and are already being used around the world. Although some commenters expressed concerns that the ASTM process might move too slowly to establish a lubricity specification by 2006, we fully expect the refining industry, engine manufacturers and end users to work together to resolve any issues as part of their normal process in dealing with customer and supplier fuel quality issues. Today's action will increase the urgency of those working to establish an ASTM D-975 lubricity specification, and we believe they will do so in time for the production and distribution of the low sulfur highway diesel fuel. PA will closely monitor this process and become involved to the degree necessary to help ensure a successful outcome.

In addition, we have no firm basis to justify a lubricity specification in today's action. One such basis might be adequate demonstration that a lubricity level below or above a certain specification would either cause emissions to increase, or hinder the operation of emission control equipment. However, we have no evidence that lubricity impacts emissions, or emission control equipment, except to the degree that a lubricity failure could lead to the emissions associated with engine failure. This issue is primarily a concern about vehicle driveability. Equipment performance is more appropriately addressed by the industry rather than government regulation by this Agency when emission issues are not present. This is consistent with past EPA practices.

One commenter suggested that using biodiesel as a fuel blending component would enhance lubricity and provide fuel value. Another commenter stated that lubricity is not an issue for low-sulfur diesel fuel when it is incorporated into the PuriNOx fuel emulsion because the additive compensates for lubricity deficiencies in the diesel fuel. While EPA staff do not necessarily agree or disagree with the technical merits of these assertions, we are not in a position as this point to specify or mandate a specific approach.

The Department of Defense (DOD) expressed lubricity concerns as well. While is true that DOD purchases their diesel fuel from commercial sources, and tends to prefer “off-the-shelf” purchases when consistent with their mission needs, the military frequently applies a “military-specification” top their purchases. In the case of diesel fuel, the military has adequate buying power to get the product needed and adequate technological resources to determine the lubricity needs of their vehicles.

(C) EPA should further examine issues related to the lubricity of low sulfur diesel fuels.

(1) EPA should fully explore issues of lubricity or fuel system seal failure because any in-use problems would adversely impact all parties involved.

Letters:

American Petroleum Institute (IV-D-343) **p. 53**
Marathon Ashland Petroleum (IV-D-261) **p. 56**
Milwaukee County Transit System (IV-D-97) **p. 1**

(2) Production of desulfurized diesel will require severe hydrotreatment of the distillate pool. In addition to removing the sulfur compounds, this process is known to remove diaromatic compounds that have been shown to impart lubricity. There are currently outstanding issues related to the selection of a proper methodology to characterize and define lubricity. Two methods (HFRR and SLBOCLE) are commonly used but are criticized for poor repeatability and their differing response to additives. ASTM is presently

developing an additional method (the Ball on Three Discs - BOTD) as well as modifications to the existing methods in an effort to propose a specification in D-975. However, progress on this method has been complicated by the attitude of some fuel suppliers that lubricity concerns should be addressed by improved engine design instead of fuel changes. Commenter notes that lubricity is a critical issue for engine manufacturers and fuel system suppliers, and recommends that EPA thoroughly review the issue of fuel lubricity and establish an enforceable lubricity requirement.

Letters:

Cummins, Inc. (IV-D-231) **p. 44**

(3) Additives will be required to replace the lubricity needed for proper engine functioning. Merely assuming that an additive will be found is unwarranted, as documented by the MTBE problem, and this issue should be studied and resolved now, before the rule is finalized.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 5, 8**

Response to Comments 4.5(C)(1)-(3):

Refer to Response to Comment 4.5(B)(3), above.

(D) EPA should establish an enforceable lubricity requirement since the proposed approach to treat diesel fuel lubricity on an as-needed and voluntary basis will not be effective at ensuring good diesel fuel lubricity.

(1) Experience has shown that treating fuel for lubricity on an as-needed basis has fallen far short of ensuring good diesel fuel lubricity and there have been numerous examples from the field where lack of lubricity in the fuel has caused premature equipment breakdown and in some cases, catastrophic failure. EPA's voluntary approach will lead to wide scale lubricity problems of an unacceptable level. Since the flawed introduction of low sulfur diesel fuel in 1993, which caused excessive lubricity and compatibility issues, the fuel injection industry has been working with diesel fuel suppliers and others to implement the proper lubricity testing protocols and precautions that will protect fuel injection equipment. ASTM subcommittee E on diesel fuel has agreed to put a cautionary appendix into ASTM D 975 related to lubricity. However, ASTM has not agreed on the addition of a lubricity limit to ASTM D 975. Therefore, until newer methods prove superior, the industry standard HFRR and SLBOCLE should be specified. EPA should force the adoption of the lubricity standard ISO 12156-2 (based on HFRR test method) for diesel fuel as part of this rule and should add a provision that incorporates any applicable lubricity standards in the future as they are agreed upon and incorporated into ASTM D 975.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 5**

Cummins, Inc. (IV-D-231) **p. 44**
Engine Manufacturers Association (IV-D-251) **p. 29**
Stanadyne Automotive Corporation (IV-D-342) **p. 1-3**

(2) In addition to incorporating an enforceable diesel fuel lubricity standard, EPA should encourage the use of a low blend of biodiesel into the entire U.S. diesel pool. Biodiesel is a clean burning, zero sulfur diesel fuel made from domestically produced renewable fats and oils, and appears to fit in well with the goals and objectives of this proposed rule. Commenter notes that they (Stanadyne) in cooperation with the National Biodiesel Board, have tested biodiesel and results indicate that the inclusion of 2 percent biodiesel into any conventional diesel fuel will be sufficient to address the lubricity concerns associated with existing diesel fuels. Blending biodiesel would eliminate the inherent variability associated with the use of other additives and whether sufficient additive was used to make the fuel fully lubricious. Commenter notes that biodiesel is not an additive but rather a fuel component since it is possible to burn pure biodiesel in conventional diesel engines.

Letters:

Stanadyne Automotive Corporation (IV-D-342) **p. 3**

(3) The issue of lubricity is particularly sensitive with regard to military fuels. Absent a required standard for fuel lubricity, suppliers will not abide by voluntary standards, and military users will face the added burden of ensuring that the highway diesel fuel used in military vehicles provides sufficient lubricity. DoD relies on the commercial market to supply highway diesel to military customers and the proposed further reduction in diesel sulfur would increase the risk and scope of lubricity problems. Due to harsher operating conditions, engines used in DoD vehicles are more vulnerable to lubricity problems than the same engines operated in commercial vehicles. EPA should ensure the development of lubricity standards and should impose a deadline for industry-wide implementation in the final rule.

Letters:

Department of Defense (IV-D-298) **p. 1-2**

Response to Comments 4.5(D)(1)-(3):

Refer to Response to Comment 4.5(B)(3), above.

(E) EPA does not need to establish an enforceable lubricity requirement since the proposed approach to treat diesel fuel lubricity on an as-needed and voluntary basis will be effective at ensuring good diesel fuel lubricity.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

American Petroleum Institute (IV-D-343) **p. 53**
Marathon Ashland Petroleum (IV-D-261) **p. 56**

(2) If biodiesel is used as a mitigating strategy to address lubricity concerns, there would be no need to determine whether to adopt a voluntary or minimum lubricity standard.

Letters:

Ag Environmental Products (IV-D-179) **p. 1**
Griffin Industries (IV-D-221) **p. 1**
MN Soybean Growers Association (IV-D-337) **p. 1**
ND Soybean Growers Association (IV-D-311) **p. 1**
NE Soybean Board (IV-D-195) **p. 4**
National Biodiesel Board (IV-D-288) **p. 2**
OH Soybean Association (IV-D-277) **p. 1**
OH Soybean Council (IV-D-278) **p. 1**
West Central (IV-G-40) **p. 1**
World Energy Alternatives (IV-D-336) **p. 1**

(3) Commenter notes that when the 500 ppm standards was imposed in 1993, some problems with lubricity arose that were quickly addressed by the industry. Currently the industry, without any regulatory requirements, ensures that its products meet lubricity standards and no problems have arisen since the early days of the initial sulfur program. EPA should adopt a market approach since industry would ensure that diesel fuel has adequate lubricity, particularly diesel fuel supplied to the military.

Letters:

Independent Fuel Terminal Operators Association (IV-D-217), **p. 11-12**

Response to Comments 4.5(E)(1)-(3):

Refer to Response to Comment 4.5(B)(3), above.

Issue 4.6: Other Diesel Fuel Issues

(A) EPA should also impose standards for other fuel parameters, as described in the World-Wide Fuel Charter, such as cetane, aromatics and distillation.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Alliance of Automobile Manufacturers (IV-F-9, 59,190) **p. 114** (IV-F-117) **p. 168** (IV-F-191) **p. 89**
Association of International Automobile Manufacturers (IV-D-259) **p. 1**
CT DEP (IV-D-142) **p. 1**
DaimlerChrysler (IV-F-15, 116) **p. 292** (IV-F-117) **p. 96**,191) **p. 173**
Engine Manufacturers Association (IV-D-166) **p. 1**
Oregon DEQ (IV-D-145) **p. 1**

Response to Comments 4.6(A)(1):

Based on data available at this time, we have concluded that sulfur is the only diesel fuel property that needs to be controlled to enable heavy-duty diesel engines to meet the standards we are finalizing in today's action. The efficiency of the aftertreatment devices that we expect to be used by manufacturers to meet the new standards is directly impacted by the sulfur content of the fuel, but has essentially no correlation with other fuel properties. However, we will continue to evaluate whether other fuel properties or fuel additives need to be controlled to protect emission control systems in general or provide adequate protection of public health.

(2) Higher cetane diesel fuel has better ignition qualities and is more desirable for engine calibration. Additional emission benefits could be realized if future diesel engines could be calibrated for a higher cetane fuel. Even though some earlier studies indicated that higher cetane fuel could increase NO_x emissions in existing engines, this has not been the result in studies conducted by VW or in the European EPEFE study. Higher cetane levels significantly reduces NO_x, HC, and CO emissions. EPEFE studies have shown a 9 percent reduction in NO_x and up to a 40 percent reduction in HC emissions when cetane is increased from 50 to 58. Higher cetane reduces starting crank time, cold start white smoke and engine combustion noise; and improves cold starting and fuel consumption. Some commenters specifically recommended that EPA establish a minimum cetane of 55 for diesel fuel.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 5-6**
DaimlerChrysler (IV-F-167)
Engine Manufacturers Association (IV-D-251) **p. 28**
Volkswagen (IV-D-272) **p. 2**

Response to Comment 4.6(A)(2):

It is true that diesel fuels with higher cetane numbers have better ignition qualities than fuels with lower cetane numbers, and that higher cetane may thus lead to more efficient combustion in some compression ignition engines. As a result cetane controls could lead to small changes in NOx emissions. The magnitude of any potential NOx reductions from cetane control has not been clearly established, so that we cannot ascertain whether cetane controls might be cost-effective. The Agency is in the process of conducting a thorough analysis of the effects of diesel fuel parameter changes on emissions which will be completed in 2001. In the meantime, cetane number does not appear to affect the efficiency of the aftertreatment that we expect manufacturers to use to meet our new standards nor does compliance with our standard anticipate the need for cetane improvement. As a result, we do not believe it is necessary to establish a higher cetane number standard in concert with our new engine standards.

Some studies do suggest that higher cetane numbers will produce reductions in emissions from existing U.S. engines under the Federal Test Procedure. However, at least one study conducted jointly by EPA and the engine and oil industries concluded that increasing the cetane number actually increases NOx emissions for engines equipped with exhaust gas recirculation (EGR).[79] Since most diesel engines in the future will be equipped

[79] "Gaseous Emissions From A Caterpillar 3176 (with EGR) Using A Matrix of Diesel Fuels (Phase 2)," September 1999, report from Southwest Research Institute under EPA Contract Number 68-C-98-169.

with EGR, this study casts grave doubt on the potential benefit of cetane changes. In a past action, EPA evaluated other potential diesel fuel changes and concluded that they are either ineffective or too costly for the improvement in emissions performance delivered.

(3) In addition to setting limits for fuel cetane and aromatics, EPA should also ensure that distillation characteristics, H/C ratio and density are improved. All of these parameters should be comparable to the fuels currently distributed in Europe. One commenter noted that holding fuel density within a narrow tolerance can allow engine calibrators to optimize the combustion process, which leads to lower emissions and improved fuel consumption. The commenter added that a reduction in the heavy end of the distillation curve will help reduce particulate emissions. Another commenter specifically noted that EPA should adopt the category 4 diesel fuel category of the World Wide Fuel Charter for this rulemaking but with a 5 ppm sulfur cap.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 4-8**
DaimlerChrysler (IV-D-344) **p. 4-5**
Volkswagen (IV-D-272) **p. 2**

Response to Comment 4.6(A)(3):

There is some data suggesting that control of diesel fuel properties such as aromatics, distillation characteristics, H/C ratio, and/or density could lead to some emission reductions. However, these types of controls are neither necessary to enable diesel engines to meet the new engine certification standards we are finalizing today, nor are the associated emission reductions likely to be substantial. In our Notice of Proposed Rulemaking we proposed that diesel fuel properties other than sulfur not be controlled in this rulemaking for these reasons, and we have not seen any comments or new data to suggest that our focus on sulfur inappropriately excluded other means of generating substantial cost-effective emission reductions.

We also do not believe that harmonizing U.S. diesel fuel standards with those in Europe makes sense at this time. European refineries differ from those in the U.S. because diesel comprises a significantly higher fraction of transportation fuels in Europe. In addition, manufacturers currently meet different engine certification standards in different countries, based on different test cycles. Any consideration of harmonizing diesel fuel standards with Europe or any other country should be dealt with in a more encompassing discussion of mobile source pollution which would fall outside the scope of this rulemaking.

(4) The process of removing sulfur in diesel will result in small but significant quality improvements in other fuel properties, such as increased cetane number and index, reduced aromatics and polyaromatics, and a lower gravity fuel. These improvements are well documented in the EMA MathPro study. EPA should maintain those average improvements by incorporating them into the certification fuel and in-use fuel specifications proposed in 86.113-07 and 86.1313-07. Specifically, EPA should establish the following fuel specifications: certification and verification test fuel should have a cetane number and index at 42-52 and minimum aromatic content of 23%; commercial fuel should have a cetane number and index at 42 and a maximum aromatic content of 31%; both testing and commercial fuels should

have API gravity range at 33.5-38.5. (cites to MathPro study, Exhibit 7).

Letters:

Engine Manufacturers Association (IV-D-251) **p. 28**

Response to Comment 4.6(A)(4):

Small improvements in diesel properties occurring incidentally as a result of desulfurization will easily fall within the range of variability exhibited by current in-use highway diesel fuel. In fact these improvements, if they occur, may be too small to be measured accurately. According to the National Petroleum Council's report on petroleum refining[80], desulfurization of highway diesel to very low levels would result in an increase in cetane index of at most one number, and two vendors actually predicted no change in cetane number.

The diesel fuel property ranges given in 40 CFR Part 86 for certification testing are intended only to reasonably bound the range of possible values that the engine may experience in-use. Even after the sulfur level of highway diesel fuel is lowered to below 15 ppm, we believe that the existing certification fuel property ranges will remain representative of the range of possible in-use values. Therefore we have determined that it is not necessary to change the values for fuel properties other than sulfur in certification fuel at this time. See also response to comment 7.1(B).

(5) EPA should reduce both total aromatics and polyaromatics. Lower aromatic diesel fuel reduces NO_x, particulate emissions and PAH emissions. European test programs demonstrate 6% reductions in NO_x and particulate emissions when these properties are reduced. Commenters recommended that EPA establish a maximum 15% aromatic limit and a maximum polyaromatics content of 2%.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 6**
Engine Manufacturers Association (IV-D-251) **p. 28**
Volkswagen (IV-D-272) **p. 2**

Response to Comment 4.6(A)(5):

We have determined that changes in the aromatic content of highway diesel fuel are not necessary to enable the efficient operation of the aftertreatment we expect will be used to meet the new engine standards we are finalizing today. Therefore we are not finalizing new controls on the aromatic content of highway diesel fuel in today's action. It is possible, however, that additional controls on aromatics could lead to reductions in the emissions of various pollutants, some of which are toxic substances such as benzene. During a rulemaking completed in 1990, EPA concluded that aromatics control was not cost effective. Nonetheless, we will continue to evaluate the potential for significant emission reductions in addition to the cost of controlling aromatics in our ongoing efforts to reduce pollution from mobile sources.

---

[80] "U.S. Petroleum Refining," June 2000, National Petroleum Council report for the U.S. Secretary of Energy

(B) Sulfur content of fuel is the only fuel property that should be regulated.

(1) Agrees with EPA that it is appropriate to only address sulfur level in on-road diesel at this time because other fuel properties such as cetane, aromatics, polyaromatics, distillation and end point have relatively minor effects on emissions compared to sulfur level. Cites EPA's Heavy Duty Engine Work Group Program which demonstrated cetane and aromatics differences result in only minor differences in NO_x emissions. One commenter also notes in regard to the light duty market that sulfur is the only fuel property that should be regulated: changes to diesel fuel other than sulfur requested by light duty diesel manufacturers for a market that does not exist based on emission controls not yet developed for light duty engines is entirely inappropriate. Koch Petroleum adds that its Performance Gold and Soy Diesel achieve environmental benefits comparable to low-aromatics diesel, while lowering out of pocket operating costs. Since market based solutions achieve the same benefits, regulation of parameters such as aromatics is unnecessary. Koch further cites to the preamble and an SAE paper that emission control devices are responsible for reducing emissions, and "all other fuel properties" have only minor effects on emissions. The cost of producing a low aromatic, high cetane diesel would be over twice that of producing 30 ppm diesel. Adding detergents is a more cost effective way to achieve reductions from the existing fleet.

Letters:

American Petroleum Institute (IV-D-343) **p. 52-53**
British Petroleum (IV-D-242) **p. 4**
ExxonMobil (IV-D-228) **p. 19**
Koch Industries (IV-D-307) **p. 2, 3**
Marathon Ashland Petroleum (IV-D-261) **p. 55**
National Petrochemical & Refiners Association (IV-D-218) **p. 17**
Phillips Petroleum Company (IV-D-250) **p. 2**

Response to Comment 4.6(B)(1):

We agree that it is appropriate to set only new sulfur standards for highway diesel fuel in this rulemaking. Sulfur is the only diesel fuel property which appears to have a significant effect on the efficiency of heavy-duty diesel aftertreatment devices. However, we will continue to evaluate the potential environmental benefits and associated costs of changes to other diesel fuel properties.

(2) Commenter notes that mandates for increased cetane number or index would be difficult for the refiner to meet. Provides detailed discussion of the reasons for naturally low cetane number from San Joaquin Valley crudes, and the limits of improving cetane numbers by using cetane enhancers. Also argues that increases in cetane number/index would unfairly penalize San Joaquin Valley crudes because it would require significantly more processing than other crudes; San Joaquin crudes comprise approximately 13 percent of domestic supply.

Letters:

Golden Bear Oil Specialists (IV-D-111) **p. 2-4**

Response to Comment 4.6(B)(2):

We are not setting new cetane number or index standards in today's action. Any future actions which seek to change the existing standards for cetane or any other diesel fuel property will be subject to a thorough evaluation of the impacts on refiners in a public process.

(C) EPA should advocate the use of synthetic diesel since blending this type of diesel into current and future stocks will help refiners achieve the 15 ppm standard and will also have significant environmental and energy security benefits.

(1) Synthetic diesels have been developed and tested by Syntroleum and others, and meet or exceed properties specified by ASTM D975. This fuel is similar to diesel but has superior combustion emission characteristics (i.e. lower NO_x, PM and toxics emissions than even the cleanest fuels currently on the market), has no detectable sulfur, aromatics, olefins or metals, has a 74-plus cetane number, and exceeds specifications for the highest quality diesel fuel described in the April 2000 World Fuel Charter. The environmental benefits can be realized immediately since synthetic diesel can be used in existing conventional diesel engines. Laboratory engine tests conducted by Southwest Research Institute have demonstrated the Syntroleum diesel fuel significantly reduces vehicle exhaust emissions as compared to conventional diesel as well as CARB diesel and Swedish City diesel. The absence of sulfur in this type of fuel enables vehicles operating on synthetic diesel to use advanced sulfur-sensitive emission control technologies.

Letters:

Hart/IRI Fuels Information Services (IV-F-190) **p. 254**
Syntroleum (IV-D-260) **p. 1-3**, (IV-F-73, 163)

(2) Synthetic diesel also has a very low solubility in water, has significantly lower toxicity than conventional diesel, and is more biodegradable.

Letters:

Syntroleum (IV-F-73, 163)

(3) Synthetic diesel will provide substantial energy security benefits since the gas-to-liquids conversion technology can be used by the entire energy industry for the production of synthetic fuels. Feedstock to the Syntroleum Process can vary widely from pipeline quality natural gas to methane rich gas, which are abundant worldwide.

Letters:

Hart/IRI Fuels Information Services (IV-F-190) **p. 254**
Syntroleum (IV-F-73)

(4) A study by Oak Ridge National Laboratory (ORNL/TM-1999/258) identified substantial energy security benefits that would be realized with the increased use of synthetic diesel since it would reduce our reliance on imported oil as a transportation energy source and since it can be produced domestically. The use of this type of fuel would also increase competition, thus reducing fuel prices overall.

<u>Letters:</u>

Syntroleum (IV-F-73)

(5) Since our reliance on diesel engines is growing, the use of synthetic fuel will provide the refining industry with greater flexibility to meet increased demand.

<u>Letters:</u>

Syntroleum (IV-F-73)

(6) The reduction of sulfur levels can be achieved with a combination of desulfurization technology and the blending of synthetic diesel fuels. This could be a less costly and less energy intensive solution for reaching the 15 ppm standard.

<u>Letters:</u>

Syntroleum (IV-F-73, 163)

(7) The use of synthetic diesel fuel is a technology-neutral fuel that has the potential to change the fuel industry since it enables emissions reductions in existing diesel engines and could accelerate the commercialization of the fuel cell.

<u>Letters:</u>

Syntroleum (IV-F-73)

(8) Another commenter generally expressed support for the use of this type of fuel and noted that EPA should support DOE if they choose to approve a petition that would add synthetic diesel to the list of alternative fuels as defined by the Energy Policy Act.

<u>Letters:</u>

Hart/IRI Fuels Information Services (IV-F-117) **p. 206**

(9) Commenter cites to the July 17, 2000 issue of Hart's Diesel Fuels News (vol. 4, no. 13). This issue includes data that supports the contention that the environmental benefits associated with ultra low sulfur diesel (including synthetic diesel) can be superior to the benefits achieved through the use of alternative fuels. This conclusion is supported by a recent study conducted by the Swedish consultant Ecotraffic, which compared exhaust gases from transit buses using ultra low sulfur diesel to transit buses using alternative fuels, including compressed natural gas (CNG). This study showed that ultra

low sulfur fuels, when combined with exhaust after-treatment can achieve ultra low particulate and toxic emissions levels. In addition, the conclusion is supported by test data showing that PM trap-equipped diesel engines produce similar or even low PM mass emissions than CNG engines, and a new Swedish study finds clean diesel less of a cancer threat than CNG. Commenter concludes that ultra clean diesel, including synthetic diesel, should be a major part of the solution to reduce mobile source emissions.

Letters:

Syntroleum (IV-D-260) **p. 3**

(10) The GTL process technology has the potential to convert vast unutilized natural gas reserves into high value products such as ultra-clean diesel or synthetic diesel. Given a natural gas to synthetic oil conversion ratio of 10 to 1, the vast amounts of stranded gas (i.e. no local market) could be converted to 250 billion barrels of synfuels which is almost equivalent to all the estimated oil reserves of Saudi Arabia. Both Exxon and Shell have considered plants in the 50 to 100 thousand barrels per day range, which according to an independent report (commissioned by Syntroleum) would be extremely profitable since unlocking enough gas to make 100,000 barrels of Fischer Tropsch Products (Synthetic Diesel Fuels) could increase price and earnings per share by 26 percent. The fundamental economics driving GTL are feedstock driven and synthetic diesel fuel can be less expensive to make than conventional diesel on a "greenfield basis." Commenter provides additional discussion and analysis (including cited documentation that includes reference testing of Fischer-Tropsch Synthetic Diesel Fuels) to support their position on this issue.

Letters:

Syntroleum (IV-D-260) **p. 3-6**

Response to Comment 4.6(C):

EPA staff acknowledges the comments on synthetic diesel fuels. EPA does not normally promote one fuel blend or compliance approach over another, but instead relies upon the market place for such decisions. Synthetic diesel fuel can be used as part of the total diesel pool provided that it meets EPA regulatory requirements.

(D) Supports the use of biodiesel.

(1) But, cautioned EPA against the simple blending of nonsulfur biodiesel with conventional diesel fuel.

Letters:

National Biodiesel Board (IV-F-191) **p. 249**

(2) With biodiesel's healthy emissions attributes, ultra low sulfate levels, and lubricity characteristics, it can play a role in helping meet the standards set out by the proposed rule. EPA should allow fuel manufacturers, refiners, or

retailers to simply blend no-sulfur biodiesel with conventional diesel fuel to reduce sulfur content or to gain other emissions or economic benefits. Biodiesel is available today and there is no need to wait until 2006 to use an ultra low sulfur fuel for diesel engines. Biodiesel has been proven effective in over 30 million miles of on-road use, has been given a clean bill of health by Health Effects testing of the EPA, and needs no capital investment or separate distribution systems. One commenter cited to the NBB's Tier I Section 211(b) submission to EPA, which shows the significant emission reduction benefits that result from the use of biodiesel.

Letters:

Ag Environmental Products (IV-D-179) **p. 1-2**
Griffin Industries (IV-D-221) **p. 1-2**
MN Soybean Growers Association (IV-D-337) **p. 1**
ND Soybean Growers Association (IV-D-311) **p. 1-2**
NE Soybean Board (IV-D-195) **p. 1-4**
National Biodiesel Board (IV-D-288) **p. 1-2**
OH Soybean Association (IV-D-277) **p. 1**
OH Soybean Council (IV-D-278) **p. 1-2**
West Central (IV-G-40) **p. 1**
World Energy Alternatives (IV-D-336) **p. 1**

(3) Use of biodiesel would advance the federal government's goals to displace petroleum and increase the use of biomass fuels as described in Executive Orders 13101, 13134, and 13149.

Letters:

Ag Environmental Products (IV-D-179) **p. 1**
Griffin Industries (IV-D-221) **p. 1**
MN Soybean Growers Association (IV-D-337) **p. 1**
ND Soybean Growers Association (IV-D-311) **p. 1**
NE Soybean Board (IV-D-195) **p. 1-4**
National Biodiesel Board (IV-D-288) **p. 1-3**
OH Soybean Association (IV-D-277) **p. 1**
OH Soybean Council (IV-D-278) **p. 1**
West Central (IV-G-40) **p. 1**

Response to Comment 4.6(D):

Biodiesel appears to have the potential to be used as a diesel fuel blending component which also reduces emissions. Nonetheless, EPA does not normally promote one fuel blend or compliance approach over another, but instead relies upon the market place for such decisions. Biodiesel can be used as part of the total diesel pool provided that it meets EPA regulatory requirements.

(E) EPA should harmonize fuel standards with Canada and Mexico.

(1) There is a large volume of heavy-duty truck traffic across the borders between the U.S. and Mexico and the U.S. and Canada. The lack of harmonized, ultra low sulfur fuel will cause severe operational problems and damage to

emission control systems from operation with higher sulfur fuels in Canada and Mexico. One commenter noted that if fuel standards are not harmonized, EPA should reconsider the implementation date of the 2007 rule.

Letters:

Cummins, Inc. (IV-D-231) **p. 46**
Detroit Diesel Corporation (IV-D-276) **p. 7**
Engine Manufacturers Association (IV-D-251) **p. 30**

(2) U.S. fleets will be at a significant competitive disadvantage versus their Canadian and Mexican competitors if fuel standards are not harmonized. In addition, multinational fleets will be motivated due to cost considerations to purchase and register these new vehicles in Canada. EPA has failed to address these issues.

Letters:

Cummins, Inc. (IV-D-231) **p. 46**

Response to Comment 4.6(E)(1) and (2):

EPA staff is concerned about the potential for poisoning aftertreatment systems on vehicles crossing international borders and being refueled with high sulfur diesel fuel Such disparities in diesel fuel quality exist now, but with generally lesser impact. Truck operators will need to take extra precautions regarding refueling points, and it is clearly in the long term best interest of the environment to work for North American in-use fuel quality harmonization.

(F) EPA should preempt state, regional, or local standards or regulations on diesel fuel.

Some commenters expressed concern that state or local diesel fuel controls may cause disruptions in supply and/or prices. One commenter specifically mentioned a proposed low sulfur diesel fuel requirement by a local air quality management district in California as an example of such potential disruption in supply and prices. One commenter specifically mentioned the Texas Low Emission Diesel rule as an example of a state diesel fuel regulation in a SIP provision that should be disapproved. One commenter urged EPA to advise states of the express preemption of state diesel fuel controls under CAA section 211(c)(4)(A) as including state controls of sulfur, cetane index and number, aromatics, distillation, and gravity for highway diesel fuel, and to advise them that states are preempted from regulating any properties for both highway and nonroad diesel fuel because such controls would conflict with the federal programs, needlessly increase costs for the oil industry, and potentially create serious supply situations. This commenter also urged EPA to actively discourage states from adopting diesel fuel programs in order to protect the nationwide benefits EPA seeks from this federal program from the interference and disruptions that state diesel fuel initiatives are sure to create. Another commenter recommended that EPA add a new section with specific regulatory language to address this issue as follows: 86.1854-01 Preemption of Non-Federal Standards for Diesel Fuel: No State, or territory, commonwealth or possession, or political subdivision thereof, shall issue or enforce a standard or regulation for purposes of motor vehicle emissions control regarding the content of diesel fuel or its use in motor vehicles or motor vehicle engines after ***(insert***

date of final rule).

Letters:

American Petroleum Institute (IV-D-343) **p. 82-85**
American Trucking Association (IV-D-269) **p. 3**
CA Trucking Association (IV-D-309) **p. 4-6, 8-9**
Koch Industries (IV-D-307) **p. 10**
Phillips Petroleum Company (IV-D-250) **p. 2**
Swift Transportation Company (IV-D-263) **p. 1**

Response to Comment 4.6(F):

As stated in the preamble, CAA section 211(c)(4)(A) prohibits states (and political subdivisions of states, which shall be included in the term "states" for this response) from establishing controls or prohibitions respecting motor vehicle fuel characteristics or components for the purposes of motor vehicle emission control if EPA has established a control of the fuel characteristic or component. This preemption applies to all states except California, in accordance with CAA section 211(c)(4)(B).

EPA also states in the preamble that the highway diesel fuel sulfur levels established in today's rulemaking modify EPA's existing standards and, as a result, do not initiate any new preemption of state authority. Since today's rulemaking does not extend to any characteristic or component of highway diesel fuel except sulfur content, it is not relevant to this rulemaking to address preemption under section 211(c)(4)(A) of other characteristics or components of highway diesel fuel such as cetane index and number, as one commenter suggests. EPA has stated, however, that because of EPA's controls of highway diesel fuel in 80 CFR 80.29, states are preempted under section 211(c)(4)(A) from establishing highway diesel fuel controls respecting sulfur content, cetane index, aromatics content, and the use of certain visible dyes.

As a result of this explicit preemption of sulfur content of highway diesel fuel, states other than California with highway diesel fuel sulfur control programs not already approved into their SIPs will need to obtain a waiver from EPA under section 211(c)(4)(C), unless the state standard is identical to EPA's sulfur standard. EPA implements this provision within the guidance it set forth on August 25, 1997, as cited by this commenter, and requires that the state justify its state fuel control program as necessary to achieve a NAAQS even if the state implemented all other reasonable and practicable non-fuel control measures.

EPA recognizes the concerns associated with the potential disruption caused by numerous state (or "boutique") fuels. In most situations, EPA believes that a uniform national program is the best way to protect public health and minimize disruption to the country’s efficient fuel distribution network. As the number of state fuels increases, the fuel distribution network becomes less efficient. Therefore, EPA's general expectation is that states will limit state fuel programs that differ from federal standards to situations where local or unique circumstances warrant control.

This is consistent with EPA's role in implementing the CAA preemption provisions described above. This approach is reflected in EPA's August 25, 1997, guidance, which EPA follows in reviewing any request from a state for a waiver of preemption, such as the current request from Texas for its low emission diesel fuel rule. As noted above, however, California is not subject to the same CAA preemption provisions, so California is not required to obtain a waiver of preemption for the low sulfur diesel fuel requirement proposed by the air quality management district in California mentioned by one commenter.

One commenter recommended that EPA advise states that they are implicitly preempted from controlling all diesel fuel properties, for both highway and non-road diesel fuel, under the Supremacy Clause of the U.S. Constitution. EPA explained in the preamble the possibility that a court could consider whether a state sulfur control is implicitly preempted under this clause. EPA has thus given states notice of the possibility, but EPA believes it is premature to predict that a court would in fact make such a determination with respect to any particular case.

Another commenter recommended specific regulatory language that would preempt all state regulation of highway diesel fuel after the date of this final rule. EPA rejects this recommendation because it would establish a broader preemption of state fuel controls than the CAA authorizes. As described above, state controls on highway fuel are preempted under section 211(c)(4)(A) to the extent EPA has already controlled the component or characteristic, but states are allowed the opportunity to justify an exception to (or "waiver" of) preemption under section 211(c)(4)(C).

(G) Commenter proposes EPA adopt seasonal specifications, requiring low sulfur fuel through the cold months, and higher sulfur fuel in warmer months.

(1) Such a change would permit refiners to operate another 3-6 months without a catalyst change, and would reduce production costs by .1 to .3 cpg with no significant environmental penalty.

Letters:

Koch Industries (IV-D-307) **p. 9-10**

Response to Comment 4.6(G):

While the commenter did not define “lower” and “higher”, the idea is not workable. The level of diesel fuel sulfur needs to be consistent year round to ensure the proper functioning of the emissions control equipment we anticipate will be used to meet the emission standards in today’s rule.

(H) Before proceeding with the proposal, EPA should study the effect of low sulfur diesel (15 or 50 ppm) on agricultural and other nonroad equipment.

(1) Agricultural nonroad equipment currently operate and likely will continue to operate using onroad diesel fuel. There are significant operating differences in this equipment that should be studied before the proposal is finalized. This would be similar to the study conducted jointly by EPA and USDA in the mid-80s during conversion to unleaded fuel. (See also Issue 11.)

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 5**

Response to Comment 4.6(H):

While there is some highway diesel fuel used in nonroad applications, the majority of nonroad equipment uses nonroad fuel. Another portion of nonroad equipment likely is fueled on occasion with highway fuel. We are unaware of any problems which might occur due to the occasional use of low sulfur highway fuel. For tha small portion of the nonroad fleet which might routinely be fueled with highway fuel, we are also unaware of any significant problems which will necessarily result byt the operator will need to assure that its choice to use highway fuel rather than nonroad fuel will not cause operating problems. We note that nothing in this rule encourages the use of 15 ppm sulfur highway diesel fuel in nonroad applications.

(I) EPA should encourage the implementation of non-monetary incentives such as NSR offsets and other emissions credits in order to facilitate the introduction of 15 ppm fuel.

(1) Commenter provides no further supporting documentation.

Letters:

National Automobile Dealers Association (IV-D-280) **p. 3**

Response to Comment 4.6(I):

As in the Tier 2 gasoline sulfur rule, EPA is now working on guidance for the states to implement policy on emissions effects. Once implemented, this policy will also be applied to today's diesel fuel rule.

(J) Before proceeding with the proposal, EPA should study the effect of low sulfur diesel on transit buses.

(1) The operating cycle of a transit bus differs significantly from that of a diesel truck and therefore, it cannot be assumed that the impact of low-sulfur diesel on transit buses are the same as the impact to trucks. EPA should more fully consider the following issues: whether low-sulfur diesel will have an adverse impact on the fuel economy for transit buses, whether diesel engines (old or new) using low-sulfur fuel would require a special engine oil and different oil change intervals, and whether the use of low-sulfur fuel would increase the life cycle cost of operating a transit bus. EPA should also clarify the impact that low-sulfur diesel will have on the engine (e.g. engine-related subsystems, exhaust, turbo charger, and auxiliary heaters).

Letters:

American Public Transportation Association (IV-D-275) **p. 3-4**
Milwaukee County Transit System (IV-D-97) **p. 1**

Response to Comment 4.6(J):

As part of the process used for establishing a transient data cycle for heavy-duty engines, EPA studied differences between truck and bus operation. The conclusion reached was that their urban operating characteristics were similar. There is no data to suggest that this has changed. There is no reason to expect that the use of low sulfru diesel will reduce feul economy and the removal of the contaminant sulfur should at least directionally extend maintenance intervals and component life. However, as was discussed in 4.6(A), the fuel needs to have proper lubricity additives.

(K) EPA should consider the use of new cleaner burning diesel fuels that have recently been developed.

(1) Clean Diesel Technologies, Inc. has developed a formulation that incorporates its Platinum Plus bimetallic fuel borne catalyst (FBC) and is capable of reducing PM by 33 percent and NO_x emissions by 10 percent as compared to a commercial No. 2 diesel fuel. This cleaner burning fuel is based on a high quality pipeline grade of jet/kero diesel fuel plus an additive package containing a lubricity agent, detergent and the bimetallic platinum/cerium FBC. Engine tests indicate that there is no fuel economy penalty or loss of power associated with the new fuel blend.

Letters:

Clean Diesel Technologies, Inc. (IV-D-157) **p. 1-5**

Response to Comment 4.6(K):

The commenter has done considerable work in this area and has demonstrated the technical adequacy and effectiveness of the approach used. However, EPA does not set standards requiring the use of specific fuel additive packages, but leaves to the market place the ability of manufacturers to meet standards based on the technology they select for the fuel available. The package described by the commenter has the potential to reduce in-use emissions, but falls far short of the goals in the NPRM.

(L) EPA should investigate the potential adverse effects of desulfurization to fuel properties.

(1) For cold flow performance, usually #1 diesel or jet fuel is added to the diesel blend. Adding jet fuel will be precluded because of its high sulfur content, and any change to jet fuel sulfur levels would likely require in depth study by FAA. Also, dramatically reducing sulfur in the fuel will result in increased hydrogen, which will raise pour points and cloud points of the fuel. Further work is needed to investigate these concerns.

Letters:

Big West Oil, LLC (IV-D-229) **p. 6**

Response to Comment 4.6(L):

Cold flow performance and pour points are important characteristics of diesel fuel. In situations where this is critical, refiners will have to add desulfurized blending components or additives to maintain performance.

ISSUE 5: ECONOMIC IMPACT

Issue 5.1: Costs for New Diesel Vehicles

(A) The costs of complying with the engine and vehicle standards are reasonable.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

NY Assembly - Health Committee (IV-F-38)

(2) Reports results of survey in which 85% of 1,000 respondents agree that up to four cents per gallon is a reasonable increase for cleaner diesel fuel that significantly reduces pollution.

Letters:

Lake Snell Perry & Associates (IV-D-321) **p. 2**

Response to Comment 5.1(A):

We concur with the comment that the cost for complying with the engine and vehicle standards are reasonable given the substantial emission reductions they provide. The fact that a majority of the public feels that a four cent per gallon increase in fuel costs would be a reasonable price to pay for the benefits that clean diesel fuel provides bolsters our belief that the costs for this program are reasonable. While the estimate of fuel costs for the final rule is slightly higher, five cents per gallon, the equivalent of nearly one cent per gallon in vehicle maintenance savings should also result. Furthermore, we believe that the majority of the public based on their support for today's rule would also support the updated five cent per gallon cost in order to realize the benefits of this rule.

(B) The proposed emission standards can be achieved in a cost-effective manner if very low sulfur diesel fuel is available.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Manufacturers of Emission Controls Association (IV-F-26, 187), (IV-F-190) **p. 108** (IV-F-116) **p. 47** (IV-F-117) **p. 89** (IV-F-191) **p. 120**

Response to Comment 5.1(B):

We agree with the commenter that these substantial emission reductions can only be had in a cost effective manner if low sulfur diesel fuel is widely available, as is required by this rulemaking.

(C) EPA's proposal could lead to significant increases in the cost per truck due to the additional emission control hardware that will be required.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

American Petroleum Institute (IV-F-182, 117) **p. 161**
CO Petroleum Association (IV-D-323) **p. 2**
Capellan, Claudia, et. al. (IV-D-338) **p. 1-2**
IN Retail Council (IV-D-211) **p. 1**
MI Petroleum Assoc./MI Assoc. of Convenience Stores (IV-D-202) **p. 1**
National Federation of Independent Business (IV-D-243) **p. 2**
VA Aggregates Association (IV-D-177) **p. 1**
VA Trucking Association (IV-D-191) **p. 1**
WI Motor Carriers Association (IV-D-189) **p. 1**

(2) Another commenter asserted that the costs of purchasing and maintaining after-treatment technologies cannot be evaluated at this time because they are not in widespread use.

Letters:

American Trucking Association (IV-F-191) **p. 42**

(3) EPA estimates a total cost increase per truck of over $6,000, and these estimates may not include all costs given that the technologies evaluated are not yet in general use. One commenter concluded that as a result, it is not possible at this time to accurately predict the significant maintenance and cost issues associated with the standards. This commenter (ATA) provided significant additional discussion regarding EPA's cost assumptions and why the estimated costs to truck owners and operators has been underestimated.

Letters:

American Trucking Association (IV-D-269) **p. 27-30,37-41**, (IV-F- 191) **p. 42**

(4) EPA's estimate that the incremental hardware cost of the proposal for HD trucks of about $1,600 per vehicle in the long term is too low. The long term cost increase is likely to be in the range of $3,500 to $4,000 to equip these engines with aftertreatment suitable both to reduce NO_x, NMHC and PM and to have the requisite 435,000 mile useful life.

Letters:

Mack Trucks (IV-D-324) **p. 4**

(5) The cost of new intercity motorcoaches with the required emission reduction equipment could easily add $4,000 to $8,000 to the overall cost.

Letters:

American Bus Association (IV-D-330) **p. 6**

Response to Comment 5.1(C):

We agree with the commenters that the additional costs for the advanced emission control technologies and for the needed low sulfur diesel fuel are non-trivial and must be estimated as accurately as possible. However, we disagree with any implication that because these costs are non-trivial that the benefits of the program are some how outweighed by the costs. To the contrary we believe based upon our cost effectiveness and benefits estimates, that the costs of the program are reasonable when consideration is given to the significant emission reductions realized through the application of the technology.

One commenter suggests EPA's cost estimates are optimistically low because uncertainty about the emission control technologies means that the cost of the truck will invariably be higher. While we do agree that cost estimates made several years in advance of the implementation of the technology is inherently uncertain, we disagree with the suggestion that the costs are therefore invariably higher. The uncertainty in the estimates means that the cost of the program may be higher or lower than we have estimated. Indeed, past history of Agency rulemakings would suggest that currently unanticipated technology improvements could lead to costs well below those estimated here. The commenter further raises concerns that we have not addressed additional costs to the vehicle manufacturers in the implementation of the technology specifically citing concerns about increased heat rejection necessitating the use of larger more expense radiators and new truck designs. We disagree with the assertion raised here. We do not project that heat rejection will increase due to the engine changes needed to meet the Phase 2 standards, costs for emission controls. It is not clear from the comment why the commenter believes heat rejection would go up in order to meet the Phase 2 standards, however it may be for some of the same reasons addressed in issue 3.2.1(M).

Another commenter suggests an alternative cost estimate of $3,500 to $4,000 for a heavy heavy-duty diesel engine meeting the Phase 2 standards but does not provide any additional information to explain how this estimate was derived. Absent this information or direct criticism of the method EPA used to estimate costs, we can not agree with the commenter's estimate. Similarly the estimate for increased cost of the intercity buses given in the comment was based upon "some automotive engineers" without giving a specific basis for the estimate. Absent additional information on this estimate we can not agree with the comment.

(D) EPA has underestimated the costs of PM control technology.

(1) EPA estimated the cost of the CDPF at $900, while MECA placed it at $1,500, and EPA's contractor EF&EE reported it at $1,200. Total cost of the SCR/CDPF system is several hundred dollars less than EPA's cost estimates.

Letters:

American Petroleum Institute (IV-D-343) **p. 69**
Marathon Ashland Petroleum (IV-D-261) **p. 73-74, 95**

(2) EPA's estimates of the hardware costs for PM traps are engineering cost estimates that are based on the assumption that the technologies will develop as quickly and as favorably as EPA predicts. EPA does not provide estimates of how a less favorable development of the technologies would affect ultimate hardware costs. In addition, EPA's cost estimates assume that supply of the emissions control devices will be infinitely elastic beginning in 2007 when the emissions standards start phasing in. However, unless several firms rapidly acquire the ability to produce the necessary emissions control equipment,

supply will not be perfectly elastic. Prices above average cost may persist for several years should some of the firms now developing the technologies patent key discoveries and thus gain market power. In addition to these concerns, EPA's cost estimates assume that the long-run supply of key resources, such as precious metals used in catalysts, is infinitely elastic and that the increase demand for those resources created by the proposed rule will not drive up resource prices.

Letters:

Mercatus Center at GMU (IV-D-219) **p. 15**

Response to Comment 5.1(D):

Our cost estimates made for the CDPF system are based upon the best available information on current and future practices in the manufacture of these technologies. We appreciate that other estimates can be made for these costs, but absent criticism of the method or particular assumptions we have used in our cost estimates, we must disagree with the assertion in the comment that our estimate is too high. Further we would like to clarify that our near term cost estimates for CDPFs fall within, or are higher than, a range of estimates made by the Manufacturers of Emission Controls Association (MECA) based upon a survey of its members (see docket A-98-32 item II-D-09).

The estimates for the CDPF technology are cost estimates and not price estimates. They do not necessarily account for all factors which while not changing cost could change price. We believe that our cost estimates reflect the most likely costs for the technology based upon reasonable development. To make estimates based on other unspecified development outcomes would be speculative. The suppliers of these technologies are the same companies that supply similar products today for the light duty passenger car market which has annual sales of approximately 15 million units per year in North America alone. We consider the suggestion that they will be unable to supply the much smaller heavy-duty truck market in 2007 as unlikely. We have not based our cost estimates for the CDPF technology upon proprietary technologies. Should a proprietary technology be developed which is more desirable than the system we have estimated here, but is more expensive, it will be up to the consumer to choose between the technologies. In reality the likely reason for choosing a new proprietary technology is because it represents a cost savings over the existing technology. Therefore we disagree with the assertion that our cost estimates are too low for CDPFs.

One comment implied that precious metal costs cannot be assumed to remain at the levels they are today because increased demand will drive up prices. While we do not necessarily disagree with this comment, estimating how the Phase 2 standards will impact these prices is inherently problematic. When the CAA was being amended in 1990, there was much speculation that a new emphasis on rhodium for automotive catalysts would drive up demand and, therefore, prices. While the price did increase due to market speculation, the prices soon fell back to the levels seen prior to 1990. We acknowledge that the Phase 2 standards will result in increased demand for platinum in the highway sector. However, how that may impact the demand for platinum in other sectors (the bulk of platinum production is used in jewelry), and the total market demand, is exceedingly difficult to predict. Further, recycling of automotive catalysts will mean that platinum for automotive applications will in the future be a renewable resource whose cost in the long term would fall to the cost of production (cost of recycling). For this reason, we believe we are best served by assuming a precious metal price consistent with our recent Tier 2 rule as it provides a meaningful comparison to the costs generated by that rule. Other estimates that we could attempt to generate would be speculative at best.

(E) EPA has underestimated the costs of NO_x control technology.

(1) Some of the cost estimates for NO_x adsorbers, which have yet to be produced, are in the $3000 range, and EF&EE reported an average around $1,450, several hundred dollars above EPA's estimates. Total cost of the SCR/CDPF system is several hundred dollars less than EPA's cost estimates.

<u>Letters:</u>

American Petroleum Institute (IV-D-343) **p. 69**
Marathon Ashland Petroleum (IV-D-261) **p. 73-74, 95**

(2) EPA's estimate of the hardware costs for NO_x adsorbers are engineering cost estimates that are based on the assumption that the technologies will develop as quickly and as favorably as EPA predicts. EPA does not provide estimates of how a less favorable development of the technologies would affect ultimate hardware costs. In addition, EPA's cost estimates assume that supply of the emissions control devices will be infinitely elastic beginning in 2007 when the emissions standards start phasing in. However, unless several firms rapidly acquire the ability to produce the necessary emissions control equipment, supply will not be perfectly elastic. Prices above average cost may persist for several years should some of the firms now developing the technologies patent key discoveries and thus gain market power. In addition to these concerns, EPA's cost estimates assume that the long-run supply of key resources, such as precious metals used in catalysts, is infinitely elastic and that the increase demand for those resources created by the proposed rule will not drive up resource prices.

<u>Letters:</u>

Mercatus Center at GMU (IV-D-219) **p. 15**

<u>Response to Comment 5.1(E):</u>

Our cost estimates made for the NO_x adsorber based catalyst system are based upon the best available information on current NO_x adsorber applications and expected future practices in the manufacture of these technologies. We appreciate that other estimates can be made for these costs, but absent criticism of the method or particular assumptions we have used in our cost estimates, we must disagree with the assertion in the comment that EPA's estimate is too high. The reasons for the small differences between our estimate and the estimate of our contractor can be seen in chapter V of the RIA. These differences reflect small changes in assumptions and methods for estimating the costs for the technologies. We believe that the estimates we have reached reflect a best estimate of the future cost for the reasons articulated in chapter V of the RIA.

The comments raised with regards to supply elasticity, proprietary interests, precious metal prices, etc. are all raised in the same context with the same reasoning as the issues raised in 5.1(D). Please refer to 5.1(D) for our response to these issues.

(F) EPA's analysis underestimates the cost of compliance for manufacturers.

(1) Commenter notes that since EPA did not provide access to their cost methodology, they (Cummins) used the EPA assumptions that are outlined in the proposed rule along with their own cost methodology and current estimates for the cost of implementing the proposed rule. Commenter notes that their compliance cost estimates are several times that of EPA, which leads to a higher estimate of the total lifetime cost estimated for new trucks. Commenter adds that in estimating compliance costs, EPA has not adequately accounted for the requirement that the emission control systems operate for 435,000 miles, which increases the estimate of lifetime compliance costs.

<u>Letters:</u>

Cummins, Inc. (IV-D-231) **p. 37**

(2) In developing their compliance cost estimates, EPA has over-simplified the potential combination of technologies and has only assumed implementation of a PM trap combined with a NO_x adsorber. EPA has stated that it expects manufacturers to adapt various technologies "fine tuned to each application" to meet the demands of each market segment they serve but has ignored the costs to develop other competing or potential technologies. EPA should use the EGR development costs as the model to estimate costs since the EGR systems being developed for MY2002/2004 and the likely systems that will be used to meet the 2007 standards, represent derivative development of hardware purchased from suppliers and applied to a base engine product, including control system development.

<u>Letters:</u>

Cummins, Inc. (IV-D-231) **p. 38**

(3) EPA's development cost analysis does not adequately account for all costs associated with testing requirements. EPA has failed to account for the cost of certification and does not incorporate the costs and complexity associated with deterioration factor (DF) testing. In addition, the proposed rule does not address the costs involved in developing the necessary additional test resources and measurement capabilities that will be required to assure compliance with the standards. EPA has also failed to account for the costs of increased numbers of tests that result from increased test-to-test variability, which would include the cost of additional tests, the costs of procuring new test cells, and the costs of employing additional personnel to conduct multiple tests. The costs of evaluation of the various alternative control systems and the required product durability testing (beyond DF determination testing) are also not included in EPA's analysis.

<u>Letters:</u>

Cummins, Inc. (IV-D-231) **p. 38-39**

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 76-77**

(4) EPA has made several inaccurate assumptions regarding the hardware costs associated with ensuring compliance with the proposed standards. EPA has allowed for the exhaust aftertreatment hardware suppliers to recoup their development costs by allowing for a 29 percent markup from their direct costs to their selling price to the engine manufacturer. In this case, EPA has not accounted for realistic recovery by the engine manufacturers of their system development and integration costs or the markup of the OEM vehicle manufacturer to the end customer and as a result has underestimated the initial cost impact to the end user. EPA has also ignored the impact of the low volumes for each technology on the variable hardware costs. Low volumes typically result in higher costs per unit as the development costs are amortized over a smaller volume of products. EPA has made several other inaccurate assumptions such as setting an arbitrary warranty rate of 1 percent; not allowing for fluctuations in the cost of precious metals required for the emission control technologies; not accounting for the impact of varied ambient conditions to PM/HC control technologies; and not accounting for the engine manufacturer's financial liability associated with potential system failures, recalls, or enforcement actions.

Letters:

Cummins, Inc. (IV-D-231) **p. 39-40**

(5) EPA has based its cost estimates on the use of speculative technologies. EPA's design assumptions for the cost analysis do not reflect the minimum system necessary to achieve all the proposed requirements and do not acknowledge that a by-pass system is required. EPA's analysis does not include the costs associated with the second PM trap, the second NO_x catalysts, the second sulfur trap, the associated control valves, required sensors for the NO_x aftertreatment system, other sensors required for the PM trap and sulfur trap regeneration systems and the added complexity and capability for the onboard engine control module. In its assumption that no by-pass system is required, EPA is ignoring the probability that the duration between regeneration for the PM, sulfur and NO_x control systems are different, which will have an impact on the system design, development costs, certification process and operating costs. EPA also states that the same electronic control system hardware developed for the 2004 engines will be applied to the 2007 products but the complex exhaust after-treatment systems required for this proposal will require much more electronic control capability than the 2002/2004 engine products, which will lead to additional increases in compliance costs.

Letters:

Cummins, Inc. (IV-D-231) **p. 40**

(6) EPA assumes that an oxidation catalyst would be required to meet the 2002/2004 standards and that this catalyst could be removed as a cost savings for the MY 2007 urban bus engines. This assumption is incorrect since an oxidation catalyst downstream of the NO_x aftertreatment system will

be required to deal with HC or CO 'slip' that occurs during the regeneration process for all 2007 engines. The addition of this catalyst will add several hundred dollars of direct cost per engine. EPA's direct cost hardware estimates appear to be less than half of what is expected to achieve the proposed standards.

Letters:

Cummins, Inc. (IV-D-231) **p. 40**

Response to Comment 5.1(F):

With regards to the assertion that we failed to provide access to our cost estimate, that misunderstanding has been corrected with the commenter. The details of the cost estimate and methodology were provided in a memo to the docket at the time of the NPRM and referenced by the cost tables in the draft RIA. The commenter had simply missed the reference contained in an endnote. We provided the commenter with the docket item number after becoming aware of the misunderstanding and answered questions that they had regarding the cost estimate methodology (the teleconference with the commenter is documented in A-99-06 item IV-E-24).

We disagree with the conclusion of the commenter that our cost estimates significantly underestimate the cost of compliance with the Phase 2 standards. The commenter provided additional information which was identified as Confidential Business Information (CBI) to substantiate their opnion that our costs are too low. Although we can not respond in detail to their submission due to its identification as CBI, we can say that with regards to the cost estimates of individual components our estimates and the commenters were remarkably similar. What was markedly different between the CBI submission of the commenter and our own estimates of the cost were assumptions made about the expected technology configurations. The commenter identified each function that the total system would need to accomplish (storage of NO_x, reduction of NO_x, oxidation of HC/CO, oxidation of H2S, capture of PM, regeneration of PM, etc.) and then estimated a separate component cost designed to accomplish each individual task. We have no doubt that if such a complicated system as the one identified by the commenter were required to meet the Phase 2 standards, the costs would be higher than we have estimated. However, we strongly disagree with this view of the future technology. As we explain in detail in chapter III of the RIA we believe there are significant synergies among the system components needed to meet the Phase 2 standards, as evidenced by testing at NVFEL and by Toyota's recent news releases describing their DNPR technology. Please also refer to our responses to issues 3.2.1(C) and 3.2.1(J).

We disagree with the assertion that our cost estimates do not reflect the total lifetime operating cost for heavy-duty vehicles. The lifetime operating costs estimated in the RIA are for the full life of heavy-duty vehicles, including the regulatory useful life and beyond based upon the expected vehicle life from our inventory models. The commenter suggests that EPA use the EGR development costs as a good guideline for the development costs of the technologies needed to meet the Phase 2 standards. In fact, the research and development costs that we have estimated will be needed to meet the Phase 2 standards, more than $600 million, are well in excess of the estimates made in setting the Phase 1 EGR based standards. Perhaps the commenter is referring to an internal estimate of EGR development costs; however those costs are not identified in the comment. The fixed costs estimated in the RIA do directly account for certification costs, although this is not inclusive of costs for DF testing as identified by the commenter. The substantial research and development costs include the cost to do DF testing which will be a fundamental part of developing the technology for production.

We disagree with the suggestion that additional testing will be necessary due to greater test-to-test variability. As we explain in our response to issues in 7.4.5 we believe that the new measurement procedures will decrease test to test variability. We believe that the additional cost to implement these new test procedures can be reasonably considered as part of the overall research and development costs. The test procedure changes do not require substantial new investment in test hardware to implement. The new procedures can be adopted over time allowing the costs to be accrued during the normal course of equipment replacement and manufacturers are making some of these changes already in order to improve repeatability for existing standards since this reduces their cost of compliance (a savings we have not accounted for in our analysis). The cost for evaluation of various alternative technologies is clearly a normal cost of research and development. If a single solution was known with no need to test variations or alternative technologies there would be little need for research investment. Instead we believe that there will be substantial need for further research and development as indicated by the large cost we have estimated for research and development.

We do not agree with commenter that we should include markup for vehicle manufacturers in our cost analysis or that we have failed to provide for realistic recovery of investment. It is important to note that our analysis estimates the *marginal cost* of our standards and not the effect of our standards on the actual *vehicle price.* There are many factors that effect vehicle price that are not considered in this analysis such as demand elasticity or the availability of competitive engine models. We do not believe that vehicle manufacturers will incur significant costs in addition to the increased purchase price of the engine. Since vehicle manufacturers are expected to minimize the time between delivery of the engine from the engine manufacturer and sale of the vehicle to the ultimate purchaser, there should be little cost to them in terms of handling a higher cost engine. We do not dispute that vehicle manufacturers may include a markup in their final price, but we believe that it would be done in an attempt to maximize profits rather than to recover increased operating costs. We believe that the methods we have used to account for the total value-added steps in the supply chain reflect likely incremental cost impacts. Finally, it should be noted that even if we were to include a significant vehicle manufacturer markup in our analysis for heavy heavy-duty engines, it would not change our conclusion that these standards are very cost-effective.

We agree with the commenter that low volumes can result in higher cost per unit given a fixed development cost. However, with regards to the technology development needed to meet the Phase 2 standards, we believe that development costs can be spread across the entire range of engines sold by a manufacturer. This is because aftertreatment based control technologies can generally be developed for a single application and then applied over a range of similar applications. The development history of three-way-catalyst based systems for light duty passenger cars shows this to be true. Therefore, we believe that our convention of spreading the development costs over all engine sales is appropriate.

We believe that the estimate made of warranty claim rates (one percent of vehicles) is a reasonable estimation of likely warranty claim rates. Vehicle and engine manufacturers strive to have warranty and repair rates on any individual component on a car or vehicle well below one percent. The commenter seems to suggest that the reason that the warranty claim rate would be higher than one percent is because of the complexity of the system. We disagree with the suggestion that the emission control system would be more complicated than many existing automotive systems such as diesel fuel systems, air conditioning systems, and anti-lock braking systems.

We have not accounted for the cost of an active PM control system as noted by the commenter because we do not believe that such a system will be necessary in order to meet the Phase 2 standards. Please see our response to comment 3.2.1(G). We do not estimate a cost for the financial liability related to recalls and enforcement actions because we do not project additional liability due to the Phase 2 controls standards.

We have changed our analysis of the need for a diesel oxidation catalyst based upon the comments we received and our understanding of how the emission control technologies are likely to work as explained in detail in chapter III of the RIA. We now project that a diesel oxidation catalyst will be applied to provide additional HC control as needed from HC slip during NO_x regeneration and to provide control of H2S emissions during desulfation. We therefore no longer account for a net cost savings from urban buses due to the removal of an existing oxidation catalyst. Further, we have added the cost of an additional diesel oxidation catalyst for all heavy-duty diesel vehicles in our estimates.

(G) EPA's analysis underestimates the operating and maintenance costs that will be imposed on consumers.

(1) EPA has underestimated the adverse impacts to fuel economy due to the proposed standards. Achieving EPA's engine-out emission targets will result in a 5% increase in fuel consumption with respect to today's (MY2000) HHDEs. There will also be fuel consumption increases caused by the regeneration requirements of the NO_x and PM after-treatment systems. EPA has chosen to ignore the analysis of the consulting organization EF&EE and it remains unclear how EPA determined the fuel economy and efficiency values used to estimate the costs of this proposal.

<u>Letters:</u>

Cummins, Inc. (IV-D-231) **p. 41**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 76-77**

(2) Changes to engine design that are necessary to meet the proposed standards will lead to increased operation costs to the user. An increase in the weight of the engine will reduce payload as well as operator revenue. The engine will have more reliability and durability issues that add to operating costs. The impact on total operating costs to the user will be at least three to four times higher than EPA's estimate of 2 percent.

<u>Letters:</u>

Cummins, Inc. (IV-D-231) **p. 41**

<u>Response to Comment 5.1(G):</u>

We disagree with the assumption made by the commenter that fuel consumption will increase due to the Phase 2 standards as we explain in response to comments 3.4(G) and 3.4(C). We expect if there is an increase in engine weight it will be small in relation to the gross vehicle weight of heavy-duty vehicles. We therefore do not expect a significant economic impact due to a possible increase in vehicle weight. We disagree with the vague suggestion by the commenter that operating costs will increase three to four times over our estimates. The commenter seems to have reached this conclusion based upon a belief that our fuel costs are too low and that operating costs will be higher due to the application of the Phase 2 standard enabling technologies. We disagree with both premises as explained in responses to issues 5.1(F) and 5.8.1.

(H) EPA should recognize that increased capital and operating costs to publicly-subsidized transit services as a result of this rule will have to be offset by increases in federal support for public transit.

(1) EPA should coordinate with the Federal Transit Administration on this rule, since it would have a significant impact on the financial bottom line of publicly-subsidized transit services. Failure to coordinate may result in undermining clean air efforts through necessary public transit fare increases that divert riders back to their automobiles.

Letters:

NJ Transit (IV-G-4) **p. 1-2**

Response to Comment 5.1(H):

We appreciate that the incremental cost of the advanced emission control technologies will incrementally increase costs for transit authorities. However, we disagree with the assertion that these incremental costs will be substantial in relation to the total operating cost of an urban bus. As we show in chapter 5 of the RIA, the incremental cost for the new technologies represents less than one percent of the total cost for an urban bus. We believe that it is unlikely that an increase in transit fares of similar magnitude would deter significant amounts of riders. In contrast, we think it is possible that the significant improvement in local air quality due to reductions in diesel PM and odor may increase ridership, as many people may be avoiding the use transit services due to concerns about diesel emissions.

Issue 5.2: "Learning Curve" Issues

(A) By incorporating benefits due to a "learning curve," EPA assumes that this will be the last round of emission reductions and neglects the development costs associated with these improvements.

(1) Commenter provided significant discussion regarding EPA's costs analysis (see Issue 5.9) but provided no further detailed information or analysis regarding the "learning curve" in particular.

Letters:

Cummins, Inc. (IV-D-231) **p. 38**

Response to Comment 5.2(A):

The application of the learning curve is unrelated to potential future emission standards. The learning curve phenomena describes the fact that as manufacturers gain experience manufacturing an item they find new ways to lower costs through better manufacturing processes. Future emission standards would only change this phenomena if the new standards caused production of the existing technology to cease. If the existing technology is no longer manufactured it has no costs, as opposed to reduced costs due to the learning curve. Our method to account for the learning curve phenomena does not include an assumption of future emission regulations, because such a possibility is not relevant to the calculation.

Therefore, we disagree with the comment that, by applying the learning curve cost reductions, we have assumed that this will be the last round of emission reductions. If we propose future emission standards more stringent than the Phase 2 standards, we will again conduct a complete cost analysis that would represent the incremental costs relative to those estimated for the Phase 2 standards. We would consider the learning curve cost reduction again at that time and apply its effects in a manner appropriate to the unique aspects of that potential future rule. We cannot assume nor predict emission standards beyond those being promulgated in this rule, so it would be inappropriate for us to ignore the learning curve effects in the context of the Phase 2 standards.

We also disagree that we have neglected the development costs associated with improvements that result in a learning curve. The commenter did not provide any data or information as to the magnitude of these development costs over time. We believe that these costs, if any, would be small and not anything over and above their base developmental costs for their engines since the “learning curve” benefits occur primarily from doing things the first time and learning from it rather than from specific actions taken to research and develop improved methods.

(B) The impact of the learning curve on cost reduction in the context of EPA's proposed rule may be insignificant.

(1) The emission control technologies and development processes required to achieve the proposed emission levels are more reminiscent of a chemical plant than a manufacturing process and therefore, the benefits attributable to the learning curve/cost reduction process may not be realized. Commenter does not provide detailed analysis on this issue or additional explanation regarding why this is the case.

Letters:

Cummins, Inc. (IV-D-231) **p. 39**

Response to Comment 5.2(B):

The commenter contends that the learning curve and cost reduction process may not be realized in the context of the Phase 2 engine standards. We disagree with this comment. As discussed in Chapter V of the RIA and in the Tier 2 RIA, the learning curve is a well documented and accepted phenomenon. For variable costs, research in the area of costs of manufacturing has consistently shown that as manufacturers gain experience in production, they are able to apply innovations to simplify machining and assembly operations, use lower cost materials, and reduce the number or complexity of component parts. We believe that, to ignore its potential impacts on costs altogether, as the commenter seems to suggest, would be overly pessimistic and inconsistent with what industry experience has shown to be true. The data contained in the studies on the learning curve as referenced in the RIA support the commonly used factor of 20 percent, which is approximately the average factor for the industries included in the studies.

The operation of exhaust emission control systems may be analogous to the operation of a chemical factory since pollutants are controlled by reacting them to form benign products over catalyst systems. However, this observation by the commenter is irrelevant with respect to the application of the learning curve in cost estimates. The learning curve phenomena describes the observation that manufacturing costs decrease over time due to improvements in manufacturing processes. The manufacturing processes used to make the emission control technologies are typical of much of industrial manufacturing including processes such as extrusion and metal rolling and are not similar to the operation of a process chemical plant.

Issue 5.3: Diesel Vehicle Maintenance Cost Savings

(A) For vehicles produced in the years immediately preceding the introduction of low-sulfur fuel, the savings associated with reduced engine corrosion and wear due to the use of the low sulfur fuel would be substantial.

(1) For a vehicle near the end of its life in 2007, the benefits of using low sulfur fuel would be insignificant. However, those vehicles purchased in the years immediately preceding implementation of the fuel standard would experience significant benefits in the form of reduced corrosion and wear to the piston rings, cylinder liners, exhaust system, and EGR as well as reduced deposits and less of a need for alkaline additives in the oil. The estimated savings would be $153 for light heavy-duty vehicles, $249 for medium heavy-duty vehicles, and $610 for heavy heavy-duty vehicles and urban buses.

Letters:

STAPPA/ALAPCO (IV-D-295) **p. 13**

Response to Comment 5.3(A):

We concur with the comment and have incorporated these savings in our analysis.

(B) In addition to its role as a technology enabler, low-sulfur diesel fuel gives benefits in the form of reduced sulfur-induced corrosion and slower acidification of engine lubricating oil, leading to longer maintenance intervals and lower maintenance costs.

(1) These benefits would apply to new vehicles and to the existing heavy-duty vehicle fleet beginning in 2006 when the fuel is proposed to be introduced.

Letters:

American Lung Association (IV-D-270) **p. 20**
STAPPA/ALAPCO (IV-D-295) **p. 12**

Response to Comment 5.3(B):

We concur with the comment and have incorporated these savings in our analysis..

(C) EPA assumes that lower fuel sulfur content will extend the oil life by reducing the depletion of the total base number (TBN), which would reduce the frequency of oil changes. However, TBN depletion is only one cause of oil degradation, which can also be caused by soot, and EPA's speculation that lower sulfur will reduce maintenance costs in this context, is tenuous.

Letters:

Cummins, Inc. (IV-D-231) **p. 40**

Response to Comment 5.3(C):

We appreciate that there may be other factors which also effect oil quality and oil change intervals. However absent analysis or a suggestion by the commenter of a more accurate estimate, we continue to believe that our estimate of a 10 percent increase in oil change interval is appropriate. Our estimate is based upon a survey of industry respondents and analysis done under contract to EPA.

(D) EPA has overestimated the maintenance benefits of a 15 ppm diesel fuel.

(1) Commenter provides no further supporting documentation or detailed analysis.

Letters:

American Petroleum Institute (IV-D-343) **p. 74**

Response to Comment 5.3(D):

Our estimate of the maintenance savings made possible through the application of low sulfur diesel fuel are based upon a survey of industry respondents and analysis of oil impacts on maintenance. Absent substantive comment that suggest specific flaws in our analysis we continue to believe that our estimates of the potential cost savings due to the use of low sulfur diesel fuel are appropriate. We disagree with the commenters assertion that these savings are overestimated.

Issue 5.4: Possible Influence of Proposal on HDV Sales

(A) The proposed engine/vehicle and fuel standards would raise the cost of new HDVs to the point where fewer new vehicles are sold and would create incentives to rebuild current engines rather than purchasing new engines.

(1) One commenter also noted that the rise in costs of the low-sulfur fuel could also be a deterrent for new vehicle sales.

Letters:

Petroleum Marketers Association of America (IV-F-67)

Response to Comment 5.4(A):

We disagree with the assertion that increased purchase and operating costs related to the Phase 2 standards will lead to substantial deferred purchases of new vehicles. As we explain in response to issue 8.1.1 we expect that the actual price of the new low sulfur diesel fuel will be approximately equal to than any remaining high sulfur fuel in most markets under our temporary compliance option. Given roughly equivalent fuel costs, the actual operating cost differences between the existing fleet and the new fleet are expected to be small. Consequently, under the provisions of the final rule, we do not believe the cost of the fuel will have any meaningful impact on vehicle purchases.

The choice to rebuild or to buy a new engine is a complex one and is not made on cost differences alone. New engines often offer additional benefits which can more than offset the savings from rebuilding existing engines. Further, the incremental vehicle costs estimated in this rule and described in chapter V of the RIA reflect only a small fraction of the cost of a new vehicle. For the most expensive new engines, heavy heavy-duty engines, the incremental vehicle cost increase is estimated to be three percent. Although this issue has been raised for every heavy-duty rulemaking EPA has undertaken we have never observed a significant change in rebuild practices or fractions due to new vehicle emission standards. We do not believe based upon historical evidence that the Phase 2 standards will lead to a substantial increase in engine rebuilds at the expense of new lower emitting engine sales.

(B) A phase-in option would provide strong incentive to purchase 2005/2006 model year engines to extend the ability to use the lower priced, high sulfur fuel.

(1) This result would undercut EPA's emission reduction objectives and is another reason not to include a phase-in option.

Letters:

NATSO (IV-F-17)

Response to Comment 5.4(B):

We disagree with the assertion of the commenter that any fuel program which is not introduced as 100 percent of the fuel supply will lead to deferred purchases. While this concern may arise more with the various phase-in scenarios on which we requested and received comment, we are convinced that the design of the fuel program will avoid such concerns. The lower sulfur diesel fuel will be widely available, and as discussed in issue 5.4(A) is likely to be priced very similarly to high sulfur diesel fuel, eliminating any motivation to pre-buy engine or defer purchases.

(C) Differences in fuel economy, increased acquisition costs, and the fact that diesel engines are designed to run for a long time will provide an incentive for truck owners to continue to operate existing, higher emitting, better fuel economy trucks rather than buy new.

(1) Commenter provides no further detail or supporting information.

Letters:

Cummins, Inc. (IV-D-231) **p. 37**

Response to Comment 5.4(C):

See our response to comment 5.4(A).

Issue 5.5: Costs for Gasoline Vehicles

(A) EPA should not assume that light duty technologies and costs apply to heavy-duty truck compliance.

(1) It is not accurate to assume that light duty technologies and costs apply to HD truck compliance. The larger size of these vehicles, including larger and additional tires, suggests that the increase in emissions from background sources may be significantly greater than that for light duty vehicles. Background emissions contribute a larger fraction of whole vehicle emissions than from light duty vehicles, which increases the challenge for reducing fuel vapor emissions beyond what is required for light duty vehicles. In addition, the materials used in the larger vehicles are not the same as those used in current light duty vehicles (i.e. nylon and monolayer HDPE are more prevalent in larger trucks). Therefore, the replacement with low permeation materials will result in a higher incremental cost than indicated by EPA (Table III-C.3). Commenter provides an estimate of what the costs are likely to be based on new canister array, returnless fuel system, upgrade of fuel system materials, and air inlet control measures and recommends that EPA thoroughly evaluate the costs of compliance associated with these factors.

Letters:

Ford Motor Company (IV-D-293) **p. 9-10**

Response to 5.5(A):

Our proposed rule used a cost estimate of $4 per vehicle for compliance with the evaporative emission standards. This was the cost estimate used in our Tier 2 light-duty cost analysis. Given that the Tier 2 estimate was for light-duty applications, and because the heavy-duty vehicles are typically equipped with larger fuel tanks than are light-duty vehicles, the $4 cost estimate may underestimate the cost that will be incurred by “typical” heavy-duty vehicles. However, we believe that the $32 to $45 cost estimate suggested by the commenter represents a worst-case estimate rather than an average cost that can be applied across the HD gasoline fleet. Such an estimate may apply for vehicles that have the largest of fuel tanks and/or are equipped with out-dated materials. Because many of the heavy-duty vehicles will indeed have fuel tanks and evaporative emission control systems essentially equivalent to some light-duty trucks (heavy light-duty trucks and medium-duty passenger vehicles) and will, therefore, incur compliance costs similar to the light-duty cost of $4, while others will incur costs similar to those suggested by the commenter, we believe a mid-term level of $21 per vehicle is most appropriate. This cost is applied uniformly across the heavy-duty fleet and is reflected in our cost estimate. See Chapter V of the RIA for the details of our cost basis.

Issue 5.6: [Reserved]

Issue 5.7: Encouraging Innovative Technologies

(A) Expressed support for the creation of financial incentives for manufacturers to produce and market alternative technology/fuel vehicles such as natural gas,

electric vehicles, and fuel cell vehicles.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

American Lung Association (IV-F-161, 192) **p. 8**
CA PIRG (IV-F- 190) **p. 280**
Center for Neighborhood Technology (IV-F-11)
Chicagoland Transportation and Air Quality Commission (IV-F-10)
City of Arcata (IV-D-200) **p. 2**
Coalition on the Environment and Jewish Life (IV-F-184)
Estler, Danielle (IV-F-21)
IL Public Interest Research Group (IV-F-18)
Kotgal, Kalpana (IV-F-192) **p. 17**
Mexican-American Community Foundation (IV-F-179)
Nolan, Catherine (IV-D-169) **p. 1**
Sierra Club (IV-F-159)
Stuckey, Stephanie (IV-D-182)
U.S. PIRG (IV-F- 190) **p. 185** (IV-F-192) **p. 134**
Village of Oak Park Dept. of Public Health (IV-F-8)
West Harlem Environmental Action/Envr Justice Network (IV-F-76)

(2) Assistance such as grants, tax credits, or a revolving loan program would encourage municipalities to purchase clean vehicle technologies in advance of the regulations because currently the high costs and uncertainty regarding vehicle reliability, performance and durability are significant obstacles.

Letters:

L.A. City Council (IV-F-176)
Mathews, Erik, et al (IV-D-24) **p. 1**

(3) EPA should provide tax breaks and other incentives to companies that manufacture and purchase alternative-fuel HD vehicles and should devise a program that emulates the California ZEV mandate for transit buses on a national level.

Letters:

International Center for Technology Assessment (IV-D-313) **p. 4**

(B) EPA should adopt strong "Blue-Sky" standards for truly clean advanced technology vehicles and alternative fuel vehicles.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

CA Air Resources Board (IV-D-203) **p. 6**
Coalition for Clean Air (IV-F-190) **p. 177**
NY State Assembly (IV-D-266) **p. 2**

(2) Such standards would create incentives for State and Fleet Programs and would help establish a substantial market for low emission engines. Some added that even though EPA cannot provide the tax incentives or direct funding to make State and local ATV/AFV programs work since this will require the involvement of the Departments of Transportation and Energy, EPA should provide guidance to States that wish to allocate SIP credits for ATV/AFV programs. One commenter noted that by setting "blue-sky" standards, EPA can determine exactly what should be the goal for the next level of regulation. One commenter (MECA) provided specific recommendations for Blue Sky standards and added that an interim Blue Sky category could be established for those engines meeting EPA's proposed 2007 standards prior to the time those standards go into effect.

Letters:

American Lung Association (IV-F-72, 191) **p. 146**
CA Air Pollution Control Officers' Association (IV-D-109) **p. 2**
Manufacturers of Emission Controls Association (IV-D-267) **p. 3, 10**
Natural Resources Defense Council (IV-F-75, 191) **p. 68**
STAPPA/ALAPCO (IV-D-295) **p. 24-25**
TX Natural Resource Conservation Commission (IV-G-3) **p. 3**
U.S. PIRG (IV-F-71, 190) **p. 185**

(C) EPA should encourage or mandate the use of alternative fuels or technology. Many of these commenters noted that there are a number of existing, new, and/or emerging technologies and fuels that could be used as an alternative to conventional diesel fuel.

(1) Commenters provided no further supporting information or detailed analysis. This comment was made by approximately 14,000 private citizens.

Letters:

20/20 Vision (IV-F-58)
Acoff, Jeffrey, et. al. (IV-G-11)
Alliance of Automobile Manufacturers (IV-F-190) **p. 114** (IV-F-117) **p. 168**
American Lung Association (IV-F-72, 192) **p. 8**
American Lung Association of Colorado (IV-D-54)
American Lung Association of Los Angeles (IV-D-47)
American Lung Association of Metropolitan Chicago (IV-D-237) **p. 1**
American Lung Association of NJ (IV-D-224) **p. 2**
American Lung Association of OR (IV-D-165) **p. 1**
American Lung Association of Orange County (CA) (IV-D-176) **p. 1**
American Lung Association of SD (IV-D-31) **p. 1**
American Lung Association of TN (IV-D-19) **p. 1**
American Lung Association of VA (IV-D-205) **p. 1**
Appalachian Office of Justice & Peace (IV-D-99) **p. 1**
Arab Community Center for Economic and Social Services (IV-D-112) **p. 1**
Asamoah, Nikiya (IV-D-09)
Bagnarol-Reyes, Carolina, et. al. (IV-G-24)
Bastin, Clinton (IV-F- 117) **p. 119**

Beeman, Nora, et. al. (IV-G-09)
Braun, Carl and Norma (IV-D-69)
CA Air Resources Board (IV-F-190) **p. 13**
CO Environmental Coalition (IV-F- 191) **p. 237**
CO Public Interest Research Group (IV-F-191) **p. 219**
Cassara, Bob (IV-F-65)
Center for Environmental Health (IV-D-89) **p. 1**
Center for Neighborhood Technology (IV-F-11)
Chicagoland Transportation and Air Quality Commission (IV-F-10)
Citizen, physician (IV-F-190) **p. 76**)
City of Los Angeles Environmental Quality and Waste Man (IV-F-190) **p. 95**
Clean Air Council (IV-F-116) **p. 333**
Clean Air Network (IV-D-292) **p. 2**, (IV-F-191) **p. 84**
Clean Air Now Campaign (State PIRGs & citizens) (IV-D-357, 358)
Clean Fuels Development Coalition (IV-F-191) **p. 225**
Coalition for Clean Air (IV-F-190) **p. 177**
Chung, Payton, et. al. (IV-D-133)
Connor, Thomas, et. al. (IV-D-132)
Corcoran, Janet (IV-D-128)
DE Nature Society (IV-D-285) **p. 1**
Davidson, Karin, et. al. (IV-D-79)
Dickson, Victoria, et. al. (IV-D-77)
Dolman, Suzanne, et. al. (IV-D-341)
Downtown Community Association (IV-D-118) **p. 2**
Economic & Social Justice (IV-F-117) **p. 236**
Environmental Advocates (IV-F-35)
Environmental Health Watch (IV-D-212) **p. 1**
Environmental Law & Policy Center of the Midwest (IV-F-6)
Estler, Danielle (IV-F-21)
Fleming, Scott, et. al. (IV-D-13)
Fletcher, Robert E. (IV-F-117) **p. 175**
Flowers, Bobbie (IV-G-67)
Foley, Deborah (IV-G-56)
Fox, John (IV-F- 191) **p. 75**
Franczyk, Catherine A., et. al. (IV-D-233)
Freechild, Aquene, et. al. (IV-G-60)
Friends of the Children (IV-F-158)
GA Forest Watch (IV-D-67) **p. 1**
GA State Senator (IV-F- 117) **p. 179**
Grand Canyon Trust (IV-D-317) **p. 2**
Golland, Laurie, et. al. (IV-G-33)
Hacienda Heights Improvement Association (IV-F-172)
Hackel, Barbara, et al. (IV-D-14) **p. 1**
Hart/IRI Fuels Information Services (IV-F-117) **p. 206**
Higginson, Norman, et. al. (IV-D-196)
Hirschi, Alexander (IV-D-07)
Hoosier Environmental Council (IV-D-281) **p. 1**
Hopkins, Steve, et. al. (IV-G-07)
Hyatt, Robert E. (IV-D-94)
IL Public Interest Research Group (IV-F-18)
Institute for Global Solutions (IV-F-175)
Kachik, Thomas (IV-D-11)

Khalsa, Mha Atma S. (IV-D-71)
Kinyon, John, et. al. (IV-G-13)
Kotgal, Kalpana (IV-F-192) **p. 17**
Kwan, Jeffrey (IV-G-32)
Landfall Productions, Inc. (IV-D-27)
League of Women Voters of Louisiana (IV-D-199) **p. 1**
League of Women Voters of New Orleans (IV-D-210) **p. 1**
Legal Environmental Assistance Foundation (IV-D-126) **p. 1**
Lichtman, Elijah (IV-D-08)
Lind, Karen, et. al. (IV-D-121)
Lu, Rong (IV-F-162)
MO Coalition for the Environment (IV-D-235) **p. 1**
Margolis, Benjamin (IV-D-33)
Mayer Computer Services (IV-D-81)
Mayor and citizens of Fort Collins, CO (IV-F-191) **p. 211**
Montgomery, Jack, et. al. (IV-D-78)
Mothers for Clean Air (IV-D-95)
NC Waste Awareness and Reduction Network (IV-D-51) **p. 2**
NJ PIRG (IV-F-116) **p. 314**
NY Assembly - Health Committee (IV-F-38)
NY State Senator (IV-F-83)
NYC Council (IV-F-80)
NYC Environmental Justice Alliance (IV-F-116) **p. 317**
Natural Resources Defense Council (IV-F-75, 190) **p. 102**
Nerode, Gregory, et. al. (IV-D-04)
Northwest District Association (IV-D-117) **p. 2**
OH Environmental Council (IV-D-130) **p. 2**
OR Toxics Alliance (IV-D-175) **p. 2**
Orr, David (IV-F- 191) **p. 258**
Packard, Josh (IV-G-54)
Private citizen (IV-D-12)
Public Advocate for the City of New York (IV-D-222) **p. 2**
Rhubert, Pamela J. (IV-D-15) **p. 1**
Richards, Donna and Bill, et. al. (IV-G-19)
Riggles, Ruth, et. al. (IV-D-102)
Rock, Steve, et. al. (IV-G-22)
Rodriguez, Dolores, et. al. (IV-D-91)
Rutherford, Jolene, et. al. (IV-D-347)
STAPPA/ALAPCO (IV-F-190) **p. 21**
Schmitz, Randy, et. al. (IV-D-46)
Sierra Club (IV-F-159)
Sierra Club, GA Chapter (IV-D-348) **p. 1**
Sierra Club, Lone Star Chapter (IV-D-287) **p. 2**
Sierra Club, PA Chapter (IV-D-197) **p. 2**, (IV-D-204) **p. 1**
Smith, Bryan R., et. al. (IV-D-105)
Smith, Curt, et. al. (IV-D-49)
Southern California Ecumenical Council (IV-F-178)
Southern Queens Park Association, Inc. (IV-D-36) **p. 1**
TN Environmental Council (IV-F- 117) **p. 154**
Tacha, Athena and Richard Spear (IV-G-06)
Toxics Action Center (IV-G-02)
Transportation Techniques (IV-F- 191) **p. 246**

Tseng, Joyce, et. al. (IV-D-03)
U.S. PIRG (IV-F-71, 190) **p. 185** (IV-F-192) **p. 134**
Unity Center (IV-D-75) **p. 2**
Varsbergs, Krista, et. al. (IV-D-38)
Village of Oak Park Dept. of Public Health (IV-F-8)
W. Houston St. (Manhattan) Block Association (IV-F- 116) **p. 268**
Washington Regional Network (IV-D-18) **p. 1**
West Harlem Environmental Action/Envr Justice Network (IV-F-76)
Williams, Mary, et. al. (IV-D-122)
Zellers, Tim (IV-F- 116) **p. 209**
Zweig, Robert (IV-D-30)

(2) One commenter specifically noted that investing in compressed natural gas (CNG) infrastructure would move us toward a transportation future based on hydrogen. CNG can fuel conventional vehicles and can also be optimized for use in future technologies such as hybrid electric vehicles and is the fuel feedstock that can be most easily converted into hydrogen, which will be helpful in the eventual commercialization of hydrogen fuel cell vehicles. Another commenter supported converting most diesel buses to CNG. Another commenter argued that EPA should encourage the use of natural gas engines for large buses and trucks. One commenter focused on hydrogen and noted that it would be the best alternative fuel, since it can be made from water and is totally non-polluting.

<u>Letters:</u>

Glendale-La Crescenta Advocates (IV-D-80) **p. 1**
Gostafson, Keith (IV-F-117) **p. 200**
INFORM, Inc. (IV-F-47)
Metropolitan Atlanta Rapid Transit Authority (IV-F- 117) **p. 122**

(3) Commenters noted that alternative fuels are both cleaner and will reduce our dependence on foreign oil.

<u>Letters:</u>

L.A. Dept of Water & Power (IV-F-190) **p. 79**
Stewart, Jim (IV-F-170)

(4) Although natural gas vehicle manufacturers cannot afford to invest in research and development of aftertreatment devices, the aftertreatment technologies developed for diesel are transferable to natural gas vehicles.

<u>Letters:</u>

CA Natural Gas Vehicle Coalition (IV-F- 190) **p. 135**

(5) One commenter specifically recommended that EPA require 25% of buses in high-smog areas to use fuel cell technology by 2005.

<u>Letters:</u>

Tseng, Joyce, et al (IV-D-3)

(6) EcoEngine is a pollution free engine that is 75% more efficient than the average automobile and 35% to 50% more efficient than diesel engines in trucks and buses. This engine is capable of using any type of fuel including ethanol and hydrogen, is cheaper to build than current engines, can be retrofitted into existing vehicles and can be designed to fit any type of on-road or nonroad vehicle.

Letters:

EcoEngine, Inc. (IV-G-18) **p. 1**

(7) Alternative Fuel Technology, using breakthrough technology, on June 16, 2000, completed and passed all the emission requirements for EPA Certificate of Conformity of a Heavy Duty DT466 Dedicated Natural Gas Engine (based on the Navistar 7.3 engine). This new engine offers an incentive for diesel fleet owners to switch out (repower) their trucks to a new powerful Natural Gas engine at a cost of about $20,000 to the fleet owners. EPA should encourage the implementation and use of natural gas and hydrogen technologies through financial and other incentives.

Letters:

Alternative Fuel Technology, Inc. (IV-D-62), (IV-D-65) **p. 1-3**

(8) One commenter discussed the propane fired buses that are used in Acadia National Park as a possible model for other areas. The commenter suggested that the rule should include provisions that encourage alternatively fueled vehicles and funding for such vehicles.

Letters:

The Coalition for Sensible Energy (IV-D-264) **p. 1,2**

(9) One commenter discussed the low sulfur gasoline invented by Irving Oil in Canada, which is available in Canada and Maine, at no extra charge.

Letters:

The Coalition for Sensible Energy (IV-D-264) **p. 2**

(10) EPA should develop performance or design designations that would assist programs seeking to reward the adoption of new technologies or designs. These designations could serve as automatic program qualifiers that eliminate the need for different jurisdictions to test or verify the performance of the technology and could serve as marketing tools that help increase public awareness and pressure for the adoption of new technologies. PuriNO$_x$ fuel could be a valuable component of the program since it offers an immediate reduction in emissions and should be included as a contributing factor in any broader total-system approach to encourage innovative technologies.

Letters:

Lubrizol Corporation (IV-G-49) **p. 5**

Response to 5.7(A), (B), and (C):

We agree with the commenters that increased use of alternate fuels and other advanced technologies could have significant benefits. However, we lack the authority to pursue many of the programs suggested by commenters. The CAA does not give EPA the authority to change tax policy or otherwise provide the type of financial incentives suggested. Nor can we mandate things like alternative fuel/engine use without a clear, cost effective, environmental justification to do so. Even then, EPA generally sets performance based emission standards not design standards, leaving to industry the decision of the best way to achieve the standards.

We agree that alternative fuels can have significant emission advantages over conventional diesel engines using conventional diesel fuel. We expect that the new standards will provide manufacturers with a strong incentive to increase their development of alternate-fueled engines. We believe that alternate-fueled engines, unlike diesel engines, will be able to meet the new standards without a change to the quality of their fuel. Thus, given the interest expressed by manufacturers in generating early certification emission credits as part of our ABT program, it seems likely that some will try to introduce as many alternate fueled-engines as they can by 2007. Also, with the Blue Sky provisions contained in the final rule, alternate-fueled engines may be able to play a role in the Phase 2 program as these vehicles may be able to meet the Phase 2 standards more easily than diesel engines given that, as stated, alternate-fueled engines need not wait for changes to the quality of their fuel.

The new standards could also encourage the use of alternate fuels apart from the ABT program. Historically, the introduction of alternate fuels has been hampered by concerns about fuel costs, vehicle costs, and/or a customer reluctance to accept fundamentally new technologies. Alternate-fueled engines will certainly need to change because they cannot meet the standards using the emission controls used on today's vehicles. Therefore, to the extent that alternate fueled-engines can meet these new standards with lower costs (relative to diesels), this rulemaking could have the effect of making them more competitive with diesels. It is important to note, however, that diesel engines complying with the Phase 2 standards will be as clean or cleaner than today's alternate-fueled engines, and will perhaps be every bit as clean as Phase 2 alternate-fueled engines. That is, while alternate-fueled engines can and will be improved to meet the Phase 2 emission standards, they probably will not provide any large emission benefit relative to diesel engines given the low level of the Phase 2 standards.

Finally, we believe that our existing regulations already contain provisions to address to fuels that include fuel additives, such as PuriNOx. See §86.1313(b)(4).

Issue 5.8: Costs of Fuel Change

Issue 5.8.1: Refinery Costs

(A) The proposed 15 ppm diesel fuel sulfur standard will not be financially difficult for the refiners to achieve.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

DaimlerChrysler (IV-F-167, 116) **p. 292** (IV-F-117) **p. 96**
Engine Manufacturers Association (IV-F- 191) **p. 39**
NY Assembly - Health Committee (IV-F-38)
Natural Resources Defense Council (IV-D-168) **p. 5**
Udall, Mark (IV-D-173) **p. 2**

(2) Some commenters point to the large profits that almost all refiners have incurred in recent months to support their position that the industry currently has sufficient funds to invest in the necessary desulfurization process. Commenters noted specifically that the largest oil companies in the U.S. reported nearly $12 billion in profits in just the first quarter of 2000 alone, and that this level of profits illustrates that the investment required to comply with this rule is not prohibitive. Other commenter noted that the profits for the second quarter of 2000 were $15 billion, quadruple the cost of compliance. A commenter also noted that BP Amoco has reported that its 15 ppm sulfur fuel will be sold in California in 2001 at an additional cost of five cents per gallon. Another commenter stated that BP would be selling low-sulfur fuel in California without any increase in cost to consumers.

Letters:

Coalition for Clean Air (IV-F-190) **p. 177**
Consumer Policy Institute (IV-D-186) **p. 6**
Environmental Law and Policy Center (IV-D-331) **p. 4**
Natural Resources Defense Council (IV-F-75, 190) **p. 98** (IV-F-191) **p. 68**
Permanent Citizens Advisory Committee (IV-D-318) **p. 1,2**
Public Advocate for the City of New York (IV-D-222) **p. 2**
The Coalition for Sensible Energy (IV-D-264) **p. 2**
Transportation Alternatives (IV-D-332) **p. 3**
West Harlem Environmental Action (IV-F-116) **p. 237**

(3) Opposes refiner's arguments that reducing the public's cancer risk is not worth the costs of retooling their infrastructure to provide clean fuel.

Letters:

CA Natural Gas Vehicle Coalition (IV-F- 190) **p. 135**

Response to Comment 5.8.1(A)(3):

We agree with this comment and we refer readers to the health benefits and the cost-effectiveness sections of the RIA.

(4) EPA's cost estimates are reasonable, accurate, and also consistent with estimates by a refining industry consultant. One commenter added that by setting the compliance date so far into the future, EPA has allowed extra time for refiners to comply which should help lower costs. This commenter also cites to the MathPro study as performed for EMA that estimates the refining

cost at between 4 and 6 cents per gallon for a 2 to 20 ppm average sulfur level for on-highway fuel. This study used a higher rate of return on capital than assumed by EPA and included reduced sulfur levels for nonroad diesel.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 16-17**
Environmental Defense (IV-F-56)

Response to Comment 5.8.1(A)(4):

We compare our cost estimate for meeting the 15 ppm sulfur cap standard with other cost estimates in our response to 5.8.1(B)(7).

(5) The oil industry contends that costs will be excessive since one-third of U.S. diesel fuel is light cycle oil that is more difficult to desulfurize than other components because it contains a high concentration of sterically hindered compounds. However, the MathPro study takes this fact into account in concluding that diesel desulfurization costs would not be unreasonable. It is clear that the refining industry has overstated the relevance of this issue as a potential argument against an ultra low sulfur requirement. Commenter refers to the experience in the early 1970s of removing lead from gasoline, during which many of the same arguments regarding excessive costs and infeasibility were presented by the oil industry, and notes that none of these concerns came to pass.

Letters:

International Truck & Engine Corp. (IV-D-257) **p. 10-11**

Response to Comment 5.8.1(A)(5):

We compare our cost estimate for meeting the 15 ppm sulfur cap standard with other cost estimates in our response to comment 5.8.1 (B)(7).

(6) One commenter provided the report "Refining Economics of Diesel Fuel Sulfur Standards, Supplemental Analysis of the 15 ppm Sulfur Cap" as further documentation supporting their conclusions that meeting the 15 ppm sulfur standard will be affordable for refiners and that the overall costs are reasonable. This study provides an analysis of three scenarios consisting of an on-road diesel fuel cap of 15 ppm combined with nonroad diesel fuel sulfur standards of 3500 ppm (average), 350 ppm (average), and 15 ppm (cap).

Letters:

Engine Manufacturers Association (IV-G-15) **p. all**

Response to Comment 5.8.1(A)(6):

We compare our cost estimate for meeting the 15 ppm sulfur cap standard with other cost estimates in our response to comment 5.8.1 (B)(7).

(7) The refining industry has overstated the costs of meeting the 15 ppm standard.

Letters:

Environmental Defense (IV-F-169)

Response to Comment 5.8.1(A)(7):

We compare our cost estimate for meeting the 15 ppm sulfur cap standard with other cost estimates in our response to comment 5.8.1(B)(7).

(8) First, the timing of the changes together with planning gasoline desulfurization and MTBE phase-out, will allow for integrated planning. This could include realigning process units to optimize use of existing hydrotreating capacity, or determining sizing of a hydrogen plant to accommodate both gasoline and diesel desulfurization, while also factoring in the hydrogen increase obtained by increasing reformer severity to make up for MTBE octane loss. Second, the incremental cost differential between 15 and 50 ppm is not substantial, approximately one cent/gallon, and the combined cost of gasoline/diesel desulfurization is less than 25% of RFG capital costs. The refiners that cannot afford 15 ppm likely cannot afford 50 ppm either, and EPA cannot help these refiners escape the reality of the marketplace.

Letters:

Hart/IRI Fuels Information Services (IV-D-154) **p. 2-3**

Response to Comment 5.8.1(A)(8):

See response to comment 5.8.1(B)(1).

Response to Comment 5.8.1(A):

EPA conducted an analysis of the impact of this rule on the capital investments which must be made by refiners in Chapter 5 of the Final RIA. There, we found that the oil industry has the financial capability to fund the investments needed to comply with the 15 ppm sulfur standard. Furthermore, our benefit cost analyses in Chapter 7 of the Final RIA clearly shows that the benefits of this rule far outweigh the costs.

EPA's primary basis for justifying its rulemakings is whether the rulemaking meets the requirements of the Clean Air Act. This rule is justified by the need for emissions reductions that this rule will provide and that the technology requirements are feasible, taking cost into account. As we conclude in our discussion on cost-effectiveness in the Preamble and in Chapter VI of the RIA, we find that this rulemaking is cost-effective. However, we are also concerned whether the refining industry, or a part of the industry, is able to afford this rulemaking. We believe that refiners can afford this requirement and news of increased profits in the industry provides us more confidence that these requirements will be affordable. We are concerned, though, about the overlap of the other regulatory requirements, such as the Tier 2 rulemaking, with this diesel fuel sulfur standard, especially on the smaller refiners in the U.S. such as those in the Rocky Mountain states. In Chapter IV of the RIA and in the response to comment (B) (2) in this section, we provide our projections of the amount of investments expected to be made in each year for both this rule and the Tier 2 rule and note that the combined investments are still less than the investments made by the refining and marketing portions of the industry did in the early 1990s. In the response to comment 5.8.1(B) (7), we compare our cost estimate to those made by others. Our concern for the smallest refiners in the U.S. is an important reason why we provided those refineries special hardship privileges.

Statements by refining companies, such as BP Amoco and Tosco, that they will desulfurize their highway diesel fuel earlier than necessary is further evidence that this rule is affordable. If it was too expensive, these companies would likely find that consumers' willingness to pay would be exceeded by the cost of desulfurizing diesel fuel.

We agree with comment (3) and we refer readers to the health benefits and the cost-effectiveness in sections 5.9 and 5.10 of this document, and Chapter VI and VII of the RIA.

(B) EPA's compliance cost estimates for refiners are underestimated.

(1) Some of these commenters noted only generally that the proposed 15 ppm diesel fuel sulfur standard will be far too costly. Some commenters added that it is unreasonable to expect refiners to absorb the costs of implementing this standard, particularly when refiners are also dealing with the implementation of low-sulfur gasoline under the Tier 2 rule. One commenter noted that reducing diesel fuel sulfur below 30 ppm increases compliance costs exponentially. Phillips cites to the NPC report to support their position on this issue and stated that its projected capital investment for diesel desulfurization using conventional technologies are two to three times their planned Tier 2 expenditures, despite the fact that their diesel production is half that of their gasoline production.

Letters:

Andrews, Robert (IV-D-134) **p. 1**
Countrymark Cooperative (IV-F-30)
ExxonMobil (IV-D-228) **p. 2-3,**
Independent Fuel Terminal Operators Association (IV-D-217) **p. 3-5**
Marathon Ashland Petroleum (IV-D-261) **p. 2**, (IV-F-74)
NY Assoc. of Service Stations & Repair Shops (IV-F-45)
Petroleum Marketers Association of America (IV-F-67)
Phillips Petroleum Company (IV-D-250) **p. 5**
Ports Petroleum Co, Inc. (IV-F- 117) **p. 190**
Remster, John (IV-F-28)
U.S. Chamber of Commerce (IV-D-329) **p. 5**
Western Independent Refiners Association (IV-D-273) **p. 3**

Response to Comment 5.8.1(B)(1):

The justification for this rule is discussed in the response to comment 5.8.1(A). We believe our cost analysis is a true and accurate reflection of the costs the industry is likely to incur, and we corroborate our cost estimate in responses to comments 5.8.1(B) (2), (B) (3) and (B) (7). For information on how our diesel fuel desulfurization cost estimate was made and how it compares to other cost estimates on the 15 ppm sulfur cap standard, the reader is directed to section (C) of Chapter V in the RIA. With respect to the higher cost of reducing the highway diesel fuel to meet a 15 ppm cap standard relative to meeting a 30 ppm averaging standard, we conclude that since meeting a 30 ppm sulfur standard would not allow the emission control devices to operate as designed to meet the emission standards, the cost of desulfurizing highway diesel fuel to 30 ppm is not important. What is important is that desulfurizing highway diesel fuel to meet a 15 ppm cap standard is cost effective when we consider the emission reductions which we estimate will be realized. Our estimated aggregated capital cost of meeting this 15 ppm highway diesel sulfur cap standard is $5.3 billion, which is about 15 percent higher than the $4.6 billion estimated to be incurred for meeting the Tier 2 sulfur standard. For refiners that produce a similar ratio of highway diesel to gasoline, we would expect that they would be faced with a similar relationship in capital costs. It is interesting to note that one of the commenters on this issue about the relative capital cost of meeting Tier 2 and meeting this rule announced a new technology for desulfurizing diesel fuel since submitting their comments.[81] The company asserts that this new diesel desulfurization technology would significantly reduce the cost of desulfurizing diesel fuel. However, the potential cost reduction due to this new technology is not reflected in our cost analysis for this Final Rule because we have not been able to fully evaluate the viability of the new technology, nor its cost impact on the industry. We believe that refiners can afford the investments which much be made to meet both Tier 2 and this highway diesel sulfur standard, and we address this issue in our response to comment (B) (2) below.

We believe that the premises used in the NPC study referred to by the commenter were conservative and lead to the overestimation of cost. For example, the NPC study assumed that half of diesel fuel would be produced by refineries that would have to put in grassroots units to meet a 30 ppm highway diesel sulfur standard. We think that fraction is too conservative as discussed in Chapter IV of the RIA. Also, another industry study funded by API concluded that a lower percentage of highway diesel fuel (40 percent) would be produced by refineries which would put in grassroots units to meet the much more stringent 15 ppm cap standard.

(2) Commenters noted that EPA based its cost estimate on unreasonable expectations that existing diesel hydrotreating could be modified to produce adequate volumes of 15 ppm cap diesel fuel and asserted that such catalyst improvements have not been demonstrated. One commenter noted that the NPC report documents that existing hydrotreaters could be used with modifications but only by sacrificing significant output volumes. Commenters note that this rule's impact on the supply and cost of diesel fuel should be based on commercially proven desulfurization technology. One of the commenters added that higher pressure treating with larger volumes of catalyst would be much more expensive than EPA estimates. Commenters noted that it would take roughly $4 billion (EPA's estimate for 15 ppm cap fuel) to achieve a 30 ppm average and a 50 ppm cap. This information is derived from the NPC study, "Assuring the Adequacy and Affordability of Cleaner Fuels", requested by DOE with participation by EPA. Most refiners will be forced to build grassroots hydrotreaters in order to produce the same quantity of diesel as currently produced. DOE estimates of the cost of producing 15 ppm diesel is more than twice the EPA estimate. One commenter refers to the study released by Turner, Mason & Co., "Costs/Impacts of Distributing Potential Ultra Low Sulfur Diesel," February

[81] Announcement made by Phillips Petroleum of their S-Zorb desulfurization process being adapted to desulfurize diesel fuel.

2000, as further supporting documentation.

Letters:

American Bus Association (IV-D-330) **p. 4**
American Petroleum Institute (IV-D-343) **p. 41, 72-74**
British Petroleum (IV-D-242) **p. 5**
CO Petroleum Association (IV-D-323) **p. 1**
Citgo Corporation (IV-D-314) **p. 2**
Countrymark Cooperative (IV-D-333) **p. 2-3**
ExxonMobil (IV-D-228) **p. 13-14**, (IV-F-105) **p.12**
Marathon Ashland Petroleum (IV-D-261) **p. 38-44, 74-80**
Murphy Oil Corporation (IV-D-274) **p. 12-13**
Sinclair Oil Corporation (IV-D-255) **p. 6-7**
Swain, Edward (IV-D-162) **p. 2**

Response to Comment 5.8.1(B)(2):

The information which we received from a number of vendors supports our assumption that current diesel desulfurization units will mostly be revamped to meet the new diesel sulfur standard. We met with Criterion, Akzo Nobel, UOP, and Haldor Topsoe, which are all diesel desulfurization catalyst vendors. These vendors say that current hydrotreaters can be revamped to meet the 15 ppm cap standard which we proposed. The revamp would not be a simple modification on the existing reactor, but would require the addition of a second reactor with two to three times more catalyst, probably operating at a moderate pressure (i.e., 800 - 1000 psi). The catalyst used will be selected from a portfolio of newer, more active catalysts, probably a cobalt molybdenum (CoMo) catalyst in the first stage, and a nickel molybdenum (NiMo) in the second stage. It will also be necessary to scrub hydrogen sulfide from the recycle hydrogen gas and use the best liquid distributors for distributing the diesel fuel equally over the entire catalyst bed. In addition, those refiners treating cracked stocks, or aromatic straight run stocks, would probably need to strip out the hydrogen sulfide in the diesel fuel generated in the first reactor before the diesel fuel reaches the second reactor. Hydrogen sulfide must be stripped out because it inhibits the desulfurization of sterically-hindered sulfur compounds which come primarily from cracked stocks and these compounds comprise a significant fraction of the remaining sulfur which must still be removed. Our capital costs are based on this technology .

The commenter states that the only desulfurization technology which refiners will use is that which is commercially proven. However, the only desulfurization technologies which are commercially proven to desulfurize diesel to under 10 ppm is ring opening and hydrocracking. Both of these technologies are strategies for "upgrading" a low quality distillate stream by cracking the larger, aromatic hydrocarbon compounds into a lighter, more parafinic blend over a noble metal catalyst. Because these reactions occurs using a noble metal catalyst, the sulfur must first be reduced to low levels (i.e. less than 50 ppm) in a first stage. The product from this technology is upgraded in the noble metal catalyzed second stage to a higher cetane number and boiling over a lower range of distillation temperatures. This process consumes a significant amount of hydrogen. However, the expense of using more hydrogen and purchasing more expensive catalysts is offset by the significant price improvement which highway diesel fuel commands over residual fuel (on the order of 25 cents per gallon), the typical feedstock for this process. Since current highway diesel fuel already meets highway diesel fuel cetane and distillation requirements, ring opening is not necessary, and is cost-inefficient unless the refiner intends to switch to poor feedstocks in conjunction with this change. It is cost inefficient because some of the diesel compounds will be cracked to lighter compounds such as fuel gas, and the hydrogen consumption would be excessive.

Instead, vendors of diesel desulfurization technology have assured us that to meet single digit parts per million sulfur levels under the 15 ppm diesel fuel cap sulfur standard, a technology called hydrogenation will be used. Hydrogenation, which is generally best accomplished by using NiMo catalysts, saturates one of the aromatic rings of sterically-hindered, sulfur-containing polyaromatic compounds enabling the catalyst to reach and remove the sulfur from these compounds. It is important to mention that an equilibrium is established by the temperature at which the reactions occur, which controls the extent of aromatic saturation and the amount of hydrogen consumed. We are assured by the vendors who we met with, which have demonstrated this technology in their pilot plants, and to a limited degree commercially, that this desulfurization sequence will allow refiners to meet their sulfur targets.

With respect to revamping an existing hydrotreater or putting in a new grassroots unit, refiners with whom we have spoken have said that they will generally revamp their hydrotreaters. At this year's NPRA Q & A meeting held in San Francisco, refiners were asked if they would not revamp their desulfurization units, and put in grassroots units. Several industry technical experts, speaking on behalf of the refining industry, said that refiners would revamp their existing hydrotreaters and not mothball their existing highway diesel fuel capital investment. The experts said that some refiners may change the service of their existing hydrotreater from treating highway diesel to either a gasoline hydrotreater, to meet the Tier 2 requirements, or to a nonroad hydrotreater, if more stringent standards are established for nonroad, allowing them to put in a grassroots unit to meet this rule's stringent sulfur requirement. One refining person said that if a unit is very, very old, implying that it is more the exception rather than the rule, that a refiner may choose to scrap it and start from scratch with a new unit.

In the process of establishing this rulemaking, we spoke to a number of refiners about what their plans would be to meet a 15 ppm highway diesel fuel sulfur cap standard. The refiners said that they would revamp most of their existing hydrotreaters, however, some had made preliminary plans to put in grassroots units in some of their refineries. One of the refiners we spoke to said that in those refineries where they are putting in a grassroots unit, they have other uses for their equipment. In our cost analysis, we assume that 80 percent of refineries producing highway diesel fuel will revamp their existing diesel hydrotreater units to meet the 15 ppm cap standard, and the other 20 percent will put in grassroots units. We believe that this estimate is reasonable.

The NPC study's assumption about the need for installing grassroots units in refineries is more conservative than the assumptions made in the subsequent study by API. For this and other reasons, we don't think that the assumptions made by NPC are reasonable, therefore we don't believe NPC's estimates on the cost of desulfurizing diesel fuel are reasonable.

Considering the above and incorporating it in our cost analysis, EPA projects that the refining industry will have to invest about 5 billion dollars in capital to enable their refineries to produce highway diesel fuel which meets the 15 ppm cap standard. While we believe that these costs are not excessive, they must be considered in the context of the investments which are estimated to be needed to meet the Tier 2 gasoline sulfur requirements. From Chapter IV of the Final RIA, the following matrix summarizes our estimates of the investment costs which must be made by the refining industry to meet the Tier 2 and this rules diesel sulfur requirements:

Projected Capital Costs to be made by the U.S. Refining Industry to meet Diesel and Gasoline Sulfur Standards ($Billion)

Program	2002	2003	2004	2005	2006	2007	2008	2009	2010
Tier 2	1.7	1.11	0.85	0.63	0.17	0.02	0.04	0.02	
Diesel			1.2	1.7	0.6		0.6	1.0	0.3
Total	1.7	1.11	2.05	2.33	0.77	0.02	0.64	1.02	0.3

RIA Chapter IV

The capital investments which we project will be made by refiners to meet the Highway diesel and Tier 2 sulfur requirements are less than what refiners spent in their downstream operations in the early 90's to meet the environmental requirements at that time. During the 9 year period from 2002 through 2010, we project an industry capital investment of about $9.9 billion compared to the 6 year period from 1990 through 1995 when investment in refining and marketing totaled about $16.5 billion, or about 65 percent higher, not considering the effects of inflation. The annual average for 2002 through 2010 is $1.1 billion, which is less than half the annual average of $2.75 billion in 1990 through 1995. Thus, we conclude that these investments are not excessive. The investments made by the refining and marketing industry are summarized here.

Environmental Investments made by the Refining and Marketing Industries in the Early 1990s

Year	1990	1991	1992	1993	1994	1995
Investment	1.5	2.0	3.6	3.6	3.5	2.3

U.S. Petroleum Refining, Assuring the Adequacy and Affordability of Cleaner Fuels

To address the comments made concerning how our cost estimates compare to other estimates which were made by DOE and NPC, we refer the reader to the response to comment 5.8.1(B) (7).

(3) Some commenters noted that EPA has failed to adequately account for the difficulty and expense of removing sulfur from all the refinery streams, and therefore, has underestimated the compliance costs and that the investments required to reduce diesel sulfur levels to 15 ppm would be close to $8 billion as opposed to the $4 billion as estimated by EPA. One commenter added that this estimate does not even account for increased operating costs and loss of production to rerun off-spec product while the industry learns how to run the new technologies to meet the strict 15 ppm standard. Another commenter noted that EPA's estimate is based on optimistic predictions of hydrotreating catalyst improvements and concludes that theoretical predictions of these improvements should not be the basis for estimating the cost of production.

Letters:

American Bus Association (IV-D-330) **p. 4**
American Petroleum Institute (IV-F-16, 42, 182, 117) **p. 161** (IV-F-191) **p. 114**
Big West Oil, LLC (IV-D-229) **p. 3-4**
CO Petroleum Association (IV-D-323) **p. 1**
Citgo Corporation (IV-D-314) **p. 2**
Countrymark Cooperative (IV-F-30)
ExxonMobil (IV-D-228) **p. 10**
Food Marketing Institute (IV-D-283) **p. 2**
LA Mid-Continent Oil and Gas Association (IV-D-319) **p. 1**
National Petrochemical & Refiners Assoc./CITGO (IV-F-117) **p. 101**
National Petrochemical & Refiners Association (IV-F-31, 44)
Remster, John (IV-F-28)
Ultramar Diamond Shamrock Corporation (IV-F-191) **p. 136**

Response to Comment 5.8.1(B)(3):

We believe that our estimates of the cost of desulfurizing diesel are appropriate. To address these comments primarily made by the oil industry that we underestimated the cost to desulfurize diesel fuel, we will make a comparison of the amount of hydrogen needed to desulfurize diesel fuel with API's study (which is also consistent with the study which Mathpro did for EMA) since hydrogen demand is the most important cost of desulfurizing diesel fuel. For our Final Rule, we analyzed the cost of desulfurizing highway diesel fuel in a similar manner which Charles River did for API, which is to estimate the cost for each refinery. This most recent analysis considered the amount of light cycle oil (LCO) and other cracked stock, such as coker distillate, which each refiner blends into their distillate, and estimated the desulfurization cost based on the fractions of each blendstock. We estimated the hydrogen consumption for desulfurizing each of these blendstocks based on information shared with us by the vendors. For hydrogen consumption we used the following for treating untreated diesel blendstocks to 7 ppm, the level needed to meet a 15 ppm cap standard. For a comparison, we included the hydrogen consumption used by Charles River in their analysis for API.

Comparison of the hydrogen consumption of grassroots Hydrotreaters and Revamped Hydrotreaters used in the EPA analysis compared to the analysis performed for API
(Solution Losses Included)

	Straight Run		Coker Distillate		Light Cycle Oil	
	Grassroots	Revamp	Grassroots	Revamp	Grassroots	Revamp
EPA	240	96	850	230	1100	375
API*	200	90	1160	260	1350	450

* The API hydrogen consumption values are approximate as they were read off of a chart.

Next we compared our hydrogen consumption values to those from API and vendors, who provided estimates to the National Petroleum Council (NPC) for treating a diesel fuel with 25% LCO, 10% coker distillate, and 65% straight run and a T-90 point of 610° F. To derive our and API's estimated hydrogen consumption for each of these fuels, we simply weighted the hydrogen consumption values for each blendstock by the blendstock fractions assumed for this typical diesel fuel. These values are presented in the following table.

Comparison of the Hydrogen Consumption for Desulfurizing a Typical Highway Diesel Fuel

	Revamp	Grassroots	Target Sulfur Level	Includes Solution Losses?
EPA	180	520	7 ppm	Yes
API	200	580	7 ppm	Yes
Akzo Nobel	15	290	10 ppm	Yes
Criterion	160	375	10 ppm	?
Haldor Topsoe	50	350	10 ppm	No
UOP	121	411	10 ppm	Yes
IFP	-	1020	30 ppm	Yes

To compare the hydrogen consumption values in the table, it is important to understand how the different assumptions used in creating the hydrogen consumption values impact the values. The vendors were analyzing the hydrogen consumption for meeting 10 ppm, however our estimate of hydrogen consumption and API's estimate are for achieving 7ppm, the expected target sulfur level to meet the 15 ppm cap standard. We don't know how each vendor would adjust their hydrogen consumption values to meet a 7 ppm under a 15 ppm cap standard, however, we assigned a 20 scf/bbl increase for the more stringent sulfur target based on information which we received from one of the vendors. Furthermore, we assigned 25 scf/bbl for solution losses. Each vendor assigned a different values for solution losses between the various. Evaluating the hydrogen consumption values in the table, and considering the adjustments needed to put the various estimates on the same basis, our hydrogen consumption values are lower than API's, but they are higher than all the vendor's hydrogen values, except for IFP's. We believe that our hydrogen consumption values are similar to the vendors' and API's estimates because we assume similar technologies for desulfurizing highway diesel fuel. This hydrogen consumption estimate provides further support that our cost estimates are appropriate, and that they are fairly consistent with the oil industry's analysis.

We believe our cost estimates are the best supportable estimates at this time. However, if someone believes our cost estimates could be low, such an optimistic view might be appropriate. There are at least two reasons why diesel desulfurization costs will decline further before 2006 or 2010 when refiners will have to comply with this rulemaking. First, the activity of diesel desulfurization catalysts is expected to improve before then. In fact, two catalyst vendors, Criterion and Akzo Nobel, announced the availability of newer more active catalysts during the last half of this year. Further improvements are expected over time. Even improved catalysts which become available after diesel desulfurization revamps and new units which are started up can be incorporated into the diesel hydrotreater. Diesel desulfurization catalysts lose activity over time and need to be replaced to maintain the productivity of the desulfurization unit. When refiners change out their catalyst, they can load a more improved catalyst to replace the older, less efficient catalyst. Another reason why desulfurization costs should be optimistic is that several diesel desulfurization technologies have been announced which are expected to be lower cost technologies. These technologies, which includes biodesulfurization, chemical oxidation and adsorption, were not far enough along in their development to provide cost estimates for this rule, however, they could be far enough along in their development so that refiners investing for 2010 could take advantage of the lower costs which these processes could offer.

(4) Although desulfurization ring opening and de-aromatization technologies work in Europe, it is only where light cat cracked cycle oil volume is minimal and outlets for higher sulfur diesel/heating oil exist. In the US, sulfur compounds in light catalytic cycle oil require expensive, high severity hydrotreating for removal. Some European countries such as Sweden also constrain the final boiling point of City Diesel to be low enough to exclude many refractory sulfur compounds. EPA provides no resolution to this problem.

Letters:

British Petroleum (IV-D-242) **p. 6**

Response to Comment 5.8.1(B)(4):

As summarized from an involved discussion on this issue in Chapter IV of the RIA, we are convinced that refiners will further desulfurize their highway diesel fuel to meet the 15 ppm sulfur cap standard using the hydrogenation method for desulfurizing diesel fuel. Our conviction that refiners will use the hydrogenation method is based on our discussions with four different vendors of desulfurization hardware, and is also the basis for the API, NPC, and EIA cost estimates. Hydrogenation saturates one ring of polyaromatic compounds to facilitate the removal of sulfur from those compounds. The hydrogen demand using the hydrogenation route for desulfurization is moderate (see the response to 5.8.1(B) (3) for estimates). If refiners choose to use ring opening and dearomatization, they do so for a different set of reasons. Such technology works for any feed which needs to be upgraded by increasing the cetane number and lowering the boiling or distillation temperature range of the feed. A commercial example of ring opening is the Lyondel-Citgo's highway diesel desulfurization unit at their Houston refinery which processes a very heavy, predominantly cracked feedstock distilled from Venezuela crude oil. One-third of the feed to their ring opening unit is light cycle oil, one-third is coker, and one-third is straight run feed. Lyondel-Citgo is currently processing that blend of feed to their highway diesel fuel to upgrade the material from residual oil to highway diesel fuel so that they can sell it for a much higher value product. However, we have been reassured by vendors that refiners would not be expected to choose to use this technology to further desulfurize their existing highway diesel fuel to meet a 15 ppm cap standard because of the costs involved and because the technology would increase cetane and lower the boiling range temperature of their highway diesel fuel for no apparent reason. However, a refiner could use this technology to convert residual oil to highway diesel fuel if it wanted to expand their pool of highway diesel fuel to increase their profits.

(5) One commenter noted that the operating costs for a refiner to comply with the proposed standard will be significant since as the desulfurization catalyst ages, the reactor temperatures must be raised to achieve target sulfur levels and there are limits to raising the temperature. At 15 ppm with 70 percent heavy-cracked stocks, the cycle life of the catalyst will be reduced from 24

months to 8 months. This reduction significantly raises the operating costs by requiring more frequent catalyst replacement and additional shutdowns, and will result in a loss of diesel production. The more frequent replacement of the catalyst may raise the cost of diesel production by as much as 7 cents a gallon in addition to the loss in production.

Letters:

Citgo Corporation (IV-D-314) **p. 6**
National Petrochemical & Refiners Assoc./CITGO (IV-F-117) **p. 101**

Response to Comment 5.8.1(B)(5):

We are aware of Lyondell Citgo's (commenter's) situation at their Houston refinery. The refiner put in a processing facility to produce highway diesel fuel meeting the federal 500 ppm diesel sulfur cap standard from a feedstock which is a heavy mixture comprised approximately of 1/3 straight run, 1/3 coker distillate and 1/3 LCO. The feedstock is low in cetane and heavier than diesel fuel and must be processed severely to upgrade both the feedstock's cetane and the distillation endpoint. The upgrading process involves ring opening which opens the aromatic rings of the heavy aromatic feedstock improving both the endpoint and the cetane of the fuel. Since that unit was started up, the unit is processing heavier feedstock than what the unit was originally designed to handle, and the operating temperature is lower than designed to prolong the cycle length (the time between when the catalyst must be changed out) of the unit. While the ring opening requires that the feedstock's sulfur concentration be decreased first prior to being reacted over the ring opening catalyst, the sulfur level which must be achieved is perhaps only on the order of 50 to 100 ppm sulfur. When an EPA staff person visited the Lyondel Citgo refinery, the second reactor was not even being used. Instead, the ring opening catalyst was loaded into the bottom of the first reactor.

We believe that Lyondell-Citgo has several options for meeting the more stringent sulfur standard. First, the most active diesel desulfurization catalysts would likely be used, and the most recently announced catalysts are perhaps 1/3 more active than the catalyst loaded in the facility now, and future catalysts will likely improve on this even more. After opting for the most effective catalysts, other options available to the refiner to meet the new diesel sulfur standard include backing out some of the feedstock (most likely, some of their LCO) to reduce the space velocity of their current unit, increasing the temperature of the reactor to improve the desulfurization reaction rate which would also reduce the cycle length of the catalyst, or putting in more catalyst by either dense packing the current reactors, or putting in additional reactor volume. The refiner needs to decide what option or combination of options makes the most sense for their situation. However, the refiner is not limited to shorter cycle lengths as the only option since the other two options which we discuss here are also available. We are confident that most refiners will not choose the option which would reduce the cycle length of their diesel hydrotreater. It is likely that this refinery can take advantage of the temporary compliance margin option at this refinery to stage their investments since the refinery has two diesel desulfurization trains. One train could be modified for 2006, and the second one for 2010.

(6) Commenters referred to the recent assessment by the National Petroleum Council (an advisory committee to the Secretary of Energy) entitled "Assuring the Adequacy and Affordability of Cleaner Fuels," June 2000, as supporting documentation. This document provides an overview of the U.S. petroleum

refining industry as well as a detailed discussion in Chapter 3 on reducing the sulfur content of on-highway diesel fuel. This includes an overview of the distillate market, distillate hydrotreating technology, technology for reducing diesel sulfur, the costs for achieving 30 ppm sulfur on-highway diesel, and the limitations of linear programming modeling to predict investments and operating costs.

Letters:

American Trucking Association (IV-D-269) **p. 18-20**
Countrymark Cooperative (IV-D-333) **p. 5**
ExxonMobil (IV-F-800)
LA Mid-Continent Oil and Gas Association (IV-D-319) **p. 1**
Murphy Oil Corporation (IV-D-274) **p. 13**
National Petrochemical & Refiners Assoc./CITGO (IV-F-117) **p. 101**
National Petrochemical & Refiners Association (IV-F-31, 44)
U.S. Department of Energy (IV-G-28) **p. 4, Att. 3 + 4**

(7) The NPC and DOE studies demonstrate that the EPA's estimates of the costs required to meet its proposal are underestimated by 195-264%. Given the close convergence of DOE, CRA, and MathPro costs, EPA has underestimated the costs. The PRISM model predicted 40% of refiners would have to build new facilities to comply with the rule, and API urges EPA to re-estimate the cost impacts of meeting the 15 ppm cap based upon findings consistent with the PRISM model. Commenters provide significant data and discussion to support their position on this issue.

Letters:

American Petroleum Institute (IV-D-343) **p. 70-75**
British Petroleum (IV-D-242) **p. 5**
Marathon Ashland Petroleum (IV-D-261) **p. 38-39, 75**

Response to Comment 5.8.1(B)(6) and (7):

In their comments to us, EMA, DOE and API all submitted costs for meeting a 15 ppm highway diesel fuel cap standard. We adjusted the cents per gallon cost estimates for the EMA and DOE cost studies to represent the amortization of the capital costs at a 7 percent rate of return before taxes, which is how we calculate our per-gallon cost. DOE provided two separate cost estimates, a conservative cost estimate and an optimistic cost estimate. The conservative cost estimate is based on ring opening technology, however, since vendors of diesel desulfurization technology have convinced us that such technology will not be used, and even API based their desulfurization cost estimate on the less expensive hydrogenation technology, we did not include DOE's ring opening technology here. Instead we present DOE's costs which we believe is based on hydrogenation technology.[82] We were not able to adjust the API cost estimate since we did not receive a capital cost estimate from API. Since NPC did not provide a cost estimate for meeting a 15

[82] DOE did not specify what technology they assumed would be used for their more optimistic cost estimate, however, their contractor created the more optimistic cost estimate after we shared vendor submissions with them, so presumably they based the optimistic cost estimate on the hydrogenation method of desulfurizing diesel fuel.

ppm cap standard, we did not summarize their cost estimate in this table, instead we discuss these costs further below in this response. These costs are presented in the following table:

Comparison of National Average Refining Cost Estimates
(7 percent rate of return on investment before taxes, except where noted)

	Average Cost (cents per gallon)	Capital Cost ($ billion)
EPA	4.3	5.3
Mathpro for EMA *	4.2 - 6.1 (4.6)	3.4 - 6.1 (3.9)
EnSys for DOE * †	4.2 - 4.4 (4.2)	2.7 - 4.5 (3.1)
CRA for API (10% after tax rate of return)	6.2	---

* Lower end of range assumes 100 percent revamped equipment while the upper end assumes all new equipment; values in parentheses represent 20 percent revamped costs and 80 percent grassroots costs.
† DOE costs are only for the Gulf Coast refining region, which have slightly lower per-gallon costs than the entire U.S., and almost half the capital costs. These are DOE's optimistic cost estimates; we are reporting these because they are based on technology which is expected to be used by refiners to meet the 15 ppm sulfur cap standard.

We believe that we can explain the difference between our costs and the costs estimated by EMA, DOE and API. We will first compare our per-gallon cost with those by EMA and DOE contained in the parentheses, which is interpolated based on 80 percent of the revamp cost and 20 percent of the grassroots cost. Before discussing the per-gallon costs, it is important to put the DOE costs on a more comparable ground. DOE's costs are only for PADD 3 which is the largest of all the PADDs and it produces about half of the volume of highway diesel produced in the country. If we extrapolate the PADD 3 costs to the rest of the U.S. based on our relative PADD 3/U.S. costs, we estimate that DOE's nationwide cost would be about 4.5 c/gal. Thus the EMA and DOE costs are about the same and slightly higher than our costs. In Chapter V of the RIA, we discuss the various cost studies and make several observations on the studies. One important observation we made about both the EIA and DOE studies is that they base their hydrogen costs on new hydrogen plants. However, many refineries, including almost all of PADD 3, can purchase cheap hydrogen from third parties at a lower cost than hydrogen produced from a small refinery-based hydrogen plant. We believe that if these studies had considered the lower cost of hydrogen available from third parties for a portion of the total hydrogen demand, their costs would be about the same as ours.

The API costs could not be specifically adjusted from 10 percent after tax ROI to 7 percent before tax ROI because API did not provide details of their capital costs. However, we will make an approximate adjustment based on some assumptions. If we assume that capital costs comprise the same portion of API's total costs as our costs, we would estimate that API's costs would adjust to 5.6 cents per gallon. In reality, API's costs would be expected to adjust to an even lower cost than that because the capital costs likely contribute a higher portion of the overall costs than our analysis. API assumed that 40 percent of the costs are based on grassroots costs, and API used higher factors for estimating stream day capacity from the calendar day throughput. Another likely reason why the API costs are higher than ours is that API probably based its hydrogen cost completely on production from new hydrogen plants which, like the EMA and DOE analyses, would overstate the costs.

Our capital costs compare well to those from these other studies. EMA's estimated costs were based on PADDs 1, 2, and 3 which represents about 80 percent of the U.S. production of diesel fuel. If we adjust those costs (using the interpolated costs in the parentheses) higher to account for the remaining production volume of the rest of the U.S. refiners, we estimate the capital costs for entire U.S. refining industry meeting the 15 ppm sulfur cap standard based on the EMA cost study to be just under $5 billion. Thus, EMA's capital costs are slightly lower than our capital costs. DOE's cost estimate represents the refining cost for PADD 3 which represents only about half of the U.S. refining industry's highway diesel fuel production. Adjusting the capital costs upward to account for the entire U.S., we estimate the aggregate capital cost for the U.S. refining industry meeting the 15 ppm sulfur cap standard based on the DOE cost study to be about 6.5 billion. DOE's extrapolated capital costs are somewhat higher than our costs. However, as we discussed in Chapter V (C) of the RIA, DOE's costs include a redundancy factor which increases the desulfurization unit's volume upward by 15 percent under the presumption that refiners will size their unit significantly larger to account for a possible shortfall in the performance of their new unit, and this is already after sizing their unit 20 percent larger than the calendar day volume. We believe that DOE's redundancy's factor is extreme. If we were to remove that factor, DOE's capital costs would be under $6 billion which is slightly higher than ours. API did not provide capital costs for us to compare with our costs.

We reviewed the National Petroleum Council's (NPC) report of the impact of environmental programs on the refining industry. The report only evaluated the cost of a 30 ppm average highway diesel sulfur standard, so we could not compare that report's estimated costs with ours since we are promulgating a more stringent 15 ppm sulfur cap standard. We do have some comments on the study though. The study used the cost study which Mathpro did for EMA, however, it applied a conservative set of assumptions to the study's cost estimate. NPC assumed that half of highway diesel fuel would be produced by grassroots units and the other half by revamps. This is very conservative considering that API assumed that a smaller fraction of highway diesel fuel would be produced by grassroots units despite evaluating a much more stringent 15 ppm sulfur cap standard. NPC also increased Mathpro's capital and operating costs based on the presumption that the vendors under report their capital and operating cost estimates, and NPC made that adjustment despite not even seeing the vendors' cost information which Mathpro used in their cost study.

(8) Commenters also noted that price increases at the pump will be significant as a result of these excessive implementation costs. One commenter estimates 12 cents/gallon.

<u>Letters:</u>

American Trucking Association (IV-D-269) **p. 18-19**
Farmland Industries (IV-F-29)
NY Assoc. of Service Stations & Repair Shops (IV-F-45)
National Petrochemical & Refiners Association (IV-F-31)
Remster, John (IV-F-28)

(9) Some commenters asserted that a number of refiners may cease operations or at least the production of diesel fuel as a result of the excessive costs of complying with the proposed sulfur standard.

Letters:

American Trucking Association (IV-D-269) **p. 18-19**
CO Petroleum Association (IV-D-323) **p. 1-2**
Countrymark Cooperative (IV-D-333) **p. 5**, (IV-F-30)
Ergon & Lion Oil Co. (IV-F-117) **p. 183**
Farmland Industries (IV-F-29)
LA Mid-Continent Oil and Gas Association (IV-D-319) **p. 3**
National Petrochemical & Refiners Assoc./CITGO (IV-F-117) **p. 101**
National Petrochemical & Refiners Association (IV-F-31, 44)
Remster, John (IV-F-28)

Response to Comment 5.8.1(B)(8) and (9):

The commenters provide no basis for stating that the price increase at the pump will be significant, and the one commenter did not substantiate their estimate for a 12 cents per gallon price increase. It is very difficult to estimate price increases since they are market phenomena. For example members of the API have repeatedly explained to us that the price differential between an environmentally required fuel such as Reformulated Gasoline (RFG) and the 500 ppm highway diesel fuel sulfur cap standard only reflects the operating cost of producing that fuel, not the capital cost, due to sufficient investment by refiners to meet the environmental requirement. If that is the case here, we would expect the price at the pump for the 15 ppm sulfur fuel to be less than 4 cents per gallon more expensive than 500 ppm sulfur fuel while it is still being sold, and less than 7.0 c/gal more expensive than nonhighway diesel fuel.[83]

However, price increases can be much higher than the cost to produce due to a significant shortage in a submarket for the fuel as evidenced by the higher prices for gasoline in the Midwest in the early Summer of 2000. We believe that the market will not experience high prices for meeting the 15 ppm cap standard because of certain provisions included in the Final Rule. We believe that the temporary compliance margin and the small refiner hardship provisions will prevent the possibility for price spikes for several reasons. During the period 2006 and 2010, the production of 15 ppm sulfur highway diesel fuel will be much larger than demand avoiding any supply issues during that period of time. We believe that a supply shortfall and associated price increases will not occur in 2010 because refiners not investing in 2006 will be able to assess what markets they can best sell into when full implementation with the 15 ppm cap standard is required in 2010. Not investing until having to meet the program requirements in 2010 gives those refiners more time to procure the capital for meeting the program requirements. Also, conventional desulfurization catalysts are expected to improve by 2010 and emerging diesel desulfurization technology may well be commercially available which would reduce their perceived costs for participating in producing 15 ppm sulfur fuel and would likely even the playing field compared to the lower cost producers which are likely to begin producing highway diesel fuel in 2006.

(10) One commenter noted that the proposed rule consists of a significant capital investment in an industry with very low return on capital.

[83] The average price difference between the 500 ppm highway diesel fuel and nonhighway diesel fuel is 2.7 cents per gallon, however, the range in different PADDs is 0 - 4 cents per gallon.

Letters:

American Petroleum Institute (IV-F- 191) **p. 114**

Response to Comment 5.8.1(B)(10):

EPA acknowledges that the return on capital has been lower for the refining industry than many other industries over the last decade. However, the refining industry's return on investment has been better over the last year as described in comments which we received on this rule, probably due to the fact that refineries are operating near or at full capacity. This situation creates some anticipation that return on investment for the refining industry could be better in future years. Whether if the refining industry is earning a high or low return on capital, we believe that they can afford to make these investments. As an example, despite earning low returns on capital in the early '90s, refiners invested a significant amount of capital to meet the Clean Air Act requirements being implemented during that time. As discussed in response to comment (B) (2) above, the dollar investments of this program and Tier 2 are less than those investments, and this comparison does not consider the effects of inflation. Thus, we conclude that the refining industry can afford the investments which they would have to make to meet the program's requirements.

(11) One commenter cites to API's estimate that more than 30% of the petroleum stocks currently processed for end-use as highway diesel fuel with 500 ppm sulfur would be processed for other uses due to the high cost to the refiner to produce low sulfur diesel. It is not technologically feasible for refiners to process low sulfur diesel at a price that the market would bear. The loss of one third of the highway diesel supply, which is currently at capacity, would result in adverse impacts to other businesses and consumers through increased fuel costs.

Letters:

American Trucking Association (IV-D-269) **p. 19-21**

Response to Comment 5.8.1(B)(11):

EPA's goal is to develop a final program that will ensure a smooth implementation of the program, and avoid any potential for shortages in the supply of highway diesel fuel. A key ingredient to meeting this goal is that we are providing sufficient lead time for refiners to begin planning their desulfurization investment strategies. We believe that providing almost 6 years lead time for many refiners is sufficient for the refining industry to be able to plan for the necessary volume of low sulfur highway diesel fuel that will be needed in 2006. The temporary compliance option provides many refiners up to 9 years to comply.

Charles River Associates conducted the study for API which concluded that the proposed diesel sulfur rule would result in a significant shortfall of highway diesel fuel supply. The results of the study, however, were a direct result of the assumptions made. Since a number of the key assumptions were not substantiated, the results of the study are in question, and EPA cannot support its conclusions.

First, CRA ignored the fact that there is an oversupply of highway diesel fuel today;

15 percent of highway diesel fuel is currently used in nonroad applications. This means that the refining industry actually overbuilt desulfurization capacity for the current 500 ppm sulfur standard that became effective in 1993. Any potential shortage of highway diesel fuel would lead these non-essential users to switch to nonroad diesel fuel or heating oil. In addition, CRA assumes that refiners that do invest to meet the sulfur requirement will build their highway diesel hydrotreaters 40 percent larger than calendar day demand. If refiners do invest at this level, it seems likely that the industry would over invest again. Even our estimates that refiners would build their highway diesel hydrotreaters 20 percent larger than demand provides some margin for guaranteeing supply, especially considering that catalyst technology will continue to improve making diesel hydrotreaters sized over the next several years even more overdesigned.

Second, CRA assumed that 20 refineries could profitably exit the highway diesel fuel market entirely, and a large number of additional refiners partially would exit the market by shifting their highway diesel production to other distillate markets. CRA further assumed that other refiners currently not producing highway diesel fuel would not profitably enter into the market in the future. Although some refineries may choose to exit the highway diesel fuel market or lower current production volume, we fully expect that other refineries will choose to enter the highway diesel market or expand current production. CRA did not conclude that this is the case because it did not even analyze the impact of this additional supply on the prices which could be obtained in these markets, or even if these alternative markets could physically absorb all of this material. Much of this material reported to be moved out of the diesel fuel market is not diesel fuel quality, but poor quality blendstock. It is not clear that such material could be blended into nonroad diesel fuel and CRA did not analyze this likely problem. We do not see much opportunity for the refining industry to shift production to other distillate products. These markets would quickly become saturated, making them less profitable We expect that refineries will fully analyze this situation prior to making decisions about desulfurization investments. As a result, we believe that the refining industry as a whole will prepare to meet the expected demand for highway diesel fuel in 2006. We note that similar shifts in the market occurred when the 500 ppm sulfur standard became effective in 1993. Refer to Issue 8.1.1 for a more complete discussion of supply concerns.

(12) Commenter refers to a recent NPRA paper presented in March 2000, which shows revamping costs of $20 million for a 30,000 B/D unit (even assuming the changes in operation philosophy are successful) to meet a 15 ppm standard, but only $6.8 million to meet a 50 ppm cap as recommended by many refiners.

<u>Letters:</u>

Big West Oil, LLC (IV-D-229) **p. 3-4**

<u>**Response to Comment 5.8.1(B)(12)**</u>:

We are aware of that paper by UOP and partially based our capital cost estimate to meet a 15 ppm cap standard on the capital cost estimates made in that paper.

(13) Some commenters referred to the CITGO Petroleum facility at Lyondell and noted that the actual cost of the desulfurization technology used at this facility are roughly twice what EPA has estimated. One of these commenters

specifically noted that the feedstocks to this revamped facility are 30 percent straight-run stocks from the crude distillation unit and 70 percent heavy-cracked stocks from conversion units and that these heavy-cracked stocks are significantly more difficult to treat to the 15 ppm level. The commenter added that operating data for this facility shows that to consistently desulfurize to 15 ppm or below, a significant portion of the cracked material must be removed from the feed, which will reduce diesel production.

Letters:

Citgo Corporation (IV-D-314) **p. 5-6**
National Petrochemical & Refiners Assoc./CITGO (IV-F-117) **p. 101**
National Petrochemical & Refiners Association (IV-F-31, 44)

(14) One commenter also provided discussion on the capital improvements to the Lyondell-CITGO refinery, which were completed in 1996 and included the installation of the world's largest freestanding reactor. Catalyst volume in this 50,000 barrel per day unit was increased from 40,000 pounds to 1.7 million pounds at a capital cost of $86 million (which includes $69 million for the process unit and $17 million for the supporting facilities). This is much higher than the $30 million cost for a typical refinery processing light cycle oil as estimated by EPA. Citgo itself estimates that the Lyondell unit can treat less than half of the diesel pool to a 15 ppm average. Catalyst cycle life will be reduced to unacceptably short intervals. Citgo would have to invest over $270 MM at that unit alone to ensure that production meets a 15 ppm average. A 15 ppm cap would cost over $340 MM. In addition, a simple retrofit is not possible on many units since most older, smaller units do not have sufficient reactor design pressures, the requisite high-purity hydrogen supply, a suitable fractionation system, or other hardware.

Letters:

Citgo Corporation (IV-D-314) **p. 6**
National Petrochemical & Refiners Assoc./CITGO (IV-F-117) **p. 101**

Response to Comment 5.8.1(B)(13) and (14):

Our responses to (B) (4) and (B) (5) above addresses some of the commenter's concerns about costs using the Lyondel-Citgo refinery as an example. However, we want to address some the specific points made by the commenters in an additional response here. First, the first stage reactor is very large earning the right to be called the largest free standing reactor. It is important to note, though, that refiners do not need to proceed in the way that Lyondel-Citgo did in desulfurizing and upgrading their diesel fuel. Lyondel-Citgo chose to operate their diesel desulfurization and upgrading unit at 650 psi, not 800 - 900 psi. If they would have designed their unit operate at the higher pressure, they would have been able to use much smaller reactors, but with thicker walls, however, the overall capital costs would not be much different.

Second, the Lyondel-Citgo diesel desulfurization and upgrading unit is primarily designed for ring opening, not desulfurization. Lyondel-Citgo is increasing the cetane number of their feed from 30 to 40, decreasing the aromatics from 70 to under 40 volume percent, and increasing the API gravity by about 7 numbers, which translates into a significant reduction in the distillation boiling range of the feedstock. The sulfur of the feed is reduced from 1.3 percent to under 0.01 percent (100 ppm) which allows the product to well exceed the current 500 ppm sulfur cap standard. However, if the unit is operated as designed (with a lower endpoint and operated at a higher reaction temperature), the vendor which designed the unit informs us that the unit is capable of desulfurizing the highway diesel fuel down to under 20 ppm.

Because the desulfurization and upgrading unit is designed primarily for upgrading, a large part of the investment was made to upgrade the diesel fuel and that part of the investment could be avoided if the refinery only needed to reduce the sulfur of the feedstock without needing to improve the other diesel fuel qualities. The vendor which designed that particular unit was one of the vendors we met with so we know that a unit designed only for desulfurizing and not upgrading diesel fuel would be a lower cost unit. We also understand that the diesel desulfurization and upgrading unit at Lyondel-Citgo was not installed as a simple revamp, despite the fact that there some facilities in place for some mild hydrotreating. Instead, the unit could be considered as a hybrid between a revamp and a grassroots unit which is another reason why the capital costs are significant for this unit.

(15) Another commenter added that the cost of compliance for the Lion Refinery in Arkansas (55,000 barrels per day) will be approximately $25 million with the 50 ppm standard and that these costs will double if the 15 ppm standard is required.

<u>Letters:</u>

Ergon & Lion Oil Co. (IV-F-117) **p. 183**

<u>Response to Comment 5.8.1(B)(15)</u>:

The capital cost investment we estimate the Lion refinery would have to make to meet the 15 ppm cap standard is consistent with Lion's estimate.

(16) Commenter notes that its costs at one refinery to meet the 1993 500 ppm standard were over $83 million, so the EPA estimates are far too low. Commenter notes that farmer co-ops have higher costs than other refiners because they produce a higher percentage of diesel to serve their agricultural needs.

<u>Letters:</u>

Cenex Harvest States Cooperatives (IV-D-232) **p. 8**

<u>Response to Comment 5.8.1(B)(16)</u>:

We presume that Cenex is referring to the NCRA refinery in its comments. We can use our current cost model for estimating what Cenex may have invested at that refinery to meet the 500 ppm sulfur cap standard. The capital investment for meeting the 500 ppm cap standard would be expected to cost about the same as the capital cost of revamping that unit to meet the 15 ppm cap standard. This is because our grassroots unit costs are about twice the cost of a revamp. Based on this relationship of costs, our capital cost estimate of the Cenex refinery meeting the 500 ppm sulfur cap standard is consistent with Cenex's cost. This comparison corroborates our cost model, and suggests that Cenex does not face higher costs than other refineries since their historical costs are consistent with our cost model which is designed to represent typical refiner diesel desulfurization costs.

(17) The capital costs discussed in the literature do not account for inside refinery operation changes that will be necessary in addition to the process units. Feed tanks, day tanks, piping, and blending operations all will likely need changes to ensure the refiner can deliver on-spec product. There are tremendous costs associated with these changes.

Letters:

Big West Oil, LLC (IV-D-229) **p. 5**

Response to Comment 5.8.1(B)(17):

In our discussion of the capital hardware needed in refineries to meet a 15 ppm cap standard in the draft Regulatory Impact Analysis, and in that document for this final rule, we only discuss the major equipment needed in refineries to produce highway diesel fuel which meets the 15 ppm cap standard. However, our cost analysis is based on engineering and construction firm estimates of the inside and outside battery limits costs to revamp refineries to meet the 15 ppm cap standard. The outside battery limit costs includes such items as the piping needed to connect the revamped unit to the rest of the refinery, and it is also meant to include some costs for other facilities such as control buildings and administrative offices, primary substation and switchgear, utility generation systems, waste and water treatment facilities, and flare costs. In addition, we included the addition of a short term storage tank as a separate line item for holding potentially off spec material after hydrotreating. Furthermore, we estimated that refiners will size their desulfurization units 20 percent larger than necessary, 5 percent of which for reruns of offspec product. Then we added an 18 percent contingency factor for the capital costs, and a 12 percent contingency factor for operating costs to handle any additional costs that may not be included in the cost estimate. Therefore, we believe that we accounted for all the cost items identified by the commenter.

(18) Commenter notes that EPA's cost estimates do not address the costs of environmental controls required by the permitting rules. PSD and NSR permits require BACT/LAER emission controls that can total several million dollars per refinery.

Letters:

LA Mid-Continent Oil and Gas Association (IV-D-319) **p. 1**

Response to Comment 5.8.1(B)(18):

Capital costs for meeting BACT and LAER emission controls would be attributed to this rulemaking if a diesel desulfurization capital investment is being made in a refinery and the unit requires, for example, the installation of a heater that would increase the NOx emissions from that refinery, and existing NOx control regulations are triggered which require the use of BACT or LAER emission controls. However, we anticipate that most refiners will revamp their existing hydrotreater, thus the heat needed for reaction for both the existing and the add on unit would be provided by the existing heater. Since no new heaters would be installed in the refinery, no increases in NOx emissions are expected and no capital costs would be incurred for NOx emissions control. Even refineries which are putting in a grassroots unit to replace their existing hydrotreater are expected to simply replace an existing heater with a newer heater, thus no net increase in emissions would be expected. However, some of those refineries may have to install NOx controls for the replacement heaters, depending on the emission requirements which pertain to that individual refinery. We also believe that some refineries will be converted from producing nonhighway diesel fuel to producing highway diesel fuel. These refineries would be installing a brand new heater to desulfurize their nonhighway diesel fuel and it is possible that these refineries will have to install BACT or LAER controls. Since capital costs for meeting BACT or LAER are expected to be incurred primarily by a portion of the few refineries which will put in new grassroots units, we believe that our contingency factor, which increases our capital costs by 18 percent, would cover any costs associated with these controls.

(19) In evaluating the compliance cost to refiners, EPA has expressed confidence in the vendors' estimates of lower pressure requirements and lower costs, even though it is acknowledged that vendors typically underestimate their capital costs and utility demands for the refining process for marketing reasons. EPA has stated that even if vendors' costs are underestimated, it can be justified since these same vendors will be making improvements in their desulfurization technologies. Commenter notes that if self-interest motivates vendors to underestimate costs and refiners to overestimate costs, then neither set of estimates can be considered truly reliable. Adjusting an unreliable set of estimates with unspecified "improvements" in desulfurization technology does not provide credible evidence of the likely increase in average refinery costs. In addition to these concerns, EPA's cost estimate may be misleading since it does not account for the rapid increase in demand that is likely to result from the proposed fuel standard. Increased prices charged to refiners by vendors of desulfurization equipment may persist for an extended period of time, thus increasing overall compliance costs.

Letters:

Mercatus Center at GMU (IV-D-219) **p. 16-17**

Response to Comment 5.8.1(B)(19):

The commenter points out a number of uncertainties inherent in the inputs and procedures which are used to estimate costs. We agree that such uncertainties exist and we attempted to balance the uncertainties to derive the best possible cost estimates.

(20) Investments of at least $8 billion, and as high as $13 billion, will be required to prepare U.S. refineries to produce 100 percent of their on-road diesel fuel at below 10 ppm sulfur. National investment costs were estimated by scaling PADD III results from the report entitled "Modeling Impacts of Reformulated Diesel Fuel, August 14, 2000, assuming that the same diesel desulfurization

technologies will be required across regions and that investment cost is directly proportional to mass sulfur reduction and to regional cost adjustment factors. In addition to these costs, reductions in MTBE and controls on gasoline benzene may add to these investment requirements. One of the factors contributing to the high cost is the need for high pressure HDS units to ensure reliable production. EPA's RIA fails to address the reliability of production in its choice of a low pressure HDS strategy and thus, in its cost estimation. Commenter cites to Chapter 3 of the NPC report (p. 68 to 76) and notes that until additional data is obtained on this issue, it should be assumed that a combination of lower and higher pressure HDS technology will be necessary.

Letters:

U.S. Department of Energy (IV-G-28) **p. 4, Att. 3 + 4**

Response to Comment 5.8.1(B)(20):

DOE's cost analysis estimated a range of costs based on two different diesel desulfurization technologies, DOE labeled one technology as conservative and the other as optimistic. The conservative technology assumes that ring opening technology will be used while the optimistic technology assumes that a more modest desulfurization technology will be used which we believe represents hydrogenation. We discuss these two methodologies for meeting the 15 ppm sulfur cap standard in Chapter IV of the RIA and in responding to comments B2 and B4 in Section 5.8.1 of this document. We are convinced from our conversations with vendors that hydrogenation will be the technology of choice by refiners to meet the 15 ppm sulfur cap standard. Furthermore, EMA, and API both presumed the use of hydrogenation in their cost analyses. Thus, we think that only DOE's optimistic technology should be considered when estimating capital investments from their analysis, as how we responded to comments 5.8.1 B 6 and 7.

For the final rule we discussed and addressed concerns about the reliability of diesel fuel desulfurization technology when it is applied to meet the 15 ppm sulfur cap standard. First, we included the cost of a storage tank to account for the storage of batches of offspec product when the desulfurization unit has failed to meet the sulfur standard. Then we sized the diesel desulfurization unit 5 percent larger and increased the operating costs by 2 percent to process batches of offspec material (the operating costs are lower than the capital size increase since the batch was treated once already and due to its lower sulfur level, its treatment costs would be significantly lower the second time through). Based on our conversations with vendors, we don't believe that cycle lengths would be shorter. In our discussion in Chapter V of the RIA and in our response to comments 8.1.2 B 2 below, we describe our understanding that cycle lengths would not be expected to decrease compared to cycle lengths today. This is because after the first stage, which is or equivalent to today's diesel hydrotreater, the new second stage of a revamped hydrotreater will be treating a much cleaner feedstock and its optimal operating conditions are less severe than today's hydrotreater. Thus, it is the cycle length of the first stage, or today's diesel hydrotreater, which will establish the cycle length of the revamped diesel hydrotreater.

Refiners may use a range of different pressures to treat their highway diesel fuel to meet the 15 ppm sulfur cap standard, however, we disagree with DOE that the costs will be dramatically different based on using different pressures. Vendors assured us that desulfurizing diesel fuel using hydrogenation as the desulfurization technology can occur over a range of pressures. Lower pressures require larger reactors, while higher pressure units can use much smaller reactors, but their walls must be much thicker to withstand the higher pressure. There are tradeoffs using either approach thus the costs are not significantly different at either end of the pressure range. We understand that to avoid having to use very large vessels with a very large volume of catalysts, refiners will generally use moderate pressures, on the order of 900 psi. Vendor submissions to EPA which we used to estimate desulfurizing diesel fuel were based on 650 and 900 psi.

When we were writing up this final rule, requirements were not yet established for toxics and MTBE, thus we did not consider any costs on the refining industry for these potential programs. We did consider Tier 2 since that was finalized at the end of 1999.

(C) EPA should delay the rule until the U.S. can put in place financial incentive plans similar to those used in Europe to help refiners get to 50 ppm.

(1) The UK and Germany did not require desulfurization until tax incentives had been put in place. The U.S. should follow a similar approach, especially given the extra costs of moving to 15 ppm fuel.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 3**

Response to Comment 5.8.1(C):

EPA does not have the authority under the Clean Air Act to provide tax incentives. The provisions of the Clean Air Act, on the other hand, allow and in certain cases, direct, EPA to impose quality standards on transportation fuels. The U.S. Congress can, at its discretion, provide such incentives after this rule is promulgated.

(D) EPA needs to analyze the costs of the fuel changes on the agricultural sector specifically because of the unique nature of how diesel fuel is used in this sector.

(1) First, farmers tend to use on-road fuel for nonroad equipment because it is the only fuel available. Second, their use is seasonal, and EPA needs to carefully consider the need to be able to obtain fuel at competitive prices at these crucial times. Third, the farmer co-op refineries are often the only fuel suppliers in these areas. The marginal cost for these refineries may be much higher than the 4 cents/gallon estimate EPA provides, which would mean unusual price increases for agricultural interests.

Letters:

Agricultural organizations as a group (IV-D-265) **p. 1-3**
USDA (IV-D-299) **p. 1-2**

<u>Response to Comment 5.8.1(D):</u>

In Chapter 4 of the Final RIA, EPA presents estimates of the maximum cost of meeting the new sulfur standard for any refinery under both the temporary compliance option and after full implementation of the program. These maximum costs range from 4.1-5.5 cents per gallon under the temporary compliance option and 5.1-8.2 cents per gallon thereafter. As highway diesel fuel costs have been averaging over $1.50 per gallon over the past year (over $1.00 per gallon excluding taxes), the potential price increases due to this rule are roughly 4-8%. Fuel costs represent a small fraction of total farm expenditures, so a 4-8% increase should not be a significant impact on overall farm expenditures. In addition, farmers have the option of fueling their farm equipment with nonroad diesel fuel. Historically there has not been a large incentive to do this, because the prices of highway and nonroad diesel fuel have only differed by 2-3 cents per gallon. However, with the new highway diesel fuel sulfur standard, the price differential will likely increase. This will provide operators of nonroad diesel equipment with an increased incentive to demand this fuel and distributors to provide it. While we have not assumed that use of highway diesel fuel in nonroad diesel equipment will decrease in assessing the cost impacts of this rule, such use is likely to decline. This will reduce overall demand for highway diesel fuel, reducing its cost and reducing the impact of this rule on nonroad diesel equipment operators.

(E) Refineries in the western U.S. would bear proportionately higher economic burdens to meet a 15 ppm standard.

(1) Most of the distillate pool in the West is used to produce on-road fuel, so the western refineries must treat cracked and uncracked feedstocks to on-road specifications. In the East, refiners are likely to treat the uncracked stocks for on-road use and divert the harder to treat distillates to home heating and other nonroad uses. When this disparity is coupled with the smaller refinery size in the West, it constitutes an overwhelming compliance problem for western refiners. This is unfair because the western U.S. receives the least benefit from the rule. Commenter provides data and excerpts from the NPC report to support this position.

<u>Letters:</u>

Sinclair Oil Corporation (IV-D-255) **p. 5-7**

<u>Response to Comment 5.8.1(E)</u>:

EPA estimates the fraction of highway diesel fuel represented by cracked stocks for refineries in each PADD in Chapter 5 of the Final RIA. Based on this assessment, we do not agree with the commenter that western refiners, particularly those in the Rocky Mountain states, will have to process more cracked stocks than those in the East. One reason for this is that nonroad diesel fuel must still meet an ASTM specification for cetane and this cetane specification cannot be met with large amounts of cracked stocks. Heating oil, which is consumed primarily in the East, has no cetane specification. However, both heating oil and nonroad diesel fuel are usually transported and stored as one product, so most refiners cannot produce heating oil without also meeting the cetane specification for nonroad diesel fuel.

EPA's analyses presented in Chapter 5 of the Final RIA confirm the commenter's assertion that western refiners (excluding those in California and Washington state) are small in size than those in the East. Because of this, Rocky Mountain refiners generally face higher capital investments and compliance costs per barrel of capacity. Two factors mitigate this disparity.

One, Rocky Mountain refiners do not generally compete directly with eastern refiners. Pipeline capacity from PADD 3 into PADD 4 is limited and transport by truck or rail is not economically competitive.

Two, EPA has provided Rocky Mountain refiners with two options to ease the burden of this rule. One option is available to small refiners. The other is available to refiners who ship fuel primarily into the Geographic Phase-In Area. We believe that these two options compensate for the disparate per barrel economic impacts of this regulation on western refiners, as discussed elsewhere in this rule.

(F) EPA should support the implementation of tax credits to facilitate the introduction of a 15 ppm fuel.

(1) Commenter provides no further supporting information or detailed analysis.

<u>Letters:</u>

National Automobile Dealers Association (IV-D-280) **p. 3**

<u>Response to Comment 5.8.1(F)</u>:

EPA does not have the authority under the Clean Air Act to provide tax incentives. The provisions of the Clean Air Act, on the other hand, allow and in certain cases, direct, EPA to impose quality standards on transportation fuels. The U.S. Congress can, at its discretion, provide such incentives after this rule is promulgated.

Issue 5.8.2: Cost of Lubricity Additives

(A) The cost of lubricity additives will be higher than EPA's estimates.

(1) DoD experience with lubricity additives indicates that the cost of these additives will be much higher than 0.2 cents per gallon and is likely to be between 1 and 5 cents per gallon.

<u>Letters:</u>

Department of Defense (IV-D-298) **p. 2**

<u>Response to Comment 5.8.2(A):</u>

See response following comment 5.8.2(B).

(B) The cost of lubricity additives will be minimal.

(1) The cost of additization is minimal at approximately 0.2 cents per gallon.

Letters:

Cummins, Inc. (IV-D-231) **p. 44**

Response to Comment 5.8.2(A) and (B):

In considering these comments, we have found no basis in today's action to use a different average cost estimate to treat low sulfur diesel fuel for lubricity than that which was used in the proposal. Of the two comments we received on this issue, one supported our cost estimate of 0.2 cents per gallon. The other was submitted by the Department of Defense (DoD), which indicated it has experienced lubricity additive costs from one to five cents per gallon. We believe that DoD's experience with lubricity properties and lubricity additives is not typical of commercial users for several reasons. First, DoD commented that, due to harsher operating conditions, engines used in DoD vehicles, especially tactical vehicles, are more vulnerable to lubricity problems than the same engines operated in commercial vehicles. Second, the fuel DoD uses at its facilities is purchased under contract usually for a year or longer. Thus, the DoD fuel generally is from a single supplier and does not have the beneficial effect of blending or mixing different batches of fuel or fuel from different suppliers, such as that which occurs in the commercial market. As discussed in Section IV of the RIA, blending or mixing different batches of diesel fuel minimizes the effect of isolated poor lubricity fuels. Consequently, DoD might be taking more aggressive action in responding to lubricity concerns than might be needed for commercial applications. Third, DoD is using an additive that is primarily a corrosion inhibitor. It is our understanding that DoD found that the additive it uses to address a corrosion property in the fuel is also effective at improving lubricity, and subsequently has been using that additive to also address its lubricity concerns. If DoD were able to ignore its corrosion property concerns, it is possible that a formulation specifically for lubricity might cost less, or that its treat rate could be less, than that of the corrosion inhibitor formulation and treat rate it currently uses. Finally and most importantly, we believe that DOD's experience is more reflective of the prices that might be experienced with specialty additives supplied in relatively small quantities. With the 15 ppm standard, most, if not all, of the nation's highway diesel fuel may need to be treated for lubricity. Economies of scale associated with bulk production as opposed to more specialty products will drive down the unit cost of lubricity additives considerably.

Issue 5.8.3: Distribution Costs

(A) EPA underestimates the impact on costs due to the implementation of a 15 ppm standard, that will result from fuel distribution difficulties, such as downgrading and other logistics between the refiner and retailer.

(1) Cost increases from downgraded product will include truck transportation to remove contaminated product from terminals, investment in tankage to segregate on-highway fuel, costs of cleaning or dedicating tanks, ships, barges, and transport trucks, and increased testing expenses.

Letters:

American Petroleum Institute (IV-D-343) **p. 42-43**

(B) EPA does not offer sufficient evidence to justify its estimated increase in transportation costs that will result from the proposed rule.

(1) EPA has estimated an increase in the distribution costs for pipeline operators and terminal operators by a total of 0.2 cents/gallon and has dismissed the claim by API that pipeline companies will not be able to ship the lower sulfur fuel without picking up additional levels of sulfur from other fuels within the distribution system. EPA has asserted that the only significant source of sulfur contamination in pipelines occurs at the interface between fuel shipments but does not address the issue that highway diesel may pick up sulfur clinging to the inner surface of pipelines that has been left behind by the transport of other fuels. EPA has not provided sufficient evidence to justify its claim that the proposed rule will increase transportation costs by an average of only 0.2 cents/gallon.

Letters:

Mercatus Center at GMU (IV-D-219) **p. 17-18**

Response to Comments 5.8.3(A) & (B):

The Regulatory Impact Analysis (RIA) evaluates the various potential sources of sulfur contamination. Each of the points raised by the above commenters is addressed in the RIA. Please refer to the RIA for a detailed discussion regarding our assessment that the existing distribution system can accommodate the distribution of highway diesel fuel meeting a 15 ppm sulfur cap with modest changes and additional costs. Our sulfur program will not cause the need for a segregated distribution system to carry highway diesel fuel meeting a 15 ppm cap on sulfur content. The changes that will be required in the distribution system to limit sulfur contamination in highway diesel fuel meeting a 15 ppm cap are discussed in detail in section IV.D. in the RIA on the feasibility of distributing highway diesel fuel that meets a 15 ppm cap on sulfur content. Comments related to the feasibility of limiting sulfur contamination during the distribution of highway diesel fuel meeting a 15 ppm cap on sulfur content and the potential economic impacts of sulfur contamination are also addressed under 8.1.1. (A), (B), & (C) in this document. The costs associated with these changes are discussed in section V.C.3. in the RIA.

We estimate that once our sulfur program is fully implemented, the cost of distributing highway diesel will be 0.5 cents per gallon higher than it is currently. This increase in cost is comprised of the following component costs:

1) The cost to distribute the additional volume of highway diesel fuel that will be needed to compensate for the reduction in the energy density of highway diesel fuel that will accompany the removal of sulfur to meet the 15 ppm cap.

2) The cost to downgrade the additional volume of highway diesel fuel to lower value product. This additional downgrade is necessary to adequately limit sulfur contamination during distribution by pipeline.

3) The increased economic impact for the current volume of highway diesel fuel that must be downgraded to a lower value product.

4) The increased cost of terminal testing.

5) The cost to optimize the distribution system to limit sulfur contamination, including testing the system to evaluate the potential sources of contamination and making minor changes that we did not specifically assign a cost to.

During the initial years of our program when a limited fraction of the highway diesel fuel distributed can continue to meet a 500 ppm cap on sulfur content, we estimate that distribution costs will be 1.1 cents per gallon of highway diesel fuel supplied. The main reason for the difference in cost during the initial years of our program is due to the need for additional storage tanks to handle a second grade of diesel fuel during this period. Two other costs exist only during only during the first four years of our program:

1) The cost of additional storage tanks needed to handle the interface volumes between batches of highway diesel fuel and batches of kerosene or jet fuel. This cost is completely amortized during the initial years of our program.

2) The cost to downgrade the additional interface volumes associated with the shipment of a second grade of highway diesel fuel by pipeline.

The component costs identified for our fully implemented program also exist during the initial years of our program. However, the presence of a limited volume of 500 ppm highway diesel fuel during this period causes the magnitude of these component costs to be somewhat different.

We believe that the discussion in the RIA provides sufficient justification for our cost estimates for the components outlined above. There were some instances where we recognized that the rule would cause some change to current industry practice, but we concluded that the associated costs would not be significant. In other instances, we evaluated issues that commenters suggested might result in costs under our program, but concluded that they were not a significant concern. We believe that the RIA provides sufficient support for our assessment of such issues as well.

(C) Pipeline operators currently have insufficient information to determine the potential differences in economic impact between a 15 and 50 ppm standard.

(1) Commenter provides the results of a pipeline survey to support this point. The issue is made more complicated because there is no current testing equipment the pipelines can use to measure changes in sulfur content at these low levels. Thus, the approach that is likely to be used will be to make a protective cut using the middle portion of a ULSD batch, and then downgrade and re-refine the surrounding batches. The survey results estimated the amount of downgraded product from 0.42% to 57%, which indicates the overall uncertainty on this issue at this time.

<u>Letters:</u>

Association of Oil Pipelines (IV-D-325) **p. 2, att.**

Response to Comment 5.8.3(C):

In its comments on the NPRM, the Association of Oil Pipelines (AOPL) stated that depending on the size of the pipeline, the nature of the surrounding batches, the size of the ultra low sulfur diesel batches, and the capability of the testing information the downgrade (downgrade of highway diesel fuel meeting a 15 ppm sulfur cap shipped by pipeline) was estimated to be from 0.42 percent to 57 percent - a huge range and not to be relied upon for making valid economic impact estimates. We agree that these estimates would not form a reliable basis for our evaluation of amount of highway diesel fuel that would need to be downgraded to a lower value product as a result of our program. The high upper bound in these estimates apparently incorporates the assumption that batches of highway diesel fuel meeting a 15 ppm cap would be unusually small and that sulfur testing would be required to determine the location of the interface between a batch of highway diesel fuel and adjacent batches of high sulfur products in the pipeline. We do not believe these assumptions are valid.

During the initial years of our program, approximately 25 percent of highway diesel may continue to meet a 500 ppm sulfur cap. At least 75 percent of highway diesel fuel will be required to meet a 15 ppm cap on sulfur content during this period. Therefore, the preponderance of the highway diesel fuel supplied in any given area will meet a 15 ppm sulfur cap. Given this, we believe that it is reasonable to assume that the pipeline batches of highway diesel fuel meeting a 15 ppm cap on sulfur content will not be substantially smaller than batches of highway diesel fuel that are shipped by pipeline today.

We believe that the current methods of determining the location of the interface between batches in the pipeline can continue to be used to identify the location of interfaces associated with pipeline shipments of highway diesel fuel batches meeting a 15 ppm sulfur cap. See section IV.D.2.b. in the RIA for our evaluation of the suitability of the current methods used to identify the location of pipeline interfaces for use in determining the location of the interface between a batch of highway diesel fuel meeting a 15 ppm cap on sulfur content and adjacent batches of other products.

We believe that a reasonable estimate of the increased volume of highway diesel fuel that would need to be downgraded to a lower value product can be derived using the range of estimates provided by AOPL members of the current downgrade volume, and the evaluation that downgrade losses will double as a result of our program. In their comments on the NPRM, AOPL stated that the diversity in the characteristics of their members operations led to a wide range in the estimates of the current downgrade volume which ranged from 0.2 percent to 10.2 percent of the total volume of low sulfur diesel fuel shipped by pipeline. These estimates included all of the sources of downgraded highway diesel fuel in the pipeline system.

We believe that the estimates provided by AOPL members provides an adequate characterization of the range of current downgrade volumes across the diverse pipeline distribution system. To derive an estimate of the average downgrade for the pipeline system as a whole today, we used the range of downgrade estimates from AOPL and a characterization of the pipeline distribution system in terms of pipeline diameter and length derived from the PennWell pipeline database. Due to the characteristics of fluids as they travel through a pipeline, the larger the pipeline diameter and the longer a batch of product is pumped through a pipeline, the greater degree of mixing with adjacent batches that will take place. Furthermore, larger diameter pipelines tend to be relatively more complex than smaller diameter lines (i.e. have more tank farms and connections to other lines) leading to a larger number of interface volumes being generated for any given batch of fuel as it travels to its ultimate destination.

We assigned a specific estimate of percent downgrade from those provided by AOPL members to each pipeline diameter included in the PennWell database, ranging from 10.2 percent for the largest diameter pipeline to 0.2 percent for the smallest diameter line. In doing so, we assumed that downgrade increases linearly with the cross sectional area of the pipeline. To account for the impact of pipeline length on downgrade volume, we weighted the downgrade estimate for each pipeline diameter by the fraction of total pipeline system length represented by that diameter. By this method, we estimated that the average downgrade for the pipeline system as a whole currently is approximately 2.2 percent of the highway diesel fuel shipped by pipeline.

We are assuming that when the 15 ppm cap on highway diesel fuel sulfur content is implemented, it will no longer be possible to cut any of the interface volume into highway diesel fuel. This is referred to as a protective interface cut, which we believe corresponds to a doubling of the volume of highway diesel interface volume downgraded to a lower value product for many pipeline operators. Certain pipeline operators already make a protective interface cut. For these operators, our assumption of a doubling of downgrade volume as a result of our program will result in a conservatively large estimate of our program's impact. Some individual AOPL members stated that a protective interface cut would be necessary to limit sulfur contamination during the shipment of 15 ppm highway diesel fuel. Some AOPL members also stated that the amount of highway diesel fuel that would need to be downgraded to a lower value product would likely double as a result of our sulfur program. Given the uncertainties regarding the various sources of highway diesel fuel that must be downgraded to a lower value product, we believe that assuming that highway diesel fuel downgrade volume will double as a result of the implementation of a 15 ppm sulfur provides an appropriate level of confidence that we are not underestimating the impact of our sulfur program.

By applying the assumption that highway diesel fuel volumes will double as a result of our sulfur program to the estimate of the current downgrade volume (2.2 percent of highway diesel fuel supplied) we estimated that an additional 2.2 percent of the highway diesel supplied will need to be downgraded to a lower value product to adequately limit sulfur contamination as a result of the implementation of the 15 ppm sulfur standard under our program. Please refer to section IV.D.2. in the RIA for a detailed discussion of how we derived this estimate.

Since a 50 ppm cap on the sulfur content of highway diesel fuel would not enable the vehicle emissions standards under our program, it is not a relevant exercise to compare the distribution costs under a 50 ppm scenario to those under the 15 ppm which we adopted as part of our program. Nevertheless, we believe that there would likely be little or no difference in the cost of distributing highway diesel fuel meeting a 15 ppm versus a 50 ppm cap on sulfur content. Under either scenario, we believe that pipeline operators would need to ensure that none of the interface between a batch of highway diesel fuel and an adjacent batch of high sulfur product in the pipeline is cut into the batch of highway diesel fuel. All of the other assumptions used in estimating the distribution costs under out program would also likely remain unchanged. Consequently, its unlikely that it would be significantly less costly to distribute highway diesel fuel meeting a 50 ppm versus a 15 ppm cap on sulfur content.

Issue 5.8.4: Other Fuel Change Costs

(A) EPA's estimate of the rise in diesel fuel costs is too low since it does not account for the fact that reduced supplies will cause price spikes. (See related comments on fuel supply impacts under Issue 8.1.1.)

(1) The sulfur standard will result in supply decreases. These decreases will result because of: high capital expenses that some refiners will choose not to incur by halting production; the inability to remove sufficient sulfur from some blendstocks; downgrades from pipeline contamination; and the inability to use higher sulfur fuel imports to make up for domestic shortages. The reduced supplies will limit sources of fuel for independent marketers and weaken their competitive position. Also, it will lead to large price spikes because of supply shortages. Some commenters noted that EPA's 4.5 cents/gallon estimate is far too low, and argue that recent experiences with heating oil in the Northeast and RFG in the Midwest are better examples of the types of price increases that are likely to occur. These price spikes could have significant effects on the economy as a whole because of the importance of diesel fuel prices on transportation costs. One commenter (ATA) noted that API has estimated supply decreases of 30% as a result of the proposed rule and using a statistical regression model to estimate the impact of this reduction on the cost of fuel, the commenter asserts that this decrease will result in a 25.1% increase in diesel prices over 12 months. Another commenter cited to the Charles River Associates (CRA) study as attached to API's comments that indicates the potential for a 35 to 52 cent per gallon increase in diesel fuel costs that could result in the initial stages of a program that includes a 15 ppm standard.

<u>Letters:</u>

American Bus Association (IV-D-330) **p. 5-6**
American Trucking Association (IV-D-269) **p. 27-34**
Exxon Mobil (IV-D-228) **p. 16**
Marathon Ashland Petroleum (IV-D-261) **p. 75**
NATSO (IV-D-246) **p. 8**
National Petrochemical & Refiners Association (IV-D-218) **p. 3**
New England Fuel Institute (IV-D-296) **p. 5**
Ports Petroleum Co, Inc. (IV-F- 117) **p. 190**
Society of Independent Gasoline Marketers of America (IV-D-328) **p. 4-5**, (IV-F-191) **p. 196**

(2) The recent gasoline price debacle across the nation and specifically in the Midwest is an indication that EPA's cost estimate of four cents per gallon is far too low. The recent price hikes were a direct result in part to EPA's reformulated gasoline program and are an indication that the proposed rule may have a much more significant impact on fuel prices than EPA

anticipates. Commenter specifically suggests that EPA withdraw the rule until it has completed an accurate cost-benefit analysis that reflects the true costs that the consumer will be expected to absorb.

Letters:

Agricultural Retailers Association (IV-D-178) **p. 4**
American Trucking Association (IV-D-269) **p. 32**
North American Equipment Dealers Association (IV-D-194) **p. 4**

(3) The true fuel costs to the consumer of EPA's proposal is 15 cents per gallon, including production costs, distribution costs, manufacturing fuel economy loss, emission control fuel economy penalty, and maintenance benefit. EPA has used a number of inaccurate assumptions or data in their calculations of the fuel costs resulting from their proposal. In addition to not fully accounting for the impact of supply shortfalls, these include, EPA's assumed rate of return on refiner investment, the true costs of segregation and downgrading, and fuel economy impacts. In addition, the appropriate cost should be the average cost of all refiners on a volume-weighted basis. However, if the supply is not adequate, the fuel cost to the consumer will be the incremental cost of the refinery supplying the most expensive fuel into the market. EPA should address these issues in its cost estimates in the final rule. Commenter notes that in contrast to EPA's proposal, the total fuel cost for API's proposal is 5.7 cents per gallon.

Letters:

American Petroleum Institute (IV-D-343) **p. 74-75**

(4) EPA's reliance on a study prepared for EMA by MathPro, Inc. entitled "Refining Economics of Diesel Fuel Sulfur Standards" (October 5, 1999) is misplaced since this study explicitly assumed away the most troubling aspect of the proposed rule - that the volume of diesel fuel produced may change. Estimating possible effects of the various sulfur standards on production was outside the scope of this study. In addition, this study addressed only the costs of production incurred by refineries and did not address the storage and distribution costs incurred downstream of the refinery. This study presents an inaccurate picture by focusing only on production costs and ignoring broader market factors of supply and demand.

Letters:

American Trucking Association (IV-D-269) **p. 33-34**

(5) Commenter provides detailed analysis of NPC and DOE estimates of fuel costs to the consumer resulting from the rule, and revises EPA's cost estimates to more accurately reflect the cost-benefits of the proposal.

Letters:

Marathon Ashland Petroleum (IV-D-261) **p. 74-83**

(B) The proposed sulfur standard for diesel fuel is unlikely to cause price spikes due to refiner compliance costs.

(1) The refining industry's arguments regarding their compliance costs and the potential for price spikes as a result of these costs, are inconsistent with EPA's assessment that fuel costs will increase 4-5 cents per gallon and are also inconsistent with cost estimates developed by MathPro, Inc. Currently, BP (ARCO) is selling its low sulfur fuel for a 5 cent premium in California. Commenter notes that the oil industry implemented the 1993 on-road sulfur rule that reduced sulfur from 5,000 to 500 ppm without triggering any long term price increases.

Letters:

International Truck & Engine Corp. (IV-D-257) **p. 9**

(2) One commenter provided the report "Refining Economics of Diesel Fuel Sulfur Standards, Supplemental Analysis of the 15 ppm Sulfur Cap" as further documentation supporting their conclusions that meeting the 15 ppm sulfur standard will be affordable for refiners and will not lead to excessive fuel costs at the pump.

Letters:

Engine Manufacturers Association (IV-G-15) **p. all**

Response to Comments 5.8.4(A) and (B):

Regarding the comments concerning EPA's estimated costs for the new fuel standard, all technical information provided with these comments was considered as we developed the final cost estimates. The reader is referred to Chapter 5 of the Final RIA for a complete description of this information and how it was considered.

The comments are based on the premise of supply shortages. Comments dealing directly with the issue of fuel supply are analyzed in Issue 8.1.1 of this document. The reader is referred there, as well as to Chapter 4 of the Final RIA more detailed assessments of the issue of supply. The reader is particularly referred to EPA's analysis of the Charles River Associates and Baker and O'Brien study performed for API which predicted that this rule would result in large supply shortages and enormous price spikes. As summarized in Issue 8.1.1, Issue 5.8.1 (B) (11) and Chapter IV of the RIA, EPA believes that this study contains a number of serious flaws which make its conclusions spurious.

As a result of these analyses, EPA concludes that a combination of a number of factors make it unlikely that any shortages will result from the rule. One such factor is the difficulty that refiners face in shifting their current highway diesel fuel to other markets. The price available in these markets drops quickly as supply increases (for the same basic economic reasons that supply shortages cause price spikes). Another factor is the temporary compliance option. This option allows almost half of U.S. refineries to delay their investment for four years. This narrows the likely cost differential between refiners, reducing concerns that refiners will not be able to recoup their investment. This additional time also allows the market to assess the impact of the new standard on costs and prices and allows refiners facing higher costs to take advantage of the experience of the refiners meeting the new standard in 2006. This should narrow the long run cost variation between refiners. Overall, absent supply shortages, there is no reason to expect this rule to cause price spikes.

Beyond the flawed studies used to project supply shortages, the commenters' ability to project supply shortages and resulting price spikes 6 years into the future is speculative, at best. Furthermore, many of the above commenters referred to price spikes and their impact on the economy. These commenters use the terms costs and prices interchangeably. EPA evaluates these two aspects of a rule quite differently. When EPA assesses costs, the only costs which are considered are true social costs. Social costs entail the consumption of natural resources and labor. Thus, desulfurizing diesel fuel involves costs, since equipment must be built and operated and hydrogen, among other things, must be produced and is consumed. Excess profits to refiners resulting from payments for sulfur credits which exceed the costs, on the other hand, involve the transfer of funds from one entity to another. The monetary transfers do not involve real resources and are not considered costs in our analyses.

In addition to costs, EPA also considers other economic impacts. These impacts can include financial impacts which do not involve social costs. The price spikes referred to by the commenters above fall into this category. In general, price increases can either be more or less than increases in social costs. The price spikes referred to above would be examples of the former, where the increase in price far exceeds the actual costs experienced by refiners and distributors. Price spikes tend to arise when there is a physical shortage of fuel and can be significant because the price sensitivity of fuel is quite low. This means that large changes in the price of fuel have little effect on the demand for fuel (i.e., fuel consumption).

EPA agrees that significant supply shortages of highway diesel fuel would have serious economic impacts on the nation. In fact, EPA considered the issue of potential supply shortages seriously and designed the final diesel fuel program to minimize the potential for supply disruptions and associated price spikes. The primary purpose of the temporary compliance option and the small refiner program is to ensure that adequate supplies of highway diesel fuel are available in 2006.

Some commenters indicated that the new diesel sulfur cap could cause temporary and occasional price spikes, as was caused by the reformulated gasoline program during the summer of 2000 in the Midwest. First, EPA does not believe that these price spikes were caused by the reformulated gasoline program. Second, we acknowledge that the production of diesel fuel compliant with the 15 ppm sulfur cap will be contingent on the proper operation of hydrotreaters or other analogous equipment. Because of this contingency, we believe that refiners will construct their equipment in a way to allow additional distillate material to be processed in order to occasionally reprocess material which did not meet the 15 ppm standard. At the same time, all types of refining equipment, distillate hydrotreaters included, must occasionally be shut down due to emergencies. In these cases, the excess production capacity at other refineries which was built to allow reprocessing of off-specification material, could be used to increase production and make up for the shortfall. Also, within limits, the operating conditions of distillate hydrotreaters can be varied to allow increased production (e.g., increased temperature). While increasing temperature will decrease catalyst life in the long run, for short periods, it can be used to increase supply. EPA believes that relatively small price increases (e.g., 2 cents per gallon) should encourage refiners to increase supply, even at the expense of shorter catalyst life. This commenter also suggested that EPA perform a cost-benefit study. This has been done and the results of this analysis is summarized in the Final RIA.

We disagree with API that the true fuel costs to the consumer of this rule is 15 cents per gallon. The reader is referred to Chapter 5 of the Final RIA, where all relevant data and information are considered in estimating the fuel-related costs of this rule to be just over 5 cents per gallon. Also, this cost was determined across all refiners on a volume-weighted basis. It should be pointed out that the Charles River and Baker and O'Brien study performed for API did not provide any of the details of its analysis which would allow EPA to determine its accuracy. We have also assessed the potential maximum cost for producing 15 ppm diesel fuel of any refiner within each PADD. Assuming market shifting to and from offhighway diesel production, this cost is 5 cents per gallon in the lowest cost PADD, and 8 cents per gallon in the highest cost PADD. The reader is referred to Chapter IV and V of the Final RIA for the details of this analysis.

EPA did not rely directly on a study prepared for EMA by MathPro, Inc. entitled "Refining Economics of Diesel Fuel Sulfur Standards" (October 5, 1999). However, this study does confirm the refining costs which we estimate using our own model.

(C) EPA has underestimated the impact of increased fuel costs to truck owners and operators.

(1) Commenter provides no detailed analysis on this point.

Letters:

CO Petroleum Association (IV-D-323) **p. 2**

(2) Some commenters specifically noted that the rule could add about $2,600 to the annual expenses of truck owners and operators, should the cost of diesel fuel rise as expected.

Letters:

American Petroleum Institute (IV-F-16, 42, 182, 117) **p. 161** (IV-F-191) **p. 114**
American Trucking Association (IV-D-269) **p. 28**
Marathon Ashland Petroleum (IV-F-74)

(D) The proposed diesel fuel standard would have an adverse economic impact on smaller communities that rely exclusively on trucking for the delivery of consumer goods.

(1) EPA's proposed rule will lead to supply shortages and fuel price increases, which will affect the ability of trucking businesses to purchase adequate supplies of fuel and to deliver goods to smaller or more rural communities. Trucks play a crucial role in local delivery, and a shortage of very low sulfur

highway diesel fuel could have an adverse impact on local economies if trucks do not have adequate diesel fuel.

Letters:

American Trucking Association (IV-D-269) **p. 26-27**

(E) Since it will lead to increased fuel costs, EPA's proposal will have an adverse impact on certain businesses, including those that provide vital public services.

(1) Intercity motorcoach companies, many of which operate on low margins, would see the cost of doing business increase significantly as a result of the proposed rule. Higher fuel costs and/or inadequate fuel supplies would have an adverse impact on motorcoach companies. In this context, there is also the concern that current diesel engines may not operate safely or efficiently on the new low sulfur fuel. Commenter provides "Motorcoach Census 2000," a study of the motorcoach industry in the U.S. and Canada, which contains general information on the industry.

Letters:

American Bus Association (IV-D-330) **p. 6**

(2) Higher fuel costs and the potential for reduced diesel fuel supplies would impair the ability of private waste service firms to provide adequate services and protect public health. Costs to collect garbage, recyclables and yard waste will inevitably increase as fuel prices rise. If EPA's estimates are correct, the increased cost of the diesel fuel necessary to collect garbage would be at least $300 to $400 per truck per year, which would be even higher if API's estimates are correct. EPA should address this issue and clarify whether there are any fallback plans if adequate fuel supplies cannot be provided at a reasonable cost to consumers.

Letters:

National Solid Wastes Management Association (IV-D-90) **p. 1-2**

(3) The concrete industry is essentially a transportation industry, which is required to deliver a perishable product on a dependable basis to various customers. A disturbance in fuel availability and prices will have a severe impact on both the financial stability of the ready mixed concrete industry and on the cost of one of the nation's most basic building commodities.

Letters:

National Ready Mixed Concrete Association (IV-D-271) **p. 1**

(4) EPA's proposal will have an adverse impact on businesses that rely on diesel vehicles, trucks, and buses for the purpose of transporting people and goods

to where they need to be. There is great potential that the proposed regulations will limit essential fuel supplies to farmers, truckers, and other users of diesel fuel and significantly increase the cost of new diesel vehicles and other consumer goods.

Letters:

AL Farmers Federation (IV-D-206) **p. 1**
Agricultural Organizations as a group (IV-G-26) **p. 1**
Coal Operators & Associates, Inc. (IV-D-64) **p. 1**
ID Barley Commission (IV-D-312) **p. 1**
IN Builders Association (IV-D-208) **p. 1**
IN Retail Council (IV-D-211) **p. 1-2**
KS Cooperative Council (IV-D-187) **p. 1**
MD Farm Bureau (IV-D-192) **p. 1**
MFA Oil Company (IV-G-16) **p. 1**
MI Petroleum Assoc./MI Assoc. of Convenience Stores (IV-D-202) **p. 1**
Mid-Atlantic Petroleum Distributors' Association (IV-D-124) **p. 1**
National Grain and Feed Association (IV-D-301) **p. 1**
VA Aggregates Association (IV-D-177) **p. 1**
VA Agribusiness Council (IV-G-1) **p. 1**
VA Trucking Association (IV-D-191) **p. 1**
WI Motor Carriers Association (IV-D-189) **p. 1**

(5) Commenter provides no further supporting information or detailed analysis.

Letters:

Capellan, Claudia, et. al. (IV-D-338) **p. 1-2**
MN Chamber of Commerce (IV-D-28) **p. 1**

(F) EPA has failed to consider the economic impact of the proposed regulations on food prices, which will rise as a result of increased diesel fuel costs.

(1) EPA's initiative will increase food distribution and fuel transportation costs significantly, which may well result in higher food prices. This impact should not be treated lightly since these costs will have an adverse affect on every household, particularly those with limited incomes.

Letters:

Food Marketing Institute (IV-D-283) **p. 2**

(G) EPA should address the issue of how increases in the price of diesel fuel that may result from this rule, will be monitored and whether there will be a mechanism to prevent significant cost increases.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

American Public Transportation Association (IV-D-275) **p. 3**
Milwaukee County Transit System (IV-D-97) **p. 1**

(H) Marginal and average costs for desulfurized diesel fuel will be higher than EPA has estimated.

(1) Under a 100 percent production requirement and assuming all necessary investments are made, it is estimated that the cost of the marginal production of low sulfur diesel will be over 11 cents per gallon above today's diesel fuel. Average cost increases are estimated at 7 to 8 cpg. Marginal costs, which reflect the cost increment for the last barrel required to meet market demand for the ultra-low sulfur diesel fuel, will be higher than average cost because of both the smaller and less efficient marginal refinery configurations and because of the difficulty of handling the most difficult to desulfurize diesel blendstocks. Marginal cost is a key factor in determining the price consumers will pay for the new ultra low sulfur diesel.

Letters:

U.S. Department of Energy (IV-G-28) **p. 5, Att. 3 + 4**

Response to Comments 5.8.4(C) through (H):

The commenters summarized above state that the price increases associated with this rule will be substantial and will have serious economic impacts on various sectors of the economy. Most of these commenters did not provide any independent information or technical analysis supporting their claim of high price increases or showing the impact high prices would have on their businesses. Those that did referred to a study performed for API by Charles River Associates and Baker and O'Brien. EPA analyzes this study in Section 8.1.1 of this document and Chapter 4 of the RIA and found it to contain serious flaws which invalidate its conclusions.

EPA has performed its own assessment of costs under the new sulfur cap. These costs average just over 5 cents per gallon. Including the fact that some refiners face higher costs than others could increase this by 2-3 cents per gallon in some areas. Whether these costs will be fully passed on to consumers is impossible to predict. That will depend on the overall supply of and demand for highway diesel fuel. With the temporary compliance option and the small refiner program, we believe that supply will be more than adequate. Price hikes in the area of these average and maximum costs should not seriously impact the economic sectors mentioned by the commenters. These price increases would only represent 3-5% of total fuel costs and fuel costs are themselves a small fraction of the total costs faced by these industries. Fuel price swings much larger than this are a part of typical day to day business operations today. Also, the cost benefit analyses summarized in the Final RIA indicate that the benefits of this rule to society far outweigh the costs.

EPA has no authority to control fuel prices.

The commenter provides no basis for the statement that marginal cost is the key factor in determining the price to consumers. This is not the case today for many fuels, including gasoline and diesel, since refiners have been shown to be price takers and have faced a lower return on investment compared to other industries.

Issue 5.9: Cost Effectiveness of Program

(A) The rule is cost-effective.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

WI DNR (IV-D-291) **p. 1**, (IV-F-25)
West Harlem Environmental Action/Envr Justice Network (IV-F-76)

Response to 5.9(A):

We agree with this comment.

(B) The proposed standards are too costly.

(1) Compared to other mobile source control measures that have been pursued by EPA, the cost per ton emission reduction is higher than comparable mobile source rulemakings. The proposed standards are not necessary to maintain compliance with the NAAQS and NO_x disbenefits are likely to reduce estimated emission reductions. EPA has not adequately considered this phenomenon (see also Issue 2.2), and therefore has underestimated the cost-effectiveness of the rule. Commenter provides additional discussion on this issue and concludes that EPA's overall cost estimates are unrealistically optimistic.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 76-77**

Response to Comment 5.9(B)(1):

It is true that some previous programs have been more cost effective than the program we are proposing today. However, it should be expected that the next generation of standards will be more expensive than the last, since the least costly means for reducing emissions is generally pursued first. Even with this expectation, the $/ton values for NO_x+HC for the standards we are finalizing today fall within the range of the Tier 1 vehicle standards, and are very close to those for our recently promulgated Tier 2 vehicle/gasoline sulfur program and our on-board diagnostics program. For PM, our cost-effectiveness falls within the range of $/ton values for the 1996 urban bus standards, our urban bus retrofit/rebuild program, and the 1994 highway HD diesel rule.

In addition, a more appropriate cost-effectiveness comparison is not to previous control measures, but rather to potential future controls which might have been implemented in lieu of the program we are finalizing today. Although these potential future controls could not provide the dramatic emission reductions that are expected with today's rule, they do provide a benchmark for what might be expected in terms of the cost-effectiveness in the future. In the context of the Agency's rulemaking which would have revised the ozone and PM NAAQS[84], the Agency compiled a list of additional known technologies that could be considered in devising new emission reductions strategies. Through this broad review, over 50 technologies were identified that could reduce NO_x, VOC, or PM. The cost-effectiveness of these technologies averaged approximately $5,000/ton for VOC, $13,000/ton for NO_x, and $40,000/ton for PM. Although a $10,000/ton limit was actually used in the air quality analysis presented in the NAAQS revisions rule, these values clearly indicate that, not only are future emission control strategies likely to be more expensive (less cost-effective) than past strategies, but the cost-effectiveness of our engine/diesel sulfur program falls within the range of potential future strategies. In fact, our program is considerably more cost-effective than the average of those potential future programs. It should also be noted that the monetised health benefits of our program outweigh the program costs, as discussed in more detail under Issue 5.10.

We have taken into account the potential for NO_x disbenefits due to our program. See response to comment 2.2(D). We do not believe that potential NO_x disbenefits will substantially reduce the estimated reductions in ambient ozone concentrations associated with our rule. Regardless, NO_x disbenefits only affect ozone concentrations, not the amount of reduction in NO_x emissions due to our program. NO_x disbenefits are taken into account in our assessment of the health benefits associated with our program. In addition, we do believe that the proposed standards are necessary to protect public health and welfare from adverse health effects associated with ambient concentrations above the 1-hour ozone NAAQS. See responses to Issue 1.1(A)(3), Issue 2.1(J)(3), and Issue 2.2(A).

Finally, we do not believe that the costs of our program are unrealistically optimistic. Our cost estimate for the catalyzed diesel particulate filter technology compares well to estimates made by the Manufacturers of Emission Control Association (MECA) based on a survey of their members (see docket A-98-32 item II-D-09). Therefore the cost estimates are believed to accurately reflect a consensus of the likely future cost for this technology and is not considered to be unduly optimistic. The cost estimates for the other technologies considered by EPA were made using the same methodology and are therefore expected to reflect a similar degree of accuracy. As for our estimates of the cost of desulfurizing diesel fuel, we have found that our costs are reasonable. See responses to comments under Issues 5.1, 5.3, 5.5, and 5.8.

In its detailed comments, the commenter also raises the issue of fuel economy. Our responses to concerns about fuel economy and its impact on cost can be found under Issue 3.4.

Finally, it should be noted that cost-effectiveness is only one measure for comparing our program to other programs. Our cost-benefit analysis is another tool for assessing our program. According to the analysis described in Chapter VII of the RIA, the benefits of our program outweigh the costs.

---

[84] This rulemaking was remanded by the D.C. Circuit Court on May 14, 1999. However, the analyses completed in support of that rulemaking are still relevant, since they were designed to investigate the cost-effectiveness of a wide variety of potential future emission control strategies.

(2) First, it is nearly impossible to determine cost-effectiveness when the technology to meet the standards is highly uncertain. This problem is compounded by refiners having to meet Tier 2 gasoline standards at the same time. The cost estimates also need to account for indirect costs of having to compete for scarce engineering and construction resources. In addition, ABT approaches are unworkable because the ultra-low 15 ppm level does not provide adequate room to average down off-spec fuel batches.

Letters:

Murphy Oil Corporation (IV-D-274) **p. 13**

Response to Comment 5.9(B)(2):

We based our cost-effectiveness analysis on the technologies expected to be used to meet our standards. We do believe that the refinery technology needed to achieve sulfur levels of below 15 ppm is currently available. See response to comment 5.8.1(B)(2).

In our analysis of the costs associated with desulfurizing diesel fuel to below 15 ppm, we have in fact considered various other factors such as compliance with the Tier 2 low sulfur gasoline requirements. See our response to comment 5.8.1(B)(1) on Tier 2 co-compliance. Although we have not quantified the costs associated with alleged competition over scarce engineering and construction resources, we have evaluated this issue and concluded that there will be sufficient resources to meet the refining industry's needs. Refiners will not have to comply with the 15 ppm standard until 2006 at the earliest, giving substantially more than the four years leadtime typically included in new fuels standards of this magnitude. In addition, we have added a phase-in to our sulfur program that will mitigate much of the problems associated with scarce resources. Thus we believe that this timeframe should be sufficient for establishing contracts for the new equipment that will be necessary to meet the 15 ppm standard.

The diesel fuel ABT program does not allow averaging around the 15 ppm sulfur level. The ABT program allows refiners to earn credits if they produce more 15 ppm fuel than required under the Temporary Compliance Option we are adopting. For a discussion of comments on our diesel fuel ABT program, see our responses to Issue 6.2.

(3) Commenter notes generally that EPA has not conducted an adequate cost-effectiveness and fiscal impact analysis and that it appears that implementation of the proposed standards will be too costly.

Letters:

National Ready Mixed Concrete Association (IV-D-271) **p. 2**

Response to Comment 5.9(B)(3):

The commenter did not provide any details to support its position that the cost effectiveness analysis presented in our proposal was inadequate. After our detailed review of the costs and emission reductions associated with our program, we believe that our analysis is sufficiently comprehensive and that our program is cost effective as described in the RIA.

(C) EPA has not analyzed the cost-effectiveness of the Supplemental Emission Requirements and Tests (SERT).

(1) EPA has failed to provide any analysis of the cost-effectiveness of the SERTs in the context of the proposed rule. Manufacturers anticipate significant costs associated with the imposition of the numerous and complex new requirements represented by the SERTs. Meeting these requirements will result in design compromises that will increase costs and/or reduce engine performance, life or fuel economy. EPA has failed to meet its responsibility to perform a cost-effectiveness analysis before finalizing the supplemental emission requirements.

Letters:

Detroit Diesel Corporation (IV-D-276) **p. 25**
Engine Manufacturers Association (IV-D-251) **p. 66**

Response to Comment 5.9(C):

The SERT was not a new requirement in this rulemaking, though we did revise the requirements originally established in a previous rule setting standards for model year 2004 heavy-duty diesel engines [65 FR 59896, or "2004 rule"]. We do agree that some additional testing will be necessary to comply with the supplemental standards in this rulemaking, but do not agree that the provisions contained in today's final rule will require manufacturers to construct new test facilities. The regulations finalized in the 2004 rule were designed in such a manner that manufacturers will be able to rely significantly on engineering analysis in addition to testing. The costs associated with compliance with the revised SERT requirements in this rulemaking have been included in our estimates of the total costs for our program, though they are expected to be minimal. However, our program is an integrated whole and thus we have not separated costs and emission reductions associated with the FTP and SERT. As discussed in our response to comment 3.1.1(L), it is difficult if not impossible to determine how much emission reduction can be attributed separately to the supplemental requirements or the FTP standard. For this reason we have not developed separate cost-effectiveness estimates for other individual components of our program. It would not be reasonable to consider SERTs separately from rest of the program, and thus our cost-effectiveness estimates represent our program as a whole.

(D) EPA's cost-effectiveness analysis for the requirement to close crankcase breathers is flawed.

(1) Using EPA's assumption that this provision will eliminate 100 pounds of emissions over the life of the vehicle and the cost estimate of $49 plus $268 for the breather system and replacement filters, translates into a cost-effectiveness of $6340 per ton of emissions reduced. This analysis does not include the labor cost for breather maintenance and filter replacement; the maintenance costs for charge cooler, intake system, or aftertreatment system cleaning; or the impact of offsetting emission increases due to loss of performance of these systems. In addition, EPA's analysis does not consider

the fact that most of the NMHC component of the assumed emission reduction is in the form of oil vapor, which is not a reactive hydrocarbon and does not contribute to ozone formation in the atmosphere. It is arguable whether oil vapor should be considered an air pollutant given the fact that its residence time in the atmosphere is limited. When all of these factors are considered, the cost per ton of emissions reduced by this provision will be substantially higher than EPA has estimated.

Letters:

Detroit Diesel Corporation (IV-D-276) **p. 22-23**

Response to Comment 5.9(D):

Oil vapor is a pollutant, as discussed more fully in our response to comment 3.1.1(P)(1). It is reasonable, therefore, to consider controls on crankcase emissions. However, we are using an integrated systems approach to setting new standards in this rulemaking, and as a result we believe it is appropriate to view the new crankcase and tailpipe standards as being two elements of a single strategy for reducing emissions from HDDE. As a result, we combined the crankcase standards with our new tailpipe standards for both HDDE and HDGV, as well as the new standard for diesel sulfur content, to calculate the cost-effectiveness of our program. We did not set the new crankcase standards on the basis of their stand-alone cost, emission reductions, or cost-effectiveness. Rather, we set the crankcase standards on the basis of how they contributed to the total engine costs, emission reductions, and cost-effectiveness.

We have revised our controls on crankcase emissions for this final rulemaking so that manufacturers must comply with a performance standard instead of a mandate to use a closed crankcase ventilation (CCV) system. However, for purposes of the analysis of costs, we have continued to assume that manufacturers will use CCV systems. In our analysis of the costs associated with our new crankcase emissions standards, we determined that the labor costs were too small to characterize accurately. The maintenance interval associated with servicing the crankcase is designed to match the oil change interval and would therefore be handled in the same service event. In addition, we believe that these advanced crankcase systems will remove the bulk of the oil which could foul the intake system as described by the commenter, and there would likely be a maintenance benefit associated with the resulting reduced oil consumption which we have not taken into account. Therefore we expect no new net maintenance costs for that system.

(E) EPA should rely on incremental cost effectiveness when determining the optimal standards.

Response to Comment 5.9(E):

We do not believe that an incremental approach to cost-effectiveness is more appropriate than an average approach. As described in the NPRM, nearly all other previous control programs made use of an average approach to cost-effectiveness. It would be misleading to the compare the incremental costs of NO_x and NMHC control under our diesel engine/sulfur program to the average costs of other programs. In addition, data on incremental costs and emission reductions for other programs are difficult to procure.

Incremental cost-effectiveness is not a reasonable approach for other reasons as well: the results are highly dependent on the size of the increment chosen, the change to new technology is extremely difficult to predict on the increment, and the choice of technology for various incremental points is not straightforward. We have therefore retained our traditional approach to cost effectiveness which uses average rather than incremental costs and emission reductions. Note also that a comparison of costs to monetised health benefits is an alternative to cost-effectiveness which provides an indication of whether our standards are optimal. See responses to Issue 5.10.

(1) EPA's approach of accounting for "global" cost effectiveness is intended to make the proposal look more reasonable, but this approach results in excessive costs and places at risk essential fuel supplies. An "incremental cost effectiveness" approach would yield substantial emissions benefits at a much lower cost to end users.

Letters:

National Petrochemical & Refiners Association (IV-D-218) **p. 18**

Response to Comment 5.9(E)(1):

We disagree that the use of an incremental approach to cost effectiveness would necessarily have resulted in lower costs. Our technology assessment led us to conclude that significant reductions in emissions from heavy-duty diesel engines would require the use of aftertreatment such as NO_x adsorbers and PM traps, and that these devices could tolerate no more than 15 ppm sulfur. Diesel fuel sulfur reductions were necessary in order to enable the aftertreatment to operate efficiently and thus do not offer a means for balancing aftertreatment and fuel costs. An incremental approach to cost effectiveness would not have changed our conclusion that aftertreatment devices require sulfur levels to be no higher than 15 ppm in order to effectively reduce emissions. See also response to 5.9(E)(2) below.

It is worth noting that our standards under 202(a)(3) require us to promulgate standards which reflect the greatest degree of emission reduction achievable, giving appropriate consideration to cost, energy, and safety factors. The standards we set are not premised on the need to promulgate the most cost-effective standards.

Our cost-effectiveness analysis is not intended to make our proposal look more reasonable, but instead represents what we believe is the appropriate way to analyze the cost-effectiveness of our rule. The levels of the standards and the fuel requirements all interact with each other, and we believe that it is best to view the cost-effectiveness of the program as the integrated system that it is.

(2) Using an incremental basis could have resulted in the identification of a lower total cost and much more cost-effective proposed emission standards than what is currently proposed. No assessment of cost vs. NO_x burden impact was considered other than for the standards EPA has proposed.

Letters:

Cummins, Inc. (IV-D-231) **p. 41**

<u>Response to Comment 5.9(E)(2)</u>:

Following the requirements of Section 202(a)(3) of the Clean Air Act, we have set new standards for heavy-duty trucks that reflect the greatest degree of emission reduction achievable through the application of technology which we determine will be available for the model year to which the standards apply. The Act does not require us to evaluate cost effectiveness as a means for judging the appropriateness of new standards, but instead directs us to set new standards on the basis of what is technologically feasible. We are also required to give appropriate consideration to cost, energy, and safety factors associated with the application of such technology. However, we have included an evaluation of cost effectiveness to further inform our decision, and we have used this evaluation in concert with other criteria to conclude that our new standards are appropriate. An incremental approach to cost effectiveness as a means for setting new standards as suggested by the commenter would not be consistent with the Act's directives to set standards on the basis of technological feasibility. But consistent with past rules we have considered cost-effectiveness in our standards-setting process.

(F) EPA has not provided adequate analysis of the cost-effectiveness of the proposed rule.

(1) EPA concludes that the proposed rule is cost-effective because the estimated average cost-per-ton figures fall within the range of cost-per-ton figures estimated for other pollution control programs. This approach assumes that other programs pass a benefit-cost test and that the reductions from the proposed rule will have comparable health and welfare effects. EPA counts all emission reductions as if each ton will produce similar health and welfare benefits. However, many tons will produce no benefits and may even cause harm (i.e., NO_x disbenefits). EPA has artificially reduced its cost-per-ton estimate by including all emission reductions when only a fraction of those will provide benefits. Commenter provides significant discussion regarding EPA's assumptions and why the cost-effectiveness estimates may have been overestimated.

<u>Letters:</u>

Mercatus Center at GMU (IV-D-219) **p. 18-20**

<u>Response to Comment 5.9(F)(1)</u>:

The commenter blurs the distinction between cost-effectiveness and cost-benefit analyses. Cost-benefit analyses have been used in some mobile source recent rulemakings to supplement the more traditional cost-effectiveness analyses. Whereas cost-effectiveness seeks to compare the program costs to the emission reductions that are expected to result from that program, cost-benefit analyses attempt to ascertain the degree to which the program reduces adverse health and welfare effects, comparing the estimated monetary value of those reductions to the costs of the program. Both cost-effectiveness and cost-benefit analyses are useful tools for evaluating our rule, but their respective purposes are different. Trying to choose which tons should be included in our cost-effectiveness analysis and which should be excluded, as the commenter suggests, mixes in benefit considerations more properly dealt with in the cost-benefit analysis. We have conducted a cost-benefit analysis for this rule, and have concluded that the monetised benefits do in fact far outweigh the costs. See our responses to Issue 5.10 and Chapter VII of the RIA.

As stated above, cost-effectiveness only has relevance when compared to alternative strategies. Thus we must use an approach to calculating the cost-effectiveness of our annual, nationwide program that is consistent with the approaches taken for calculating the cost-effectiveness of various alternative strategies. That is, we compare total emission reductions to total cost to produce a cost per ton of emission reduction. To exclude some emission reductions from our cost-effectiveness analysis would yield an invalid comparison with other strategies for attaining and maintaining the NAAQS.

Beyond the fact that we are maintaining consistency with the approach to cost-effectiveness used for other programs, we believe that all the emission reductions have benefits other than reducing the levels of criteria pollutants in nonattainment areas. These include reductions in air toxics, reductions in secondary fine PM, reductions in CO, and reductions in damage to agricultural crops, forests, and ecosystems from ozone exposure. In addition, there are ozone health benefits to be gained in attainment areas, since there is no apparent threshold for biological responses to ozone exposure. Emission reductions in attainment areas also help to maintain clean air as the economy grows and new pollution sources come into existence. For these reasons we believe it is appropriate to include all emission reductions produced by our program in our cost-effectiveness analysis.

The commenter goes on to say that he believes our cost estimates are optimistic and that our cost-effectiveness estimates are biased downward as a result. For a more detailed discussion of the process we went through to determine costs and the reasons that we believe our cost estimates are reasonable, see our responses under Issue 5.1 for engines and Issue 5.8.1(B) for fuels.

(2) EPA's cost estimates only address the proposed rule's impact on long-run average cost. Those estimates do not consider how short-run marginal cost may be affected. This would include how costly it will be to replace the loss of a portion of supply due to occasional disruptions caused by accidents or weather that would temporarily disable the industry's facilities. The severity of a price increase in the context of a supply disruption would depend on how easily and cheaply alternative supplies of lawful fuel can be obtained. Short-run demand for diesel fuel is highly price inelastic and therefore, a relatively small percentage change in supply causes a much larger percentage change in price. EPA should more fully consider this issue in the context of the proposed rule.

Letters:

Mercatus Center at GMU (IV-D-219) **p. 20-21**

Response to Comment 5.9(F)(2):

It may be true that unforeseen events such as accidents or severe weather could impact production levels at individual refineries. However, we do not anticipate widespread supply shortages, as described in our responses under Issues 5.8.1(B)(11) and 5.8.4(A). Our schedule for bringing all highway diesel fuel down to the 15 ppm standard is gradual enough to allow refinery capacity to exceed anticipated demand and thus absorb occasional and partial disruptions of supply. Once the program is fully implemented and all highway diesel fuel must meet the 15 ppm sulfur standard, other refineries should be able to meet any resulting supply shortfalls just as today. Still, in response to concerns about potential supply shortages, we have implemented a temporary compliance option and various hardship provisions for the 15 ppm sulfur standard. See our responses to Issue 4.1(F) and 8.1.

(3) The RIA's methodology for allocating costs among pollutants bias downward its cost-per-ton estimates for PM. EPA's cost-per-ton estimates for PM are highly sensitive to the methodology chosen to allocate implementation costs among pollutants and it appears that EPA has allocated as much cost as possible to the ozone precursors instead of to PM. Commenters raises a number of points in the context of this issue. First, EPA's "SO2 credit" illustrates the importance of cost allocation. Since virtually the entire nation now meets the SO2 NAAQS standard, the reduction in SO2 emissions under the proposed rule would appear to provide relatively few benefits. Therefore, it is unclear why any "credit" should be made for SO2, which reduces the cost-per-ton estimate for PM significantly. Second, EPA's allocation of costs for PM and NO_x + NMHC may bias its results. EPA has attributed some of the cost of tightening a 25 ppm cap alternative to its proposed 15 ppm cap to ozone precursors, even though such tightening only affects PM reductions. If EPA had allocated costs among the pollutants differently, it could have found that the proposed rule would be an unusually expensive way to reduce PM emissions. Commenter provides data on alternative net present value cost-per-ton estimates to illustrate their point on this issue. Third, EPA's lengthy time horizon may bias downward net percent value cost-per-ton estimates for both PM and NO_x and NMHC. EPA's use of 30-year net present value cost estimates assumes that annual costs and emission reductions can be estimated reliably long into the future. Commenter provides significant discussion on these issues and concludes that the proposed rule may be a relatively expensive way to reduce PM emissions since the incremental costs would be high and since the cost-per-ton of PM removed would greatly exceed the upper limit promised by President Clinton (cites to memo from Clinton to Browner dated July 16, 1997 on implementation of the ozone and PM NAAQS). Commenter notes that costs per ton of PM emissions removed will be dramatically higher than EPA's estimate and between 2 and 8 times higher than what EPA considers acceptable.

Letters:

Mercatus Center at GMU (IV-D-219) **p. 21-26, 31-32**

Response to Comment 5.9(F)(3):

Although our program was not intentionally designed to produce reductions in SO_2 emissions, such reductions are produced incidentally by virtue of setting a lower diesel sulfur standard. These reductions do have value, as described below. We therefore believe it appropriate to calculate the cost-effectiveness of our program both with and without a credit for these incidental reductions. Comparisons to alternative control strategies can be made with either the credited or uncredited values. The results show that our program is cost-effective regardless of whether the credit for SO_2 emissions is included. Note that our rule produces other reductions in pollutants which we are not directly giving a monetary value, such as toxics, secondary PM, and CO. Also, there are other benefits for reductions in pollutants which are not monetised, such as visibility, eutrophication of waterways, acid rain, etc.

The cost credit for SO_2 emission reductions was based on the average cost-effectiveness for potential future SO_2 control strategies as described in the RIA. We do not believe that the current market price for SO_2 credit trading is an appropriate source for valuing the SO_2 emission reductions from our program. The value ascribed to our SO_2 emission reductions should represent alternative sources for SO_2 reductions. Since SO_2 credit trading is already occurring, it does not represent a means for replacing the SO_2 emission reductions that our program is generating. The only source for alternative SO_2 emission reductions that could be instituted if our program did not exist is potential future programs that have not yet been implemented.

Though we recognize that most areas now meet the NAAQS for SO_2, we continue to believe that reductions in SO_2 emissions will be beneficial. For instance, many areas are still out of attainment for PM, and atmospheric SO_2 does contribute substantially to the formation of secondary PM. As new PM control measures are implemented in the future, the cost of those programs is likely to increase, and it is possible that strategies such as more stringent SO_2 emissions controls could become viable means for reducing PM. Thus we still believe it is appropriate to take into account the reductions in SO_2 emissions that will result from our program, and to apply the value of those SO_2 reductions entirely to the calculation of cost-effectiveness for PM.

The commenter points out that the alternative program scenario we evaluated in the NPRM in which the sulfur cap is 25 ppm shows the same NO_x and HC emission reductions as for our proposed program with a 15 ppm cap. For the 25 ppm cap scenario, we assumed that, if the technology were enabled with this sulfur level, virtually the same emission standards would be achieved. However, as stated in the NPRM , Section III of both the preamble and RIA, and in our responses under Issue 4.1, we do not believe that the aftertreatment technologies being considered in this rule will be enabled and are capable of reaching our engine standards at 25 ppm.

The commenter goes on to conclude that none of the costs associated with a reduction in sulfur of 25 ppm to 15 ppm should be attributed to the calculation of cost-effectiveness for NO_x+HC. As noted above, this comment is based on the erroneous conclusion that NO_x + HC emission performance would be unchanged. In fact, a sulfur cap of 15 ppm is necessary to meet the standards we are finalizing in this final rule.

The commenter further presumes that cost-effectiveness analyses should be done on an incremental basis, such that only the costs and emission reductions associated with a change in the sulfur cap of 25 ppm to 15 ppm would be used to calculate $/ton values. However, as discussed in our response to comment 5.9(E), we did not conduct an incremental cost-effectiveness analysis for our program, and we do not believe that incremental cost-effectiveness analyses described by the commenter are appropriate in this rulemaking. Our "average" approach to cost-effectiveness took into account all the costs and all the emission reductions associated with either the 25 ppm alternative sulfur cap or our proposed 15 ppm sulfur cap, both of which were compared to the same baseline, namely the current in-use sulfur level of 340 ppm. Using this average approach and the cost allocation procedure described in Chapter VI of the RIA, we continue to deem it appropriate to allocate 75 percent of the costs for the 15 ppm sulfur cap to the calculation of cost-effectiveness for NO_x+HC.

In its detailed comments, the commenter suggests that allocating 50 percent of fuel costs to the calculation of PM cost-effectiveness is more appropriate than allocating only 25 percent. We disagree. The allocation of fuel costs should be consistent with the fuel's enabling function in our program, namely that the 15 ppm standard is being promulgated because it is necessary in order to enable both the PM trap and NO_x adsorber to operate efficiently. But since cost-effectiveness is emission-based rather than technology-based, it was necessary for us to allocate fuel costs associated with each aftertreatment technology to the pollutants affected by those technologies. A more detailed description of our cost allocation methodology is given in Chapter VI of the RIA. The result is that 25 percent of the fuel costs are allocated to PM.

The commenter suggests that a 30-year timeframe for calculating net present value of costs and emission reductions is too long and that our estimates cannot be reliably predicted for that timeframe. The 30-year timeframe is consistent with the approach taken in many previous rulemakings, and is used in order to fully capture all of the costs and emission reductions associated with new engines which only fully replace existing engines over a long period of time. A significantly shorter timeframe would account for all of the costs of the diesel fuel sulfur standard, but would ignore the emission reductions associated with new engines which have not yet been sold and thus have not yet replaced existing engines in the fleet. As for the reliability of the estimates in the long term, our approach to estimating long-term costs and emission reductions is also consistent with the approach taken in other rulemakings, and represents the best available methodology.

Finally, the commenter suggests that the cost-effectiveness of our program exceeds the upper limit discussed by President Clinton in a 1997 memo, particularly for PM. We agree that the uncredited cost-effectiveness for PM may exceed the $10,000/ton value given in that 1997 memo. However, we continue to believe that our program is cost-effectiveness for PM control. The referenced memo was a discretionary action that was specific to EPA's process of revising the NAAQS for PM and ozone, and thus did not establish requirements for all Agency programs. In addition, we are not setting new standards in today's action in order to meet the revised NAAQS. It should also be noted that the $10,000/ton metric was intended to be used as a maximum value in the air quality modeling conducted for the rulemaking to revise the ozone and PM NAAQS; only those programs costing less than $10,000/ton were actually modeled in that rulemaking. Using this limitation, most, but not all, nonattainment areas came into attainment. It might be surmised, then, that programs costing more than $10,000/ton would need to be implemented for all areas to reach attainment. However, cost-effectiveness is only a relative measure, having relevance only when the $/ton value for one program is compared to the $/ton value for an alternative program. The limit of $10,000/ton used in the NAAQS revisions rule is not an Agency benchmark applicable to all new control strategies, but instead was used only to determine which control strategies among the myriad of possibilities would most likely be implemented. Finally, several past programs were less cost-effective than the program we are finalizing today, so we continue to believe that our program is appropriate. See also the response to comment 5.9(B)(1).

(4) EPA has not demonstrated that its proposed rule is superior to the

alternatives. EPA has concluded that the 50 ppm cap is less cost-effective than its proposed 15 ppm cap. However, EPA's analysis underlying this conclusion appears seriously flawed since it violates the economic law of increasing costs in several places. Under the law of increasing costs, a stricter standard must cost more than a less stringent standard. It is implausible that EPA can conclude that choosing a lower sulfur cap would provide additional clean air benefits and save money. EPA has not provide cost estimates for the 50 ppm cap based on the same engine emissions standards as for the other three fuel standards it considers. In addition, EPA may be unduly pessimistic regarding the European experience with 50 ppm sulfur diesel. The different failure rates in Finland and Sweden are insufficient grounds to base a fuel sulfur standard for the U.S. given its diverse geography and climate. EPA should inquire more deeply into the reasons for the positive results experienced by the U.K.

Letters:

Mercatus Center at GMU (IV-D-219) **p. 26-28**

Response to Comment 5.9(F)(4):

The so-called law of increasing costs does not impose the same kinds of constraints on cost-effectiveness as it does on costs. Since cost-effectiveness compares the costs to the emission reductions (typically $/ton), cost-effectiveness can go up even if costs remain the same or go down. This effect results from the fact that benefits associated with different emission standards (in this case the engine certification standards associated with either the 50 ppm cap or the 15 ppm cap) can be very different. In the NPRM, the total 30-year net present value costs of the 50 ppm alternative program were in fact lower than the costs of the proposed 15 ppm program ($35.4 billion verses $37.7 billion). Despite this, the $/ton values associated with the 50 ppm alternative program were higher than those for the proposed 15 ppm program.

The engine certification standards we are finalizing today simply would not be possible without very low sulfur. See Chapter III fo the RIA. The engine certification standards we believe would be possible with a 50 ppm sulfur cap are not the same as those that would be possible under a 15 ppm sulfur cap, because the required aftertreatment technology would have to be different and could not meet the standards we are promulgating today. The lower sulfur cap of 15 ppm enables the NO_x adsorber and PM trap to operate efficiently, producing the highest amount of emission reductions among the alternative strategies discussed in the NPRM. As a result, the cost-effectiveness of the proposed 15 ppm cap program was significantly better than that for the alternative 50 ppm cap program.

Finally, the failure rates in Finland and Sweden provided one benchmark in our determination of the maximum sulfur level that PM traps could tolerate and still operate efficiently. See our responses to Issues 3.3, 4.1, and 5.9(E)(2).

(5) EPA has manipulated their figures to make the cost-effectiveness calculations appear "appropriate." EPA has put all the fuel costs into the NO_x adsorber part of the calculation. EPA has also chosen to combine the NO_x and NMHC benefits and to separate these from PM. NMHC (VOC) reductions are due to

the CDPF, not the NO_x adsorber or the SCR and therefore, makes EPA's combination problematic. Commenter notes that NMHC should not be considered in a cost-effectiveness analysis and provides revised cost-effectiveness figures that EPA should consider.

Letters:

American Petroleum Institute (IV-D-343) **p. 77-79**
Marathon Ashland Petroleum (IV-D-261) **p. 81-82**

Response to 5.9(F)(5):

In determining how to allocate costs to the various pollutants in our cost-effectiveness analysis, we did not allocate all fuel costs to the NO_x adsorber. As described in Chapter VI of the RIA, we allocated the fuel costs first to the individual components of the aftertreatment technology, since the fuel standard of 15 ppm is being promulgated only because it is necessary in order to enable the aftertreatment to function efficiently. We then further divided the fuel costs evenly between the pollutants that the aftertreatment affects.

We have chosen to calculate cost-effectiveness in terms of NO_x + HC because these two pollutants act together to produce tropospheric ozone. This approach is consistent with the approach taken in several past rulemakings. We calculated separate cost-effectiveness values for PM because there are separate NAAQS for ozone and PM.

Issue 5.10: Cost-Benefit Analysis

(A) The health benefits of the rule, including reduced costs related to hospitalization for lung ailments, far outweigh the costs that will be imposed as a result of these new requirements.

(1) Commenters provided no further supporting information or detailed analysis. This comment was made by approximately 92 private citizens.

Letters:

Barrett, Bruce (IV-D-93)
Beeman, Nora, et. al. (IV-G-09)
Chung, Payton, et. al. (IV-D-133)
Citizens for a Better Environment (IV-F-3)
City of NY, Borough of Manhattan (IV-F-51)
Corcoran, Janet (IV-D-128)
Damitz, Kyle and Colleen (IV-F-20)
Davidson, Karin, et. al. (IV-D-79)
Evans, David (IV-F-116)
Fleming, Scott, et. al. (IV-D-13)
Franczyk, Catherine A., et. al. (IV-D-233)
Holy Spirit Church (IV-D-83)
Khalsa, Mha Atma S. (IV-D-71)
Lind, Karen, et. al. (IV-D-121)
Lipka, Richard P. (IV-D-92)

Montgomery, Jack, et. al. (IV-D-78)
NY State Attorney General's Office (IV-F-61)
Natural Resources Defense Council (IV-F-75)
Nerode, Gregory, et. al. (IV-D-04)
Pastor of Culver-Palms United Methodist Church (IV-F-177)
Richards, Donna and Bill, et. al. (IV-G-19)
Riggles, Ruth (IV-D-102)
Rodriguez, Dolores, et. al. (IV-D-91)
Ruth, Richard T. (IV-D-73)
Smith, Maria (IV-D-72)
StarQuest Leasing Company (IV-G-17)
Vid, Da (IV-D-70)
West Harlem Environmental Action/Envr Justice Network (IV-F-76)
Williams, Mary, et. al. (IV-D-122)

Response to Comment 5.10(A)(1):

We agree with the comments that the benefits to society outweigh the costs.

(2) One commenter noted that the government is subsidizing the polluters by forcing the health industry to bear the costs of their economic impacts.

Letters:

Hacienda Heights Improvement Association (IV-F-172)

Response to Comment 5.10(A)(2):

We would like to clarify that EPA does not directly subsidize any industries. Our goal is to adequately carry out the mandates of the Clean Air Act while minimizing the costs resulting from controlling emissions.

However, the emissions from diesel engines and fuels targeted by this rule produce pollution that burdens many parts of society, especially sensitive populations such as children, the elderly, and individuals with pre-existing respiratory conditions. PM, Ozone, CO and HAP pollutants have been associated with health endpoints that can cause exposed sensitive groups to use more medical services (e.g., medication, doctors visits, hospitalization, and emergency room visits). We agree that these emissions should be reduced.

(B) The added fuel costs of approximately 4 cents per gallon would be a reasonable cost considering the significant benefits that will be achieved regarding pollution reductions and is unlikely to have a significant impact on the national economy.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

American Lung Association (IV-F-72)

MN Chamber of Commerce (IV-D-28) **p. 1**
NESCAUM (IV-D-315) **p. 9**
Natural Resources Defense Council (IV-D-168) **p. 5**, (IV-F-190) **p. 98**
STAPPA/ALAPCO (IV-D-295) **p. 11**

Response to Comment 5.10(B)(1):

We agree with the comments.

(2) The public expressed its view in a nationwide opinion survey conducted recently in which 85 percent of those polled believe that an increase of up to 4 cents a gallon is justified for a significant reduction in pollution.

Letters:

American Lung Association (IV-D-270) **p. 20**
Udall, Mark (IV-D-173) **p. 2**

Response to Comment 5.10(B)(2):

We agree with the comments that the benefits outweigh the costs of this program.

(3) These estimates are consistent with the findings of MathPro in "Refining Economics of Diesel Sulfur Fuel Standards" (October 1999).

Letters:

Environmental Defense (IV-D-346) **p. 10-11**

Response to Comment 5.10(B)(3):

We generally agree with the commenter on the consistency of the costs between our cost estimates and those by Mathpro. See our response to 5.8.1 (B) (6) and (7) for further discussion.

(C) EPA has failed to provide an adequate and accurate analysis of the costs and benefits of its proposal.

(1) Under section 211(c)(2)(B), EPA must prepare a benefit-cost analysis and compare the emission control systems that are or will be in general use that require a low-sulfur fuel with those systems that are or will be in general use but do not require a low-sulfur fuel. While the proposal describes the benefit-cost analysis process, EPA has not provided a benefit-cost analysis for public comment. EPA should issue this analysis as soon as possible with notification to the public and additional time to comment on the analysis.

Letters:

American Petroleum Institute (IV-D-343) **p. 3, 93**
Marathon Ashland Petroleum (IV-D-261) **p. 2, 86**

<u>Response to Comment 5.10(C)(1):</u>

In the proposed rule, EPA presented its assessment that although the full quantification of the economic benefits would not be available until the final rule, we believed that the health and welfare benefits would substantially outweigh the costs. This assessment was based on the similarity between the HD Engine/Diesel Fuel rule and Tier 2/Gasoline Sulfur rule in terms of cost per ton of emissions reduced, emissions reductions, and types of health and welfare benefits expected.

We have completed a benefit-cost analysis for those benefits we were able to quantify for the final rule. That analysis fully verified the expectations outlined in the NPRM.

EPA's discussion of compliance with the requirements of section 211(c)(2)(B) of the Act can be found in Appendix A of the RIA and in response to comments section 12(E).

(2) EPA's intention to finalize the BCA when finalizing the rule will deprive the public of the opportunity to review and comment on the merits of the Agency's economic analysis and EPA's belief that the health benefits will exceed the costs.

<u>Letters:</u>

ExxonMobil (IV-D-228) **p. 11**

<u>Response to Comment 5.10(C)(2):</u>

We believe that we presented enough detail of our proposed economic analysis methodology for the public to comment on the merits of our approach. In addition, more details are available in the Tier 2/Gasoline Sulfur RIA regarding the application of these methods in a similar mobile source rulemaking context. The Tier 2/Gasoline Sulfur RIA was referenced in the NPRM to this rule. Given that in a recent rulemaking with similar magnitude and distribution of emissions reductions and cost per ton, the net benefits were $20 billion in 2030, we feel that it was reasonable to conclude that the net benefits to society for this rulemaking will also be positive. The commenters did not provide additional information to support any belief to the contrary. See also the response to comment 5.10(C)(1).

Our costs estimates were available at the time of the proposal. EPA provided a detailed cost-effectiveness analysis in the proposal. A cost-benefit analysis of the rule is not required under section 202. Regarding the commenter's complaint that EPA only provided a draft RIA at the proposal stage and won't finalize the BCA until the final rule, EPA could not provide a final BCA prior to the final rule being completed. Obviously, the costs and benefits of a rule can only be determined at the time the final rule is being completed, because we don't know what the costs and benefits of a rule will be until we know what the final standards are. EPA's final analyses arise from the analyses and information provided in the proposal and we are not required to delay this rule to allow further comment on the final analyses. Moreover, as discussed elsewhere, delaying this rule would reduce the amount of leadtime provided for refiners and engine manufacturers. Refiners and engine manufacturers urged us during the Tier 2 rule to complete this rule quickly.

(3) Without a BCA, commenter cannot determine whether EPA's general

assessment that the costs are less than the Tier 2 costs accurately addresses the significant costs to farmer co-ops, including refineries, pipelines, terminals, local co-ops and farms.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 6**

Response to Comment 5.10(C)(3):

We analyzed the feasibility and costs of the proposed program in the Draft RIA, and our final analyses are in the Final RIA, Chapter 4 and 5. In these analyses, we address the impact of the program on all refiners for their entire volume of highway-compliant fuel, as well as all points in the distribution system nationwide, including those refineries, terminals, pipelines, retailers owned by farmer cooperatives. We considered a wide range of factors including individual refinery locations and characteristics; locations and storage capacities of terminals; the capacities, directions, and endpoints of pipelines; and the numbers and capacities of retail outlets nationwide. By looking at each major segment of the distribution system in this manner, we believe we have incorporated the key aspects of farmer cooperative's participation in the national petroleum system into our economic analyses.

(4) Commenter provides an analysis based on DOE's "Modeling Impacts of Reformulated Diesel Fuel" and highlights the deficiencies in EPA's cost analysis. Commenter concludes that EPA's estimated cost of 4 cents per gallon is underestimated by almost 11 cents if investment costs, fuel economy impacts and distribution costs are reflected and that the industry proposal (i.e. 50 ppm) will cost 5.7 cents/gallon and is also more cost effective per vehicle. Because under either proposal the emissions benefits are roughly equivalent, the cost benefit analysis weighs in favor of the less-expensive industry proposal.

Letters:

ExxonMobil (IV-D-228) **p. 11-12**

Response to Comment 5.10(C)(4):

DOE initially modeled the cost of desulfurizing diesel fuel based on diesel fuel ring opening or upgrading technology. DOE then received a number of comments by vendors and refiners on the DOE analysis pointing out that ring opening technology is not needed, but severe hydrotreating would be used instead. We believe these comments caused DOE to include a second set of costs, which they term optimistic costs, which are based on severe hydrotreating and these costs are much lower. We believe that these other costs are more representative of the actual costs of desulfurizing diesel fuel and we compare these costs to our costs in Chapter IV of the RIA. We also discuss how the DOE costs compare to our costs in response to comment 5.8.1 (B) (11).

(5) The analysis fails to account for the nationwide inflationary, ripple effect of the proposal that will occur as a result of higher refiner costs, reduced fuel supplies, and increased fuel and vehicle costs.

Letters:

CO Petroleum Association (IV-D-323) **p. 2**

Response to Comment 5.10(C)(5):

The program is not expected to have a significant inflationary effect because the increased vehicle costs and operating costs represent only a small change in existing costs, as described in Chapter V of the RIA. For example, for HHD diesel vehicles, which carry much of the nation's freight, the total lifetime vehicle and operating cost is expected to increase by only about 3 percent. Furthermore, the increased fuel and vehicle costs will be offset by monetary benefits in the form of lower health care costs, improved worker productivity and reduced agricultural crop damage, which is estimated in our benefit-cost analysis to amount to approximately $4.5 billion per year once the fleet is fully turned over and the program phased in. We also have analyzed the risk of supply shortfalls of highway diesel fuel and concluded that our final program is designed to avoid such shortfalls. The commenter is directed to review our response to comment 5.8.1 (B) (11) for a more complete discussion on this aspect of the program.

(6) EPA overstates the emission reductions that will result from the proposed 2007 emission standards of HD diesel engines and this. EPA's estimate of the emissions benefits from the proposed HD diesel engine standards are overstated. The HD engine emission inventory has been significantly inflated (see also Issue 2.2), which increases the emission reductions that can be attributed to the proposed emission standards. EPA's proposal compares the cost per ton of emission reduction in this rule with other recent EPA mobile source rulemakings (i.e. a comparison of the cost per ton of NO_x and NMHC reduction achieved in the Tier 2 rule, "2004" rule, Tier 1 rule, and others). If the cost per ton in this rule were calculated using an inventory consistent with the prior rulemakings cited by EPA in Table V.F.3 (65 FR 35498), the benefits of the proposed rule would be halved, which would increase the cost per ton of emission reduction by a factor of two. The proposed rule's cost per ton is at least 50 percent higher than all but two of the rules cited by EPA and is twice the average of the upper bound estimates for the eight rules cited by EPA.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 75**

Response to Comment 5.10(C)(6):

We believe that the models we used to develop emission inventories for this rulemaking, as well as the associated data inputs and assumptions, were appropriate and produced the best possible estimates of the baseline emissions and emission benefits of our program. See responses to Issues 2.2(F)(3) and 2.2(G)(3) for a more detailed discussion of our models and inventory estimates.

The primary utility of a cost-effectiveness analysis is in determining if the control strategy under consideration represents an appropriate next step in efforts to reduce pollution compared to alternatives. In this context, one approach is to compare the present program with past programs. The commenter argues that it is inappropriate to compare the present program using up-to-date information with past programs that used then-current but now out-of-date information. Instead the commenter believes it is appropriate to use old, out-of-date and knowingly incorrect inventory information for the purposes of conducting a cost-effectiveness analysis of the current program. We reject such a suggestion and believe that only accurate and available information should be used to determine both costs and emission benefits for our rules. Furthermore, a better comparison of cost-effectiveness is to compare this rule with alternative regulations which would have similar emission benefits in terms of tons reduced, the national distribution of those tons, and the particular pollutants impacted. In fact, if comparisons are made to potential future programs as described in the RIA, it becomes clear that our program represents a cost-effective strategy, among available alternative control strategies, for obtaining substantial reductions in emissions of ozone precursors and PM. See response to comment 5.9(B)(1).

(7) The cost impacts of imposing supplemental emission requirements and tests, at both FTP and expanded ambient conditions, will be enormous and should be fully considered. EPA has not met its statutory burden to review and evaluate the costs of its proposed standards and requirements.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 81**

Response to Comment 5.10(C)(7):

We disagree with these comments. First, we disagree with the comment that the cost of complying with the supplemental emission requirements (i.e., the SET and the NTE requirements) will be enormous. As discussed in Chapter 3 of the RIA, the emission control technology hardware which will be used to comply with the FTP is also capable of complying with the supplemental requirements, and the variable hardware costs is the vast majority of the engine costs for this rule. In addition, the supplemental requirements will require research and development costs with respect to engine calibration and integration of control strategies, and these costs are included in the research and development costs we have included in our cost analysis; please see Chapter 5 of the RIA which discusses our estimates of HDDE R&D costs associated with this rule. Therefore, we also disagree with the comment that EPA did not fully consider these costs; we did both in the proposal and in this final rule.

We also disagree with the comment that we have not met our statutory burden regarding the standards promulgated in this final rule. CAA Section 202(a) requires the Agency to give appropriate consideration to cost, among other factors, when setting new emission standards for HDDEs, which as discussed above, we have done.

(8) EPA has not given appropriate consideration to cost under the requirements of the CAA (Section 202(a)(3)) nor has it complied with the requirements of Executive Order 12866 to select a regulatory approach that will maximize net benefits to Americans. Commenter provides significant discussion on this issue, noting that EPA has not demonstrated that the proposed rule can provide substantial benefits since in the preamble and draft RIA for the proposed rule, EPA does not quantify any of the expected benefits in terms of

dollars even though many of the expected costs are in fact, quantified. EPA has only offered a limited numerical accounting of the rule's benefits in the form of estimated reductions, which are not adequately supported by factual evidence. (See also Issue 2.1 and 2.4.)

Letters:

Mercatus Center at GMU (IV-D-219) **p. 7-8**

Response to Comment 5.10(C)(8):

EPA disagrees with the comment. Section 202(a)(3) requires that standards for heavy duty engines "reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator believes will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology." EPA has given considerable consideration to cost, within the mandate of section 202(a)(3). EPA has performed cost effectiveness analyses for both the proposed and final rules. The analyses indicate that the cost-effectiveness of this rule is within the range of cost-effectiveness total for other mobile source regulations and will provide considerable reductions in pollutants. We have also examined viable alternatives in our analysis for this rule and we believe we has chosen the option that is most the cost-effective option to achieve the requirements of the Act. These analyses are based on considerable factual evidence. The commenter does not explain its view that the factual evidence does not support these analyses.

In addition, though the Clean Air Act does not require benefit-cost analysis to be performed, a benefit-cost analysis was completed to determine efficiency of the program. For the final rule, EPA conducted a benefits-cost analysis, putting into monetary terms the emissions reductions benefits enumerated in the proposal. This analysis is discussed in detail in the preamble and section V of the RIA for this final rule. The analysis indicates that this rule will lead to substantial benefits that well outweigh the costs of the rule. Even so, there are significant unquantified benefits in our full analysis due to deficiencies in the literature (see Table V-G.2 in the preamble to the final rule for unquantified benefits categories). Even with these limitations, we estimate that the benefits will exceed costs and that public welfare will increase. At proposal, we provided our rationale for stating that we believed that the benefits would be comparable to the Tier 2/Gasoline Sulfur rule, and our final RIA confirms this belief.

EPA's analysis under Executive Order 12866 must take account of the underlying statutory requirements of the Clean Air Act, and we believe that we has fulfilled our requirements under the statute and EO 12866.

(9) EPA's benefit-cost analysis will not accurately portray the effects of the proposal. By using a benefit-cost "snapshot" for a single, distant year, 2030, EPA ignores all of the development and start-up costs. An accurate benefit-cost analysis considers all years for which reliable dollar estimates of benefits and costs can be made. This approach also prevents any useful analysis of how the magnitude of development and start-up costs will affect the pace at which clean air benefits are delivered to American citizens. The higher the up-front costs are, the slower vehicle turnover will be, and therefore, the more

distant the delivery of clean air benefits. EPA's proposed rule may force Americans to pay more in costs than they would receive in clean air benefits and an alternative rule that provides a smaller annual "maximum" dollar benefit, but provides that maximum more quickly, could better serve our citizens.

Letters:

Mercatus Center at GMU (IV-D-219) **p. 29-30**

Response to Comment 5.10(C)(9):

EPA has considered the development and start-up costs explicitly in its analyses. In addition, we have also considered the pace at which clean air benefits are delivered. The HD Engine/Diesel Fuel program has various cost and emission related components, as described in the proposal and final rule. These components would begin at various times and in some cases would phase in over time. This means that during the early years of the program there would not be a consistent match between cost and benefits. This is especially true for the vehicle control portions of the program, where the full vehicle cost would be incurred at the time of vehicle purchase, while the fuel cost along with the emission reductions and benefits resulting from all these costs would occur throughout the lifetime of the vehicle. Because of this inconsistency and our desire to more appropriately match the costs and emission reductions of our program, our analysis uses a future year when the fleet is nearly fully turned over (2030).

In the years before 2030, the benefits from the HD Engine/Diesel Fuel program will be less than those estimated in the final RIA, because the compliant heavy-duty fleet will not be fully phased in. Annualized costs, on the other hand, reach nearly their full value within a few years of program initiation (once all phase-ins are completed). This can be seen by comparing the anticipated emission reductions described in section II.D of the preamble to the final rule with the aggregate costs of section V.E. Thus, a benefit-cost ratio computed for the earlier years of the program would be expected to be lower than a ratio based on our 2030 analysis. On the other hand, since the estimated benefits are more than ten times the costs in 2030, the emission reduction and cost trends suggest that it is likely that annual benefits would exceed costs from a time early in the life of the program.[85]

Furthermore, to the extent that a lower ratio of benefits to costs early in the program is the result of the mismatch of costs and benefits in time, a simple analysis of an individual year would be misleading. A more appropriate means of capturing the impacts of timing differences in benefits and costs would be to produce a net present value comparison of the costs and benefits over some period of years (an approach analogous to the aggregate cost effectiveness presented in section V.F of the final rule). Unfortunately, while this is relatively straight-forward for the costs, it is currently not feasible to do a multi-year analysis of the benefits as this would require a significant amount of air quality modeling to capture each year. EPA did not have the resources to conduct such an intensive analysis. See also the

[85] While emission reduction trends give a general indication of the likely trends in the benefits, there are sufficient non-linearities and interactions among pollutants in the atmospheric chemistry used in our modeling that it is not possible to attempt a quantitative estimate of the benefits simply from changes in the inventories in years that were not fully modeled.

response to comment 5.10(B)(8) for further discussion of the appropriate use of cost analysis for the purposes of this rule.

(10) EPA's analysis does not recognize the impact of regulatory costs on public health. It is widely recognized that health improves as family incomes rise and empirical evidence indicates that regulatory programs can harm health indirectly by reducing incomes. EPA's proposed rule would be costly, therefore lowering incomes and as a result, may lead to an overall adverse effect on public health.

Letters:

Mercatus Center at GMU (IV-D-219) **p. 30**

Response to Comment 5.10(C)(10):

The costs of this rulemaking will have a negligible, if any, impact of U.S. household income. First, the costs are spread out over the 30 year period of this analysis with the costs in 2030 being $4.3 billion. Second, the magnitude of these costs relative to the U.S. economy is very small. For example, the U.S. gross domestic product (GDP) is estimated by the Department of Energy at $14 trillion in 2024, while the cost of this rulemaking is roughly $4 billion in that year, or only 0.03 percent of GDP. Therefore, the likelihood is very remote that price increases resulting from this action would cause household income to change by any noticeable amount. Thus, we find no basis for the commenter's assertion that the cost impact of this rule will result in an adverse impact on an average person's health.

In addition, EPA does consider the well-established public health implications of its rule, noting that the program will result in significant improvements in the health of children, the elderly, people with underlying respiratory disease, and other sensitive populations. Each year, the program is likely to result in thousands of fewer premature deaths, thousands of fewer hospital admissions from cardiac and respiratory ailments, hundreds of thousands of fewer asthma attacks among asthmatics, millions of fewer days missed from school and work for respiratory problems.

The commenters offer a specific test that they feel the rule must meet: that EPA's rule must avoid at least 2,500 lives over a 30 year period. As an illustrative example, the premature deaths avoided in the period 2020 to 2030 could be as many as 40,000 over the 10-year period, which is substantially more than the 2,500 fatalities that the commenters cite over 30 years. Although we may not agree with their risk-risk trade-off framework, the rule satisfies the test on the commenters own terms.

We believe that the health and welfare benefits are substantial and spread over the entire exposed population. Costs, while significant for those bearing the costs, are not major for the total economy when viewed on a per capita basis.

(11) Given the high costs of meeting the proposed diesel fuel sulfur standard, EPA should more fully evaluate the costs vs. benefits of a 50 ppm diesel fuel sulfur standard as compared to the 15 ppm standard.

Letters:

Perfection Oil Company (IV-D-41) **p. 1**

Response to Comment 5.10(C)(11):

While we costed out the difference in refining costs for desulfurizing highway diesel fuel to an average of 50 ppm and to meet a 15 ppm cap standard for the NPRM, we did not consider a 50 ppm average standard for the final rule because since the NPRM we concluded that the emission control hardware would not function adequately on the higher sulfur level.

(12) EPA should not use the claimed public health benefits in non-transport attainment areas as benefits in the benefit-cost analysis.

Letters:

American Petroleum Institute (IV-D-343) **p. 5**
Marathon Ashland Petroleum (IV-D-261) **p. 4**

(D) EPA has failed to take into account the costs of imposing the NTE as required under the CAA and has also failed to identify the environmental benefits associated with the NTE.

(1) Section 202(a)(3)(A) requires that EPA give "appropriate consideration to cost, energy and safety factors" associated with the application of the technology used to achieve new emission standards. EPA has failed to consider the costs associated with NTE and has provided no data showing that the NTE contributes to emission reductions or that this provision is necessary to provide adequate compliance assurance. EPA has failed to provide any sort of cost-benefit analysis showing that the NTE is cost-effective.

Letters:

International Truck & Engine Corp. (IV-D-257) **p. 23**

Response to Comment 5.10(D):

We disagree with these comments. First, we disagree with the statement that the Agency has not considered the costs associated with the NTE requirements. CAA Section 202(a) requires the Agency to consider costs, among other factors, when establishing new standards for HDDEs, which is what we have done in this final rule. As discussed in response to the comment under issue 5.10(C)(7), the Agency has estimated the costs of complying with all of the HDDE emission requirements promulgated in this rule, including the NTE requirements.

We disagree with the comment that the Agency has failed to demonstrate that the NTE contributes to emission reductions or is necessary to provide adequate compliance assurance. As discussed in response to comments 3.1.1(L) (1) & (2), the Agency has clearly articulated the need for the supplemental emission requirements, including the NTE. (see responses to comments 3.1.1(L) (1) & (2)).

Finally, we disagree with the comment that the Agency is required to perform either a cost-benefit analysis or a cost-effectiveness analysis with respect to the NTE requirements. As the commenter correctly cited, CAA Section 202(a) requires the Agency to consider costs, among other factors, when setting new HDDE standards. The statute does not require the Agency to perform either a cost-effectiveness analysis or a cost-benefit analysis, and certainly does not require such analysis for individual pieces of a program. Nevertheless, the Agency has performed a cost-effectiveness analysis of the HDDE standards established in this rule as a whole, as well as a cost-benefit analysis. As discussed in the preamble and in the final RIA, this rule is cost-effective, and is similar to the cost-effectiveness of other recent mobile source pollution control rulemakings, and the cost-benefit analysis performed for this rule shows the monetary benefits of the rules outweighs the costs of the rule significantly.

(E) EPA's cost-benefit analysis is a political tool, and not useful for comparing alternatives.

(1) It is too difficult to determine accurately, the monetary value of health and environmental benefits and this uncertainty contributes to the ease at which the data can be manipulated to serve a pre-determined purpose. EPA described the cost-benefit analysis process in the NPRM, but did not issue the analysis as part of the proposed rule. This implies that EPA has already predetermined the outcome of the cost benefit analysis, yet is withholding it until the final rule, which does not allow time for peer review. This is an abrogation of the rulemaking process and EPA should release the Benefit-Cost analysis as soon as possible for public comment.

Letters:

American Petroleum Institute (IV-D-343) **p. 81**
Marathon Ashland Petroleum (IV-D-261) **p. 86**
National Petrochemical & Refiners Association (IV-D-218) **p. 13**

Response to Comment 5.10(E):

At proposal, EPA solicited public comment on its regulation and analytical approach. No outcome was pre-determined; however, EPA did compare the program to other past regulations to inform the public of the likely magnitude of benefits once analyses were performed. EPA's methodologies and data have long been in the public domain. Most of our methodologies and underlying benefits data are in public dockets for previous rulemakings or parts of public reports (e.g., Tier 2/Gasoline Sulfur docket and section 812 reports to Congress). These methodologies have been scrutinized by the public and appropriately peer-reviewed (see references below). The models and many key assumptions have been examined by the independent Science Advisory Board. See also the responses to issue 5.10(C)(1) and 5.10(C)(2).

References:

EPA-SAB-COUNCIL-ADV-99-012, 1999. The Clean Air Act Amendments Section 812

Prospective Study of Costs and Benefits (1999): Advisory by the Health and Ecological Effects Subcommittee on Initial Assessments of Health and Ecological Effects: Part 1. July 28, 1999.

EPA-SAB-COUNCIL-ADV-00-001, 1999. The Clean Air Act Amendments Section 812 Prospective Study of Costs and Benefits (1999): Advisory by the Health and Ecological Effects Subcommittee on Initial Assessments of Health and Ecological Effects: Part 2. October 29, 1999.

US EPA 1999. The Benefits and Costs of the Clean Air Act. EPA Report No. EPA-410-R-99-001, November 1999.

US EPA 1999. Regulatory Impact Analysis for the Tier 2/Gasoline Sulfur Rule. US EPA Office of Air and Radiation. Washington, DC. December 1999.

EPA-SAB-EEAC-00-013. An SAB Report on EPA's White Paper *Valuing the Benefits of Fatal Cancer Risk Reduction*. July 27, 2000.

(F) EPA's cost/benefit analysis should take into account that the cost and availability may differ significantly in various parts of the nation.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

American Public Transportation Association (IV-D-275) **p. 3**

Response to Comment 5.10(F):

EPA's benefits analysis does take into account that the benefits may be different in different parts of the country. We provide detailed air quality modeling and take into account regional differences as appropriate in our benefits methodology (e.g., visibility valuation). Also, the refining costs are estimated on a refinery-by-refinery basis using regional cost inputs. The benefits are compared to the costs, however, on a nationwide basis.

ISSUE 6: ALTERNATIVE PROGRAM OPTIONS

Issue 6.1: Phase-in Approach

Issue 6.1.1: Supports Phase-in Approach (Fuel Standard)

(A) Because only a small percentage of the fleet would require the low-sulfur fuel at first, this approach would reduce costs without interfering with emission benefits.

(1) This approach would allow large refiners to provide a percentage of their production to the low sulfur market and then take advantage of advances in desulfurization over time to meet the increasing requirements for the amount of low sulfur diesel. Marketers/retailers should be allowed to select which diesel they wish to market so that they are not required to add tankage and other systems to handle two diesel grades.

Letters:

Placid Refining Company, LLC (IV-D-230) **p. 4**

(2) A phase-in could reduce the fuel related costs by 2-3 cpg during the phase in period; and would substantially reduce the risks of supply disruptions and price spikes. Allowing a significant part of the market to remain at higher sulfur diesel will benefit those who produce off-spec products (from maintenance turn-arounds, upsets, etc.) and those whose pipelines carry jet fuel which contaminate low sulfur diesel. Delaying investment through a phase in is worth $5-1 billion using EPA estimates for refiner capital and operating costs. To reduce costs, commenter supports credit trading which allows higher cost producers to defer their products. Doing so would eliminate the PADD IV and small refiner issues, and let the market drive the program.

Letters:

Koch Industries (IV-D-307) **p. 4, 6**

(3) The phase-in would ensure that fuel supply disruptions and price spikes do not occur during the transition to the new fuel. It would also reduce costs to consumers, and to small refiners/farmer co-ops that face high capital costs to desulfurize diesel fuel. EPA should structure the program so that large refiners have incentives to supply the ultra-low sulfur fuel in the early years.

Letters:

USDA (IV-D-299) **p. 3-4**

(B) Supports a phase-in that would be voluntary for refiners.

(1) Supports a voluntary phase-in for those few refiners who can take advantage of it, but believes that this option will not provide flexibility to most refiners, especially small refiners and farmer co-ops.

Letters:

Countrymark Cooperative (IV-D-333) **p. 11**

(C) A volume phase-in would allow refiners to spread out their investments over a longer period of time.

(1) A volume phase-in would allow refiners to spread their investments over a five to seven year period and would create the potential for HDS technology improvements, which may lower the total investment costs. This approach would also allow refiners to delay addressing the heavier and cracked blendstocks, which is difficult to desulfurize. In addition, smaller cost increases would be possible at the smaller volumes associated with a phase-in. These cost increases, at less than 10 ppm average sulfur, are likely to range from about 5 cpg at 25 percent of on-road demand to 6 cpg at 75 percent of all on-road diesel, making a phase-in of the low sulfur diesel an attractive environmental protection program. Commenter provides two documents that discuss this issue and provide additional supporting data and information: "Analysis of the Cost of a Phase-in of 15 ppm Sulfur Cap Diesel Fuel," Center for Transportation Research, Argonne National Lab, August 2000; and "Consumers' Views on the Availability of Cleaner Diesel Fuel," Oak Ridge National Lab, June 14, 2000.

Letters:

U.S. Department of Energy (IV-G-28) **p. 4, Att. 5 + 6**

Response to 6.1.1(A), (B), and (C)(1):

We agree that a fuel program that allows refiners to continue producing a limited amount of current highway fuel (meeting a 500 ppm sulfur cap) while also producing 15 ppm sulfur fuel reduces any supply concerns without interfering with the benefits of the new engine standards, and potentially reduces costs. With today's final rule, we are adopting a temporary compliance option that allows refiners to continue producing a limited amount of highway diesel fuel meeting a 500 ppm sulfur level while majority of the fuel produced by refiners must meet a sulfur level of 15 ppm. The temporary compliance option is optional for refiners. It will last for four years and includes averaging, banking and trading provisions which allows refiners that produce more than the required amount of 15 ppm sulfur fuel (or produce it earlier than required) to earn credits which can be banked or sold to other refiners that produce less than the required amount of 15 ppm sulfur fuel.

As described in section IV of the preamble for today's rule, we believe the temporary compliance option will ensure there are adequate supplies of highway diesel fuel once the fuel program begins. Section V of the preamble and Chapter IV of the RIA for today's rule, contain our complete analysis of the fuel supply issue. As described in section IV of the preamble, we are also adopting special provisions for small refiners that allow them to continue producing 500 ppm sulfur throughout the duration of the temporary compliance option which should reduce costs for small refiners. Together, these provisions provide a supply “safety valve” by allowing the highest cost producers of diesel fuel, those most likely to curtail their production, additional time to determine the most economical way to comply.

While we have serious concerns with the appropriateness of and the basis for much of the DOE cost analysis, our main concern with any of the phase-in recommendations is the need to ensure widespread availability of 15 ppm diesel fuel. Without such availability, the economic and environmental benefits of the rulemaking would not be achieved. Given the amount of 15 ppm sulfur fuel that must be produced under the temporary compliance option, we believe based on our analysis in Chapter IV of the RIA that there will be widespread availability of 15 ppm without any retailer requirements. Therefore, marketers and retailers will be allowed to select which fuels they market. We will not require any marketer or retailer to sell both 15 ppm and 500 ppm fuels. We believe most will carry only one highway diesel fuel because of the high cost of carrying more than one fuel. A phase-in allowing a higher percentage of 500 ppm sulfur fuel increases the risk that 15 ppm sulfur fuel would not be available on a widespread basis, and would increase the need for a retailer availability requirement. For these reasons, EPA does not believe a higher percentage of 500 ppm sulfur fuel is appropriate.

We believe the temporary compliance option will result in a cost saving to refiners as it will allow some refiners to delay compliance with the 15 ppm sulfur requirement. As described in Chapter V of the RIA for today’s rule, we estimate that refiners will be able to save as much as $1.7 billion over the duration of the temporary compliance option compared to a requirement that all highway diesel fuel comply 15 ppm sulfur. While much of this savings will be offset by increased costs in the distribution system, we project that in total, a small overall savings should result from refiners taking advantage of the temporary compliance option. (Refiners who are able to delay investment in desulfurization equipment should be able to realize lower costs as improvements in technology occur, however, we have not included such cost savings in our cost analysis and do not believe technology improvements are necessary to allow production of 15 ppm sulfur diesel fuel.)

(2) Commenter suggests a phase-in involving 30 ppm sulfur in 2006, 20 ppm in 2007, 15 ppm in 2008, and 10 ppm in 2012. EPA should mandate no price differentiation between different grades of diesel at retail stores.

Letters:

Consumer Policy Institute (IV-D-186) **p. 6**

Response to Comment 6.1.1(C)(2):

As described in Chapter III of the RIA for today’s rule, we believe that the technologies engine manufacturers will employ to comply with the standards being adopted today will require the use of diesel fuel with a sulfur level of 15 ppm or less. Allowing refiners to produce a higher sulfur fuel for use in 2007 model year and later heavy-duty diesel trucks would inappropriately jeopardize the efficiency of the emission controls resulting in significantly higher emission levels. Therefore, we are adopting a fuel program that requires refiners to start producing 15 ppm sulfur diesel fuel in mid-2006. Also, owners of 2007 and later model year heavy-duty diesel vehicles will be required to use diesel fuel with a sulfur level of 15 ppm or less.

With regard to mandating that there be no price differential between the 15 ppm and 500 ppm sulfur diesel fuels, we do not have the authority and do not think it would be appropriate to mandate prices of fuels. Given the provisions of the fuel program being adopted, we expect the price of 15 ppm and 500 ppm sulfur fuels to be similar to each other at retail outlets in most of the country.

Issue 6.1.2: Opposes Phase-in Approach (Fuel Standard)

(A) Expressed opposition to the concept of providing a phase-in for the fuel sulfur standards because phasing in the sulfur standard would be logistically difficult and financially burdensome to refiners, distributors, and retailers.

(1) Commenters noted that a phase-in is impractical and would be too costly since this approach would require investment in additional tanks, piping and pumps to accommodate two different grades of fuel and noted that this type of investment would only be necessary for a few years, and would result in spot outages, price increases and fuel cross-contamination. Some (NATSO & PMAA) provided significant discussion on this issue including analysis of the phase-in alternatives presented by EPA and recommend that to avoid significant adverse economic impacts, EPA should not incorporate any sort of phase-in of the fuel standard. API noted that the cost of the proposal, as estimated by TM&C, would exceed $1 billion -- a cost that cannot be justified for a temporary program of 3-4 year duration. EPA's projected cost increase of 4 cents per gallon would provide a strong incentive for deliberate misfueling and API's projected cost increase of 10 cents per gallon would force truckers to misfuel just to stay in business. (See also Issue 6.1.3.) Another commenter raised some of these same arguments and also added opposition to combining a phase-in with an ABT program.

Letters:

Ackerman Oil Co., Inc. (IV-D-21) **p. 1**
American Bus Association (IV-D-330) **p. 4-5**
American Petroleum Institute (IV-D-343) **p. 66-67**
American Trucking Association (IV-D-269) **p. 15**
Big West Oil, LLC (IV-D-229) **p. 2**
Bossom's Quasky Mart (IV-D-44) **p. 1**
British Petroleum (IV-D-242) **p. 3**
CA Trucking Association (IV-D-309) **p. 1-2**
Cenex Harvest States Cooperatives (IV-D-232) **p. 7**, (IV-F- 191) **p. 232**
Chevron (IV-D-247) **p. 6**
Collier, Shannon, & Scott (IV-F- 117) **p. 24**
Engine Manufacturers Association (IV-D-251) **p. 17-18**
Equiva Services (IV-D-226) **p. 2**
ExxonMobil (IV-D-228) **p. 19**, (IV-F-800)
Farmland Industries (IV-F-29)

Harold Dickey Oil Corp. (IV-D-43) **p. 1**
Independent Fuel Terminal Operators Association (IV-D-217) **p. 13-15**
James Enterprises, Inc. (IV-D-40) **p. 1**
Johnson Petroleum, Inc. (IV-D-17) **p. 1**
Kendle Oil Company (IV-D-42) **p. 1**
MT DEQ (IV-D-254) **p. 8**
Marathon Ashland Petroleum (IV-D-261) **p. 3, 70, 95**, (IV-F-74)
Meyer Oil Company (IV-D-45) **p. 1**
NATSO (IV-D-246) **p. 1-10**, (IV-F-17)
NY Assoc. of Service Stations & Repair Shops (IV-F-45)
National Association of Convenience Stores (IV-D-279) **p. 2**, (IV-F- 191) **p. 168**
National Federation of Independent Business (IV-D-243) **p. 2**
National Petrochemical and Refiners Association (IV-D-218) **p. 4**
Nauss Oil Company, Inc. (IV-G-21) **p. 1**
New England Fuel Institute (IV-D-296) **p. 5-7**
PA Association of Milk Dealers (IV-D-23) **p. 1**
Perfection Oil Company (IV-D-41) **p. 1**
Petroleum Marketers Association of America (IV-D-245) **p. 1-14**
Phillips Petroleum Company (IV-D-250) **p. 6**
Ports Petroleum Co, Inc. (IV-F- 117) **p. 190**
Sinclair Oil Corporation (IV-D-255) **p. 10**
Society of Independent Gasoline Marketers of America (IV-D-328) **p. 6**, (IV-F-191) **p. 196**
Tosco (IV-D-84), (IV-D-304) **p. 3**, (IV-F-157)
Welsh, Inc. (IV-D-22) **p. 1**

<u>Response to Comment 6.1.2(A)(1):</u>

EPA agrees with the commenters that a gradual phase in of the 15 ppm fuel would likely create significant problems for the program at little overall cost savings to the nation. In particular, such a phase in would likely result in 15 ppm fuel not being readily available in a number of areas around the country, absent a retailer availability requirement.

While EPA's temporary compliance option and small refiner program have a number of things in common with a gradual phase in, EPA believes that there are important differences which will make the program workable and serve to ensure adequate supply of highway diesel fuel in 2006. The main differences result from the volume of highway diesel fuel required to be 15 ppm sulfur at the start of the program. Based on our analysis in Chapter IV of the RIA, we believe this will ensure that 15 ppm fuel is widely available across the country at a cost comparable to 500 ppm fuel, without the need for a retailer availability requirement or other such requirement. We expect 15 ppm fuel will be the fuel of choice for distributors and marketers, including pipelines, terminals and retail outlets, based on the volume. The decision to carry 500 ppm fuel alone, or in combination with 15 ppm fuel, will be entirely voluntary. While we do project, as discussed in Chapter V of the Final RIA, that a number of terminals and other entities will choose to invest in tankage to handle both grades diesel fuel over the transition period, we also project that the fuel production savings resulting from the continued production of 500 ppm fuel will offset these costs. Consequently, as discussed in Chapter IV of the RIA and in later responses to comments, we believe that misfueling will be of limited concern under the provisions finalized today.

We have designed the temporary compliance option and small refiner program to keep distribution costs to a minimum, while easing the task of the refinery system to produce adequate supplies of highway ppm fuel. For example, the 15 ppm fuel production requirement is relatively high: 80%. Given the distribution system's reluctance to carry an additional fuel, the fact that most of the production of highway diesel fuel will meet the 15 ppm standard means that most of the distribution system need only carry one fuel: 15 ppm. Because most vehicles during between 2006 and 2010 will be able to use 500 ppm fuel, the 500 ppm fuel can be utilized near the refinery where it is produced. In addition to this local distribution, we expect the major pipeline systems (Colonial, Plantation, TEPPCO) to carry both highway diesel fuels. The 500 ppm fuel may not be carried at every terminal, but will be carried at those terminals where it can be handled more easily and where large quantities can be distributed to retail (i.e., those terminals serving large numbers of high volume truck stops). Likewise, not every retail outlet need carry the 500 ppm fuel. While the average cost of modifying a truck stop to handle a second fuel averaged over $100,000, according to NATSO, many truck stops estimated much lower costs. These lower cost truck stops would likely be the ones to carry both 15 and 500 ppm fuel, if it were economically to their advantage to do so.

We also believe that the credit program will keep the cost of both highway diesel fuels very close. Those refiners choosing to produce 15 ppm fuel will be able to sell their credits to other refiners choosing to wait until 2009 or 2010 to comply with the new standard. This sale of credits should approximately compensate them for at least 20% of their production costs. Refiners producing 500 ppm fuel will have to buy credits for 80% of their production. The overall expenditures of the two sets of refiners should be roughly equal on a per gallon basis at the refinery gate, if the market power of the refiners buying and selling credits is balanced. In this case, refiners selling credits will be able to demand a price for their credits which covers their costs on a per gallon basis. However, if credits are in short supply, the price may exceed costs and the cost of producing 500 ppm fuel, including purchasing credits, could exceed that to produce 15 ppm. Or, if more credits are being generated than are needed, then the price of a credit could be less than the full cost of producing 15 ppm fuel. In any event, the cost of credits should make the prices of 15 ppm and 500 ppm fuels much more similar in the marketplace than if unlimited amounts of 500 ppm fuel could be produced and marketed.

EPA has taken a relatively conservative approach to estimating the capital investment costs associated with the temporary compliance option and small refiner program. We considered the fact that the fleet will be slowly turning over to post-2006 vehicles even during the 2006-2010 period. We also assumed that centrally fueled fleets, card locks and service stations would not carry the 500 ppm fuel. We assumed that only truck stops would carry the 500 ppm fuel and that every truck stop in an area receiving 500 ppm fuel would invest in being able to handle both fuels. This expanded the geographical area necessary to absorb all of the 500 ppm fuel being produced and the cost of doing so. We still only estimated about $1 billion in capital investment. A the same time, the refining side would be able to save roughly $1.7 billion. This also provided nearly half of all refineries 3-4 more years of leadtime prior to investment. Thus, while the overall savings associated with the temporary compliance option and small refiner program is relatively small, it is a savings and the benefits in terms of supply certainty are significant. Thus, we have determined that the additional costs to the distribution system are worth the benefits elsewhere, particularly the assurance it provides of adequate supplies of highway diesel fuel at the start of the program.

(2) EPA should consider the experience in 1993, when retail dealers were required to distribute two types of distillate - on-road diesel fuel with 500 ppm sulfur and nonroad distillate for heating and other purposes. This requirement compelled the distribution sector to segregate its operations - storage tanks, trucks, hoses and related equipment. This undertaking was very costly and burdensome to dealers' operations and it took a number of years for these dealers to fully recoup their costs. A phase-in program for ultra-low sulfur diesel fuel would force dealers who have only recently recovered from the 1993 rule, to undergo the process again. Even a voluntary program would cause distribution problems and would lead to uncertainty for dealers regarding the sources of supply and level of demand.

Letters:

New England Fuel Institute (IV-D-296) **p. 6**

Response to Comment 6.1.2(A)(2):

As pointed out under Issue 6.1.2(A)(1), we believe that the distribution of 500 ppm fuel will be limited to those pipeline systems which can handle an additional diesel fuel at reasonable cost. A large volume of 500 ppm fuel can be distributed by truck directly from refineries producing this fuel to areas already receiving truck shipments from the refinery. A few major pipelines will be capable of distributing the remainder where it is likely to also be distributed by truck from a limited number of large terminals. The distributor need invest to carry both fuels only if it is in his economic interest to do so. As the volume of both 15 and 500 ppm fuels will equal the volume of highway diesel fuel absent this rule, we believe that those parts of the distribution system handling both fuels will be able to do so without any loss of overall capacity.

(3) Commenters argued that the dual fuel option would decrease the fungibility of the fuel products and lead to breakdowns in the efficient pipeline system used to transport fuel.

Letters:

Ports Petroleum Co, Inc. (IV-F- 117) **p. 190**
Society of Independent Gasoline Marketers of America (IV-F-191) **p. 196**

Response to Comment 6.1.2(A)(3):

Both 15 ppm sulfur diesel fuel and 500 ppm sulfur diesel fuel will be fungible products in the distribution system during the transition period. As discussed in Chapters IV and V of the RIA, there are likely to be costs and impacts on the distribution system in order to carry both fuels, but these will be manageable. In general, we expect both fuels to be carried where it is economically advantageous to do so, compared to carrying just one fuel.

(4) Commenter noted that adopting a phase-in may create problems with foreign refiners and imported diesel fuel.

Letters:

Tosco (IV-D-304) **p. 6-7**

Response to Comment 6.1.2(A)(4):

We do not expect that the fuel program being adopted today will create problems with foreign refiners and imported diesel fuel. The fuel program has been designed so that foreign refiners and importers of highway diesel fuel must comply with the same provisions as domestic refiners for the highway diesel fuel imported into the United States. In addition, foreign refiners and importers of highway diesel fuel are allowed to take advantage of the flexibilities being adopted today, including participation in the averaging, banking and trading program and the small refiner flexibilities being adopted today (if the foreign refiner meets the definition of "small refiner").

(5) Commenters noted that a phase-in would endanger the nation's energy supply as refiners choose not to invest in developing their facilities in favor of producing the high sulfur diesel that will be in demand for many more years. EPA should analyze the supply shortfall and costs of diesel, jet fuel and heating oil resulting from the proposal.

Letters:

American Petroleum Institute (IV-D-343) **p. 67**
Marathon Ashland Petroleum (IV-D-261) **p. 70**

Response to Comment 6.1.2(A)(5)

The 80% highway diesel fuel production mandate prevents refiners from avoiding complying with the 15 ppm standard, unless they have purchased credits from other refiners over-producing the new fuel. Also, the limited duration of the program limits this issue to 3-4 years. Finally, EPA did analyze the capability of refiners shifting their current highway diesel fuel to other markets and found that this could be done only at significant economic cost in terms of lost revenue. (The reader is referred to Chapter 5 of the RIA where this analysis is presented and under issue 8.1.1. of this document.) At the same time, compliance with the new sulfur standard does not affect a refiner's ability to produce other products, such as jet fuel or heating oil.

(6) Commenter noted that a phase-in would not change a refinery's investment decision because most refiners would build the same new facilities regardless if the market demanded 50% of the fuel be 15 ppm or 100%. Furthermore, the cost savings of delaying the investment for 2-4 years would be overwhelmed by the distribution costs for 2 grades of diesel.

Letters:

Tosco (IV-D-304) **p. 3-4**

Response to Comment 6.1.2(A)(6):

We believe the temporary compliance option being adopted today will impact a refinery's investment decisions. Under the averaging, banking and trading program included with today's program, we expect most refiners will make only one fuel for the highway market. Some refiners will produce all of their highway diesel fuel at the 15 ppm sulfur level and generate credits. Other refiners will purchase credits from refiners that produce all 15 ppm sulfur fuel and then continue to produce all 500 ppm sulfur diesel fuel. Therefore, we believe the temporary compliance option and the small refiner hardship provisions will provide flexibility to a number of refiners and allow them to delay investment in desulfurization technology.

With regard to the cost savings of delaying investment the reader is referred to Chapter V of the RIA for a detailed discussion of the cost of the fuel program. In addition, the reader is referred to the response to comments on issue 6.1.2(A)(1) for a short summary of the estimated cost savings under the temporary compliance option and small refiner hardship provisions (compared to a requirement that all fuel meet 15 ppm sulfur).

(7) One commenter added that if EPA chooses to pursue this option, the costs to refiners, distributors and retailers should be thoroughly examined.

Letters:

Collier, Shannon, & Scott (IV-F-117) **p. 24**

Response to Comment 6.1.2(A)(7):

We have analyzed the cost of the fuel program being adopted today for all levels of the highway diesel fuel distribution system, including refiners, distributors, and retailers. The reader is referred to Chapter V of the RIA for the complete analysis.

(8) At least, any phase-in should be voluntary for refiner co-ops.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 7**

Response to Comment 6.1.2(A)(8):

The transition compliance option being adopted today is a voluntary program for all refiners, including farmer co-ops. A refiner may choose to participate in the program or they may choose to produce all of their highway diesel fuel at the 15 ppm sulfur level beginning in mid-2006. If they qualify for the GPA refiner provisions or hardship provisions discussed in section IV of the preamble, they may opt for the relief granted there instead.

(9) Commenter provides results of pipeline survey to document that the phase-in approach would be difficult for pipelines because they do not have adequate tanks to accommodate the range of fuels, and the pipelines would not want to incur the cost, or permitting burdens, of adding tanks that would be need only for a short period.

Letters:

Association of Oil Pipelines (IV-D-325) **p. 4, att.**

Response to Comment 6.1.2(A)(9):

EPA considered the information provided by the Association of Oil Pipelines in developing its temporary compliance option and small refiner program. As pointed out under Issue 6.1.2(A)(1), we believe that the distribution of 500 ppm fuel will be limited to those pipeline systems which can handle an additional diesel fuel at reasonable cost. A large volume of 500 ppm fuel can be distributed by truck directly from refineries producing this fuel. A few major pipelines will be capable of distributing the remainder where it is likely to also be distributed through a limited number of terminals. If it is in their economic interest to do so, they will. Otherwise, since it is voluntary, they can avoid the cost and burden. Refiners interested in continuing to produce 500 ppm fuel until 2010 will consider the distribution system's capability to distribute their 500 ppm fuel prior to relying on this option.

(B) Opposes any phase-in that would require distributors or retailers to market both fuels because of the high costs involved.

(1) This is important for farmer co-ops who cannot afford to create a dual fuel distribution system. The high-volume highway outlets should have adequate supplies available to meet limited demand in early years.

Letters:

Agricultural organizations as a group (IV-D-265) **p. 2**
National Council of Farmer Cooperatives (IV-D-351) **p. 7**

Response to Comment 6.1.2(B):

Our fuel program does not require any distributor or retailer to market any specific fuel. We believe retailers and distributors will make the choice of which fuel or fuels to distribute based on what fuels are available to the retailer or distributor and the cost of providing more than one fuel at their outlets.

(C) Expressed opposition to the concept of providing a phase-in for the fuel sulfur standards because this approach would jeopardize the effectiveness of the control technologies and would decrease the likelihood that the diesel engine standards are achieved.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Alliance of Automobile Manufacturers (IV-F-9, 59, 117) **p. 168** (IV-F-191) **p. 89**
American Lung Association (IV-F-72)
CO Environmental Coalition (IV-F- 191) **p. 237**
Chevron (IV-D-247) **p. 7**

City of Chicago (IV-D-240) **p. 5**
GA Department of Natural Resources (IV-D-268) **p. 1**
GA Public Interest Research Group (IV-F- 117) **p. 43**
NY DEP (IV-F- 116) **p. 73**
NY State Assembly (IV-D-266) **p. 1**
STAPPA/ALAPCO (IV-F-78)
Toltz, Ken (IV-F-191) **p. 215**
U.S. PIRG (IV-F-71, 190) **p. 185**

(2) There is no benefit to a fuel phase-in since it would require the management of two grades of diesel fuel and the issues of possible misfueling, compliance complexity, and consumer awareness may jeopardize the emission reduction goals.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 12-13**
Chicago DEP/Chicago Metropolitan Mayors Caucus Clean Ai (IV-D-335) **p. 5**
DaimlerChrysler (IV-D-284) **p. 5**
Engine Manufacturers Association (IV-D-251) **p. 17**
Equiva Services (IV-D-226) **p. 2**
International Truck & Engine Corp. (IV-D-257) **p. 11-12**
Phillips Petroleum Company (IV-D-250) **p. 6**
Tosco (IV-D-304) **p. 3**
Volkswagen (IV-D-272) **p. +6**

Response to Comment 6.1.2(C):

We do not believe the fuel program we are adopting, which allows refiners to produce and distribute both 15 ppm and 500 ppm sulfur diesel fuels for a period of time, will jeopardize the effectiveness of the emission control technologies or the emission reductions expected from the new standards. Under the provisions of the final rule, 15 ppm sulfur diesel fuel will be the dominant fuel in the distribution system from the start of the program, limiting the likelihood that 500 ppm sulfur fuel will contaminate 15 ppm sulfur fuel. (Additional discussion of contamination is addressed under Issue 8.1.2. of this document.) The preponderance of 15 ppm sulfur diesel fuel will also limit the likelihood that someone will misfuel a 2007 and later model year truck with the wrong fuel. In addition, we are requiring that all fuel pumps dispensing highway diesel fuel have labels that identify what fuel is being dispensed. We are also requiring that all 2007 and later model year heavy-duty diesel vehicles have labels that specify the use of 15 ppm sulfur diesel fuel only. Furthermore, as discussed in response to issue 6.1.2(D)(1) and the RIA, we expect there to be little or no price differential to exist between the fuels in most markets, minimizing any incentive to misfuel. Finally, we expect truckers will want to use the correct fuel in their 2007 and later model year trucks to ensure their warranty is not voided. Chapter IV of the RIA for today's rule contains a more detailed discussion of the misfueling issue and the reasons we believe it will not be a serious problem under the fuel program being adopted today.

(D) Expressed opposition to the phase-in of a fuel sulfur standard since it would lead to higher costs for the low sulfur fuel, which would slow down truck

purchase and turnover as consumers hold onto their older vehicles to avoid higher fuel costs. This would delay progress towards the emission reduction goals of the proposal.

(1) The market reaction to a dual-fuel approach will cause economic harm to engine and truck manufacturers as companies delay purchases indefinitely due to the inevitable higher costs of low sulfur fuel.

<u>Letters:</u>

CA Trucking Association (IV-D-309) **p. 1**

<u>Response to 6.1.2(D):</u>

As described in Chapter V of the RIA, the cost of producing 15 ppm sulfur diesel fuel will be more expensive than producing 500 ppm sulfur diesel fuel. However, under the temporary compliance option, refiners wishing to produce more than 20 percent of their highway diesel fuel volume as 500 ppm sulfur fuel will have to purchase credits from refiners that have produced 15 ppm sulfur diesel fuel. Therefore, the cost of 500 ppm sulfur fuel will go up as well, even though there are no refinery changes necessary to continue producing the 500 ppm sulfur fuel. In addition, we expect that 15 ppm sulfur diesel fuel will be the main highway diesel fuel distributed by pipeline and therefore have lower distribution cost compared to 500 ppm sulfur fuel. For these reasons, we expect that the retail cost of 15 ppm and 500 ppm sulfur fuels should be very similar in most market where both fuels are available. Therefore, because the price of both the 15 ppm and 500 ppm sulfur diesel fuels will be similar, we do not believe that the fuel program will encourage consumers to hold on to their older trucks and cause delayed sales of lower-emitting vehicles.

(E) Expressed opposition to a regional phase-in of the fuel standard since it would limit the available supply and increase fuel costs in the regions affected.

(1) If a regional phase-in approach is taken, fuel purchases in the regions required to use the proposed fuel standard would cost far more than purchases in other areas. In addition, the interstate nature of trucking would amplify this effect. Commenter provides data and analysis that illustrate how a regional phase-in would have an adverse effect on the trucking industry and would lead to a competitive disadvantage for some trucking companies. Commenter provides additional discussion on the experience in California with respect to low sulfur diesel and fuel cost, and recommends that EPA adopt the proposed fuel standard without a phase-in to avoid the California single-state fuel experience where trucks from bordering states market freight rates below the costs of trucks fueling with CARB diesel.

<u>Letters:</u>

CA Trucking Association (IV-D-309) **p. 2-3**

<u>Response to Comment 6.1.2(E):</u>

We are not adopting a fuel program which requires certain areas of the country to have 15 ppm sulfur fuel while other areas have 500 ppm sulfur fuel. Instead, with today's rule, we are adopting a fuel program that ensures 15 ppm sulfur diesel fuel will be widely available in all areas of the country. Therefore, we do not expect that truckers in one region of the country will have an economic advantage over truckers from another region of the country because of the fuel program being adopted today.

(F) One commenter noted that if a phase-in of the diesel sulfur standard is necessary, then it should start in 2004, which would link the standard to Tier 2 and would ensure the availability of clean diesel for the light duty market.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

DaimlerChrysler (IV-F-15, 167, 116) **p. 292** (IV-F-117) **p. 96** (IV-F-191) **p. 173**

Response to Comment 6.1.2(F):

The low sulfur diesel fuel program being adopted today is necessary to ensure that heavy-duty diesel engine manufacturers can meet the emission standards being adopted for 2007 and later model year engines. Currently, heavy-duty diesel vehicles consume nearly all of the diesel fuel used in highway vehicles in the United States, while light-duty diesel vehicles consume a very small portion of the diesel fuel sold in this country. Therefore, we do not believe we could justify starting the low sulfur diesel fuel program earlier than needed to ensure availability for the 2007 model year. Furthermore, we do not believe light duty vehicle and truck manufacturers need low sulfur fuel to comply with the interim standards contained in the Tier 2 rule. As noted in the Response to Comment document for our recent Tier 2 rulemaking for light-duty vehicles and trucks, we expect that manufacturers will be able to comply with the interim standards for light-duty diesel vehicles and trucks using current highway diesel fuel.

Issue 6.1.3: Misfueling Concerns

(A) EPA should not pursue any sort of phase-in of the fuel sulfur standard since it could lead to deliberate or accidental misfueling, particularly if the higher sulfur fuel is offered at a lower price.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 17**

(2) Nozzle restrictions, such as a new type of interface, to prevent misfueling are unlikely to be fully effective. One commenter noted that as experienced during the lead phase-down, special nozzles will not prevent misfueling. Another noted that most diesel trucks use saddle tanks that can be easily removed and replaced by the owner. Also, at many retail stations, diesel is dispensed through a smaller nozzle that in any configuration could fit into the

larger openings in the fuel tanks.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 14-15**
NATSO (IV-D-246) **p. 7**
Petroleum Marketers Association of America (IV-F-67)

(3) Commenter noted that a sulfur sensor for the fuel tank could be installed to address misfueling concerns but could have some limitations - particularly given the fact that a sensor could be deliberately or accidentally disabled. In addition, it is fairly common that the engine is replaced but not the fuel tank, which could present additional problems if a sulfur sensor is used.

Letters:

NY State Attorney General's Office (IV-D-238) **p. 2**
Petroleum Marketers Association of America (IV-F-67)

(4) The potential for misfueling, both accidental and deliberate, is a very real concern under a phase-in scenario. The presence of two grades of diesel could result in price differentials that would serve as an incentive for individuals to use the higher sulfur or less expensive fuel. In addition, the existence of a higher sulfur fuel would provide an incentive for individuals to disable the emission control devices that would be damaged from the higher sulfur levels.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 14-15**
American Petroleum Institute (IV-D-343) **p. 66**
NATSO (IV-D-246) **p. 7**
Petroleum Marketers Association of America (IV-D-245) **p. 4-5,8**

(B) Commenter does not believe that misfueling will be a serious problem.

(1) Truckers will not use higher sulfur diesel due to higher operating costs, and because the profitability of their business is tied to the care and maintenance of their vehicles.

Letters:

Koch Industries (IV-D-307) **p. 5**

(2) Misfueling in the past (unleaded fuel) stemmed mostly from purposeful cheating. Because of the negative ramifications on the equipment, that type of misfueling should not occur in this situation. Labeling pumps to avoid misfueling seems to be acceptable.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 10, 12**

(C) Misfueling remains a critical issue that should be addressed by EPA, but should not be used as a reason to reject a phase-in approach.

(1) The risk of misfueling will exist regardless of whether a phase-in program is implemented for the fuel standard since there are other regulatory flexibilities that will lead to the continued availability of higher sulfur fuels and should not be used as a reason to reject a phase-in approach. Purchasers of new catalyst-equipped diesel vehicles will have a very strong economic incentive to find and use the correct fuel and a 5 cent per gallon differential between the low sulfur and conventional diesel will not cause these owners to use the higher sulfur fuel, which would void their warranties. On-board diagnostics and engine control integration with the emission control devices could be designed to make misfueled vehicles undriveable. However, since there are still many uncertainties associated with the impact of occasional misfuelings, ensuring reasonable fuel availability and modest price increases for the new low sulfur diesel are the best answer to potential misfueling concerns.

Letters:

U.S. Department of Energy (IV-G-28) **p. 8-9**

Response to Comments 6.1.3(A), (B), and (C):

Given the fuel program we are adopting today with its 80 percent requirement of 15 ppm sulfur fuel under the temporary compliance option for just a limited period of time, along with the fuel pump/vehicle labeling requirements, we do not expect that misfueling, either deliberate or accidental, will be a serious problem. Likewise, we do not expect that the fuel program being adopted today will encourage individuals to disable or tamper with the emission controls on the new engines. The main basis for our expectations is that we expect the price of 15 ppm and 500 ppm sulfur fuels to be very similar to each other under the fuel program we are adopting. Chapter IV of the RIA contains a full discussion of the misfueling issue and why we do not expect misfueling to be a significant problem. We do not believe that additional requirements, such as fuel nozzle requirements, sulfur sensors in the fuel tank, or other vehicle sensor requirements are needed to address misfueling concerns. We believe the fuel pump/vehicle labeling requirements should be adequate to prevent and discourage operators of 2007 and later model year trucks from using the wrong fuel.

Issue 6.1.4: Distribution System Impacts and Costs

(A) A phase-in approach would increase the complexity of the distribution system since a dual fuel stream would be required. This may lead to contamination and shortages.

(1) One commenter (EMA) cites to their comments submitted in response to the advanced notice, which advocated the adoption of a single fuel stream. Commenters also cited to the EMA-sponsored distribution study conducted by Baker and O'Brien, which indicated elevated cost and distribution complexity

("Very Low Sulfur Diesel Distribution Cost," Baker & O'Brien, Inc., August 1999), and to the report recently issued by the National Petroleum Council in conjunction with DOE ("U.S. Petroleum Refining: Assuring the Adequacy and Affordability of Clean Fuels," National Petroleum Council, June 2000) as supporting documentation.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 13-14**
Engine Manufacturers Association (IV-D-251) **p. 17**

Response to Comment 6.1.4(A)(1):

The changes that we expect will be needed in the distribution system to accommodate the presence of two grades of highway diesel fuel during the first years of our program when the temporary compliance option and small refiner hardship provisions are available are discussed in Chapter IV (Section C.3.a.) of the RIA. Please refer to this discussion for the details of our analysis. With these changes, we believe that the existing distribution system can handle the distribution of two grades of highway diesel fuel in the limited fashion envisioned under our program without market disruption. We estimated that a significant number of new storage tanks would be needed to accommodate the presence of two grades of highway diesel fuel. We also estimated that only those pipelines that can accommodate carrying two grades without a reduction in the volume or slate of fuels that they carry would do so. Please refer to the response to comment 6.1.4(A)(4), Chapter IV (section D) of the RIA, Chapter V (section C) of the RIA, and the response to comments on Issue 8 of this document for additional discussion regarding potential contamination concerns associated with the presence of two grades of highway diesel fuel in the distribution system during the initial years of our program.

(2) The introduction of a second separate grade through a phase-in would force the truck stop industry to make a tremendous capital investment to carry both products. The costs associated with upgrading a truck stop to provide both grades of highway diesel would prove to be an unrecoverable expense since the use of these two diesel fuels would be temporary. Some commenters (NATSO & PMAA) provide significant discussion and analysis on this issue and NATSO notes that their conclusions are also based on a survey of their member travel plazas and truck stops. Their survey of member truck stops reported that 45% of respondents stated it would cost over $100,000 per location to carry an additional grade of diesel fuel.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 13-14**
NATSO (IV-D-246) **p. 3-5**, (IV-F-17)
Petroleum Marketers Association of America (IV-D-245) **p. 1-2,10-11**
Tosco (IV-D-304) **p. 4**

Response to Comment 6.1.4(A)(2):

As discussed under Issue 6.1.2.(A), we project that the consumption of 500 ppm fuel will be concentrated around producers of that fuel, as well as few major metropolitan areas. In areas where 500 ppm fuel is available, we project that truck stops will be the main distributor of 500 ppm fuel. We acknowledge that some truck stops face substantial costs to modify their facilities to handle both fuels. EPA regulations do not require any individual truck stop or other final dispenser of fuel to handle either 15 or 500 ppm highway fuel during the initial years. Thus, we expect that those truck stops which can offer two fuels at the lowest cost will do so and that those which face higher costs may choose not to. When assessing the cost of the temporary compliance option, we included a cost for half of all truck stops nationwide to modify their stations to carry two fuels and fuel production savings associated with the option still exceeded the costs. However, even though we believe this seriously overestimates expected actual costs, we included the cost for such a large number of truck stops to ensure that all potential costs were considered. This number of truck stops do not need to handle both fuels.

(3) The only way to guarantee that the ultra low sulfur fuel is widely available in all parts of the country is to adopt the single fuel approach. A phase-in approach would fail to adequately provide a reliable supply of highway diesel. Due to the massive costs associated with carrying two separate grades of diesel, many distributors may decide against providing the low sulfur fuel. This could result in significant supply shortages and volatile price spikes of the low sulfur diesel. One commenter (PMAA) provided detailed analysis on EPA's phase-in alternatives and concludes that all three alternatives would actually result in a significant overall net cost to society due to the investments required to manage two types of fuel, potential damage to trucks due to misfueling, and other factors.

Letters:

NATSO (IV-D-246) **p. 4-5**
Petroleum Marketers Association of America (IV-D-245) **p. 1-7**
Tosco (IV-D-304) **p. 4**

Response to Comment 6.1.4(A)(3)

Under the provisions of the final rule, as discussed in Chapter IV of the RIA, we are convinced that 15 ppm sulfur fuel will be widely available across the country. The fuel of choice for the distribution system will be 15 ppm fuel. Conversely, 500 ppm sulfur fuel will not be available everywhere. As discussed under the response to issue 6.1.4(A)(2), distribution of 500 ppm sulfur fuel will only occur where it is economical to do so.

(4) The creation of a second, separate grade of highway diesel fuel would likely result in the cross-contamination of both grades at some point along the distribution chain. The entire diesel fuel distribution chain is configured to handle a single grade of highway diesel and there are numerous places throughout this chain where accidental cross-contamination could occur through simple human error or other causes.

Letters:

NATSO (IV-D-246) **p. 7**

Tosco (IV-D-304) **p. 4**

Response to Comment 6.1.4(A)(4):

We do not believe that the presence of a second grade of highway diesel fuel in the distribution system in the limited fashion envisioned under our program will result in additional concerns with respect to the contamination of products handled by the system. The presence of 500 ppm highway diesel fuel during this period will allow some opportunity to abut batches of 15 ppm highway diesel fuel against batches of 500 ppm fuel in the pipeline rather than nonroad diesel fuel (which has a sulfur content of approximately 3,000 ppm on average). This would tend to reduce concerns regarding sulfur contamination of low sulfur highway diesel fuel during transport by pipeline. Please refer to section IV.D. in the RIA for a discussion of the concerns associated with limiting contamination during the distribution of highway diesel fuel under our program. We attributed costs to the increased pipeline interface costs associated with the shipment of 500 ppm highway diesel fuel during the initial years of our program (see section IV.C.3.g. in the RIA). We estimated that a significant number of new storage tanks would be needed to accommodate the presence of two grades of highway diesel fuel. We also estimated that only those pipelines that can accommodate carrying two grades without placing an undue strain on their system would choose to do so. The presence of additional tanks and the fact that only a limited subset of facilities are expected to handle two grades of highway diesel fuel addresses the concern expressed by the commenter that the presence of two highway diesel fuel grades would overburden the distribution system, potentially causing increased incidents of contamination.

(B) The elevated distribution costs from a dual fuel stream may affect consumer choices and behavior -- such as the type of fuel used, as well as delayed sales of lower-emitting engines and vehicles.

(1) The increased distribution costs associated with a phase-in strategy would lead to higher fuel costs. Because profitability in the trucking industry is so sensitive to fuel cost, commercial operators would choose whichever fuel is less expensive (i.e. higher sulfur fuel). The existence of two separate heavy-duty fuel streams also may delay the purchase of newer, lower-emitting heavy duty engine technologies if truck owners are able to save the costs of operating on lower fuel sulfur levels by keeping their older trucks longer. (See also Issue 6.1.2, Point (D)).

Letters:

Engine Manufacturers Association (IV-D-251) **p. 17-18**
NATSO (IV-D-246) **p. 6-7**

Response to Comment 6.1.4(B):

See response to comment 6.1.2(D).

(C) Creating two diesel fuels in the market through a phase-in strategy would create enforcement issues for EPA that would be difficult to address or resolve.

(1) Occasionally, fuels are misdelivered and, for a truck stop receiving multiple loads per day, this possibility increases, which in turn increases the possibility of contamination. Testing or other quality control procedures are likely to be ineffective at preventing this from occurring. EPA could respond to this issue by increasing fines and levels of enforcement. However, the fuels programs have been successful because they are largely self implementing. Relying on enforcement to prevent these mistakes will likely impose new burdens on the private sector and EPA.

Letters:

Petroleum Marketers Association of America (IV-D-245) **p. 12**

Response to Comment 6.1.4(C):

We agree that the opportunity for misdeliveries to occur at retail and wholesale purchaser-consumer facilities is somewhat increased due to the presence of 2 grades of highway diesel fuel in the distribution system. However, industry can minimize these problems through appropriate business practices such as the use of standardized color codes for different diesel products on the tanker trucks and on the covers to the underground storage tanks at retail and wholesale purchase-consumer facilities.

EPA intends to rely on enforcement of this program, as in other fuel programs, to deter violations and level the playing field. We expect enforcement of this program will be similar in nature and extent as with other fuel programs. We do expect to seek substantial civil penalties against distributors or retailers/wholesale purchaser-consumers who cause misdelivery violations, in order to deter such violations. This is consistent with current practice under the RFG rule and with previous practice under the unleaded gasoline rule. We do not believe an EPA field enforcement presence substantially increases the burden of compliance for industry, and it will help ensure a level playing field.

Issue 6.1.5: Availability of 15 ppm Fuel

(A) A phase-in approach may create a situation where supply and demand are out of balance since a phase-in may lead to refiners initially producing substantially more fuel than is likely to be consumed.

(1) In this case, it is unlikely that refiners will be able to recover the costs associated with production and distribution, and the likelihood of subsequent shortages will increase as refiners adjust their operations.

Letters:

Petroleum Marketers Association of America (IV-F-67)

Response to Comment 6.1.5(A):

We expect that refiners will be able to recover the cost associated with the production and distribution of low sulfur fuel under the fuel program adopted today. While the temporary compliance option will allow refiners to continue producing 500 ppm sulfur fuel for a limited amount of time, the amount of fuel that be produced at the 500 ppm sulfur level is small (around 20 percent, or 25 percent including potential volume under the small refiner hardship provisions). The large majority of the fuel produced will have to meet a 15 ppm sulfur standard and will be priced at a level to recoup production and distribution costs. Production of 500 ppm sulfur fuel will be limited, and increased production will only be possible with a corresponding increase in the production of 15 ppm sulfur fuel, or the purchase of credits from another refiner. Consequently, it will not be possible for production of 500 ppm sulfur fuel to significantly undercut the ability of refiners to recover their costs for producing 15 ppm sulfur fuel. We expect refiners will be able to sell all of their 15 ppm fuel to pre-2007 model year trucks and recover the costs associated with producing and distributing the clean fuel.

(B) Opposes a production percentage requirement for refiners as part of any phase-in.

(1) EPA suggests limiting the amount of 500 ppm fuel that a refinery can produce for on-road use. This approach is punitive to farmer co-op refiners whose members-owners use almost exclusively 500 ppm and higher diesel. Because every farm has on and nonroad needs that vary seasonally, this approach does not work. It also appears to favor refiners with multiple refineries, which is inapplicable to farmer co-ops.

<u>Letters:</u>

Cenex Harvest States Cooperatives (IV-D-232) **p. 12**

<u>Response to Comment 6.1.5(B):</u>

The commenter implies that a diesel fuel sulfur control approach that limits the fraction of a refiner's diesel fuel that can be 500 ppm (like the temporary compliance option we are implementing in this rule) may result in changes in how highway and nonroad fuel is produced and marketed to rural customers. We agree that such changes are likely, but are not required. In addition, we do not expect that such changes will significantly affect the ability of refiners serving rural areas, including farmer cooperative refiners, to meet the needs of their customers. For example, the implementation of this rule may change today's overall fraction of highway fuel sold as nonroad fuel for farm and other uses (this is true both for farmer cooperative refiners as well all other refiners serving these markets); but, as we discussed under issue 8.1.1, we expect the program as designed to maintain sufficient supplies of fuel for highway as well as nonroad use at reasonable prices in all parts of the country. In addition, farmer co-ops can continue to sell the same fuel for both highway and nonroad use.

Despite the fact that this is only a highway diesel fuel rulemaking, we are giving credit to refiners, such as some farmer co-ops, under the ABT provisions of the final rule for all 15 ppm sulfur fuel they produce, regardless of whether it is ultimately sold for highway use or for off-highway purposes. Consequently, if these refiners choose to comply in 2006, they will receive a significant economic advantage as a result.

It is not clear based on their comments how the commenter believes the provisions favor multiple refinery refiners. The trading aspects in the ABT provisions of the temporary compliance option allow all refiners, whether single refinery or multiple refinery, to take advantage of the compliance flexibilities. Furthermore, some of the farmer co-op refiners already have co-ownership or joint operating or marketing arrangements that could readily be expanded to take advantage of the flexibility under the temporary compliance option.

(C) To address potential spot shortages, EPA can take several steps to provide knowledge and information to consumers that will allow the free market to operate efficiently.

(1) In follow-up comments to initial comments in support of a phase-in approach, the commenter suggests that EPA could establish a Web site or phone-in database of retail stations and truck stops that have ultra-low diesel during the phase-in period. The basic information would be: that ULD is available; retail location; and types of vehicles served at the location. The site could include retailer advertising if operated on a for-profit basis. Price could be included but adds complexity and possibly FTC concerns. This type of database would allow truck line schedulers and individual truckers to plan routes. Given technology advances, by that time each truck probably will have GPS capability that could provide continuous updates of closest ULD stations. Although not completely eliminating potential localized spot shortages, this approach would allow quick resolution of problems.

Letters:

Koch Petroleum Group (IV-G-8) **p. 1-2**

Response to Comment 6.1.5(C):

Under the fuel program adopted today, we expect 15 ppm sulfur diesel fuel to widely available in all regions of the United States. Therefore, we do not believe it is necessary to establish a Web site or database that lists retail outlets selling 15 ppm sulfur diesel fuel. Even so, if the private sector wished to establish its own web site or database highlighting what stations are carrying 15 ppm sulfur diesel fuel, it could only further assist vehicle operators.

(D) Under a phase-in approach, it would not be difficult to ensure the availability of low sulfur fuel at the retail level.

(1) Commenter provides the report "Consumers' Views on the Availability of Cleaner Diesel Fuel," Oak Ridge National Labs, June 14, 2000 as documentation that supports their conclusion that availability will not be a problem under a phase-in approach. If half of current retail outlets selling diesel fuel (approximately 20 percent of all retail outlets, excluding truck stops) had the new low sulfur fuel available for sale, diesel vehicle owners requiring the new fuel would find its availability to be adequate. No matter which regulatory mechanisms or alternatively, incentives are used, increased distribution system costs will be incurred with a phase-in and paid for primarily by fuel users who require the low sulfur diesel fuel.

Letters:

U.S. Department of Energy (IV-G-28) **p. 10**

Response to Comment 6.1.5(D):

The information provided by the commenter was of a very small consumer survey of diesel passenger vehicle owners, and is thus, of limited use in assessing the retail availability needs of heavy-duty, primarily commercial vehicle owners and operators. Furthermore, the responses tended to indicate not that 50 percent was acceptable, but that "more than 50 percent" was necessary, and for many, 100 percent was necessary. The provisions in our final rule, however, we believe will ensure sufficient retail availability without imposing a regulatory burden on retailers.

Issue 6.1.6: Costs/Cost Savings

(A) A phase-in approach for the diesel fuel sulfur standard will lead to significant cost savings.

(1) Commenter provides the report "Analysis of the Cost of a Phase-in of 15 ppm Sulfur Cap Diesel Fuel," Center for Transportation Research, Argonne National Laboratory, August 2000 (which draws on research from the report "Modeling Impacts of Reformulated Diesel Fuel, August 14, 2000 - also provided) as supporting documentation for their conclusion that adding a second on-road diesel fuel to the distribution and retail system represent only a small part of the total costs of bringing an ultra-low sulfur diesel fuel into general use. Overall costs of any scenario, including the phase-in, are dominated by fuel costs, which are sensitive to estimated per gallon costs and total gallons consumed. While different assumptions can be made regarding various elements of a phase-in scenario, commenter (DOE) believes that the up to $20 billion potential savings estimated in their phase-in analysis is a compelling argument to pursue a phase-in strategy. The potential economic benefits to consumers of a phase-in will significantly outweigh the potential increased costs that some fuel distributors and retailers face and the costs associated with the two fuels approach are much less than all fuel users will face with a 100 percent ultra-low sulfur production and use requirement in 2006.

Letters:

U.S. Department of Energy (IV-G-28) **p. 9-10**

(B) A phase-in approach for the diesel fuel sulfur standard would be too costly.

(1) These commenters expressed opposition to a phase-in strategy for the diesel fuel sulfur standard in whole or in part due to cost considerations. See narrative under Issue 6.1.2, points (A), (B), (D), and (E) for further discussion on this issue and a summary of the comments.

Letters:

Ackerman Oil Co., Inc. (IV-D-21) **p. 1**
Agricultural organizations as a group (IV-D-265) **p. 2**
American Bus Association (IV-D-330) **p. 4-5**
American Petroleum Institute (IV-D-343) **p. 15**
American Trucking Association (IV-D-269)
Big West Oil, LLC (IV-D-229) **p. 2**
Bossom's Quasky Mart (IV-D-44) **p. 1**
British Petroleum (IV-D-242) **p. 3**
CA Trucking Association (IV-D-309) **p. 1-2**
Cenex Harvest States Cooperatives (IV-D-232) **p. 7**, (IV-F- 191) **p. 232**
Chevron (IV-D-247) **p. 6**
Collier, Shannon, & Scott (IV-F-117) **p. 24**
Engine Manufacturers Association (IV-D-251) **p. 17-18**
Equiva Services (IV-D-226) **p. 2**
ExxonMobil (IV-D-228) **p. 19**, (IV-F-800)
Farmland Industries (IV-F-29)
Harold Dickey Oil Corp. (IV-D-43) **p. 1**
Independent Fuel Terminal Operators Association (IV-D-217) **p. 13-15**
James Enterprises, Inc. (IV-D-40) **p. 1**
Johnson Petroleum, Inc. (IV-D-17) **p. 1**
Kendle Oil Company (IV-D-42) **p. 1**
MT DEQ (IV-D-254) **p. 8**
Marathon Ashland Petroleum (IV-D-261) **p. 3, 70**
Meyer Oil Company (IV-D-45) **p. 1**
NATSO (IV-D-246) **p. 1-10**, (IV-F-17)
NY Assoc. of Service Stations & Repair Shops (IV-F-45)
National Association of Convenience Stores (IV-D-279) **p. 2**, (IV-F- 191) **p. 168**
National Council of Farmer Cooperatives (IV-D-351) **p. 7**
National Federation of Independent Business (IV-D-243) **p. 2**
Nauss Oil Company, Inc. (IV-G-21) **p. 1**
New England Fuel Institute (IV-D-296) **p. 5-7**
PA Association of Milk Dealers (IV-D-23) **p. 1**
Perfection Oil Company (IV-D-41) **p. 1**
Petroleum Marketers Association of America (IV-D-245) **p. 1-14**
Phillips Petroleum Company (IV-D-250) **p. 6**
Ports Petroleum Co, Inc. (IV-F- 117) **p. 190**
Sinclair Oil Corporation (IV-D-255) **p. 10**
Society of Independent Gasoline Marketers of America (IV-D-328) **p. 6**, (IV-F-191) **p. 196**
Tosco (IV-D-84, 157), (IV-D-304) **p. 3**
Welsh, Inc. (IV-D-22) **p. 1**

Response to Comments 6.1.6(A) and (B):

EPA performed a detailed analysis of both the refining savings and the distribution costs associated with the temporary compliance option and small refiner hardship provisions. This analysis showed that the refining savings were about $1.7 billion, while the distribution costs were roughly $1 billion. Thus, the temporary compliance option results in a net savings of about $0.7 billion. The reader is referred to Chapter V of the RIA for the details of this analysis. Based on our own analysis, we do not believe a phase-in of the nature analyzed by DOE would provide any significant cost savings and would have put at risk the tremendous economic and environmental benefits of the program.

Issue 6.2: Compliance Flexibility Option

(A) If compliance flexibilities are offered to refiners, EPA should ensure that there are requirements in place that would ensure the use of ultra-low sulfur fuel in metropolitan areas such as New York City.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Consumer Policy Institute, NY (IV-F- 116) **p. 305**

Response to Comment 6.2(A):

Under the fuel program adopted today, we expect that in excess of 75 percent of the highway diesel fuel produced starting June 1, 2006 will be 15 ppm sulfur diesel fuel. (The fuel program applies separately in each PADD, so we expect there to be widespread geographic production of 15 ppm sulfur diesel fuel.) Given the high level of production, we expect that 15 ppm sulfur diesel fuel will be the main highway diesel fuel distributed through the pipeline system. Based on these expectations, we expect widespread availability of the low sulfur fuel throughout all areas of the country. Therefore, we do not believe it is necessary to mandate the use of low sulfur fuel in any given area, since it will be widely available.

(B) Allow flexibility to permit occasional sulfur levels higher than 15 ppm.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Tesoro Petroleum (IV-F- 191) **p. 26**

Response to Comment 6.2(B):

Refiners will be allowed to produce highway diesel fuel with a sulfur level above 15 ppm for a limited time under the fuel program. Under the temporary compliance option and the small refiner flexibilities, certain refiners will be allowed under certain conditions to continue producing highway diesel fuel that meets the current sulfur standard of 500 ppm. Because of concerns over poisoning emission control systems on 2007 and later model year heavy-duty diesel trucks with the use of diesel fuel greater than 15 ppm sulfur, we will not allow refiners to sell diesel fuel with a sulfur level above 15 ppm (even if the fuel only exceeds the sulfur standard by a few ppm) as low sulfur fuel. Under the temporary compliance option or the small refiner flexibilities, such fuel would need to be sold as 500 ppm fuel or downgraded to nonroad diesel fuel. Once the temporary compliance option and small refiner flexibilities expire in 2010, a refiner will no longer be able to sell the fuel as 500 ppm sulfur highway diesel fuel because all highway diesel fuel will be subject to the 15 ppm sulfur standard. However, they will still be able to downgrade the fuel with a sulfur level above 15 ppm to nonroad diesel fuel.

(C) Opposes compliance flexibility option because aftertreatment technologies are rendered inoperable if exposed to high sulfur fuels, and therefore will not be able to meet the proposed emissions standards.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Engine Manufacturers Association (IV-F- 191) **p. 39**

Response to Comment 6.2(C):

While we agree that exposure of 2007 and later model year heavy-duty diesel vehicles to diesel fuels with sulfur levels above 15 ppm for a significant amount of operation will damage the emission control systems, we believe that the provisions of the final rule will prevent any significant amount of misfueling from occurring. The reader is referred to the response to Issue 6.1.3. In addition, Chapter IV of the RIA contains a full discussion of the misfueling issue and why we do not expect misfueling to be a significant problem.

(D) The proposed NO_x/NMHC phase-in for HDEs would partially waste the early investment in ultra-low sulfur diesel and would cause the cost-effectiveness of the regulation to be unacceptable during this period.

(1) The regulation would be more cost-effective and equitable if engine emission standards and diesel fuel requirements were implemented at the same time. The NO_x and NMHC emission reductions are the primary reason for the regulation. With the proposed phase-in, and with slow fleet turnover, refiners are being asked to spend billions of dollars by 2006 to enable technology used by a small percentage of the fleet prior to 2010. If EPA intends to provide generous flexibility to engine manufacturers, it needs to provide compliance flexibility to refiners as well.

Letters:

Sinclair Oil Corporation (IV-D-255) **p. 9-10**

Response to Comment 6.2(D):

EPA considered the possibility of phasing in the diesel fuel sulfur cap as the fleet turned over to 2007 and later vehicles. Such a program would reduce the refining costs associated with the sulfur cap substantially and provide many refiners considerable more time to select their desulfurization technology. However, there are also considerable costs associated with providing two diesel fuels to the entire highway vehicle fleet. In the final analysis, the refining savings are lower than anticipated because of limitations in the fuel distribution system. Also, even the remaining refining savings are severely mitigated by the costs associated with providing two fuels. Plus, EPA received numerous comments from those producing and distributing diesel fuel arguing against such a phase in. These comments are discussed earlier in this section (e.g., Issue 6.1).

Generally, in order for the full refinery savings to be obtained, the entire distribution system from pipeline to service station would have to carry two fuels. We evaluated the cost of adding tankage at every terminal, bulk plant, truck stop, card lock, service station and fleet refueling location and found that the cost of this tankage far exceeded any potential refinery savings. In addition, such a phase in would also require a retailer availability requirement to ensure the 15 ppm fuel was widely available across the country for the vehicles that need it, which could significantly impact fuel retailers.

We also evaluated less gradual phase in schedules, where some of the distribution system (e.g., smaller centrally fueled fleets) converted immediately to 15 ppm fuel, while the rest of the system dispensed both 15 and 500 ppm fuels. We found that these approaches saved little relative to the temporary compliance option and small refiner hardship provisions contained in the final rule. They still would have required a retailer availability requirement, which could significantly impact fuel retailers and would put at risk the tremendous environmental and economic benefits of the final rule if widespread misfueling or deferred engine purchases would result. Thus, we rejected the option of a gradual phase in of the diesel sulfur cap.

In the end, we concluded that the flexibility provided by the temporary compliance option, small refiner hardship provisions, and other hardship provisions was sufficient to address the economic impact and supply concerns raised by refiners.

In addition, the PM reductions are also a primary reason for the regulation, and there is no phase-in of the PM emission standard.

Issue 6.2.2: ABT

(A) Opposes ABT program as inconsistent with the technology-enabling rationale used to justify the low sulfur rules. The potential flexibility of the program is outweighed by the administrative burden and inequities that would arise.

(1) The technology-forcing aspect of the proposal seems to preclude utilization of any meaningful ABT program. Permitting sulfur levels to exceed the regulatory cap under any circumstances would compromise the environmental benefits of the program; and the low sulfur standard leaves no room to use any sulfur credits that might have been accrued. EPA should keep the diesel rule as clean and simple as possible, with no ABT program.

<u>Letters:</u>

Chevron (IV-D-247) **p. *2, 7**

<u>Response to Comment 6.2.2(A):</u>

As long as fuel exceeding the 15 ppm sulfur cap is not used in 2007 and later model year vehicles which require its use, allowing fuel to remain in the market higher than this level does not significantly undermine the emission reductions that result from the program. We believe the averaging, banking and trading program adopted today for refiners will provide flexibility to a large number of refiners in the early years of the program allowing them to delay desulfurization for a limited portion of their highway diesel fuel pool, resulting in a savings to some refiners. While we will allow some refiners to produce highway diesel fuel for a limited number of years subject to the current 500 ppm sulfur cap, all highway diesel fuel will need to labeled appropriately at the pump. Along with the labeling requirements for 2007 and later model year heavy-duty diesel vehicles, we believe truck owners will be able to clearly identify and use the correct fuel in their vehicles, preventing any loss of environmental benefit from misfueling with the wrong fuel.

We agree that the fuel destined for 2007 and later model year diesel trucks must meet the 15 ppm sulfur standard with no averaging, banking and trading provisions for the 15 ppm standard. The 15 ppm standard is a cap, and not an average (with averaging, banking and trading), because the advanced aftertreatment engines need fuel with sulfur level of 15 ppm or lower.

(B) An ABT program is an important flexibility provision.

(1) In establishing an ABT program EPA should allow the price of ABT credits to be determined by the market. EPA should also ensure that penalties for a 'compliance shortfall' of credits are applied only to the credit seller and not the 'good faith purchaser' and should not establish citywide surveys similar to the RFG program. A refiner should not lose its flexibility to supply some higher sulfur diesel if found liable for a violation since this approach may drive up the price in the market. If EPA chooses to include this sanction, imposition should be automatic and not subject to EPA discretion.

<u>Letters:</u>

Koch Industries (IV-D-307) **p. 6-7**

<u>Response to Comment 6.2.2(B)(1):</u>

Under the ABT program being adopted, the price of credits will be determined by the refiners involved in the credit transfer. We will not be, and we see no reason why we need to be involved in setting the price of credits.

With regard to the use of credits which are determined to be invalid, we will not allow the use of such credits for demonstrating compliance under the temporary compliance program. Both the seller and purchaser of invalid credits would have to adjust their credit calculations to reflect the proper credits and either party (or both) could be deemed in violation if the adjusted credit calculations demonstrate noncompliance. Our strong preference is to hold the credit seller liable for the violation, rather than the credit purchaser. As a general matter we would expect to enforce a shortfall in credit compliance calculations against the credit seller, and we would expect to enforce a compliance shortfall (caused by the good faith purchase of invalid credits) against a good faith purchaser only in cases where we are unable to recover sufficient valid credits from the seller to cover the shortfall. Further, we believe that credit buyers can minimize their risk by purchasing credits from parties they know and trust. The provisions that require records to show who generated the credits (and any intermediate transferee of the credits) and that limit the number of times credits can be transferred, should help buyers in assessing the validity of the credits.

If a refiner is determined to be in noncompliance with the temporary compliance option, we have included provisions that allow a refiner to exceed the amount of fuel allowed to be at the 500 ppm sulfur level by five percent, as long as the refiner makes up the credits in the next compliance period. This will provide some additional relief to refiners unable to readily find credits to cover the loss of invalid credits.

(2) An ABT program similar to the Tier 2 rule would provide more certainty of sustainable and adequate highway diesel fuel supplies by removing the extreme concerns of delivering a 15 ppm cap diesel fuel without contamination. EPA's statements suggest a 15 ppm average with an appropriate cap could allow identical low emission standards at no impact on the cost of emission control hardware.

Letters:

Phillips Petroleum Company (IV-D-250) **p. 4, 7**

Response to Comment 6.2.2(B)(2):

As described in Chapter III of the RIA for today's rule, we believe that repeated exposure of vehicles to diesel fuels with a sulfur level above 15 ppm will poison the emission control systems on 2007 and later model year heavy-duty vehicles. Therefore, under the averaging, banking and trading program we do not allow averaging around the 15 ppm level. Instead the program allows refiners to generate credits if they produce more 15 ppm sulfur fuel than required under the temporary compliance option (i.e., 80% of their highway diesel fuel). The credits can be used by refiners to produce up to an equal volume of highway diesel fuel subject to a 500 ppm sulfur standard.

(3) In establishing an ABT program, EPA should use a universal industry benchmark for how much complying diesel production is required, as opposed to separate baselines for each producer, and should set this benchmark as low as possible. EPA should also allow sales of sulfur credits to other industries (power plants, etc.).

Letters:

Countrymark Cooperative (IV-D-333) **p. 12**

Response to Comment 6.2.2(B)(3):

Under the averaging, banking and trading program for diesel fuel, the baseline requirement is the same for all refiners (except small refiners, as described below). Each refiner must produce at least 80 percent of its highway diesel fuel at the 15 ppm level or purchase an equal volume of low sulfur fuel credits to demonstrated compliance with the 80 percent requirement. Under the flexibilities adopted for small refiners, a small refiner is allowed to produce all of its highway diesel fuel to meet the current 500 ppm sulfur standard until mid-2010. However, small refiners can also participate in the averaging, banking and trading program and generate credits for any fuel meeting a 15 ppm sulfur standard.

(4) Resale of credits should be limited to no more than two resales. Repeated sales of credits could significantly reduce the Agency's ability to monitor the credits and thereby enforce its rule.

Letters:

Children's Environmental Health Network (IV-D-244) **p. 2**

Response to Comment 6.2.2(B)(4):

We agree that repeated sales of credits could significantly reduce our ability to monitor the validity of credits under the averaging, banking and trading program. Therefore, we are adopting the requirement, as proposed, that allows credits to be traded no more than twice. Any credit that is traded more than two times will be an invalid credit and cannot be used to demonstrate compliance under the temporary compliance option.

(C) There is inadequate detail on what an ABT program would look like to comment on ABT, but ABT is vital for a final rule. EPA should publish an interim final rule with ABT.

(1) Commenter provides no further supporting information or detailed analysis.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 5**

Response to Comment 6.2.2(C):

We believe the discussion in the NPRM for the rule provided sufficient detail on the provisions of a possible averaging, banking, and trading program for diesel fuel refiners. EPA did, in fact, receive a large volume and breadth of comments on this issue.

(D) Farmer co-ops have special concerns that should be built into any ABT program.

(1) Commenters provided discussion on one or more of the following issues. First, farmer co-ops should be able to pool together and be treated as a single refiner so that they can take advantage of the flexibility that large refineries with multiple refineries will receive. Second, credits for farmer co-ops should not be based on volumes above a set production percentage because these refiners must make a large percentage of 500 ppm diesel for agricultural, nonroad use. Also, limiting credits based on production percentages reduces flexibility in rural America or Rocky Mountain states, which EPA raises as a concern. In addition, farmer co-ops are likely to be some of the last refiners to convert and thus a production percentage requirement would limit their ability to develop credits. Third, farmer co-ops should be given the longest time to buy credits. EPA suggests that credits may expire by 2009. This

works against farmer co-ops. If there is a system that limits or staggers timeframes to buy/use credits based on capacity, that could help farmer co-ops.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 13-14**
National Council of Farmer Cooperatives (IV-D-351) **p. 7-8**

(2) Commenter notes generally that an ABT approach should be one option for farmer co-ops to help reduce impact of the rule.

Letters:

National Council of Farmer Cooperatives (IV-D-351) **p. 6-7**

Response to Comments 6.2.2(D):

The commenters request various forms of separate treatment for farmer cooperatives as a class compared to other refiners. As discussed in Section IV of the preamble, we have concluded that from both organizational and financial perspectives, it is not necessary or appropriate to provide such separate treatment to farmer cooperatives as a class. We expect that relative to other refiners serving rural America, our program will not disproportionately affect farmer cooperative refiners or their customers (whether members or non-members of the cooperatives). As with other refiners, we expect that the temporary compliance option may be useful to one or more of these refiners as they carry out their desulfurization projects. In addition, one farmer cooperative refiner may benefit from the special provisions for refiners marketing gasoline in the Geographic Phase-in Area (GPA) and a second is likely to benefit from the small refiner hardship provisions. The remaining two farmer cooperatives can also take advantage of the general hardship provisions in the final rule, just as they have under the Tier 2 gasoline rule. Finally, under the ABT provisions of the temporary compliance option, these refiners are able to trade credits with each other to assist them in compliance.

(E) Disagrees with EPA suggestion that refiners perform downstream quality assurance sampling as part of being able to produce 500 ppm fuel; this is an issue that pipelines and terminals must address.

(1) Commenter provides no further analysis on this point.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 14**

Response to Comment 6.2.2(E):

We believe that refiners who produce highway diesel fuel subject to the 500 ppm sulfur standard after June 1, 2006 should bear some of the burden of assuring that such highway diesel fuel is not causing contamination of motor vehicle diesel fuel subject to the 15 ppm sulfur standard at downstream facilities. We also believe that the rule minimizes this burden by only requiring that the refiner perform quality assurance testing at a small percentage of its own branded outlets. We expect that many branded refiners would, in any case, perform such downstream quality assurance testing anyway as part of its normal business practices and be able to meet affirmative defense requirements under § 80.613.

(F) EPA should define "eligible entities" broadly enough to allow the manufacture of biodiesel as an eligible generator of credits that can be averaged, banked, or traded under a "compliance flexibility option."

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

National Biodiesel Board (IV-D-288) **p. 5**

Response to Comment 6.2.2(F):

The averaging, banking and trading program adopted today allows refiners to participate if they produce motor vehicle diesel fuel. Both of the terms “refiner” and “motor vehicle diesel fuel” are defined at 40 CFR 80.2. Therefore, if the manufacturer of biodiesel fuel, or any other fuel, can demonstrate that they meet our definition of “refiner” and that the fuel they are producing meets our definition of “motor vehicle diesel fuel,” they may participate in the averaging, banking and trading program adopted today. Based on our current understanding of biodiesel production, we expect that manufacturers of such fuel would meet our definition of “refiner” and that biodiesel fuel would comply with our definition of “motor vehicle diesel fuel” and could therefore, participate in the program. However, it is the responsibility of any entity considering participating in the program to determine whether they meet the eligibility requirements and whether they want to take on the responsibilities under the regulations associated with refiner status.

(G) The viability of a credit program for diesel fuel will depend on what is proposed by EPA for the nonroad fuel.

(1) Because the primary concern with nonroad diesel applications will be emissions and not engine technology (as is the case with highway diesel fuel), it may be possible to devise a system in which diesel credits could be generated for use in offsetting against nonroad diesel sulfur standards. In this context, it is critical to know now what EPA intends to propose regarding the regulation of nonroad diesel fuel.

Letters:

Williams Energy Services (IV-D-167) **p. 5**

Response to Comment 6.2.2(G):

As described in Section VIII of the preamble for today’s rule, we believe that any specific new requirements for nonroad diesel fuel need to be carefully considered in the context of a proposal for further nonroad diesel engine emission standards. The many issues connected with any rulemaking for nonroad engines and fuels warrant serious attention, and we believe it would be premature today for us to attempt to address potential resolutions to them. We plan to initiate action in the future to formulate thoughtful proposals covering both nonroad diesel fuel and engines. However, we have established the viability of a credit program for highway diesel fuel, independent of what may happen for nonroad diesel fuel.

Issue 6.3: Availability Requirements

Issue 6.3.1: Refiner-Assured Availability

(A) EPA should not impose a refiner ensured availability requirement.

(1) Since many refiners do not have a direct relationship with retailers, the impact of an availability requirement will differ between refiners and it would be difficult for EPA to micromanage the distribution system in this way and to establish a definition for "availability."

Letters:

Petroleum Marketers Association of America (IV-F-67)

Response to Comment 6.3.1(A):

We agree with the comment. With today's action we are not adopting a refiner-assured availability program as we sought comment on in the NPRM.

(B) EPA should establish a limited refiner fuel production requirement.

(1) Based on the information on expected use of the new low sulfur diesel fuel, one approach would be to establish a production requirement for refiners set at 20 percent of a refiner's on-road diesel fuel production for 2007. This would allow for the establishment of a retail availability-based market driven phase-in of the new fuel.

Letters:

U.S. Department of Energy (IV-G-28) **p. 11**

Response to Comment 6.3.1(B):

We considered the possibility of slowly phasing in the volume of low sulfur diesel fuel as the fleet turned over to 2007 and later vehicles. However, we rejected such a phase-in because such an approach raises concerns that the new low sulfur fuel would not be available across the country for owners of new vehicles that need it. We believe such a phase-in would require a retailer availability mandate (i.e., requiring that certain retailers sell the 15 ppm diesel), which would be a complex program to design, and which in the end may not even result in sufficient availability in all parts of the country. Given that diesel fuel is less than ten percent of sales at most retail outlets, if faced with large compliance costs, particularly now in the wake of underground storage tank regulations, many retailers could easily choose not to carry diesel fuel at all. Further, there are considerable costs associated with providing two diesel fuels to the entire highway vehicle fleet under such a slow phase-in. Plus, EPA received numerous comments from those producing and distributing diesel fuel arguing against such a phase-in. With today's action, we are adopting a temporary compliance option which, based on the minimum percentage of highway diesel fuel that is required to be produced meeting the 15 ppm standard, we believe will ensure the widespread availability of low sulfur fuel and provide added flexibility to refiners. The reader is also referred to our response to Issue 6.1.1(C)(1).

Issue 6.3.2: Retailer-Assured Availability

(A) An availability requirement for service stations that distribute a certain volume of diesel fuel is unnecessary.

(1) The market will adjust appropriately so that the fuel is readily available to those that need it. Also, because nearly one-third of all trucks use their own fueling infrastructure, it may not be cost-effective to require all large service stations to invest in a separate fueling system for the new fuel.

Letters:

Koch Industries (IV-D-307) **p. 6**
Petroleum Marketers Association of America (IV-F-67)

(2) An availability requirement could be unduly burdensome for certain smaller retail stations and may require them to close entirely. In addition, this type of requirement could be prohibitive for those retailers that obtain their fuel from refiners that are exempt from the requirements because of their size and that do not have another refiner in close proximity from which to purchase the low-sulfur fuel.

Letters:

Petroleum Marketers Association of America (IV-F-67)

(3) Some commenters expressed opposition to either a retailer availability or large marketer availability mandate as part of a dual fuel option. One commenter (NATSO) noted that the fundamental flaws associated with a phase-in strategy will not be resolved by imposing a retailer availability requirement. The volume of a facility does not necessarily mean that the facility is located in an area where the demand for low sulfur fuel will be higher. This commenter provides significant discussion on this issue and notes that this type of mandate will be costly and burdensome and will not result in significant improvements in air quality.

Letters:

NATSO (IV-D-246) **p. 5-6**
Ports Petroleum Co, Inc. (IV-F- 117) **p. 190**
Society of Independent Gasoline Marketers of America (IV-F-191) **p. 196**

(4) A retailer availability requirement is unnecessary, even if small refiners are producing higher sulfur diesel fuel. Small refiners do not have a substantial share of any diesel market. Since most refiners will be producing the low sulfur diesel, there will be adequate supplies of this fuel at retail locations.

Letters:

Western Independent Refiners Association (IV-D-273) **p. 7**

(5) A retail availability requirement is unnecessary for several reasons. First, providing adequate assurance of low sulfur fuel availability at the wholesale level means that refiners should be required to produce some small fraction of their on-road diesel fuel as ultra-low sulfur at the start of the program and establishing that requirement is necessary to guide refiners' business investment plans. Second, a number of uncertainties remain that may affect how this fuel is distributed and retailed and therefore, any decision regarding retailer availability requirements should be made after a technology review in 2003. Third, additional consideration should be given to a wider range of possible regulatory approaches (including a possible phase-in) and incentive mechanisms to bring the new fuel to the retail market.

Letters:

U.S. Department of Energy (IV-G-28) **p. 10**

(B) Opposes retailer availability requirement, especially for farmer co-op controlled retail outlets.

(1) For truck stop retail locations operated by farmer co-ops, these outlets provide important sources of revenues because sales are often to non-members and the co-op can more easily use price to pass on capital expenditures. Thus, farmer co-ops already have a strong incentive to provide the 15 ppm fuel at these locations.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 10, 15**

(C) EPA must mandate the availability of low sulfur fuel, and cannot lawfully rely on a market-based approach.

(1) EPA can only realize the environmental benefits of its proposed regulations by mandating the availability of low sulfur fuel, since without this type of mandate, there is no guarantee that low sulfur fuel will be available when needed. Without low sulfur fuel, the standards clearly cannot be met and maintained, which would place manufacturers at risk of enforcement actions and warranty claims. Simply allowing the marketplace to dictate the possible availability of low sulfur fuel further undercuts the technological feasibility of the proposal.

Letters:

Cummins, Inc. (IV-D-231) **p. 55**

Response to Comments 6.3.2(A), (B) and (C):

We are not adopting any retailer availability requirements with today's action. Retailers will be free to sell 15 ppm sulfur diesel fuel, 500 ppm sulfur diesel fuel, or both. We believe the fuel program being adopted today for refiners will ensure that adequate supplies of low sulfur diesel fuel are available throughout the nation. The temporary compliance option and hardship provisions have been designed with a required level of production that we believe will ensure that 15 ppm fuel is distributed widely through pipelines, at terminals, and retail outlets throughout the country without the need for a retailer availability requirement. Our analysis supporting the design of these provisions can be found in Chapter IV of the RIA for today's rule.

Issue 6.4: Military Fuels

(A) Commenter is concerned about the potential impact of the proposed rule on the availability and quality of the aviation fuels JP-5 and JP-8.

(1) The proposed rule might force some refiners to stop manufacturing these unique fuels, further reducing supply availability and impacting military readiness.

Letters:

Department of Defense (IV-D-298) **p. 2-3**

Response to Comments 6.4(A):

The commenter provides no factual basis to support their concern that some refiners will stop producing specialty fuels for the U.S. military. We have no information which would indicate our program will have an adverse impact on the availability and quality of specialty fuels such as military aviation fuels JP-5 and JP-8. The changes to refinery operations that we envision will need to be made to comply with our sulfur program are primarily related to the addition of additional hydrotreating capability to reduce the sulfur content of highway diesel fuel. These changes will not impact a refiner's ability to produce a range of different types of fuels. We anticipate that the distillate blendstocks used to manufacture highway diesel fuel may be adjusted by certain refiners to ease the difficulty in producing highway diesel fuel meeting a 15 ppm sulfur cap. However, we do not expect that such adjustments will impact the ability of refiners to produce adequate quantities of specialty fuels or the quality of these fuels. On the contrary, it is entirely possible that additional refiners may choose to enter into the specialty fuels market to offset their investment to comply with today's new diesel fuel standard.

(B) Commenter is concerned that the multi-product commercial system will be challenged to the point that it will be unable to accommodate the transportation of military fuels.

(1) EPA should evaluate all impacts on distribution, which is of particular concern for military users of specialty fuels such as F-76, JP-5, and JP-8. Since these fuels are not fungible, distribution problems may limit the military's ability to transport the required critical volumes in order to meet operational readiness requirements.

Letters:

Department of Defense (IV-D-298) **p. 3-4**

Response to Comments 6.4(B):

We concluded that the fuel distribution system can accommodate the distribution of highway diesel fuel meeting a 15 ppm cap on diesel sulfur with modest changes (see Chapter IV, section C of the RIA). These changes will have little or no impact on the ability of pipelines and terminals to handle segregated shipments of the specialty fuels that they carry today. To the extent that it is in the economic best interest of these entities to handle these fuels today, it will continue to be in the future. In addition, we expect that projects that the distribution industry will undertake to increase its capacity to match the increase in highway diesel fuel demand over time due to economic growth will add surplus capacity that could be utilized for the distribution of the relatively small volumes of specialty products.

During the initial years of our program when the temporary compliance option and small refiner hardship provisions are available to refiners, we expect that two grades of highway diesel fuel will be carried in some parts of the distribution system (Refer to Chapter V, section C of the RIA). Given the short duration of these provisions, we do not believe that pipelines and terminals would chose to disrupt and put at risk their long term business practices of handling specialty fuels. Rather, we believe that those entities that choose to distribute both grades of highway diesel fuel during this transition period will do so by utilizing currently underutilized capacity or by constructing additional storage capacity. Therefore, we believe that the presence of two grades of highway diesel fuel in the distribution system will not limit the availability of storage tanks for use in distributing specialty fuels.

We estimated that 40 percent of pipeline systems would carry two grades of highway diesel fuel. Having two grades of highway diesel fuel in the system will place additional demands on the pipeline system associated with separating and routing the two grades. There will also be some additional volume of highway diesel downgraded to a lower value product as a result of the presence of batches of 500 ppm highway diesel fuel as well as 15 ppm fuel (see Chapter V, section C.3.g. in the RIA). These factors may tend to reduce the total capacity of pipelines that carry two grades of highway diesel fuel to a small extent. We took this into account when making our assessment that only 40 percent of pipelines would carry two grades of highway diesel fuel. We anticipate that only those pipelines that have the additional capacity to carry 500 ppm as well as 15 ppm highway diesel fuel without impacting their ability to distribute a full slate of fuels (including specialty products), will choose to do so.

(C) Commenter believes that EPA will need to exercise the existing National Security Exemption procedures to exempt tactical heavy-duty diesel vehicles from engine standards that do not allow use of JP-8 or other diesel fuel used outside of the U.S. because of sulfur-intolerant emissions control technology.

(1) JP-8 is a kerosene-based fuel that is essentially commercial Jet A-1 aviation fuel with additives to make it battlefield-equipment ready. Because tactical wheeled vehicles must be able to operate on JP-8 when deployed, they cannot contain engines with pollution control technology that is intolerant to sulfur.

Letters:

Department of Defense (IV-D-298) **p. 4-6**

(D) EPA should continue its determination that JP-8 does not meet the definition of diesel fuel under EPA's regulation and that operational readiness, logistical considerations and cost considerations warrant allowing use of JP-8 in military tactical motor vehicles.

(1) This would provide an exemption for the rapid deployment land forces at U.S. home bases which are in the process of converting all vehicles to JP-5 and JP-8 to allow quick response to operational needs.

Letters:

Department of Defense (IV-D-298) **p. 6-7**

Response to Comments 6.4(C) & (D):

We agree that it will be appropriate for the Department of Defense (DOD) to seek a National Security Exemption for tactical heavy-duty vehicles from the emission standards under our program based on the necessity that these vehicles be fueled on high sulfur military fuel. Due to national security considerations, EPA’s existing regulations allow the military to request and receive national security exemptions (NSE) for their motor vehicles from emissions regulations if the operational requirements for such vehicles warrant such an exemption. These provisions have worked successfully in the past to enable us to meet both our national air quality and security goals simultaneously. Today’s final rule does not change these provisions.

Based on EPA’s existing definition of diesel fuel, we previously concluded that JP-8 military fuel is not subject to EPA’s existing requirements for diesel fuel. A provision in our sulfur program revises the definition of diesel fuel so that JP-5 and JP-8 military fuel that is used or intended for use in diesel motor vehicles will be subject to all of the requirements applicable to diesel fuel under our program. However, we also included a provision in our program that exempts JP-5 and JP-8 fuels from EPA's diesel fuel requirements if it is used in tactical military vehicles that have a national security exemption or if it is used in tactical military vehicles that are not covered by a national security exemption but for national security reasons, such as the need to be ready for immediate deployment overseas, need to be fueled on the same fuel as motor vehicles with a national security exemption. The provision for this exemption will be sufficient to address DOD’s comment that tactical military vehicles must be fueled on JP-8 or JP-5 while in the United States to facilitate their readiness for deployment overseas. Use of JP-5 and JP-8 fuel not meeting the highway diesel fuel standards in a motor vehicle other than the tactical military vehicle described above is prohibited under today's rule. We believe that this prohibition is necessary to ensure that JP-8 is not used in vehicles equipped with the sulfur sensitive emissions control hardware that we believe will be needed to meet the emissions standards under our program.

In discussions with the Department of Defense (DOD), DOD stated that certain tactical military vehicles must be ready to be shipped overseas quickly in response to an emergency and must be ready to be fueled on whatever fuel is available under tactical conditions (typically JP-8). The use of the high sulfur fuel normally supplied under tactical situations overseas in engines equipped with the aftertreatment technology thought to be necessary to meet the emissions requirements of today's rule could result in driveability problems and permanently destroy the emission control system. To avoid problems experienced in the past when switching between fuel types, tactical vehicles which may need to be shipped overseas are commonly fueled with JP-8 military fuel while in the U.S. as well.

Therefore, it appears that requiring tactical military vehicles that may be used outside of the U.S. to comply with the vehicle emissions requirements under our program is not compatible with the operational requirements for such vehicles. We recognize the national security concerns raised by DOD, and will address this issue using the Agency procedures established for this purpose. These guidelines are contained in EPA's "Guidelines for National Security Exemptions of Motor Vehicles and Motor Vehicle Engines – Guidelines for Tactical Vehicles/Engines" We also recognize that tactical military vehicles manufactured before the requirements of today's rule become effective may need to continue to be operated on JP-8 or JP-5 fuel while in the U.S. to facilitate their readiness to be fueled on whatever fuel is available overseas. Consistent with an exemption for certain military vehicles, EPA is also exempting diesel fuel from the sulfur standard under our program, where the fuel is used in vehicles exempted from the emissions standards in this rule (pursuant to 40 CFR 85.1708) or in tactical motor vehicles that are not covered by a national security exemption but for national security reasons need to be fueled on the same fuel as motor vehicles with a national security exemption. The exemption for fuel used in tactical motor vehicles not covered by a national security exemption will require prior EPA approval in order for it to be in effect.

Issue 6.5: [Reserved]

Issue 6.6: Alaska

Issue 6.6.1: Inclusion of Alaska in the Nationwide Cap

(A) EPA should include Alaska in the nationwide cap on diesel fuel sulfur content.

Commenters indicated the proposed diesel fuel requirement should apply in Alaska. Manufacturer organizations stated that Alaska will need low sulfur diesel fuel if vehicles and engines employing advanced emission control technologies are to be operated in the state of Alaska. Any vehicles manufactured during or after 2007 will be damaged by the higher sulfur fuel. The manufacturers' ability to meet the emission standards will depend on the availability of low sulfur diesel fuel, and the existence of high sulfur fuel in Alaska would lead to adverse emission consequences. The Engine Manufacturers Association (EMA) also commented that there are a number of diesel vehicles from the lower-48 states that will be traveling to Alaska to deliver goods. Any exposure to Alaska high sulfur diesel fuel by those vehicles may permanently reduce the effectiveness of the emission control technologies employed on those engines and will substantially reduce their overall durability and performance. EMA provided additional discussion and referred to its comments on "State of Alaska Petition for Exemption from Diesel Fuel Sulfur Requirement," Docket No. A-96-26 (June 12, 1998).

Environmental and health organizations and approximately 33 public citizens commented that we should include Alaska in the new nationwide cap on diesel sulfur levels in order to help protect human health and the environment in Alaska. One commenter provided statistics on diesel use in Alaska and noted that a majority of Alaska's population would be adversely affected if yet another exemption is provided for the State. The National Park Service commented that exemptions for any area in the United States would compromise the air quality of many national parks.

Letters:

AK Conservation Alliance (IV-D-349) **p. 1**
AK Department of Environmental Conservation (IV-D-236) **p. 1**
Alliance of Automobile Manufacturers (IV-D-262) **p. 12**
Clean Air Coalition (IV-D-322) **p. 1-3**
Clean Air Coalition and AK organizations (IV-D-350) **p. 1**
Dolman, Suzanne, et. al. (IV-D-341)
Engine Manufacturers Association (IV-D-251) p. 23-27
Franczyk, Catherine A., et. al. (IV-D-233)
Northern Alaska Environmental Center (IV-D-223) p. 1
Rock, Steve, et. al. (IV-G-22)
Rutherford, Jolene, et. al. (IV-D-347)

(B) EPA should not include Alaska in the nationwide cap on diesel fuel sulfur content.

One commenter, a refiner in Alaska, indicated that we should grant an exemption to Alaska for highway diesel fuel since the environmental and human health risks posed by diesel fuel within the state are insufficient to justify the costs of low sulfur fuel in Alaska. The cost for installing desulfurization equipment will be high (estimated at over $100 million for Williams' North Pole, AK refinery) and it is uncertain whether a commercially viable technology is available for the harsh arctic environment found in many parts of Alaska. Given Alaska's unique circumstances and the high cost of compliance, Alaska's refiners face two undesirable choices - either invest millions to comply with the standard (for which there would be no return on investment) or stop manufacturing highway diesel. Applying the sulfur cap to Alaska may cause supply disruptions since additional tanks and storage would be required (of which there is currently a shortage) and it would be impractical to import an arctic grade fuel, since the diesel fuel produced in the lower 48 does not meet Alaska's pour and cloud point requirements (for temperatures as low as -60° F).

Williams Energy Services also indicated that disposing of the sulfur produced as a by-product of the hydrotreating process is very expensive in Alaska. It would be costly to landfill, which may not be allowed on a continuous basis, and would be even more costly to ship out of Alaska for disposal or use (the cost of getting it to the market would not offset the shipping costs). Williams estimated the total cost for sulfur disposal at their North Pole, AK refinery would be approximately $281,000.

In addition, approximately 17 private citizens indicated we should not include Alaska in the nationwide cap on diesel fuel content, but they did not provide supporting information or detailed analysis.

Letters:

Williams Energy Services (IV-D-167) **p. 2-4**, (IV-F-191) **p. 240**
Rutherford, Jolene, et. al. (IV-D-347)
Kinyon, John, et. al. (IV-G-13)

Response to Comments 6.6.1(A) and (B):

Chapter IV of the RIA discusses the costs and technological feasibility of the diesel sulfur standard of the final rule and Chapter III of the RIA discusses the critical need to have sulfur levels reduced to 15 ppm for the engine and emission control technologies to achieve the emission standards of the final rule. If vehicles and engines employing these technologies to achieve the emission standards will be operated in Alaska, then low sulfur diesel fuel must be available for their use. Any 2007 and later model year diesel vehicles in Alaska, or driven to Alaska, must be fueled with low sulfur highway diesel, or risk potential damage to the aftertreatment technologies or even the engines themselves. Consequently, it is also important to implement the low sulfur diesel fuel program in Alaska. Moreover, there are important environmental and public health benefits that will be achieved nationwide, including in Alaska, with cleaner diesel engines and fuel, particularly from reduced particulate emissions, nitrogen oxides, and air toxics. Therefore, we are including Alaska in the nationwide cap for highway diesel fuel sulfur content.

In Chapter IV of the RIA, we determined that the nationwide 15 ppm sulfur cap is technologically feasible. Although the engine standards established in the final rule are not based upon different technology and cost implications for Alaska as compared to the rest of the country, the low sulfur fuel program has different implications. Chapter VIII of the RIA discusses these issues, including those raised by Williams Energy Services in its comments to the proposal, and in its earlier comments during previous proposed and final actions regarding the diesel sulfur standard in Alaska. As noted in Comment B, one of Williams Energy Services' concerns is whether a commercially viable technology is available for the harsh arctic environment found in many parts of Alaska. However, we received no specific technical data indicating conventional hydrotreating technology is not feasible in Alaska. Our goal is to take action in a way that maintains the environmental benefits of the program, but still minimizes costs and impact by allowing Alaska to develop a transition plan to the new low sulfur program uniquely designed for Alaska. (See the following issues.)

Issue 6.6.2: Development of an Alternative Transition Plan for Alaska

(A) Supports Alaska having the opportunity to develop an alternative transition plan.

The Alaska Department of Environmental Conservation (ADEC) supports the proposed transition plan. It stated the proposal recognizes the unique circumstances in Alaska, the anticipated low demand in the early years of the program, and also recognizes that the State is the appropriate entity to develop the transitional plan. It commented that the one year schedule for development of the alternative transition plan may be ambitious given the nature of this issue within Alaska, but the ADEC is preparing to develop such a plan within the proposed time frame and will begin that effort immediately upon EPA's adoption of the final rule.

Two refiners provided discussion on a number of unique circumstances in Alaska that pose particularly difficult challenges for refiners operating in the State that warrant a separate timetable for implementation, if we choose to apply the proposed diesel sulfur standard to Alaska. In particular, Williams Energy Services cites our rationale in providing an exemption from the 500 ppm standard and specifically to our August 19, 1996 Notice of Final Decision that addresses this issue, and asserted that the unique conditions that existed in 1996 continue to exist in Alaska today. The on-highway diesel fuel in Alaska accounts for only five percent of the total diesel fuel sales in the State and the per capital consumption of on-highway diesel is significantly smaller than the lower-48 states. There is limited transportation and storage infrastructure that would force refiners to produce all diesel to the lowest common denominator (i.e., 15 ppm), which will increase the already high cost of living in the rural areas because of higher electricity costs from rural co-ops and diesel generators. Diesel fuel emissions are not as significant of an air pollution factor as they are in the lower-48 states since Alaska's diesel emission sources are not as numerous and are spread over a very large geographic area. Alaska is very sparsely populated and many people live in remote areas where the fuel supply delivered in the summer months must last the entire year. Another factor that contributes to the need for a transitional period is that the construction season is very short and in order to install desulfurization equipment, refiners must select the appropriate technology and obtain the necessary permits as well as complete construction in a relatively short time frame.

Letters:

AK Department of Environmental Conservation (IV-D-236) **p. 2**
Petro Star Inc. (IV-D-216) **p. 2-3**
Williams Energy Services (IV-D-167) **p. 2-4**, (IV-F-191) **p. 240**

(B) Conditionally supports Alaska having the opportunity to develop an alternative transition plan.

The Engine Manufacturers Association supports a transition plan, but only if adequate supplies of low sulfur diesel fuel and the prevention of misfueling can be ensured. Provided that the transition plan truly meets the minimum requirements set forth by EPA (cites to 65 FR 35521), it could be workable. However, manufacturers should have the opportunity to review any plan proposed by Alaska and be assured that it precludes the possibility of any misfueling.

The Alliance of Automobile Manufacturers also commented that our proposed transition period may lead to misfueling, and this concern could affect manufacturers' plans for selling new technology vehicles in Alaska. It indicated that our proposal to not base any vehicle or engine recall on emissions exceedances caused by the use of high-sulfur (>500 ppm) fuel in Alaska during the transition period would be helpful, but would not eliminate the added costs and consumer inconvenience of addressing warranty and performance problems should misfueling occur. The Alliance indicated a willingness to help Alaska adopt and implement a plan to deliver low sulfur diesel fuel throughout the state as quickly as possible.

Phillips Petroleum commented that, absent actions by the Canadian government to mirror the U.S. standards, the goals of our transition period for Alaska may be compromised. It suggested that we consider the Canadian standards and their impacts as we appropriately consider transition plans for Alaska with its extremely unique geographical and supply/demand situation.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 12**
Phillips Petroleum Company (IV-D-250) **p. 6**
Engine Manufacturers Association (IV-D-251) **p. 27**

(C) Does not support Alaska having an alternative transition plan.

Environmental and health advocates commented that we should ensure that diesel fuel sold in Alaska is as clean as in the other states by the national deadline of 2006 in order to ensure protection of human health and the environment.

Letters:

AK Conservation Alliance (IV-D-349) **p. 1**
Clean Air Coalition (IV-D-322) **p. 1-3**
Clean Air Coalition and AK organizations (IV-D-350) **p. 1**
Northern Alaska Environmental Center (IV-D-223) **p. 1**

Response to Comments 6.6.2(A), (B), and (C):

We agree that Alaska should have the same health and environmental benefits attributed to the new heavy-duty emission standards and low sulfur fuel. The final rule requires that new (2007 and later) heavy-duty highway engines sold in Alaska and the highway diesel fuel for those engines meet the national requirements. However, because of the unique circumstances in Alaska (discussed in Chapter VIII of the RIA), the national schedule for implementing low sulfur diesel fuel has more severe implications on the fuel production and distribution system in Alaska than in the lower-48 states. Fortunately, those same unique circumstances may allow for a unique fuel implementation program in Alaska. Therefore, we are allowing the opportunity for Alaska to develop an alternative transition period to phase in the low sulfur diesel fuel in a manner that minimizes costs, while still ensuring that the new vehicles receive the low sulfur fuel they need. By implementing the program in this manner, the 2007 model year and later vehicles would still achieve the new emission standards, thus achieving the environmental benefits envisioned by the final rule.

We are providing the State an opportunity to develop an alternative low sulfur transition plan, and intend to facilitate the development of this plan by working in close cooperation with the State and key stakeholders (including vehicle and engine manufacturers, refiners, retailers, distributors, truckers, environmental groups, and other interested parties). Among the criteria that are specified for an alternative transition plan for

Alaska is the requirement that the plan ensure that sufficient supplies of low sulfur diesel fuel are available in Alaska to meet the demand of any new 2007 and later model year diesel vehicles. Also, the plan should include measures to prevent contamination and misfueling, including segregation and pump labeling requirements, and those measures should be at least as stringent as those required by the national plan in the final rule. We expect that the transition plan would begin to be implemented at the same time as the national program. However, the State will have an opportunity to determine what volumes of low sulfur fuel will need to be supplied, and in what timeframes, in different areas of the State, and how those volumes may need to increase over time as the demand for the low sulfur fuel grows by increasing numbers of new vehicles. The State may consider an extended transition schedule for implementing the low sulfur program in rural Alaska based on the anticipated penetration of 2007 and later model year vehicles in the remote areas.

The manufacturers and other stakeholders will have an opportunity to assist the State in developing the plan, and to subsequently comment on the plan after the State submits it to EPA for approval. If Alaska submits such a plan to us within one year, and if it provides a reasonable alternative as described in the final rule, we will conduct a rulemaking with notice for public comment. If appropriate after considering the public comments, we will publish a final rule promulgating the new regulatory scheme for Alaska.

We believe that these provisions, along with the public process they allow, will be sufficient to address the concerns raised by the commenters. Regarding the concern about the Canadian diesel fuel sulfur standard (currently 500 ppm sulfur), Canada has publically announced their intention to adopt a highway diesel sulfur standard consistent with our final rule ("Process Begins to Develop Long Term Agenda to Reduce Air Pollution from Vehicles and Fuels", Environment Canada press release, May 26, 2000). But, this concern is not relevant to the narrow issue of an alternative diesel fuel transition plan for Alaska. It is relevant to the larger issue in the final rule implementing the nationwide 2007 and later heavy-duty engine emission standards (see comment 4.6(E)). With or without an alternative fuel-sulfur transition plan for Alaska, 2007 and later heavy-duty vehicles will be driven between the lower-48 states and Alaska through Canada. Nevertheless, we do intend to closely track Canada's efforts in implementing its low sulfur diesel fuel program.

Issue 6.6.3: Extending Current 500 ppm Exemption

(A) Supports extending the current 500 ppm exemption.

EPA should ensure that the exemption from the 500 ppm sulfur requirement remains in effect during the transition to the 15 ppm sulfur requirement. Since Alaska is not currently implementing the 500 ppm diesel fuel sulfur standard, EPA should allow for a single transition to the new 15 ppm standard to minimize refinery impacts and costs. Williams Energy Service commented on the special challenges faced by Alaska in implementing a low sulfur requirement (see Chapter VIII of the RIA), and referenced an earlier letter by the Alaska Trucking Association (Williams erroneously cited the *American* Trucking Association) stating that the new engine technology, i.e., the technology designed to meet the 2004 emission standards, may not reach Alaska in significant numbers for 10 years.

Letters:

AK Department of Environmental Conservation (IV-D-236) **p. 2**
Petro Star Inc. (IV-D-216) **p. 3**
Williams Energy Services (IV-D-167) **p.1-4**

(B) Does not support extending the current 500 ppm exemption.

The Engine Manufacturers Association commented that we should not extend Alaska's temporary exemption beyond 2002. Emission control systems used on engines and vehicles introduced into the marketplace beginning as early as 2002 to meet the 2004 standards not only will likely fail to meet those standards if operated on exempted diesel fuel with sulfur content greater than 500 ppm, but also will experience serious operational problems, and in some cases could fail completely.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 23**

Response to Comments 6.6.3(A) and (B):

The impacts to Alaska's fuel distribution system of implementing a low sulfur requirement for highway diesel fuel would likely occur whether we require the current 500 ppm standard or the new 15 ppm standard. The impacts to Alaska's refineries and fuel importers are greater at 15 ppm than at 500 ppm. It is likely that the refiners and fuel importers would have a significant incremental impact if we required Alaska to implement the 500 ppm sulfur standard in 2004 when the current exemption expires, and the 15 ppm sulfur standard in 2006 when the new national requirement becomes effective, rather than only once for the 15 ppm sulfur standard in 2006. (See Chapter VIII of the RIA)

The Engine Manufacturers Association correctly points out that emission control systems used on engines and vehicles introduced into the marketplace beginning as early as 2002 to meet the 2004 standards not only will likely fail to meet those standards if operated on exempted diesel fuel with sulfur content greater than 500 ppm, but some may also experience serious operational problems. We must balance this concern against the cost of the low sulfur (500 ppm) fuel in Alaska, and the relatively low expected exposure of 2004 technology engines and vehicles to high sulfur fuel during this interim period. As Williams Energy Services pointed out, the Alaska Trucking Association (ATA) previously wrote a letter (public Docket A-96-26, IV-D-43) indicating its concern over the cost of the fuel. The ATA stated that the impact of high sulfur fuel on new technology engines (designed to meet the 2004 emission standards) does not rise to the level of offsetting the cost involved in mandating the use of 500 ppm sulfur fuel at any time in the near future. According to the ATA, common use of that technology will probably not occur until sometime after the year 2010 in Alaska. Further, the ATA indicated the investment required for a new diesel engine is not going to be made without the availability of the proper fuel to run that engine. ATA members believe that the market will provide fuel for those new engines as needed, and there is no reason to have a mandate from the EPA or State. We agree that the use of high sulfur fuel with the 2004 technology engines and vehicles would likely require more maintenance with associated added cost. However, we also concur that, based on the assessment of the State of Alaska, the refiners in Alaska, and the Alaska Trucking Association, that the added cost of more maintenance on the 2004 technology engines and vehicles does not warrant a mandate for 500 ppm sulfur fuel in the State beginning in 2004, when the current exemption expires.

Consequently, we are extending the existing temporary exemption from the current sulfur standard of 500 ppm for the areas of Alaska served by the Federal Aid Highway System to the effective date for the new 15 ppm sulfur standard. While Alaska submitted a petition for a permanent exemption from the 500 ppm standard for these areas, we are not approving that petition. Our goal is to take action on that petition in a way that minimizes costs through Alaska's transition to the new low sulfur program. The cost of compliance could be reduced if Alaska refiners were given the flexibility to meet the low sulfur standard in one step, rather than two steps (i.e., once for the current 500 ppm sulfur standard in 2004 when the temporary exemption expires, and again for the new 15 ppm standard in 2006).

As already discussed, we are allowing Alaska to develop an alternative transition plan for implementing the 15 ppm sulfur program. During such a transition period, it is possible that both 15 ppm sulfur (for 2007 and later model year vehicles) and higher sulfur (for older vehicles) highway fuels might be available in Alaska. To avoid the two-step sulfur program described above during an alternative transition period, we would consider additional extensions to the temporary exemption of the 500 ppm standard beyond 2006 (e.g., for that portion of the highway diesel pool that is available for the pre-2007 vehicles) during Alaska's transition period. We would make a decision on any additional temporary extensions, if appropriate, in the context of the separate rulemaking taking action on the alternative transition plan submitted by Alaska.

Issue 6.6.4: Exemption from Emissions Liability

(A) Supports exemption from emissions liability

The Engine Manufacturers Association commented that the level of protection provided to engine manufacturers under the current exemption for Alaska and the proposal falls short of what is reasonable and necessary. It asserted that the use of high sulfur diesel fuel by an engine should raise a "rebuttable presumption" that the fuel has caused the engine failure, and that EPA should have the burden of rebutting that presumption. It also asserted that the emissions warranty is a regulatory requirement under Section 207, that only EPA has the authority to exclude claims based on the use of high sulfur diesel fuel.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 25-26**

Response to Comment 6.6.4(A):

We understand and concur with the manufacturers' concerns about in-use testing of engines operated in an area exempt from fuel sulfur requirements. Consequently, we affirm that, for recall purposes, we will not seek to conduct or cause the in-use testing of engines we know have been exposed to high sulfur fuels. We will likely screen any engines used in our testing program to see if they have been operated in the exempt area. We believe we can readily obtain sufficient samples of engines without testing engines from exempt areas. In reviewing the warranty concerns of the Engine Manufacturers Association, we have determined that our position regarding warranties, as previously stated and described in the proposal, is consistent with section 207(a) and (b) of the CAA and does not require any new or amended regulatory language to implement.

Issue 6.6.5: Permanent Exemption from Dye Requirement

(A) Supports permanent exemption from dye requirement

The Alaska Department of Environmental Conservation believes it is critical that an exemption from the dye requirement be maintained in order to minimize costs and problems associated with Alaska's unique fuel distribution system, and for rural Alaska to avoid separate fuel storage infrastructure.

Letters:

AK Department of Environmental Conservation (IV-D-236) **p. 1,**

(B) Conditionally supports permanent exemption from dye requirement

The Engine Manufacturers Association commented that the proposed dye exemption should not be problematic, if we also substantially reduce sulfur levels in nonroad diesel fuel. However, if we do not require nonroad fuels to be at sufficiently low sulfur levels, then we should not exempt that fuel from the dye requirement.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 28**

Response to Comments 6.6.5(A) and (B):

Under the existing exemptions, Alaska is exempt from the dye requirements for nonroad fuel and does not have separate fuel storage infrastructure as in the lower-48 states. The costs of complying with the low sulfur diesel fuel requirements could be reduced significantly if Alaska were not required to dye the nonroad fuel. Dye contamination of other fuels, particularly jet fuel, is a serious potential problem in Alaska, since the same transport and storage tanks used for jet fuel (which comprises more than half of Alaska's distillate market) are generally also used for other diesel products, including nonroad diesel products. (This issue is discussed in Chapter VIII of the RIA.) Therefore, we are granting Alaska's request for a permanent exemption from the dye requirement of 40 CFR 80.29 and 40 CFR 80.446 for the entire State.

Regarding the concern about nonroad fuel specifications, we assume that the manufacturers are concerned about sulfur contamination of highway fuels by very high sulfur nonroad fuels, and with misfueling of highway vehicles with very high sulfur nonroad fuels. The final rule does not address nonroad fuel specifications, but we are considering addressing the sulfur levels in nonroad fuel in a future separate rulemaking.

Even though Alaska will be exempt from the dye requirements for nonroad fuel, the final rule contains specific safeguards to prevent contamination and misfueling. Alaska will be required to comply with all other nationwide requirements designed to prevent misfueling and contamination. It will also be required to comply with some special requirements. For example, the high sulfur nonroad fuel must be segregated from the highway fuel to prevent contamination and misfueling. On each occasion that any person transfers custody or title to the fuel, except when it is dispensed at a retail outlet or wholesale purchaser-facility, the transferor must provide to the transferee a product transfer document complying with the requirements of § 80.462(a) and (d) and stating that the fuel is for use only in Alaska and is not for use in highway vehicles. Any pump dispensing the fuel must comply with the labeling requirements in 80.453(c). The pump label must designate the fuel as nonroad fuel, and must warn that the fuel may damage or destroy highway engines and their emission controls, and that Federal Law prohibits use of the fuel in any highway vehicle.

Issue 6.7: US Territories

(A) American Samoa, Guam, and Northern Mariana Islands should be excluded from the cap on diesel fuel sulfur content

The governments of American Samoa and Guam requested that we continue the diesel fuel sulfur content exemption in their territories, based on the economic implications detailed in their 1992 requests for exemption.

Letters:

Governor of Samoa Government (II-G-13)
Environmental Protection Agency of Guam (IV-G-43)

(B) American Samoa, Guam, and Northern Mariana Islands should be included in the cap on diesel fuel sulfur content

The Engine Manufacturers Association and Detroit Diesel Corporation commented that we should not provide any exemption from the low sulfur (15 ppm) diesel fuel. The Engine Manufacturers Association indicated that the three territories import all the diesel fuel they use, and low sulfur fuel can be imported as easily as can 500 ppm sulfur diesel fuel. The use of low sulfur fuel will ensure the durability and emissions performance of engines used in three the territories. However, if low sulfur fuel cannot be made reasonably available, we should put requirements in place to assure that sulfur in diesel fuel is capped at 500 ppm.

Both commenters expressed concern that product availability in the three territories is likely to become very limited in the long term under an exemption. As time goes by, manufacturers will phase out older on-highway engines that can tolerate higher levels of fuel sulfur and will only be producing engines which require low sulfur fuel. Detroit Diesel commented that, to avoid disruptions and ensure the continued viability of reliable transportation systems in the three territories, we should treat them the same as the fifty states and not provide any exemptions. But, if we determine that exemptions are necessary for the three territories, the proposed exemptions should be temporary measures of no more than five years duration. Further, to maximize the availability of engines, both commenters suggested that uncertified engines be allowed during the exemption period.

The Alliance of Automobile Manufacturers (Alliance) commented that the proposal to exempt these territories from the heavy-duty vehicle emission standards and the low sulfur fuel standard fails to help the Alliance members who may want to sell light-duty diesel vehicles there. Like everywhere else, the people of these areas deserve to have access to the latest technologies, but the Alliance members will be unable to sell these technologies without the cleaner fuel. The Alliance suggests that, if we were to exempt light duty diesel vehicles from Tier 2 emission standards until cleaner fuel became available, then the three territories could at least benefit from some of the new technologies.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 12**
Detroit Diesel Corporation (IV-D-276) **p. 7-8**
Engine Manufacturers Association (IV-D-251) p. **27-28**

Response to Comments 6.7(A) and (B):

As when the 500 ppm sulfur standard was implemented in 1993, we believe that compliance with the new 15 ppm sulfur standard would result in relatively small environmental benefit, but major economic burden for these territories (57 FR 32010, July 20, 1992 for American Samoa; 57 FR 32010, July 30, 1992 for Guam; and 59 FR 26129, May 19, 1994 for CNMI). We recognize there would be impact to vehicle owners and operators if new engine and emission control technologies were run using high-sulfur fuel. We believe that for the sulfur exemption to be viable for vehicle owners and operators, they would need access to either low sulfur (15 ppm) fuel or vehicles meeting the pre-2007 HDV emission standards that could be run on high-sulfur fuel without significant engine damage or performance degradation.

Contrary to the implications of the Engine Manufacturers Association's comments, importing 15 ppm sulfur diesel fuel (or 500 ppm sulfur diesel fuel, as suggested by the Engine Manufacturers Association as an alternate strategy) would be more expensive than the exempt fuel currently being imported. These U.S. territories are islands with limited transportation networks. Combined, these three territories have only approximately 1300 registered diesel vehicles. Diesel fuel consumption in these vehicles represents just a tiny fraction of the total diesel fuel volume consumed on these islands; the bulk of diesel fuel is burned in marine, nonroad, and stationary applications. Most fuel is currently imported from East Rim nations, although some is imported from Hawaii. This exempt fuel currently has no sulfur cap, and is less expensive than current 500 ppm sulfur diesel fuel. In addition, compliance with 15 ppm (or alternatively 500 ppm) sulfur requirements for highway diesel fuel would require construction of separate storage and handling facilities for small quantities of a unique grade of diesel fuel for highway purposes, or use of the low sulfur diesel fuel for all purposes to avoid segregation. Either of these alternatives would significantly add to the already high cost of diesel fuel in these territories, which rely heavily on United States support for their economies. (See Chapter VIII of the RIA)

The final rule excludes American Samoa, Guam and the Commonwealth of Northern Mariana Islands from the new diesel fuel sulfur requirement of 15 ppm and the 2007 heavy-duty diesel vehicle and engine emissions standards, and other requirements associated with those emission standards. The three territories will continue to have access to 2006 heavy-duty diesel vehicle and engine technologies, at least as long as manufacturers choose to market those technologies. We will not, however, allow the emissions control technology in the three territories to backslide from those available in 2006. If, in the future, manufacturers choose to market only heavy-duty diesel vehicles and engines with 2007 and later emission control technologies, we believe the market will determine when and if the three territories will make the investment needed to obtain and distribute the low sulfur diesel fuel necessary to support these technologies.

This exclusion from emission standards does not apply to light-duty diesel vehicles and trucks because gasoline vehicles and trucks meeting the emission standards and capable of fulfilling the same functions will be available. We believe that the market will determine when and if having access to new light-duty diesel technologies in the three territories, in place of or in addition to gasoline technologies, is important enough to obtain and distribute the low sulfur diesel fuel needed to support those technologies.

ISSUE 7: ENGINE/VEHICLE MANUFACTURER REQUIREMENTS

Issue 7.1: Certification Fuel

(A) In order to improve measurement accuracy, EPA should limit the range of allowable sulfur to ultra-low levels.

(1) EPA should allow the use of zero sulfur fuel for engine certification and SEA testing. The proposed upper sulfur limit of 15 ppm (under the full-range approach) actually represents an atypical fuel and should not be used to specify the certification fuel. In addition, the 7-10 ppm range is above the average. EPA should allow the minimum sulfur to drop to zero since it is currently unknown what the actual in-use levels will be within the allowable range.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 17**
DaimlerChrysler (IV-D-344) **p. 17**

(2) EPA should limit the range of allowable sulfur to the 7-10 ppm level, which will result in certification test results that better reflect in-use emissions.

Letters:

International Truck & Engine Corp. (IV-D-257) **p. 32**

Response to 7.1(A):

We agree with manufacturers that measured emissions are affected by the properties of the fuels specified for emission testing. Our specifications are intended to represent most typical fuels that are commercially available in use. Because we are lowering the upper limit for sulfur content in the field, we are specifying a new range of allowable sulfur content for testing. We are setting the maximum sulfur content at 15 ppm. We are setting the minimum sulfur level for the test fuel at 7 ppm because we believe that it will be relatively rare for fuel to sulfur lower than this when dispensed into a vehicle. We expect refiners to target 7 ppm as an average value, to allow sufficient margin to account for the effects of mixing and potential contamination during distribution. It would not be appropriate to allow manufacturers to use lower sulfur test fuel. We believe that this range will represent the most typical in-use fuels.

(B) EPA should adjust the allowable cetane levels, aromatics, and poly-aromatic limits of certification fuel to ensure that it will be representative of the fuel that is available in actual use.

(1) Test fuel specifications are intended to represent fuels that are commercially available and with respect to low sulfur fuel, it can be expected that there will be improvements in other fuel properties when the sulfur level is lowered.

Letters:

International Truck & Engine Corp. (IV-D-257) **p. 31**

Response to 7.1(B):

We believe that it is possible that lowering the sulfur content of in-use fuels could also change other fuel properties, as the manufacturers have suggested. However, we also believe that any changes that occur will likely be relatively small. Thus we believe that our current specifications for non-sulfur properties, which were set broadly to allow a range of representative fuels, are adequate. It is important to emphasize that we are committed to the principle that test fuels need to be fully consistent with in-use fuels. We will continue to monitor this issue. Should it become clear that the specifications being finalized are not consistent with in-use fuels, we will take appropriate action.

(C) EPA should assure that the same fuel used for certification of an engine family is available and used for in-use confirmatory testing of that engine family.

(1) Manufacturers do not control the fuel used for in-use confirmatory testing and should not be held liable for potential exceedances of the standards in-use based on improper or off-specification fuel. If EPA adopts a 5 ppm diesel sulfur cap standard, manufacturers could be reasonably assured that the proper fuel would be available for testing an engine family's performance in-use. If EPA insists on finalizing a 15 ppm diesel fuel sulfur cap, EPA should allow in-use testing to be conducted using the average fuel available nationwide, not on any fuel up to the 15 ppm cap.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 22**

Response to 7.1(C):

Beginning in the 2007 model year, the same specifications would apply to all emission testing conducted for Certification and Selective Enforcement Audits, as well as any other engine testing for compliance purposes. To extent practical, we expect to use fuel meeting these specifications that is most typical of in-use fuel. However, we retain the authority to modify by rulemaking the fuel allowable for in-use field testing. It is likely that we would consider such modifications in any future rulemaking that establishes specific in-use field test procedures.

(D) Manufacturers should be able to use biodiesel for certification purposes.

(1) Since biodiesel is not specifically mentioned in EPA's proposed rule, the ability of an engine company to certify emission levels with biodiesel to take advantage of emissions credits for ABT is unclear. It is also unclear whether the exemptions provided for diesel engine certification for CO, formaldehyde, and evaporative emissions would also apply to engines certified on biodiesel. EPA should explicitly address this issue.

Letters:

National Biodiesel Board (IV-D-288) **p. 3-4**

(2) EPA should consider additional options that would encourage adoption of biodiesel through reduction of certification costs for biodiesel. EPA should waive the certification fee costs for biodiesel as well as the NTE and SS State testing requirements proposed for petrodiesel, and should base certifications for biodiesel solely upon the required FTP test data.

Letters:

National Biodiesel Board (IV-D-288) **p. 4**

Response to 7.1(D):

Our regulations allow manufacturers to request the use of fuels other than those specified, but only with advance approval from EPA. The test fuel regulations being finalized are not changing this allowance. Thus a manufacturer could certify an engine using a biodiesel fuel, but only if the manufacturer could demonstrate that the biodiesel fuel is the fuel that the engine would actually be operated on in use. We do not believe that biodiesel should receive special exemptions. However, the regulations are being revised to clarify that the CO data waiver applies for all diesel-cycle engines. There are no evaporative or formaldehyde standards for biodiesel, so no exemption is necessary.

Issue 7.2: ABT

Issue 7.2.1: Family Emission Limit (FEL) Caps

(A) Supports the use of NO_x and PM credits rounded to 0.01 megagram.

(1) This change allows a greater degree of precision and is consistent with the order of magnitude reduction in the emission standards.

Letters:

Cummins, Inc. (IV-D-231) **p. 49**
Engine Manufacturers Association (IV-D-251) **p. 70**

Response to Comment 7.2.1(A):

We agree with the comments.

(B) The ABT FEL caps must be set at the levels of the previous standards.

(1) Setting the ABT emission caps at the level of the previous standards would be consistent with EPA's previous ABT program and would allow manufacturers to carry over a very limited number of engines that otherwise could not be certified at the new standards or could only be done so at

excessive costs. The 2004 standards are very stringent and represent the limits of emission reductions that engine manufacturers will be capable of achieving. There are limitations on the number of emission credits that could be generated which will limit the usage of credits under the new program irrespective of FEL caps.

Letters:

Cummins, Inc. (IV-D-231) **p. 49**
Engine Manufacturers Association (IV-D-251) **p. 71**

(2) EPA's concern that without the stringent FEL caps, manufacturers could use the ABT program to unnecessarily delay the introduction of exhaust emission control technologies, is unfounded and their proposed solution is counterproductive. Setting the FEL caps for 2007 compliant engines at the level of the previous standards (2.5 g/bhp-hr NO_x + NMHC and 0.10 g/bhp-hr PM) will provide the greatest incentive for low emission technology and would provide the greatest flexibility in complying with the extremely stringent standards.

Letters:

Detroit Diesel Corporation (IV-D-276) **p. 19**

Response to Comment 7.2.1(B):

We agree with the commenters that we have generally set the FEL caps at the emission levels allowed by the previous standard. However, there have been cases when we did not do this. For example, the FEL cap for NO_x+NMHC emissions from 2004 and later HDDEs (§86.004-11) is 4.5 g/bhp-hr. This is lower than the sum of the previous HDDE standards for NO_x (4.0 g/bhp-hr) and HC (1.3 g/bhp-hr). In this particular case, where the standards are being reduced by an order of magnitude, we believe that special consideration is appropriate. In the NPRM for this rulemaking, we proposed FEL caps that were lower than the previous standard, because we wanted to ensure that manufacturers did not continue to produce old-technology high-emitting engines under the new program. While we continue to support this goal, we now believe that the proposed low FEL caps are not needed for NO_x during the transition period. We believe that the other provisions of the NO_x ABT program will sufficiently address this goal. Thus, in this FRM, we are finalizing interim FEL caps for NO_x (for HDDEs and HDGEs,) that are consistent with the levels allowed by the previous standards. We are, however, adopting the proposed FEL NO_x caps for future years. We believe that it would not be appropriate to have long-term FEL caps that allowed some engines to indefinitely have emissions as high as ten times the level of the standard. When compared to the 0.20 g/bhp-hr NO_x standards, the long-term FEL caps of 0.50 g/bhp-hr for HDDEs and HDGEs are more consistent with FEL caps set in prior rulemakings.

We are also adopting the proposed FEL cap for PM emissions from HDDEs for all years. Specifically, model year 2007 and later diesel engines will not be allowed to have PM emissions higher than 0.02 g/bhp-hr. The PM cap is being set lower than the previous standard of 0.10 g/bhp-hr, in connection with the absence of the kind of restrictions on the use of PM credits that are being set for NO_x credits. Without those restrictions, we believe that it is necessary to set a lower FEL to prevent the possibility of PM credits being used to delay the implementation of the program and its benefits. We believe that the manufacturers' argument that few credits would be available prior to the introduction of the new fuel is not correct for PM. It is possible that diesel oxidation catalysts (DOCs) with relatively low precious metal content could be used with HDDEs before the introduction of the new fuel, and could generate a meaningful amount of PM credits. In fact, we believe that the ABT program will encourage some manufacturers to make greater use of DOCs to generate credits that they could use later to provide for slightly larger compliance margins for their trap equipped engines.

(C) The ABT program should be based on family emission limits as a percentage of the standard.

(1) EPA should allow cross-program trading with credits and debits calculated as a fraction of the standard rather than in absolute mass emission terms (which would address the potential negative air quality effects of trading credits between the "2004" and "2007" program vehicles). By referencing credits relative to the standards under which they were generated, EPA can preserve the ABT program's flexibility while also ensuring that the program does not result in emission increases.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 82**

Response to Comment 7.2.1(C):

See response to comment 7.2.4(D).

(D) ABT FEL caps should be separated based on GVWR.

(1) Commenter provided no further analysis or supporting documentation.

Letters:

CA Air Resources Board (IV-D-203) **p. 7**

Response to Comment 7.2.1(D):

We agree and have changed the FEL caps for complete vehicles.

Issue 7.2.2: Averaging Sets

(A) Opposes EPA's proposed averaging set restriction on ABT credit usage since this restricts flexibility and does not provide any environmental benefit.

(1) Even with EPA's phase-in approach, there is no legitimate rationale for the averaging set restriction. Because the engines from both the 2004-2006 set and the 2007 set would be operating in the fleet concurrently and because averaging credit exchanges are inherently environmental neutral, there can

be absolutely no adverse air quality impacts from allowing credits to be exchanged between the two groups of engines. EPA should not place restrictions on the ABT program simply as a means to mandate use of a specific emission control technology.

Letters:

Detroit Diesel Corporation (IV-D-276) **p. 19-20**

(B) EPA should use separate averaging sets during the phase in period for those vehicles which have and those which haven't yet been phased in.

(1) Commenter provided no further analysis or supporting documentation.

Letters:

CA Air Resources Board (IV-D-203) **p. 7**

Response to Comments 7.2.2(A) and (B):

Our ABT program allows us to lower emission standards and achieve greater emission reductions than would be possible otherwise, because ABT reduces the costs and improves the ability of manufacturers to meet the standards. Therefore, we proposed to continue the basic structure of the existing ABT program for heavy-duty engines. We also proposed some significant restrictions to prevent manufacturers from producing very high-emitting engines, jeopardizing the environmental benefits of the program, and unnecessarily delaying the transition to the new exhaust emission control technology. We do agree with those commenters that observed that we proposed more restrictions than we have set in past ABT programs. However, we do not agree that we are required by precedent to extend the existing ABT provisions to 2007 and later engines. While we understand the manufacturers' desire for EPA to continue precedents set with the 2004 diesel engine standards, we believe that each new ABT program must be considered in the context of the standards with which it would associated. Nevertheless, in developing the final ABT program, we did consider both the existing provisions and the many comments that we received. In response to those comments, we have modified the ABT program that was proposed to make it more useful to manufacturers. We have reduced the restrictions as much as possible without compromising the goals of this rulemaking. We believe that the final ABT program will provide the flexibility that the manufacturers have stated they will need to comply with the new standards.

We proposed separate averaging sets during the phase-in period: one for engines certified to the 2.5 g/bhp-hr NOx+NMHC standard, another for engines certified to the 0.20 g/bhp-hr NOx standard. We did that primarily to achieve the goals of the phase-in, but secondarily because of concerns related to the inherent difference between NOx+NMHC credits and NOx credits. After reconsidering the entire ABT program, we now believe that we should allow manufacturers to transfer credits across these averaging sets, with some restrictions. Under the final regulations, manufacturers could use credits generated during the phase-out of engines subject to the 2.5 g/bhp-hr NOx+NMHC standard to comply with the 0.20 g/bhp-hr NOx standard, but these credits will be subject to a 20 percent discount. (Each gram of NOx+NMHC credits from the phase-out engines would be worth 0.8 grams of NOx credits in the new ABT program.) This discount reflects the fact that the change from our proposed ABT program provides manufacturers with substantial flexibility in meeting the standards. The flexibility will allow manufacturers to reduce fleetwide emissions more than would have been possible with the proposed program. Manufacturers will be able to reduce emissions for a substantial percentage of their production, reflecting the use of low-NOx technologies, without being required to produce a full 50 percent of their production with NOx emissions at or below 0.20 g/bhp-hr. This will give manufacturers a greater opportunity to gain experience with the low-NOx technologies before they are required to meet the final standards across their full production.

We recognize that NOx+NMHC credits are not the same as NOx-only credits. However, we are less concerned about the differences now because of the low NMHC levels that are expected from 2004-2006 diesel engines (probably about one-tenth of the expected NOx levels) and because of the 20 percent discount that would be applied to the credits if they are transferred into the new NOx ABT program.

More specifically, there are three areas affecting the environmental integrity of the program which support the inclusion of the 20 percent discount in the provisions for converting NOx+NMHC credits to NOx credits. First, the discounting addresses the fact that NMHC reductions can provide substantial NOx+NMHC credits, which are then treated as though they were NOx credits. For example, a 2006 model year engine emitting at 2.2 g/bhp-hr NOx and 0.3 g/bhp-hr NMHC meets the 2.5 g/bhp-hr NOx+NMHC standard in that year, but gains no credits. In 2007, that engine, equipped with a PM trap to meet the new PM standard, will have very low NMHC emissions because of the trap, an emission reduction already accounted for in our assessment of the air quality benefit of this program. As a result, without substantially redesigning the engine to reduce NOx or NMHC, the manufacturer can garner a windfall of nearly 0.3 g/bhp-hr of NOx+NMHC credit for each of these engines produced. (Engines designed at lower NOx levels than this in 2006 can gain even more credits.) Allowing these NMHC-derived credits to be used undiscounted to offset NOx emissions on the phase-in engines in 2007 (for which each 0.1 g/bhp-hr of margin can make a huge difference in facilitating the design of engines to meet the 0.20 g/bhp-hr NOx standard) would be inappropriate. Similar arguments apply to the discounting of banked diesel NOx+NMHC credits and of gasoline engine NOx+NMHC credits.

Second, the more flexible ABT program being adopted in the final rule, by allowing emission reductions from one engine to offset increased emissions on another, possibly very different, engine, introduces uncertainty on a number of fronts with regard to whether that offset is truly balanced. For example, to facilitate the phase-in to the new standards, we allow the use of credits generated from large engine to show compliance on smaller engines during the phase-in years, or vice-versa. Uncertainty is also introduced in the transferring of credits from one technology regime such as EGR-based control, to another regime such as control based on exhaust emission control devices, especially considering the order-of-magnitude change in emission levels involved. In addition, the allowance for gasoline vehicle credits to be used on gasoline engines introduces uncertainty with respect to differences in such key items as test procedures, vehicle loadings, typical vehicle sizes, and in-use emissions control programs. These uncertainties cannot be removed simply through the development of accurate credit adjustment factors, because there are too many variables and unknowns. One alternative in dealing with these uncertainties would be to restrict credit usage only to closely matched engine configurations. Instead, we believe that the flat 20 percent discount factor is the appropriate means of providing the enhanced ABT program flexibility in the final rule without adding undue calculational and tracking complexity, or making the environmental benefit of the overall program uncertain.

Third, the discounting works toward providing a net environmental benefit from the ABT program, such that the more that manufacturers use banked and averaged credits, the greater the potential emission reductions overall. This is a critical element of the legal justification of the program. Under Section 202(A)(3) of the Clean Air Act, our standards must "reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology." The revisions to the ABT program in the FRM provide considerable flexibility for manufacturers. To the extent it is used, this flexibility allows manufacturers to obtain lower fleet average emissions than would have been possible under the proposed ABT program. The 20 percent discount ensures that EPA is meeting its requirement to promulgate standards that "reflect the greatest degree of emission reduction achievable".

See also response to comment 7.2.3(A).

Issue 7.2.3: Banking

(A) Opposes the proposed restrictions on the use of credits generated in model years prior to 2007.

(1) The banking program is intended to be used to ease the transition to new, more-stringent standards. EPA's proposal to prohibit the use of credits generated by engines meeting the 2006 or earlier standards for use on engines certifying to the 2007 standards contradicts this intention. The proposed restrictions also remove any ABT incentive for manufacturers to introduce any new technology to reduce emissions below the standard(s) during the 2004-2006 time period and actually would encourage the production and sale of higher-emitting engines in that time frame or order to use up any credits they have generated. EPA's proposed restrictions reneges on EPA's guarantee provided in the existing regulatory language that states "NO_x plus NMHC and PM credits from diesel cycle HDE families do not expire" (Section 86.004-15(f)(2)). EPA cannot retroactively change the rules under which manufacturers have operated and to do so would deprive the manufacturer of property without due process.

<u>Letters:</u>

Cummins, Inc. (IV-D-231) **p. 46-48, 55**
Detroit Diesel Corporation (IV-D-276) **p. 17-19**
Engine Manufacturers Association (IV-D-251) **p. 68-69**
International Truck & Engine Corp. (IV-D-257) **p. 17-19**

(2) EPA has engaged in an illegal and unconstitutional taking of engine manufacturers' property and other rights by eliminating the life of averaging, banking and trading credits which were guaranteed by EPA not to expire in its prior rulemaking on the 2004 standards.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 86**

(3) EPA's proposal to allow the use of banked NO_x and NMHC credits that are "generated from engines that meet all of the stricter standards early" is meaningless because manufacturers could not design engines to meet the proposed NO_x standard without the availability of low sulfur diesel which will not occur until 2006. In addition, EPA's apparent concern that the ABT credits could result in delayed application of the NO_x adsorber is unfounded. ABT credits will help assure the success of the NO_x adsorber during its in-use maturation period.

Letters:

Detroit Diesel Corporation (IV-D-276) **p. 17-19**
International Truck & Engine Corp. (IV-D-257) **p. 18**

(4) EPA's proposal also creates fairness problems because NO_x and NMHC credits generated and banked before 2007 will be completely useless after 2010. There will be no market for those credits since all new HDEs would be certified to the NO_x standard at that time. These credits should not be effectively eliminated simply because the standards become more stringent.

Letters:

International Truck & Engine Corp. (IV-D-257) **p. 18**

(5) To allow manufacturers to generate early credits, EPA should permit credits generated against the "2004" standards to be carried over and used in the "2007" standards program and should permit early certification of low emitting engines to the 2007 standards using the low sulfur fuel being proposed in this rule. Early credits generation programs serve as important voluntary programs under which a manufacturer can introduce low-emitting engines earlier than required and would be particularly beneficial to manufacturers in the context of the stringent "2007" standards. Credits developed during the "2004" program should not be restricted from use in later years (i.e. as "early reductions" under the proposed rule). This restriction would essentially remove the incentive for early engine introductions. Trades between the "2004" program engine families and the "2007" program engines would provide a net benefit to the environment if the credits are referenced to the standard under which they are generated.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 81-82**

(6) Any delays in the introduction of advanced NO_x aftertreatment controls as a result of allowing credits to be traded between the "2004" and "2007" programs will be limited since the "2007" standards are so low as compared

to the "2004" standards. The sales of just a few engines certified at "2004" standards when the "2007" standards are in effect would require an extremely large number of credits to be used. Because the proposed standards are 90 percent lower than the "2004" standards, the manufacturer would have to use credits representing overachievement of the standard by 90 percent for each vehicle sold without advanced NO_x control equipment. In addition, receiving an early emission reduction that is ten times the later offsetting overage is a definite benefit to the environment. Such trades will result in large overall reductions in emission and an improvement in air quality compared to a scenario where there is no cross-program trading allowed.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 83**

Response to Comment 7.2.3(A):

We have revised the ABT program in the final rule in response to comments. We have decided to allow the unlimited use of banked PM credits. After considering the comments, we believe that the FEL cap for PM, being adopted in the final rule as proposed, is sufficient to address our concerns over the use of banked PM credits. We have also decided to allow the use of banked NOx+NMHC credits generated from engines certified to the 2.5 g/bhp-hr NOx+NMHC standard for engines subject to later standards. However, we do not agree with the comments suggesting that such use should be unlimited for NOx+NMHC credits. We believe that it is necessary to discount the credits by 20 percent when they are converted to NOx credits for the new program, for reasons discussed above in the response to 7.2.2(A).

We also believe that it is necessary to set an upper bound on the number of higher-emitting engines on which a manufacturer could use such banked NOx+NMHC credits to demonstrate compliance with the 0.20 g/bhp-hr NOx standard during any one model year. The upper limit is ten percent of the manufacturer's U.S.-directed annual production of engines certifying with NOx FELs above 0.50 g/bhp-hr. This limit is necessary to prevent manufacturers from loading up credits from engines designed to the relatively much less stringent 2004 model year standards, and thus delaying their compliance with the new standards by using a large number of banked credits into the first year of the phase-in (or longer). This kind of delay would be contrary to the goals of the phase-in, which is designed to facilitate the transition to high-efficiency NOx technologies when low-sulfur fuel becomes widely available.

During the critical phase-in years, the 10 percent restriction actually corresponds to 20 percent of the phase-in engine production, because the phase-in requirement is 50 percent of total production. Because the NOx FEL cap in these years is 2.0 g/bhp-hr, these engines can actually emit at levels nowhere near the new standard, and thus are not likely to contribute to the goal of the phase-in (facilitating the introduction of the new technology). Furthermore, the 10 percent restriction must be viewed in the context of the averaging provisions of the ABT program. The 90 percent of total production that must be certified without the use of banked credits consists of 40 percent certified to the new 0.20 g/bhp-hr NOx standard and 50 percent certified to the 2.5 g/bhp-hr "phase-out" standard. However, emissions from these engines can be averaged. A looser restriction on the use of banked credits, say 20 percent, would heavily skew the balance toward the high-emitting end, allowing the mix of new and old technology engines to shift from a fairly balanced 40-50 ratio to a 30-70 ratio (the 70 percent consists of 20 percent at 2.0 g/bhp-hr NOx via banked credits plus 50 percent at 2.5 g/bhp-hr NMHC+NOx via the phase-out schedule). Considering the ABT program averaging opportunity, the confidence of broad new technology introduction becomes even more diminished and uncertain because of the relatively small percentage of "credit-using" engines needing to demonstrate compliance with the new NOx standard. Given enough banked credits, this technology delay could drag out through at least 2009. We believe that this restricted allowance does ensure that banked NOx+NMHC credits will continue to have value when the new standards go into effect, thus addressing the manufacturers concerns, while at the same time not jeopardizing the environmental benefits of the program.

We disagree with comments that restrictions on the banking of credits deprives manufacturers of property rights. The ABT program does not create any property rights. It is a regulatory program that can be changed through normal notice-and-comments procedures. The only guarantee in a regulation is the guarantee that the regulation will not be changed other than through notice-and-comment rulemaking. EPA has engaged in such rulemaking to revise the program. Nor is this change at all "retroactive." The provisions to which manufacturers object do not even take affect until the 2007 model year, at least five years from today.

Finally, EPA understands that the majority of engines built prior to model year 2007 will not be designed to meet the more stringent standard especially given the relative unavailability of low-sulfur fuel. However, EPA believes that some engines may be designed to the more stringent standards early in order to meet particular customer needs, for example, if a centrally-fueled fleet were using low-sulfur fuel for its heavy-duty engines and wished to use early-complying engines. We believe that the population of engines meeting the 2007 model year standards early will increase as we approach the date when the requirements for low sulfur diesel fuel become effective.

(B) Supports the elimination of discounts and the limitations on credit life.

(1) EPA should retain the practice of not discounting credits and placing no limits on credits life. This increases flexibility and encourages the development and use of low-emission technology earlier than would otherwise be required. However, in this context, commenters reiterated their concern regarding the limitations associated with credits generated prior to 2007 and recommended that this limitation be eliminated.

<u>Letters:</u>

Cummins, Inc. (IV-D-231) **p. 49**
Engine Manufacturers Association (IV-D-251) **p. 70**

<u>Response to Comment 7.2.3(B):</u>

See responses to comments 7.2.2(A) and 7.2.3(A).

Issue 7.2.4: Other ABT Issues

(A) Opposes the proposed prohibition on credit exchanges between phase-in and phase-out engines during the optional NO_x phase-in period.

(1) EPA's proposed restriction removes flexibility without providing any environmental benefits. The concerns that such flexibilities could be used to delay the introduction of the NO_x aftertreatment technology are completely unfounded and unsupported by any data or analysis. EPA has always set upper limit caps on the use of credits at the previous emission limit, which would serve to assure that existing engine performance is not degraded because of ABT credits. Commenters support this approach and note that having this type of ABT flexibility available to manufacturers will provide the necessary additional time to refine the technology needed to achieve optimum emission control but would prevent delayed introduction of NO_x aftertreatment technology. EPA should design an ABT program that allows full credit exchange among engine families meeting pre-Interim, Interim and Final standards.

Letters:

Cummins, Inc. (IV-D-231) **p. 48**
Engine Manufacturers Association (IV-D-251) **p. 69-70**

Response to Comment 7.2.4(A):

We have revised our ABT program in response to these commenters' concerns. See response to comments 7.2.2 (A) and 7.2.1 (B).

(B) EPA's ABT program will not lead to significant emission reductions in the long term.

(1) Having scores of different, somewhat arbitrarily established engine FELs does not lend itself to a program to encourage states and others to promote or to require the use of ultra-clean engines if they are available. An ABT program is a regulatory compliance strategy for meeting the standards that may result in lower emissions in the early years of the program, only to be offset by higher emissions in the later years and could delay the introduction of new technologies. EPA should not extend the ABT program beyond 2006.

Letters:

Manufacturers of Emission Controls Association (IV-D-267) **p. 10**

Response to Comment 7.2.4(B):

We believe that the ABT program is an important part of the entire program being established in this action. Its primary purpose is not to provide additional emission reductions, but to provide flexibility to manufacturers, and thus to enhance the cost-effectiveness and feasibility of the new standards across a manufacturers entire product line. Nevertheless, we believe the discounts being established will likely provide some small but significant emission reductions.

(C) Opposes an ABT program for mobile sources.

(1) However, if the program were modified in a way that rewarded significant improvements rather than modest incremental adjustments that can encourage gaming, the program would be more attractive and more likely to result in stimulating the introduction of significant advances. California has adopted an approach that rewards emissions levels that are 50 percent lower than the existing standard; this approach appears to be one that EPA should emulate.

Letters:

STAPPA/ALAPCO (IV-D-295) **p. 24-25**

Response to Comment 7.2.4(C):

We disagree. We believe that the ABT program is an important consideration in our determination that the new standards will be feasible. Our ABT program allows us to lower emission standards and achieve greater emission reductions than would be possible otherwise because ABT reduces the costs and improves the ability of manufacturers to . Therefore, we proposed to continue the basic structure of the existing ABT program for heavy-duty engines. Nevertheless, we have modified the program so that it will provide a net environmental benefit and encourage the early introduction of the newer technologies.

(D) Trading between engines and vehicles should be allowed.

(1) The restriction to prohibit trading credits between vehicles and engines is unnecessary since credits are already traded between engines, even though some of these engines are used in complete vehicles. Trading credits between engine-certified and chassis-certified engine families should continue to be allowed. This would provide increased flexibility by allowing manufacturers to minimize the costs of achieving the desired emission reductions and focus their redesign efforts in a model by model basis over a period of several years instead of attempting to redesign all their HD engines in a single year. In addition, the number of engines that will be certified on an engine dynamometer will be extremely limited and most of the Otto-cycle engines will be complete vehicles. Any environmental benefit from this restriction is far outweighed by the additional cost and inconvenience imposed on manufacturers. EPA should propose an exchange rate to allow trading between engines and vehicles even if it is only a default worst-case value that can be modified upon an adequate demonstration by the manufacturer.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 80-81**

(2) EPA has stated in the context of the 2004 standards, that trading between engine-certified and vehicle-certified families is not necessary since the "2004" standards are technically feasible. However, the technology forcing "2007" standards being proposed in this rulemaking represent a very different situation since it is unclear whether EPA's 90 percent reduction in NO_x emissions is even achievable. EPA should maximize the flexibility for manufacturers by allowing trading between engine-certified and vehicle-certified families, particularly since it would not have an adverse impact on the environment.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 81**

Response to Comment 7.2.4(D):

We are making changes to the ABT programs for heavy-duty gasoline engines and vehicles. One of the important changes is that we will allow exchange of credits from the chassis-certified vehicles to engines (and vice versa), subject to a 20 percent discount. We believe that this discount addresses our concerns about the uncertainty in converting between g/mi standards and g/bhp-hr standards. We do not believe that the fraction of the standard approach recommended by General Motors/Isuzu would have addressed this fundamental uncertainty. We will also allow NO_x+NMHC credits from gasoline engines certified to the combined standards (including banked credits) to be used in either of the NO_x-only ABT programs (for engines and for vehicles), also subject to the 20 percent discount. We have decided to not apply this discount for banked or averaged gasoline vehicle credits used within the vehicle ABT program. The existing vehicle ABT program is already a NO_x-only program that uses consistent g/mile standards. In addition, the new emission standards for gasoline vehicles are not expected to require fundamentally new technologies. Thus the reasons that we are applying the discounts in the other cases do not apply for NO_x credits exchanged between complete gasoline vehicles.

(E) Opposes EPA's alternative proposal to allow credits to be generated from pre-interim standard engines below some threshold emission level and used for engines complying with the interim standards.

(1) Credits earned by reducing emissions from pre-Interim standard engines by any amount should be fully applicable to Interim and later compliant engines. Setting thresholds and applying the deep discounts that a threshold approach involves, discourages the early application of emission control technology - especially technology that cannot achieve the threshold level. ABT programs are intended to provide compliance flexibility and encourage the early use of emission control technology - not to provide a direct emission benefit through discounting or credit expiration schemes.

Letters:

Cummins, Inc. (IV-D-231) **p. 48-49**

Response to Comment 7.2.4(E):

See above response to comment 7.2.3(A).

(F) Expresses general support for EPA's proposed ABT program.

(1) Commenter provides no further supporting information or detailed analysis.

Letters:

National Automobile Dealers Association (IV-D-280) **p. 3**

Response to Comment 7.2.4(F):

See above response to comment 7.2.4(C).

(G) Supports the approach to allow manufacturers to certify vehicles before the implementation date to preserve the ability to produce 2006 vehicles during 2007.

(1) EPA's "pull ahead" approach used under the recent Tier 2 rule where a manufacturer certifying a 2007 level vehicle in 2006 could then produce one vehicle in 2007 that meets only the 2006 standards, should be adopted. In this context, EPA should encourage early adoption of biodiesel for gaining additional pull ahead credits, if applicable.

Letters:

National Biodiesel Board (IV-D-288) **p. 3**

Response to Comment 7.2.4(G):

We agree with this comment in that we are finalizing a pull ahead provision very similar to that finalized in our Tier 2 rule. This provision is discussed in detail in section III.D of the preamble to this rule. Under this provision, manufacturers can take credit for diesel engines certified to the Phase 2 standards prior to the 2007 model year (prior to the 2008 model year for gasoline engines or vehicles) in exchange for making fewer diesel engines certified to these standards in or after the 2007 model year (2008 for gasoline engines or vehicles). In other words, a clean engine sold earlier than required displaces the requirement to sell a similar engine later. For diesel-fueled engines to earn this early introduction credit, they would likely need to ensure that low sulfur diesel fuel would be used. This may not be easy given that the low sulfur fuel requirement does not begin until mid-2006. To the extent that biodiesel can play a role in facilitating use of the early introduction provision, EPA is supportive because we believe the early introduction credit provisions are good for air quality.

(H) Recommends ABT Program be consistent with HD gasoline vehicle standards, in order to encourage the use of the most advanced emission control technology.

(1) EPA should verify calculated credits with actual production quantities.

Letters:

CA Air Resources Board (IV-D-203) **p. 7**

Response to Comment 7.2.4(H):

We believe that our program is consistent. We do verify credits at the end of the year based on actual production quantities.

(I) Supports a provision in the ABT program to allow for additional credits to be generated from the introduction of extra clean models.

(1) Manufacturers may wish to use PuriNO$_x$ fuel as part of a total system to generate ABT program credits. Including such fuel-use credits within the proposed ABT program could provide a very powerful incentive leading to large cost-effective emission reductions well in advance of the proposed effective dates.

Letters:

Lubrizol Corporation (IV-G-49), p. 5-7

Response to Comment 7.2.4(I):

We are finalizing a provision granting extra credits for vehicles certifying to levels below the standards prior to 2007. Beginning in 2007, manufacturers certifying to levels lower than the standards may take advantage of our ABT program to obtain credits for such engines.

Issue 7.3: Chassis Certification

(A) EPA should require chassis-based certification for all heavy-duty complete vehicles, including diesel.

(1) Chassis certification will support the expansion of state efforts to conduct heavy-duty diesel inspection and maintenance programs. Without chassis-based standards, the development of emissions standards for in-use testing will be more difficult to establish.

Letters:

CA Air Resources Board (IV-D-203) **p. 6**
Consumer Policy Institute (IV-D-186) **p. 7**
NESCAUM (IV-D-315) **p. 11**

Response to Comment 7.3(A):

We did not propose to subject complete heavy-duty diesel vehicles to chassis-based standards, although the proposal requested comment on the possibility of allowing or requiring chassis certification. We agree with the commenters that there could be significant advantages associated with certifying diesel vehicles based on a chassis test, and we are allowing diesel-fueled engines below 14,000 pounds to certify to the chassis standards. However, we do not have sufficient information at this time to conclude that *requiring* such chassis-based testing for all complete diesel vehicles would be appropriate at this time, given the considerable burdens such a change would impose on manufacturers.

Issue 7.4: Test Procedures

Issue 7.4.1: Regeneration

(A) EPA should eliminate special provisions for intermittently regenerating aftertreatment devices.

(1) EPA has proposed in section 86.1337-07(d) special provisions for aftertreatment devices that are intermittently regenerated. However, EPA's proposal is unclear, unworkable, and not representative of emissions from such devices. EPA should adopt an appropriate definition of "intermittently regenerating aftertreatment device" which should make clear that the desulfation of a NO_x adsorber would not cause a NO_x adsorber to be classified as an intermittently regenerating device. The proposed language is unclear as to whether the engine must be shut off and restarted during repeat hot cycles and there is no indication of how long the soak period should be. EPA should adopt a single procedure for engines with aftertreatment devices.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 74-75**

Response to Comment 7.4.1(A)(1):

Discrete regeneration events can be important because it is possible for exhaust emissions to increase during the regeneration process. The regeneration of a NO_x adsorber for instance, could result in increased particulates, NMHC and NO_x due to the rich exhaust gas required to purge and reduce the NO_x. We expect that in most cases, the NO_x regeneration events would be sufficiently frequent to be included in the measured emissions. Our feasibility analysis projects very frequent regeneration of the NO_x adsorbers, and continuously regenerating PM traps. Nevertheless, this issue becomes a regulatory concern because it is also conceivable that these emission storage devices could be designed in such a way that a regeneration event would not necessarily occur over the course of a single heavy-duty FTP cycle, and thus be unmeasured by the current test procedure. Since these regeneration events could produce increased emissions during the regeneration process, it will be important to make sure that regeneration is captured as part of the certification testing. However, we agree with the manufacturers that it could be impractical to require that the transient FTP be repeated until a regeneration occurs. Thus, we are not finalizing that provision. We now believe that it would be more appropriate to require manufacturers to use a mathematical adjustment of measured emissions to account for increased emissions during infrequent regeneration or desulfurization events. We would expect that these regeneration events would be controlled by the engine computer, and would thus be generally predictable. This will allow for a relatively simple regeneration factor. This regeneration factor will be applied in a manner similar to manner in which deterioration factors are already used. This will not be a significant burden to the manufacturers.

(2) In their provisions for aftertreatment devices, EPA should make clear that the proposed supplemental emission test and limit requirements - including NTEs and MAELs - do not apply during regeneration.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 75**

Response to Comment 7.4.1(A)(2):

See response to comment 7.4.3(D).

(B) EPA's proposal for addressing regeneration emissions is unacceptable.

(1) EPA's proposal for addressing regeneration emissions oversimplifies the variety of regeneration processes that might occur. Even if all regeneration processes fit into this simple paradigm, there would still be many procedural details to develop such as whether the engine is to be shut off and then restarted during repeat hot cycle, how to establish the length of the soak period after the engine is shut off and restarted, and what to do if the regeneration is not complete at the end of the cycle. EPA's approach overstates the real impact of any regeneration events that would occur. Using the highest emission levels among the numerous repeat hot cycles would not provide representative results. In addition, EPA's proposal would add significant costs to every emissions test and would increase variability in the test results since testing costs would not be contained due to the possibility of numerous cycles before a regeneration event occurs.

Letters:

Cummins, Inc. (IV-D-231) **p. 30-31**

Response to Comment 7.4.1(B):

See response to comment 7.4.1(A)(1).

Issue 7.4.2: OBD

(A) Supports including OBD requirements as part of engine/vehicle certification requirements.

(1) Commenters provided no further supporting information or detailed analysis. This comment was made by approximately 6,700 private citizens.

Letters:

Acoff, Jeffrey, et. al. (IV-G-11)
American Lung Association of Colorado (IV-D-54)

American Lung Association of Los Angeles (IV-D-47)
American Lung Association of Metropolitan Chicago (IV-D-237) **p. 1**
American Lung Association of NJ (IV-D-224) **p. 2**
American Lung Association of OR (IV-D-165) **p. 1**
American Lung Association of Orange County (CA) (IV-D-176) **p. 1**
Arab Community Center for Economic and Social Services (IV-D-112) **p. 1**
Asamoah, Nikiya (IV-D-09)
Bagnarol-Reyes, Carolina, et. al. (IV-G-24)
Braun, Carl and Norma (IV-D-69)
Center for Environmental Health (IV-D-89) **p. 1**
Children's Environmental Health Network (IV-D-244) **p. 4**
Clean Air Agency (IV-D-207) **p. 2**
Clean Air Network (IV-D-292) **p. 2**
Coalition for Sensible Energy, The (IV-D-264) **p. 1**
Connor, Thomas, et. al. (IV-D-132)
DE Nature Society (IV-D-285) **p. 1**
Davidson, Karin, et. al. (IV-D-79)
Dickson, Victoria, et. al. (IV-D-77)
Dolman, Suzanne, et. al. (IV-D-341)
Downtown Community Association (IV-D-118) **p. 2**
Environmental Health Watch (IV-D-212) **p. 1**
Fleming, Scott, et. al. (IV-D-13)
Franczyk, Catherine A., et. al. (IV-D-233)
GA Forest Watch (IV-D-67) **p. 1**
Grand Canyon Trust (IV-D-317) **p. 2**
Higginson, Norman, et. al. (IV-D-196)
Hirschi, Alexander (IV-D-07)
Hoosier Environmental Council (IV-D-281) **p. 1**
Hyatt, Robert E. (IV-D-94)
Kachik, Thomas (IV-D-11)
Legal Environmental Assistance Foundation (IV-D-126) **p. 1**
Landfall Productions, Inc. (IV-D-27)
Lichtman, Elijah (IV-D-08)
Lind, Karen, et. al. (IV-D-121)
MO Coalition for the Environment (IV-D-235) **p. 1**
Montgomery, Jack, et. al. (IV-D-78)
Mothers for Clean Air (IV-D-95)
NC Waste Awareness and Reduction Network (IV-D-51) **p. 2**
NJ PIRG (IV-F-116) **p. 314**
NY DEC (IV-F-52)
NYC Council (IV-F-80)
Natural Resources Defense Council (IV-F-75)
Nerode, Gregory, et. al. (IV-D-04)
Northwest District Association (IV-D-117) **p. 2**
OH Environmental Council (IV-D-130) **p. 2**
OR Toxics Alliance (IV-D-175) **p. 2**
Private citizen (IV-D-12)
Riggles, Ruth, et. al. (IV-D-102)
Rock, Steve, et. al. (IV-G-22)

Rodriguez, Dolores, et. al. (IV-D-91)
Rutherford, Jolene, et. al. (IV-D-347)
Schmitz, Randy, et. al. (IV-D-46)
Sierra Club, GA Chapter (IV-D-348) **p. 1**
Sierra Club, Lone Star Chapter (IV-D-287) **p. 2**
Sierra Club, PA Chapter (IV-D-197) **p. 2**, (IV-D-204) **p. 1**
Smith, Curt, et. al. (IV-D-49)
Southern Queens Park Association, Inc. (IV-D-36) **p. 1**
Toxics Action Center (IV-G-02)
Tseng, Joyce, et. al. (IV-D-03)
Unity Center (IV-D-75) **p. 2**
Varsbergs, Krista, et. al. (IV-D-38)
Wilderness Society (IV-F-117) **p. 217**
Zweig, Robert (IV-D-30)

(2) OBD systems help ensure continued compliance with emission standards during in-use operation and help mechanics to diagnose properly and to repair malfunctioning vehicles while minimizing the associated time and effort.

Letters:

American Lung Association (IV-D-270) **p. 29-30**
International Center for Technology Assessment (IV-D-313) **p. 3**

(3) As the new standards are expected to require the introduction of advanced technologies that have not yet been used on heavy-duty vehicles and engines, the OBD requirements for these systems must be designed to address all critical components, the failure of which could result in significant increases in emissions. To the extent that it is possible to include sensors that can identify potential performance problems, such as filter plugging, these should be included.

Letters:

STAPPA/ALAPCO (IV-D-295) **p. 25-26**

(4) OBD systems play an important role in helping to identify excessive in-use emissions and improve operating efficiency. EPA should implement an appropriate OBD mandate for vehicles above 14,000 lbs GVWR. A regulatory proposal with such a mandate should be issued soon and should include an implementation schedule identical to what is ultimately required in the HDE proposed rule.

Letters:

National Automobile Dealers Association (IV-D-280) **p. 4**

Response to Comment 7.4.2(A):

The agency agrees with commenters regarding the need to include OBD requirements as part of the engine/vehicle certification requirements. We also agree with the comments regarding OBD's in-use capabilities. Test programs conducted by EPA related to implementing OBD checks in Inspection and Maintenance (I/M) Programs along with feedback from external stakeholders have verified these capabilities.

As for applying OBD technology to the new diesel emission control technologies expected from this rule, the agency anticipates that much of the added technology used to comply with the emission standards will require additional sensors and computing power solely to ensure their proper operation. We expect the OBD system, which is primarily the computer software that diagnoses component condition based on the output signals of various sensors and actuators, will make use of these new sensors and actuators along with appropriate diagnostic software to carry out the diagnostic functions. Therefore, we fully expect that the existing OBD requirements will adequately address advanced technologies for <14,000 pound vehicles and engines.

As for OBD requirements on >14,000 pound vehicles, as discussed in the proposal for the Phase 1 rule (See 64 FR 58515), we intend to pursue under separate rulemaking actions a means of appropriately addressing OBD for >14,000 pounds, and we do not rule out the possibility that these provisions could be implemented by model year 2007 or earlier.

(B) The multipliers that were finalized in the 2004 HD rule should be reviewed for OBD compliance in the context of the proposed emission standards.

(1) The delay in finalizing the 2004 HD rule has not allowed enough time to thoroughly review the issues associated with OBD. The combination of these multipliers with the proposed low standards will not allow a feasible threshold and will result in an increase in "false mils." Since the 2004 HD rule has a combined standard for NO_x and NMHC and the 2007 proposal is for separate standards, there will be an added workload for manufacturers. OBD systems will need to be redesigned and reprogrammed for the 2007 MY, and with the OBD phase-in schedule in 2005/06/07, there is no stability period for the OBD system. EPA should harmonize all OBD issues with the CARB OBD II program.

Letters:

DaimlerChrysler (IV-D-284) **p. 11**

Response to Comment 7.4.2(B):

We believe that the malfunction thresholds established in the Phase 1 rule are feasible and appropriate for Phase 2 vehicles and engines below 14,000 pounds for several reasons. For gasoline vehicles, the OBD requirements are essentially equivalent to the already existing California OBD II requirements. Further, light-duty Tier 2 vehicles will need to design OBD systems to detect malfunctions at emission levels well below those required of Phase 2 gasoline vehicles and engines. We foresee no unique aspects of heavy-duty gasoline OBD systems relative to the Tier 2 OBD systems or the California OBD systems. Manufacturers will use the same engine control hardware that already exists on their heavy-duty gasoline vehicles and apply diagnostic algorithms similar to those already being used on California OBD systems and those that will be used for federal OBD systems as a result of the Phase 1 rule (Note: the Phase 1 rule required OBD on federal heavy-duty gasoline and diesel vehicles up to 14,000 pounds; See 65 FR 59896, October 6, 2000). As emission standards get more stringent in the context of the Phase 2 rule, so do the OBD malfunction thresholds given their direct relationship to standards. Therefore, OBD diagnostic algorithms for those OBD monitors having an emission malfunction threshold will have to be adjusted as will most engine and emission control system calibrations. However, most OBD monitors are not tied to emissions and are instead based solely on rationality and functionality checks. Such monitors will not need to be changed for Phase 2 gasoline vehicles.

As for diesel OBD, the requirements are, again, essentially equivalent to the existing California OBD II requirements for diesels, with the exception of exhaust emission control monitoring. As for these latter monitors, the federal OBD requirements are more stringent, but we believe that California will soon have similar OBD requirements for diesel exhaust emission control monitoring. We did not expect Phase 1 engines to be equipped with exhaust emission controls, but we do expect Phase 2 engines will be. Further, those exhaust emission control devices are expected to account for over 90 percent of the emission control on Phase 2 engines. Similar to the rationale for gasoline engines and vehicles, we do not believe it would be appropriate to have an emission control system responsible for over 90 percent of control without having appropriate diagnostics to ensure its continued performance during in-use operation.

Commenters have questioned the feasibility of the OBD thresholds for Phase 2 diesel engines. However, most of the required monitors need not be monitored against any emission threshold and are, instead, simply rationality and functionality checks. Such diagnostics are independent of the emission level to which an engine is certified. Therefore, such diagnostics will work equally well for Phase 1 and for Phase 2 engines. As for EGR monitoring, which must be done to the 1.5x the standard threshold, this should not pose serious problems given that gasoline engines are able to monitor EGR function to equivalent 1.5x the standard thresholds and the gasoline EGR monitoring approaches should readily transfer to diesel applications. Despite the tight emission delta that must be detected, 0.1 g/bhp-hr NO_x on a 0.2 g/bhp-hr NO_x engine, that level represents fully 50 percent of the standard and loss of proper EGR flow capable of resulting in such a large emission increase can be readily detected using temperature sensors, pressure sensors, or even NO_x sensors.

As for monitoring of the exhaust emission control devices, there is no requirement to monitor diesel oxidation catalysts. The PM trap need only be monitored for catastrophic failure, effectively a cracked PM trap with no backpressure or a severely plugged PM trap which, needless to say, would cause severe driveability problems for the vehicle owner. The NO_x adsorber remains as the only real feasibility issue in the context of the Phase 2 standards. We believe that NO_x adsorbers can be monitored using NO_x sensors that are currently capable of detecting NO_x emissions in the 100 ppm range. A recent SAE paper (Kato et. al., 1999) provides an in depth discussion of the accuracy, repeatability, and durability of an on-board NO_x sensor, as well strategies for using the sensor for closed loop control and OBD monitoring of an active lean NO_x absorber. In fact, the EPA NO_x adsorber test program described in Chapter III of the final RIA uses these NO_x sensors for NO_x adsorber regeneration control. By making use of these sensors, an algorithm could be readily developed to determine the functionality of the NO_x adsorber itself with no additional hardware.

Lastly, it is important to note that the OBD requirements require manufacturers to monitor emission related powertrain components and do not require monitoring of actual regulated pollutant emissions. The possibility exists that future OBD could include the on-board measurement of actual emission performance. We are following the development of a number of emerging on-board emission measurement technologies which may lend themselves to regulatory requirements in the future. These technologies include in-cylinder measurement devices, on-board PM measurement devices, and predictive emission measurement systems such as neural networks. Crank-angle resolved pressure and/or temperature measurements would allow for NO_x emission prediction, based on the current understanding of NO_x formation. (Dodge, 1996) Piezo-electric and infrared pressure sensing technologies are currently used to measure crank-angle resolved in-cylinder pressure. Based on recent advances in sensor durability, EPA expects that future advances could allow their use on-board. Lastly, neural networks have recently demonstrated a technique for accurately predicting emissions based solely on currently measured engine parameters. One study (Atkinson, 1998) has shown excellent correlation between predicted NO_x and PM measurement with respect to actual emissions measurements.

To conclude, we believe that through use of existing sensors and actuators and the addition of new sensors such as NO_x sensors for basic control of the emission control system, in combination with the sophisticated control strategies and algorithms needed to achieve the new emission standards, effective and feasible OBD systems will be enabled at the emission levels required.

Regarding the commenter's claim on stability, EPA did not propose to revise any of the OBD requirements in this rule, so the proposal could not have created any legal stability issue. However, EPA recognizes that added OBD-related workload may result from the new standards. For several reasons, EPA has revised the OBD phase-in schedule. The new schedule will remove any stability related issues by providing additional years of stability and more closely aligning the phase-ins of the new standards and the OBD requirements.

Commenters suggest that we commit to making changes to the OBD requirements based on the outcome of future rulemaking efforts by the California Air Resources Board (ARB). While we cannot make any such commitment, nor do we believe the commenter truly would want us to commit to making changes solely because ARB made changes, we do intend to continue our normal practice of working closely with ARB and harmonizing our OBD requirements where appropriate. Of course, any changes to our OBD requirements could only be done via rulemaking

References:

Kato, N., H. Kurachi, Y. Hamada: "Thick Film ZrO2 NO_x Sensor for the Measurement of Low NO_x Concentration", SAE paper 980170, pp. 76-77, 1998.

Kato, N., N. Kokune, B. Lemire, T. Walde: "Long term stable NO_x sensor with integrated in-connector control electronics", SAE paper 1999-01-0202, March 1999; also, see Memorandum to Air Docket A-98-32, from Todd Sherwood, Item IV-B-07, summarizing this paper.

Dodge, L.G., D.M. Leone, D.W. Naegeli, D.W. Dickey, K.R. Swenson: "A PC-Based Model for Predicting NO_x Reductions in Diesel Engines," SAE paper 962060, p.149, 1996.

Atkinson, C., "Emissions Prediction for On-Board Diagnostics and Engine Control", SAE

TOPTEC presentation, “Diesel Technology for the New Millennium”, April 21-22, 1998, Air Docket A-98-32, item no. II-D-02.

Chapter 3 of the final RIA for the Phase 1 rule contained in Air Docket A-98-32.

(C) EPA should revise the proposed OBD requirements.

(1) EPA's proposed extensive OBD requirements may require revisions since EPA has not provided any analysis of the technological feasibility of meeting the OBD requirements in connection with the proposed 2007 standards. The current OBD requirements were developed based on the regulations used for light duty vehicles. These regulations can be transferred for application to HD diesel engines only if the emission control systems are similar and operate at similar efficiencies, which is not the case. The threshold values that an OBD system will be required to monitor are extremely small and manufacturers believe that it is unlikely such small emission perturbations can be measured in actual vehicle/engine operation. Even if the OBD system could monitor the emission control system accurately for HD engines and vehicles, it would not be desirable to set the OBD threshold so close to the standards. Measurement accuracy issues need to be resolved before the OBD limits are finalized. One commenter specifically noted that CARB plans to review the feasibility of monitoring at such low emission thresholds and will consider changes to their OBD II regulation pertaining to LEV II vehicles. This commenter recommended that EPA commit to making the necessary changes to the regulation based on the outcome of CARB's OBD II rulemaking effort.

Letters:

Cummins, Inc. (IV-D-231) **p. 29-30**
Engine Manufacturers Association (IV-D-251) **p. 72-73**
Ford Motor Company (IV-D-293) **p. 8**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 80**
International Truck & Engine Corp. (IV-D-257) **p. 31**

(2) Vehicles over 14,000 GVWR should continue to be exempt from OBD requirements. While industry has not been informed as to the specific OBD requirements being considered, it is likely that they will be similar to those considered, but ultimately rejected as part of the "2004" rule. Commenter cites to their letter as submitted in response to the "2004" rule and reiterates their concerns associated with applying OBD to these HD vehicles. The unique configurations of these heavier vehicles require the development of separate OBD algorithms and calibration parameters. It may not be possible to develop reliable diagnostics that execute frequently under the broad range of conditions encountered by this vehicle category. HD vehicles are subject to huge variations in operating conditions (e.g. an empty vs. full dump truck) and it may be possible to calibrate a diagnostic to run when the truck is empty or full, but not both. It is not cost-effective to develop unique OBD algorithms and calibrations for this type of HD vehicle since these vehicles have a tremendous number of configurations and most of these configurations have

very small sales volumes. Commenter provides significant discussion on this issue.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 77-79**

Response to Comment 7.4.2(C):

Regarding OBD feasibility and EPA commitments based on the outcome of California rulemaking efforts, please refer to our response to comment 7.4.2(B).

Regarding OBD on >14,000 pound vehicles, please refer first to the response to comment 7.4.2(A). Given that OBD requirements for >14,000 pound vehicles are not a part of this rule, the issue is not appropriately addressed within its context.

(D) EPA should promulgate OBD service and repair information at the same time as it promulgates OBD hardware requirements.

(1) EPA extends the provisions of 40 CFR 86.004-40 regarding the emissions performance of rebuilt engines and the liability, under section 203(a)(3) of the CAA to rebuilders if emissions performance after a rebuild does not meet the standards pursuant to which the vehicle was certified. In order to ensure that parts manufacturers and, subsequently, rebuilders can meet the standards set forth in the rule, commenter (Motor and Equipment Manufacturers Association and Heavy Duty Manufacturers Association) proposes that the anticipated rule to require OBD on HD vehicles also require that information necessary for the service and repair of vehicles equipped with OBD systems be made available to the independent aftermarket at the same time as these new OBD-equipped vehicles are sold to consumers. HD vehicles and engines generally travel great distances with heavy loads and are frequently serviced, and often in the independent aftermarket. Aftermarket businesses will be immediately and adversely affected if they lack the information necessary to diagnose, service and repair emissions-related vehicle malfunctions. Commenter notes that it is not only good public policy for EPA to require that the information necessary to service and repair OBD equipped HD vehicles be made available to the public, but that EPA is mandated to issue the information availability requirements at the same time as the OBD hardware requirements. Commenter provides significant discussion on this issue, citing to appropriate sections of the CAA as well as case law to support their position.

Letters:

Motor and Equipment Manufacturers Association (IV-D-258), **p. 2-7**

Response to Comment 7.4.2(D):

The heavy-duty OBD regulations promulgated in the Phase 1 rule require manufacturers to provide available diagnostic data. This includes diagnostic trouble codes, freeze frame engine conditions and engine coolant temperature, fuel control system status, fuel trim, ignition timing advance, intake air pressure, air flow rate, manifold air pressure, engine RPM, throttle position sensor output value, secondary air status, calculated load value, vehicle speed, and fuel pressure.

EPA has also required that this information be accessible through uniform connectors, that access to the connectors be unrestricted, and that the information be provided in a set format without any need for unique decoding, thus fulfilling our requirements under section 202(m)(4). Additional information required under section 202(m)(5) would fall under the service information availability regulations. (40 CFR § 86.094-38). We did not propose to revise the service information regulations in the NPRM for this rule, so it would be inappropriate to finalize any such changes without further notice and comment. EPA does not agree that the current Service Information regulations apply to heavy duty engines. The Service Information rule explicitly referred only to "requirements for the availability of emission-related service information for all light-duty vehicles (LDVs) and light-duty trucks (LDTs)." 60 FR 40474 (August 9, 1995). Though the regulations are ambiguous on this issue, the preamble is clear. EPA agrees that, as manufacturers of heavy duty vehicles and engines below 14,000 pounds will now be required to equip their engines and vehicles with OBD systems, they apparently should also be subject to service information rules. However, EPA does not believe that the rules governing service information requirements for such manufacturers need to be promulgated at the same time as the rules for OBD. Nothing in section 202(m)(5) of the Act indicates that the two sets of regulations, which are clearly written as distinct regulations in the Act, need to be promulgated at the same time. Contrast section 202(m)(5)'s requirements with those of section 202(m)(4), which clearly contemplate that the regulations under section 202(m)(4) will be promulgated at the same time as those under section 202(m)(1). The regulations governing service information have generally raised significant issues distinct from the issue raised in OBD regulations. It is therefore appropriate that EPA undertake such actions in a separate proceeding. Indeed, EPA's initial service information regulations were issued over two years after its initial OBD regulations (60 FR 40474, August 9, 1995).

Currently, EPA is drafting a Notice of Proposed Rulemaking (NPRM) to amend the 1995 regulations. In this NPRM, we expect to propose that all of the proposed changes to1995 requirements apply to manufacturers of all heavy-duty vehicles and engines weighing 14,000 pounds gross vehicle weight (GVW) and lower beginning in model year 2005 which is the first year that such engines and vehicles are subject to OBD requirements. EPA expects to propose the same requirements for these engines and vehicles as it expects to propose for light-duty vehicles and trucks. We would request comment on the appropriateness of the proposed requirements for this sector and expect to address the need for heavy-duty service and repair information as appropriate in subsequent regulatory activities.

(E) Parts manufacturers should be provided OBD monitoring information.

(1) In light of the extension of OBD in the heavy-duty context, it is now necessary for EPA to also extend its OBD information availability regulations to include the information necessary to manufacture and remanufacture parts. Heavy-duty repair shops are even more likely than light-duty repair shops to conduct engine and parts rebuilding on their premises, in which case information about OBD system tolerances and expectations will be required to build compatible parts. EPA should reconsider its decision that parts

manufacturers and remanufacturers are not part of the automotive service and repair market.

Letters

Motor and Equipment Manufacturers Association (IV-D-258), **p. 7-8**

Response to Comment 7.4.2(E):

As noted by the commenter, the issue being raised in this comment pertains to EPA's service information availability regulations. As discussed in section (D)(1), EPA expects to issue a Notice of Proposed Rulemaking in early 2001 that will propose requirements for the availability of service and repair information for the heavy-duty sector. As part of that rulemaking process, EPA would accept comment from interested parties on issues pertaining to the proposed requirements and would address any comments we receive at that time.

(J) Opposes allowance to average across primary intended service class.

(1) EPA cannot finalize an allowance to use credits across subclasses. The existing regulations prohibit this, and EPA did not propose to change this prohibition. Finalizing such an allowance without opportunity for public comment violates the CAA and the APA. Allowing averaging "across subclasses creates a competitive advantage for certain manufacturers." Also, EPA has not demonstrated that cross-class averaging would be environmentally neutral.

Letters:

Mack Trucks, Inc.

Response to Comment 7.4.2(J):

EPA proposed to phase in the standards by a percentage of production without regard to subclass (§86.007-11(f), 65 FR 35553). We specifically requested comment on how the phase-in and the ABT program would fit together:

> In some ways the ABT program is intended to serve the same purpose as the phase_in for diesel engines. As is described below, we have proposed some restrictions to make this program compatible with the phase_in. Thus your comments on this ABT program should address how it fits with the phase_in, and vice versa.

The cross-subclass averaging allowance that is being finalized is being adopted in a manner to make it fully consistent with our phase-in, by ensuring that credits are generated and used on a consistent basis. This allowance does not fundamentally alter the nature of the phase-in, but merely provides a small degree of additional flexibility. We do not believe that this allowance will have any adverse environmental impacts, given the 20 percent discount being applied to all credits exchanges from the Phase 1 engines to Phase 2 engines.

Issue 7.4.3: Supplemental Test Procedures

(A) Supports proposed provisions for steady-state test.

(1) Supports provision that test must be conducted with all emission-related engine control variables in the maximum NO_x-producing condition that could be encountered for a 30-second or longer averaging period at the given test point.

Letters:

STAPPA/ALAPCO (IV-D-295) **p. 20**

(2) Support the proposed provision that in addition to the 13 modes of the test cycle, EPA would have the opportunity to select an additional three test points as a check to ensure the effectiveness of the engine's emission controls within the control area (e.g., ensuring that emissions do not "peak" outside of the 13-mode test points.

Letters:

STAPPA/ALAPCO (IV-D-295) **p. 20**

Response to Comment 7.4.3(A):

We agree with the comment supporting the requirement that the SET test should be conducted with the engine control variables set to result in the maximum NO_x emission rates which the test engine can produce under the conditions specified by the SET test (i.e., under standard laboratory conditions. Regarding the comment supporting the EPA selection of “mystery points”, we have eliminated the MAEL requirements and the “mystery point” requirements for Phase 2 technology engines because the stringency of the Phase 2 standards makes these requirements unnecessary. The regulations for the SET in model year 2007 as they apply to the 2004 FTP emission standards contain additional steady-state test point emission limits beyond the requirement of the SET. The Phase 1 supplemental requirements define a “Maximum Allowable Emission Limit” (MAEL) which the engines must comply with. The Phase 1 regulations allowed EPA to randomly select up to three steady-state test points prior to certification which the manufacturer would test to show compliance with the MAEL. These test points are referred to as “mystery points”. In this final rule we have eliminated the MAEL for engines certified to the Phase 2 standards. The MAEL assures that an engine is calibrated to maintain emission control similar to the SET test under steady state conditions across the engine map, not just at the pre-defined 13 test points which comprise the SET test. For Phase 1 engines the MAEL was necessary to ensure this potential for gaming did not occur because the difference between the FTP standard and the NTE standard could be large, for example, 0.625 g/bhp-hr for $NMHC+NO_x$. However, for Phase 2 engines the NTE requirements for NO_x are a mere 0.10 g/bhp-hr greater than the FTP standard. Considering this small increment, we have eliminated the MAEL for Phase 2 technology engines (engines meeting the new NO_x standard, and for engines certified with NO_x FELs below 1.5 g/bhp-hr. because it is redundant with the NTE. For the same reasons, we have eliminated the certification “mystery points” for engines complying with today’s diesel engine standards.

(B) Opposes proposed provisions for steady state test.

(1) The supplemental steady state test (also referred to as the Euro-III test) is infeasible and unnecessary. The test is not correlated with the FTP and EPA has not developed a method of comparing the relative stringency of the two tests. One commenter noted that EPA has added a requirement that the emission results at each of the three EPA-defined test points must be within ten percent of the interpolated value predicted for that test point based on the 13 standard test points and that this requirement cannot feasiblely be met. Emissions tests, including the FTP, do not usually provide results that are within five percent. CARB's policy of not requiring a recall if the in-use test results are within ten percent of the standards is indicative of how difficult it is to obtain repeatable measurements and this ten percent policy is applied to the average of a sample of ten or more vehicles, not a sample of one engine as proposed by EPA.

Letters:

Cummins, Inc. (IV-D-231) **p. 26**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 61**

Response to Comment 7.4.3(B)(1):

We disagree with the comment that the SET standard is infeasible; see response to comment 3.2.1(N). We disagree with the comment that the SET standard is unnecessary; see response to comment 3.2.1(P). We have also eliminated the MAEL and mystery point requirements for Phase 2 engines because they are unnecessary for the reasons articulated in response to comment 7.4.3(A).

(2) EPA's proposal that every point within the supplemental steady-state control area not exceed MAELs increases the stringency of any emission standard by requiring compliance with a standard at every engine operating point within the emission control area, rather than requiring that the average emissions remain below the MAEL. This requirement is not feasible since any particular engine operating point may slightly exceed the MAEL simply because the MAEL is merely a prediction based on 12 standard test points. This approach focuses unreasonably on control of emissions on a point-by-point basis, rather than on a reasonable aggregate basis.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 63**

Response to Comment 7.4.3(B)(2):

We have eliminated the MAEL and mystery point requirements for Phase 2 engines because they are unnecessary for the reasons articulated in response to comment 7.4.3(A).

(3) In an engine with multiple control parameters, it is unreasonable and

meaningless to require an engine to be in a maximum brake-specific NO_x ($BSNO_x$) producing state during the SSS test. This logic was originally proposed for engines with inj4ection timing control as the emissions controlling input. With multiple technologies present in the emission control system, it is reasonable to assume that at different times, under different conditions, control variable will be varied to achieve the required compliant emission levels. This requirement should be dropped since it is overly restrictive and will ultimately reduce the performance envelope of the emission control systems envisioned.

Letters:

Cummins, Inc. (IV-D-231) **p. 27**

Response to Comment 7.4.3(B)(3):

We disagree with the comment that the provisions of 40 CFR 86-1360-2007(e)(4) are either unreasonable or meaningless. These test provisions require the manufacturer to ensure that during the SET test, the engines control system is run so that the calibration represents the highest NO_x emitting conditions at the given test point and for the conditions under this the engine is being tested (i.e., standard FTP laboratory conditions). Engine calibrations used by a number of HDDE manufacturers indicate various engine control strategies are possible for a given test conditions, and this provision ensures that the calibration which produces the highest NO_x is tested. As documented in the Chapter 3 of the RIA, we have determined that the requirements will be feasible without overly restricting engine performance. See also the response to comment 7.4.3(A).

(C) EPA's proposed supplemental test procedures are arbitrary and subjective and fail to provide manufacturers with the ability to determine at the time of manufacture and distribution whether they will later be found to be in non-compliance.

(1) Individuals must be able to discern with certainty whether their conduct is lawful at the time that they undertake that conduct and that principle is particularly relevant in the case of EPA's supplemental test procedures. These procedures are not objective and manufacturers are not able to ensure their own compliance with reasonable accuracy. The use of testing procedures that could take place under "normal" conditions, combined with a short 30-second interval in conjunction with a not-to-exceed approach would create wide variability in testing results, would not simulate real-world conditions, and would be both impractical and unpredictable. Assuring compliance at virtually all conditions would require many combinations of test conditions and a large investment in engine emission test equipment and personnel. Commenter cites to their comments submitted in response to the 2004 standards and also cites to relevant sections of the CAA and case law to support their conclusion on this issue. Commenter provides significant discussion on this issue and notes that under applicable legal standards, such testing is unlawful.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 53-55**

Response to Comment 7.4.3(C):

We disagree with these comments. GM/Isuzu imply the NTE requirements are not defined in the regulations. The regulations specifically define both the engine operation and the ambient conditions during which the engine must comply with the NTE. The regulations define specific and constrained NTE ambient conditions, and the regulations define specific and constrained NTE engine operating conditions. The regulations also define specific numerical limits which are the NTE emission standard. Therefore, the NTE standard and requirements are not subjective at all, but are specifically defined by numerical boundaries. Manufacturers will know precisely what conditions they are required to comply with to meet the supplemental standards. GM/Isuzu comment that the proposed test procedures are subjective. However, the NTE requirements do not allow EPA to test compliance at any condition operated by an engine. The NTE regulations specify specific engine operating zones under which testing can be compared to the standard, for time durations as short as 30 seconds; however, longer sampling times can be included.

GM/Isuzu point to the phrase "any conditions that could reasonably be expected to be seen by that engine in normal vehicle operation and use", to support their comment that the NTE requirements are subjective. The regulatory requirement contained in this final rule specifies that an engine must comply with the NTE "under conditions which can reasonably be expected to be encountered in normal vehicle operation and use.", see § 86.1370-2007(a), which is a limitation on EPA's authority to test outside of those conditions. The statement regarding normal vehicle operation and use is virtually identical to the existing regulatory definition of defeat device under which both the on-highway light duty vehicle and heavy-duty engine industry have been regulated for many years. The existing applicable definition of defeat device for on-highway HD engines specified in § 86.094-2 states (underline added for emphasis);

Defeat device means an auxiliary emission control device (AECD) that reduces the effectiveness of the emission control system <u>under conditions which may reasonably be expected to be encountered in normal vehicle operation and use</u>, unless:
(1) Such conditions are substantially included in the applicable Federal emission test procedure;
(2) The need for the AECD is justified in terms of protecting the vehicle against damage or accident; or
(3) The AECD does not go beyond the requirements of engine starting.

The NTE provisions contained in today's final rule require engine manufacturers to design and control emissions below a specified maximum for the type of engine operation their product will encounter during normal vehicle operation and use. This is wholly consistent with past Agency requirements. Engine manufacturers such as General Motors will be able to rely on their more than 20 years of experience in designing engines which utilized AECDs which operate under conditions which may reasonably be expected to be encountered in normal vehicle operation and use as they develop engines to comply with the NTE standard by model year 2007.

EPA believes that manufacturers have for years and will continue to routinely evaluate their engines to ensure that their products provide a high level of performance and reliability for non-emissions related qualities during normal vehicle operation and use. The highly competitive nature of this market and its sophisticated consumer base call for such analysis by manufacturers. EPA expects that this same knowledge of how their engines are normally used and operated can be employed by manufacturers in designing for emissions performance as well as non-emissions related performance.

EPA's use of the term normal vehicle operation and use is designed to build on such current industry practices. It is not designed to address rare, unique, or abnormal operation and use, but instead focuses on what is commonly and generally viewed as normal driving and operation during urban, suburban, and interstate driving. This would not include abusive, reckless, unlawful, or unsafe driving or operation. It is aimed at the kind of operation and use that is encompassed in the limitation of recall authority to proper operation and use in section 207(c) of the Act.

The kinds of operation and use envisioned by the current definition of a defeat device and the statutory provision for recall have been employed by the agency and industry to regulate in-use emissions for over two decades. Manufacturers have also designed for in-use performance of non-emissions qualities for many years. The term "normal operation and use" in the NTE test procedure is directed at the same kind of limits on operation and use employed in these other contexts. Any subjectivity in the term "normal operation and use" is no greater in the context of the NTE than in these other contexts. The experience in the last decades in implementing these other provisions indicates that use of the same provision in the NTE requirements provides a reasonable basis for all parties to design complying engines under this provision.

Moreover, because manufacturer requirements under the NTE procedures are specifically linked to particular numerical emission values, these requirements are significantly less subjective than the previous regulatory regime. Manufacturers will know that if emissions from their engines are below a specific number under specified engine and ambient conditions, they will meet the supplemental requirements. It is only if a manufacturer cannot meet this specific number under those conditions that the term "normal operation and use" is even implicated.

We also disagree with the comments from GM/Isuzu regarding the appropriateness of the NTE's minimum sample time requirements. We believe that 30 seconds is a reasonable length of time to determine compliance with the NTE standard, which is intended to be an emissions cap, not an average standard over a long period of time (e.g., such as the 20 minute pre-existing FTP). Thirty seconds is long enough to avoid short spike's in emissions which may occur from limited operating excursions, and 30 seconds is long enough for manufacturers to control for emissions during operation which may reasonably be expected to occur during normal vehicle operation in- use. See also the response to comment 3.2.1(N) which discusses certain NTE testing provisions where the minimum sample time can be longer than 30 seconds. As discussed above, we expect that manufacturers can rely on their long experience in designing engines both for performance reasons as well as their existing requirements under the prohibition of defeat devices to control emissions during normal operation in use. We also disagree that HD diesel engine operation while heavily loaded, or during an acceleration up a hill, or operating a truck into a strong head wind are conditions which manufacturers cannot anticipate or design for. These are situations which on-highway HD diesel vehicles in the U.S. experience every day of the year across the entire country. We believe that it is reasonable and appropriate that manufacturers can anticipate these types of operation and design for emission controls as well as for engine performance (which they obviously already do today, since the vehicles continue to operate under such conditions). Further, with respect to the minimum NTE 30 second sample time, manufacturers already design engines to meet smoke standards which include engine operation over a time frame nearly as short (lugging mode smoke test) or shorter than 30 seconds (acceleration mode smoke test). GM/Isuzu comment that the NTE allows EPA discretion to test under extreme temperature conditions, though they don't specify what extreme is. As discussed above, the regulations constrain the Agency from testing outside specific temperature (and altitude) conditions when determining compliance with the NTE.

We disagree with the comment that manufacturers will need to test an "infinite" or inappropriate number of steady state and transient combinations in order to design engines to comply with the NTE. This comment inaccurately assumes that the engine emission performance would be near the 1.5 NTE standard under all or the majority of engine operation within the NTE control zone which could reasonable be anticipated to occur during normal operation and use. General Motors/Isuzu themselves commented that the NTE requirements would force them to concentrate on the highest emitting modes. The Agency agrees with this comment. Engine manufacturers will be required to perform extensive mapping of their engine's emission performance across the NTE control zone in order to develop engines to comply with the pre-existing FTP and the SET, regardless of the NTE standard. However, with respect to the NTE standard, manufacturers will be able to quickly narrow their test programs to focus in on those areas of the NTE control zone where the emissions are higher and are nearest the NTE standard. Engineering experience and logic dictates that manufacturers will not expend resources testing areas of the NTE control zone where emissions are well below the NTE standard. The same is true with respect to the expanded conditions which apply to the NTE. The manufacturers' comments would indicate that under today's FTP, they must perform development tests at every 1 deg F increment between 68 and 86 deg. F, yet this is not what is done. The effects of temperature on emissions are fairly well known, and manufacturers will only focus testing resources at the conditions which result in the highest emissions. If the emissions under these conditions can be controlled to meet the standard, then emissions will clearly meet the standards at the less difficult to meet conditions. For example, NO_x emissions tend to increase with ambient temperature, and they decrease with decreasing ambient temperature. The manufacturers do not need to waste testing resources and development time on lower ambient temperature compliance with the NTE NO_x standard, when they clearly know that higher temperatures are more difficult, and if the engine complies at higher temperatures it will then comply at lower temperatures. As another example, see the comments from Detroit Diesel Corporation on the Phase 1 NPRM regarding the NTE(EPA Air-Docket A-98-32, docket item IV-D-28) regarding the development of efficient testing schemes to determine compliance with the NTE, which indicates manufacturers have the capability to create NTE development tests which are "efficient", i.e., that do not waste testing resources.

(D) The 30-second minimum engine compliance measurement period is not an objective measure of engine emissions.

(1) A 30-second test results in undefined compliance conditions and nonrepeatable testing and is not practical. This measurement duration will impose compliance obligations that are almost limitless in their scope. The

risk of noncompliance using this approach is too high. EPA has replaced the defined and reproducible characteristics of traditional compliance testing with testing based on any 30-second on-road driving event deemed appropriate by EPA. Given the process of incremental development of the emissions control system, it is unclear how a manufacturer could decide whether the most recent revision to the development cycle improved or degraded emission control performance. When the scope of compliance evaluation narrows to any arbitrarily chosen 30-second operating mode, it is virtually certain that most changes will produce a mixed result. If an engine is to be properly characterized over its entire operating range, significantly more testing would be required. Commenter provides significant discussion on this issue and concludes that the test protocol and associated on-road emission measurement instrumentation do not have the required accuracy to measure emissions.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 62-67**

(2) There is no direct relation between compliance with a 30-second test and air quality. With compliance being judged over an arbitrary 30-second period of vehicle operation, there would seem to be no guarantee that the costs of improving performance in such narrow contexts will produce improved air quality.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 65**

Response to Comment 7.4.3(D):

We disagree with these comments. A large part of GM/Isuzu's discussion focuses on the iterative process of developing engines to comply with emission standards, and they comment that the minimum 30 second NTE sample time requirement restricts this process, and results in undefined compliance conditions and interferes with repeatable testing. As discussed in response to comment 7.4.3(C) above, the commenter implies engines will always be near the NTE emission limit, but this is not the case. There are many areas of the NTE control zone during which the engine will not be near the NTE limit, and thus the NTE will not interfere with this interactive process. For example, data presented in Chapter 3 of the RIA on the NVFEL test program shows that for a number of the NO_x adsorbers we evaluated, NO_x reductions well in excess of 90 percent occurred over broad regions of the NTE control zone. Because the NTE standard is intended to be a cap, is 50 percent greater than the FTP standard, and is based on available data, we disagree with these comments which imply the 30 second sample time will be overly restrictive. Regarding the comments on undefined compliance conditions, see response to comment 7.4.3(C).

Regarding the comment that the NTE approach, including the 30 second minimum sampling time, does not improve air quality, we disagree with this comment. The NTE standard, in combination with the FTP, the SET, and the prohibition of defeat devices, will ensure the large emission reductions we estimate will occur from the standards in this rule occur in actual use. GM/Isuzu's comments also imply they do not believe the emission benefits of the NTE are justified by the costs of complying with the NTE; please see the response to comment 5.10(D) for a response to this comment.

Regarding the comment on test protocol and emission measurement. GM/Isuzu imply emission measurement equipment is not capable of accurately measuring HDDE emissions at the levels required by the standard in this rule, this is incorrect. Please see the response to comments under issue 7.4.5.(A)

Regarding GM/Isuzu's comments on the ROVER on-board emission measurement system, we did not propose and this final rule does not require the use of a ROVER system, therefore this comment is not relevant to this rule.

Regarding the comments on time alignment of emission measurements. The Agency agrees the time alignment of the emissions sample with the engine speed/torque measurement will be important when performing NTE testing. Considering the availability of very accurate emission measurement, engine speed and torque measurement, and time measurement instrumentation, we do not expect this to be a difficult issue for NTE emissions sampling.

(E) As a result of the late release of the 2004 HD rule, there has been inadequate opportunity to fully analyze the impacts of the supplemental test procedures on EPA's proposed 2007 standards.

(1) EPA has only recently released the 2004 final rule containing details regarding the supplemental test procedures. The 2004 final rule contains detailed provisions regarding the final NTE limit program and the supplemental steady-state test modified from the ESC test cycle. EPA confirms for the first time the final conditions under which an NTE limit is applicable and also confirms final "carve-out" areas applicable to various emissions. Even though EPA and members of industry participated in negotiations and meetings in which these issues were discussed, there remained considerable uncertainty regarding the final provisions. EPA introduced the concept of an "NTE deficiency provision" applicable to HDDEs and also provides for the first time detail regarding the modified ESC test. Two weeks is insufficient time to be able to digest these complex concepts, analyze engineering and production issues and review the data relevant to emissions performance. One commenter notes that they will be providing additional comments that will specifically address the supplement test components of the 2004 rule. (See also Issue 12.2.)

Letters:

Cummins, Inc. (IV-D-231) **p. 22-26**
DaimlerChrysler (IV-D-344) **p. 17-19**
Detroit Diesel Corporation (IV-D-276) **p. 24-25**
Engine Manufacturers Association (IV-D-251) **p. 56-57**

Response to Comment 7.4.3(E)(1):

See responses to comments 12.2(H)(2-3) and 3.1.1(K)(1).

(2) The proposed supplemental emission requirements and tests (SERTs) are based on the technological feasibility of meeting a 2.5 g/bhp-hr NMHC + NO_x standard. EPA has changed the roadmap by choosing to apply multiple, complex requirements represented in the NTE zone and limits, supplemental steady state tests, maximum allowable emission limits, load response test, and expanded ambient conditions. Despite such a significant technology change, EPA has failed to demonstrate the technological feasibility of the proposed supplemental emission tests and requirements on the proposed (now-final) 2004 standards.

Letters:

Cummins, Inc. (IV-D-231) **p. 22-26**
Engine Manufacturers Association (IV-D-251) **p. 57**

Response to Comment 7.4.3(E)(2):

Issues related to the Agency's Phase 1 standards (2004 FTP and 2007 supplemental tests as they apply to the 2004 FTP standards) were fully addressed in the Phase 1 rule. The comment period for the Phase 1 rule closed on December 16, 1999. This Phase 2 rule did not contain proposals regarding the 2004 standards.

(F) The application of the supplemental testing rules prevents promising emission control technologies from being introduced, particularly if they do not exhibit constant emission control capabilities at all engine operating conditions.

(1) The supplemental test requirements adopted as part of the 2004 rulemaking severely limit the variability in the emissions rates over the HD engines operating range. Thus, the feasibility of EPA's proposed standards must be compared at the worst-case conditions rather than over the composite emissions measured over the FTP. All of the potential emission control strategies exhibit significant declines in their ability to reduce emissions at off-nominal conditions. These conditions can include low or high temperature operation, catalyst regeneration, rich operation, and other engine operating zones. The application of the supplemental testing requirements ensures that the aggressive standards being proposed cannot be met using any of the known candidate emission control systems. (See also Issue 3.2.1.)

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 49-50**

Response to Comment 7.4.3(F):

We disagree with these comments. As discussed in Chapter 3 of the RIA for this rule, and in response to comment 3.2.1(N), we have demonstrated that HDDE emission control technology is capable of achieving the supplemental test requirements (SET and NTE standards) by model year 2007. This determination is based, in part, on our assessment of the capabilities of CDPFs and NO_x adsorbers, which are clearly advanced emission control technologies. It is unclear what control technologies the commenter is referring to, and they do not describe any specific technology in their comments, beyond the generic term "catalysts". We agree that some of the control technologies, e.g. NO_x adsorbers, do exhibit peak areas of performance, and as discussed in the RIA and in response to comment 3.2.1(N), the defined NTE engine and ambient operating conditions fall within this peak emission reduction efficiency region, and hence the NTE standard can be met with the use of this technology. It should also be noted that, as discussed in response to comment 3.2.1(N) and in the RIA, CDPFs do not exhibit the same "fall off" of emission reductions described by the commenter, and hence their comments do not apply to the NTE PM standard. Finally, we do not believe that we should allow alternative technologies that are not capable of controlling emissions to levels meeting our NTE requirements, since they could result in excessive and unnecessary emissions from heavy-duty engines.

(G) Supports proposed supplemental Load Response Test for heavy-duty diesel engines.

(1) Commenter provided no further supporting information or detailed analysis.

<u>Letters:</u>

STAPPA/ALAPCO (IV-D-295) **p. 21-22**

<u>**Response to Comment 7.4.3(G):**</u>

The NPRM for this rule specifically proposed to apply the SET and the NTE requirements to Phase 2 engines, but did not propose any aspect of a Load Response Test (LRT), and this final rule contains no requirements regarding the LRT. Any issues regarding the load response test were dealt with in the Phase 1 rule, which established a LRT as a data submission requirement for HDDEs for model years 2004 through 2007.

(H) The load response test (LRT) is a useless, unnecessary, and burdensome requirement.

(1) The LRT has no correlation to any real world heavy duty truck operation. The FTP, federal smoke cycle and J1667 roadside test procedures already measure highly transient behavior. Commenter refers to their comments submitted previously on this issue in response to the 1999 Feasibility Review (2004 rule), p. 39-40 and concludes that this unnecessary test complicates manufacturers' ability to comply with the rule.

<u>Letters:</u>

Engine Manufacturers Association (IV-D-251) **p. 62**

(2) The results from this test provide no information of value that could not otherwise be obtained from other sources. In addition, the test is conducted at constant speed with no acceleration. Increasing load acceptance at constant speed is not a normal HD vehicle operating condition and therefore,

the data are not technically meaningful.

Letters:

Cummins, Inc. (IV-D-231) **p. 27**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 67**

Response to Comment 7.4.3(H):

See response to comment 7.4.3(G).

(I) The FTP together with EPA's supplemental steady state test provides adequate compliance assurance, and thus the NTE provisions are unnecessary.

(1) The supplemental steady state test involves an averaging of specified emissions points along an engine's normal power curve. Commenter provides detailed discussion regarding this test and notes that the FTP transient tests and the supplemental steady-state test combine to provide adequate compliance assurance while ensuring that an engine's certification continues to be based on real world operating conditions. Commenter adds in this context that there is no need for the NTE requirements, which are unnecessary and infeasible. [See also discussion under Issues 3.1.1 and 3.2.1.]

Letters:

International Truck & Engine Corp. (IV-D-257) **p. 19-20**

Response to Comment 7.4.3(I):

We disagree with the comment that the pre-existing FTP together with the SET are adequate to assure compliance, and thus the NTE provisions are unnecessary. As discussed in response to comment 3.2.1(P), the SET and the NTE are clearly different requirements, and the NTE provides compliance assurance over engine operation not covered by the SET. For example, the SET and the FTP apply during standard laboratory conditions, while the NTE applies at expanded conditions, in some cases up to 100 deg. F (at sea-level), while the FTP and SET only apply up to 86 deg. F, regardless of altitude. In addition, the SET is only a steady state test, while the NTE can include steady state or transient engine operation. Clearly the three test procedures, the pre-existing FTP, the SET, and the NTE, each cover engine operation not covered by the other tests, and thus the tests do complement each other. When combined with the Agency’s prohibition on defeat devices, we believe these requirements provide a comprehensive set of compliance requirements which will help ensure that engines comply with the applicable emission standard in-use, and thus help ensure the emission benefits of the standards will occur.

(J) There is no basis for extending special exemptions to alternatively fueled HDEs for the supplemental test requirements.

(1) EPA has presented no justification for providing an exemption to the supplemental test requirements for alternatively-fueled HDEs. These engines

are not always inherently lower-emitting than diesel HDEs. This provision would provide manufacturers of alternatively fueled HDEs with a commercial advantage over their diesel HDE counterparts and EPA should apply the testing requirements equally.

Letters:

International Truck & Engine Corp. (IV-D-257) **p. 31**

Response to Comment 7.4.3(J):

It is unclear from the comment what exemption the commenter is referring to. Alternatively fueled HDDEs will be required to comply with the NTE standard and with the SET standard. Though not specifically referenced in the comment, we assume the commenter is referring to the regulatory provisions established in the Phase 1 rule which would allow a manufacturer of an alternatively fueled HDDEs to petition EPA to exclude regions of the NTE control zone from NTE compliance if the manufacturer can demonstrate the engine is not expected to operate in such regions. We believe the reasoning for this minor allowance for alternatively-fueled vehicles remains valid (i.e., the shape of the NTE control zone was determined primarily to control emissions from diesel-fueled HDDEs). However, we do agree that there are reasons why we should include similar allowances for petroleum-fueled diesel engines. We will allow manufacturers to exclude from the NTE zone operation that is not possible when the engine is installed in the vehicle. We will also allow manufacturers to exclude other infrequent operation from targeted NTE testing. These allowances are described in the Preamble to this FRM.

(K) SFTP considerations for HDG complete vehicles should be deferred to a separate rulemaking.

(1) The SFTP requirements for light duty vehicles, enforced federally and in California, were based on extensive vehicle testing conducted in the early to mid 1990s, which included only a small number of larger vehicles and no vehicles over 8500 GVWR. In addition, there has been no testing conducted justifying SFTP like cycles for these vehicles. Manufacturers have no practical experience with in-use compliance over the SFTP drive cycles for light duty, much less heavy-duty vehicles. Any future SFTP rulemaking should proceed only after further testing and analysis has been performed.

Letters:

Ford Motor Company (IV-D-293) **p. 11**

Response to Comment 7.4.3(K):

We did not propose and this final rule does not contain SFTP requirements for HD gasoline vehicles.

Issue 7.4.4: Ambient Conditions (Temperature/Humidity)

(A) EPA should require manufacturers to meet the NTE standard under the range of conditions typical of days when ozone exceedances occur.

(1) EPA should increase the upper end of the temperature range to 105 degrees Fahrenheit.

Letters:

CA Air Resources Board (IV-D-203) **p. 5**
NESCAUM (IV-D-315) **p. 8**
STAPPA/ALAPCO (IV-D-295) **p. 23**

Response to Comment 7.4.4(A):

We appreciate the concerns raised by the commenters regarding the need for adequate emission controls under high temperature days due to the increased possibility for ozone formation.

We have based the upper temperature range of the NTE requirements on the technical feasibility of complying with the NTE standard. At sea-level, under one NTE compliance option, manufacturers must comply with the NTE at an ambient temperature of 100 deg. F. Under the other NTE compliance option, manufacturers would have to comply with the NTE even at a temperature of 105 deg. F, but they are allowed to use correction factors to correct emissions back to an equivalent ambient temperature of 95 deg. F. Regardless of which compliance option the manufacturer chooses, we believe emissions will be adequately controlled even at the very high temperature suggested by the commenter, because these very high temperatures occur infrequently, and because even when manufacturers are outside the conditions applicable to the NTE, they must still comply with the Agency's regulatory prohibition of defeat devices. This prohibition would prevent manufacturers from reducing the effectiveness of their emission control system, regardless of temperature, unless the engine/vehicle met one of the conditions which are allowed under the regulations.

(B) Supports applying the expanded range of ambient conditions to the new supplemental test procedures beginning no later than the 2004 model year.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

STAPPA/ALAPCO (IV-D-295) **p. 22-23**

Response to Comment 7.4.4(B):

Clean Air Act section 202(a) requires the Agency to provide 4 years of lead time for the establishment of any new HDDE emission standards. The commenter suggests the Agency apply the expanded conditions requirement to the 2004 HDDE standards. Considering that manufacturers are now into model year 2001, we are prevented from considering the change recommended by the commenter because of this 4 year lead time restriction.

(C) EPA's proposal to expand the ambient conditions under which emission testing would be conducted creates additional stringency and compliance uncertainty.

(1) The aftertreatment technologies that manufacturers will use to comply with the proposed standards are extremely sensitive to expanded ambient conditions (i.e. temperature, altitude). However, feasibility tests conducted on these technologies have been only under lab or FTP conditions. Therefore it is difficult to determine whether EPA's proposal is feasible under all actual, onroad operating conditions and EPA has not provided adequate data on this issue.

Letters:

International Truck & Engine Corp. (IV-D-257) **p. 23-24**

Response to Comment 7.4.4(C):

We disagree with the comment that the ambient conditions which apply to the NTE standard makes compliance with the standard uncertain or technologically infeasible. As discussed in response to comment 3.2.1(N), and in more detail in Chapter 3 of the RIA for this final rule, we have considered both the effects of ambient altitude and temperature on the feasibility of the NTE, and, as finalized in this rule, the NTE requirements are technologically feasible by model year 2007.

Regarding the comment on stringency, we would agree that compliance with the NTE at more restricted ambient conditions, for example, only between 60 and 70 deg. F, would decrease the stringency of the NTE standard. However, as discussed above, we have determined the NTE standards are feasible over the range of engine operating conditions and ambient conditions specified in the regulations

(D) EPA should consider a broader ambient temperature range when conducting certification testing of HDDEs using FTP.

(1) In Alaska, and other northern communities, poor air quality from fine particulate matter generally occurs during the winter at temperatures colder than the FTP temperature range of 68 to 86 degrees F. EPA should allow certification of HDDEs at colder temperatures at least comparable to cool certification temperatures (20 degrees) for light duty gasoline powered vehicles.

Letters:

AK Department of Environmental Conservation (IV-D-236) **p. 2**

Response to Comment 7.4.4(D):

We believe that it is not necessary to require lower temperature FTP laboratory testing for two reasons. First, the NTE testing requirements include low temperatures, and will ensure that emission controls are effective at low temperatures. It is very unlikely that an engine could comply with the NTE limits at some low temperature, but significantly exceed the FTP standard at that same temperature. Second, with respect to PM, we believe that the very nature of the PM traps that manufacturers will use to meet the new PM standards is such that there will not be any significant decrease in control efficiency at lower temperatures, provided low sulfur fuel is used.

Issue 7.4.5: Other Test Procedure Issues

(A) The current test procedures are not adequate for the measurement of the new emission levels proposed by EPA.

(1) Current test procedures for HDDEs have been in place for over 20 years and were developed for much higher emission levels than those currently proposed by EPA. These test procedures need to be improved considerably before very low emission levels can be reliably measured. One commenter noted that EPA should resolve this problem in close cooperation with the regulators in Europe and Japan as well as with the engine industry. Commenters provided significant discussion on this issue as well as data to illustrate the problems associated with test variability for the test methods used to measure PM and NO_x. Commenters noted that the observed test variability is incompatible with the proposed standards and concluded that by proposing to apply a measurement procedure on which emissions cannot be accurately and reliably measured, EPA has failed to meet its mandated obligation to propose standards that are technologically feasible. One commenter (Cummins) provided a statistical analysis of the impact of short term and long term precision errors at current and at proposed emission levels and provided a detailed description of the specific measurement challenges in the context of NO_x, NMHC, PM, and formaldehyde.

Letters:

Cummins, Inc. (IV-D-231) **p. 31-37**
DaimlerChrysler (IV-D-344) **p. 7, 14**
Detroit Diesel Corporation (IV-D-276) **p. 8-10**, (IV-F-7, 168, 116) **p. 198**
Engine Manufacturers Association (IV-D-251) **p. 32-35**
International Truck & Engine Corp. (IV-D-257) **p. 30**

Response to Comment 7.4.5 (A)(1):

In response to manufacturer comments, we are finalizing changes to the test procedures to reduce variability. As described below, these changes are sufficient to ensure that the test procedures do not adversely impact the feasibility of the standards.

For NO_x measurement, the changes to the test procedures include new specifications for the chemiluminescent detectors (CLDs) that take into account the current state-of-the-art of available analyzers, particularly analyzers that have been developed for measuring the low NO_x concentrations representative of current light-duty LEV vehicles and future LEV-II and Tier 2 vehicles. We have added provisions to the test procedures for both dilute continuously-integrated measurements and dilute bag-integrated NO_x measurements similar to those used for HD gasoline engine measurements. Based on testing conducted by EPA with a Tier 2 prototype GM Silverado using an older 200 Series Horiba CLD analyzer (SAE Paper 2000-01-1957, June 2000), we expect that bag-integrated NO_x measurement down to approximately one-half of the proposed 2007 HDDE NO_x standard should have a coefficient of variance (COV) better than 8 percent.

With respect to PM measurement, we have made several changes to reduce the COV of PM measurements. This was done primarily by adopting a number of changes originally recommended by Kittelson and Johnson as long ago as 1991 (SAE 910738). We also adapted sample filter media and handling procedures from ambient measurement procedures for fine-PM, and the new regulations will require the use state-of-the-art microbalances for PM filter-mass determination. We have instituted many, although not all, of these changes for our current laboratory measurements of PM from a HDDE equipped with catalyzed diesel particulate filters at NVFEL. We have demonstrated the ability to measure PM emissions between 0.002 and 0.004 g/bhp-hr with a 95 percent confidence interval of ± 0.001 g/bhp-hr (see Chapter 3 of the RIA). For an engine emitting at the standard (0.01 g/bhp-hr), this would give a COV of less than 5 percent.

(2) The Federal Test Procedure (FTP) was developed on the basis of driving patterns in the early 1970s and the operating characteristics of modern truck and bus engines have changed considerably. FTP is obsolete and a test cycle more representative of current and future engine operation is necessary to better reflect in-use driving conditions. One commenter noted that the FTP requires the engines to be operated at high engine speeds never experienced in actual use and that EPA should participate in the Worldwide Heavy-Duty Certification (WHDC) work program of the UN Economic Commission for Europe (UN-ECE). This commenter added that the US has recently signed the global agreement within the WP29 framework and EPA's involvement as well as the harmonization of highly complicated test procedures would be highly beneficial to manufacturers. This commenter also specifically proposes that EPA replace the FTP with the proposed WHDC cycle in 2008.

Letters:

DaimlerChrysler (IV-D-344) **p. 14-15**
Engine Manufacturers Association (IV-D-251) **p. 34-35**
International Truck & Engine Corp. (IV-D-257) **p. 30**

Response to Comment 7.4.5 (A)(2):

We recognize the commenters' concerns about the applicability of the FTP transient test. However, we do not agree that it is obsolete. The FTP transient test exercises engines over their full range of potential speeds and loads. This would have value, even if it were no longer representative of the most typical in-use operation. As we noted in establishing the NTE provisions, no single test cycle can perfectly represent all in-use operation. The FTP transient test remains a useful measure of emission performance. We are participating in the development of the WHDC, but it is too early for us to determine whether that process will result in an acceptable replacement for the FTP transient test. Moreover, we do not agree with the comment that the higher speeds included in the FTP test are never experienced in actual use. While they may no longer be as common as they were in the past, they do still occur. Finally, it is important to note that if we were to adopt a different test cycle, we would need to reconsider the appropriate level of the standards, and may need to set them lower.

(3) PM values of 0.02 g/bhp-hr and below are very close to the limits of detection for current technology. The total measurement error, which is around 6% for current PM levels, can account for a much higher percentage of the measured value of PM than actual PM levels. EPA should work with industry to improve PM measurement technology prior to establishing new emissions standards based on inaccurate, outdated PM measurement technology. Since part of the measurement variability is due to sulfur in the fuel, EPA should at a minimum, disregard the sulfate portion of emissions as part of PM until the test procedures can be corrected. Commenter provides additional discussion and supporting data regarding PM measurement accuracy.

Letters:

DaimlerChrysler (IV-D-344) **p. 16-17**

Response to Comment 7.4.5 (A)(3):

See our response to comment 7.4.5(A)(1).

(4) An ISO standard has been developed for the measurement of gaseous and particulate emissions from heavy duty engines and is currently in the Draft International Standard (DIS) stage (commenter provides as an attachment). EPA should adopt ISO 16183 as soon as it is published as an alternative to the current, measurement procedure.

Letters:

DaimlerChrysler (IV-D-344) **p. 17**

Response to Comment 7.4.5 (A)(4):

The ISO standard mentioned is only a draft. It would not be appropriate to make any commitments regarding whether the final version would be acceptable.

(5) To address the issue of inadequate test procedures, EPA should immediately begin a cooperative effort with industry experts to reduce test variability and to develop substantial revisions to Subpart N of Title 86 governing certification and auditing test procedures. The goal of this effort should be to reduce the variability to less than 10% of the standards.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 35**

Response to Comment 7.4.5 (A)(5):

We have been working with industry to address these concerns. As noted in response 7.4.5 (A)(1), we believe that the progress that we have made is sufficient to address the manufacturers' concerns. Nevertheless, we will continue to work with manufacturers as new methods become available.

(6) The flaws in EPA's test measurement procedures are exacerbated under the supplemental emission requirements. Engine manufacturers have seen even higher standard deviations for engine testing conducted on the supplemental steady state test than on the transient FTP. Higher variability is expected over the NTE zone compared to the transient FTP test. EPA must first fully develop test procedures and analyze and maximize measurement accuracy and once that is completed, EPA can establish technologically feasible standards and limits.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 59**

Response to Comment 7.4.5 (A)(6):

We addressed these concerns in "Control of Emissions of Air Pollution from 2004 and Later Model Year Heavy-Duty Highway Engines and Vehicles: Response to Comments". As we noted there:

> The NTE procedure specifies the conditions under which the engine must comply with the NTE standard. We have not specified the emission measurement equipment which could be used to determine compliance with the NTE, and we do not believe it is necessary to do so. However, this does not give the Agency unlimited discretion to determine compliance with the NTE as suggested by the commenters. Compliance with the NTE could clearly be determined using the laboratory equipment and procedures specified in the regulations for the existing FTP. The test equipment regulations for the existing FTP include detailed accuracy and precision requirements for the equipment, which allows manufacturers to design their engines with sufficient compliance margins to ensure that the true value (i.e., the actual value) of the engines emission performance is below the emission standard, including appropriate consideration for the accuracy and precision of the test equipment. The use of existing standard laboratory equipment will allow manufacturers to design engines to comply with the NTE standard, because the use of existing laboratory equipment will allow manufacturers to design engines with sufficient compliance margins to ensure the true value of the engines emission performance is below the emission standard. Laboratory facilities with engine dynamometers are capable of simulating any duty cycle which the engine would experience during normal vehicle operation and use during actual on-road vehicle operation. In addition, as discussed by a number of engine manufacturers, the effect of temperature, humidity and altitude on HDDE engines are well known, and manufacturers can include appropriate compliance margins to design engines to comply with the broader range of expanded conditions which apply to the NTE based on their existing expertise and knowledge. A manufacturer can therefore design engines based on laboratory equipment which ensures that the true value of the engines emission performance is at or below the emission standard, and that engine would therefore continue to comply with the standard in actual vehicle operation during normal vehicle operation and use.

(7) Commenter states that EPA did not clearly define test procedures and should develop NTE test procedures and PM measurement techniques adequate for the proposed standard without delay. The proposed PM standard on FTP is .01 g/bhp-hr based on averaged weighted composite cycle; and consequently a PM measurement accuracy required to comply with NTE limits may not be achievable under current prevailing regulations.

Letters:

DaimlerChrysler (IV-F-186)

Response to Comment 7.4.5 (A)(7):

See the response to comment 7.4.5 (A)(1).

(8) Changes to Subpart N are necessary. The current FTP emission measurement test requirements contained in Subpart N of 40 CFR Part 86 have not been significantly revised since they were adopted over a decade ago. To accurately measure emissions from HD engines at levels similar to those proposed for the 2007 standards, major improvements to the testing requirements are necessary and should include use of ultra-clean intake air, humidity and temperature controls, more accurate gas analyzers and PM measurements methods, and low sulfur test fuel. In addition, the required analyzer specifications and test procedures must be modified to ensure technically accurate emission test results. Until improvements to Subpart N are made, EPA will have no defined test procedures for HD engines that are sufficiently accurate to make compliance determinations with respect to the 2007 standards. One commenter added in this context, that without improvements in the test methods, the feasibility of the standard may be limited as much or more by the capabilities of the test methods instead of by the engine and aftertreatment technologies. Another commenter specifically recommended that Subpart N procedures and associated test practices be improved such that the standard deviation within and among lab test variabilities be reduce to no more than 10 percent of the standards and noted that this task should be accomplished no later than January 1, 2003 to allow manufacturers adequate time to upgrade their testing facilities.

Letters:

Cummins, Inc. (IV-D-231) **p. 31**
Detroit Diesel Corporation (IV-D-276) **p. 8-10**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 67**

Response to Comment 7.4.5 (A)(8):

See the response to comment 7.4.5 (A)(1).

(9) University of Minnesota research has demonstrated that laboratory test stand PM emission certification procedures, similar to EPA's recently finalized certification procedures, produce results that appear to have no relationship

to the actual PM emissions generated by vehicles operating on the highway.

Letters:

American Petroleum Institute (IV-D-343) **p. 14**

Response to Comment 7.4.5 (A)(9):

We are aware of research from the University of Minnesota that have shown some discrepancies with respect to particle numbers, but we are not aware of any similar research that shown similar discrepancies with respect to particulate mass. Since our standards are based on measurement of PM mass, we continue to believe that our test procedures are appropriate. See response to comment 7.4.5(A)(1).

(B) There may be unforeseen implementation issues related to test requirements and measurement capability since knowledge of the requirements and technology is currently limited.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Cummins, Inc. (IV-F-64)

Response to Comment 7.4.5 (B):

It is always possible for there to be unforseen implementation issues. Such issues have arisen in the past, and have been adequately dealt with either through our regulatory discretion, or through regulatory amendment.

(C) EPA should consider the use of portable "rover-like" or "HDD IM" devices as an option for testing emissions. This commenter asserted that the testing is accurate and these type of devices are small and easy to use and install.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Clean Air Technologies International, Inc. (IV-D-2) **p. 1**

Response to Comment 7.4.5 (C):

EPA is aware of such devices and will be reviewing their accuracy in the context of in-use field testing. EPA is expecting to further review this issue in a future rulemaking dealing with in-use testing.

(D) Use of on-road emission measurement systems such as the Real-Time On-Road Emission Reporter (ROVER), are inadequate to determine compliance status accurately.

(1) There are serious problems with ROVER-type systems which make this type of equipment inadequate for emission measurement and compliance purposes. These problems must be resolved before any such system is established as a regulatory compliance requirement. The major problems with the ROVER system involve equipment and process limitations that constrain the accuracy of emissions measurement, evidence of poor correlation between on-highway measurements using ROVER and standard laboratory emission testing methods, test-to-test variability resulting from these limitations, and the unlimited or undefined set of on-road conditions over which a vehicle could be tested. These measurement problems are magnified under the stringent "2007" standards. It is apparent that the ROVER-type systems are not capable of measuring compliance to the "2004" standards and because the "2007" standards are 90 percent lower than the "2004" standards, the accuracy of any such system must be improved by at least a factor of ten. Commenter provides significant discussion on this issue detailing the numerous equipment and procedural issues that must be addressed before using ROVER-type equipment for testing and compliance purposes.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 68-71**

Response to Comment 7.4.5 (D):

This comment is nor relevant to this rulemaking because we are not establishing any requirements with respect to ROVER systems in this action.

(E) EPA may not require manufacturers to conduct in-use testing.

(1) Light duty in-use compliance models (i.e. CAP 2000) are not applicable to HD engines. It is impractical to require manufacturers to remove in-use HD vehicles from their customers in order to conduct in-use emissions tests. Even though EPA claims authority to impose this requirement under section 208 of the CAA, there is no statutory basis for requiring HD engine manufacturers to conduct in-use testing. EPA should observe the clear legislative history of section 208. Congress simply did not grant EPA authority to require manufacturers to sponsor in-use testing programs when such testing was "reasonably available." Any attempt to force such in-use testing on manufacturers would nullify the clear limitation on EPA's power to require such testing in section 208. EPA's current proposal does not meet the basic statutory criterion for invoking its section 208 testing authority. In addition to this lack of legal authority, EPA has assumed that HD engine manufacturers could in fact comply with its testing rule, but the vehicle owners have no specific contractual obligation to make their engines available to manufacturers for testing. Commenter provides significant discussion on this issue, citing case law and relevant sections of the CAA and notes that requiring manufacturers to conduct in-use testing would be inconsistent with the decision making requirements of CAA 307(d)(9) and 5 USC 706.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 72-75**

Response to Comment 7.4.5 (E):

This comment is not relevant to this rulemaking because we neither proposed nor are we finalizing any requirement for manufacturers to conduct in use testing similar to CAP 2000. However, regarding the commenter's legal argument regarding our authority to require such a program in the future, please refer to Issue 27 of our Response to Comments for the Phase 1 Heavy Duty Engine Rule.

(F) EPA should remove the requirement to complete the idle CO test for HDGs since it is unnecessary.

(1) EPA should review the usefulness of the idle CO test for HDGs. This requirement was dropped under the Tier 2 rule for 2004 or later model year vehicles and continuing this requirement for HDGs would be a waste of resources since the HDG results for this testing requirement are similar to the light duty vehicle side. Current certification data indicates that idle CO emission levels are near zero due to the low CO concentration and the calculation method (percent of exhaust flow).

Letters:

DaimlerChrysler (IV-D-284) **p. 10**
Engine Manufacturers Association (IV-D-251) **p. 52**

Response to Comment 7.4.5 (F):

We have reviewed the need for the idle CO standard, and have concluded that it is not necessary for vehicles equipped with OBD systems. See response to comment 3.1.1(R).

Issue 7.5: Used Motor Oil as Fuel

(A) EPA should prohibit the practice of adding used motor oil to diesel fuel to be used in any vehicles with aftertreatment control devices.

(1) Ash forming components in the oil (i.e. sulfur and phosphorus) will deactivate catalysts if they make their way into the exhaust system. The effect is more severe in diesel systems than gasoline because diesel catalysts do not achieve the high temperatures that are required to purge them of ash deposits. In addition, the fine metallic content found in used engine oil may accelerate component wear in the fuel injection system and prematurely degrade emissions. Restricting the chemical composition of oils should occur only in conjunction with manufacturers since the resulting composition may affect the oil's performance. Used motor oils should be recycled at plants that are designed to properly treat the used oil.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 18**

Response to Comment 7.5(A):

We agree that ash formation can be potentially problematic for aftertreatment technologies. Thus, we are prohibiting the practice of adding used motor oil to diesel fuel, with one important exception. We will allow manufacturers to certify engines that are specifically designed to use such mixed fuel. For these engines, used oil can be added to the fuel, but only as specified by the certifying manufacturer. Adding more oil than allowed by the manufacturer, or adding oil that does not meet the manufacturer's specification, would be considered to be a violation of the new section 40 CFR 80.522.

(B) EPA does not have the authority under section 211(c) to control used motor oil because it's not a fuel nor fuel additive.

(1) EPA provided no rationale for its authority to control motor oil under the CAA; nor did EPA define used motor oil. EPA must remedy both of these failings in order to allow for public comment and discussion on the proposal.

Letters:

American Petroleum Institute (IV-D-343) **p. 65, 93**

Response to Comment 7.5(B):

We are only regulating used motor oil to the extent that it is used as a fuel or fuel additive. Today's action does not affect any used oil that is not used as a fuel or as a fuel additive. EPA is not creating a definition of the term "used motor oil" because the plain language meaning is sufficiently clear.

(C) Opposes the prohibition on motor oil being dispensed into truck fueling systems.

(1) The disposal of used oil is very complicated and has impacts on different environmental media. For marketers, the disposal of motor oil has been a source of continuing problems as disposal facilities go bankrupt and become superfund sites on a regular basis. As a result, burning and reusing motor oil as a fuel have become very attractive methods of disposing of this oil. The ban proposed by EPA would eliminate a cost effective disposal option and eliminates any incentive to develop a low sulfur lubricant that could be used in the vehicle engine. The use of high sulfur motor oils is unlikely to be problematic and the issue should be deferred to a separate rulemaking.

Letters:

Petroleum Marketers Association of America (IV-D-245) **p. 13-14**

Response to Comment 7.5(C):

We are aware that practice of blending used motor oil with diesel fuel is sometimes a convenient way to dispose of used oil. However, since current formulations of motor oil contain very high levels of sulfur, the addition of used oil to highway diesel fuel could substantially impair the sulfur-sensitive emissions control equipment expected to be used by engine manufacturers to meet the emissions standards in today's rule. Depending on how the oil is blended, it could increase the sulfur content of the fuel burned in the vehicle by as much as 200 ppm. Ash formation can also occur because of other contaminants in the used oil. As a result, we believe blending used oil into highway diesel fuel could render inoperative the emission control technology on the vehicle. Thus, we are prohibiting this practice for all engines not specifically designed and certified to handle these blended fuels.

(D) EPA should not require motor oil blended with fuel to be the highest sulfur content of any commercially available motor oil.

(1) EPA has proposed certain requirements with respect to motor oil blended with diesel fuel at any point downstream of the refinery. However, the proposed regulatory language is unclear and should be revised. Proposed Section 80.441(a) appears to mandate that any motor oil blended into diesel fuel be compliant with the requirements of 80.446. Such a requirement would be the equivalent of an outright ban on such blending as motor oil cannot meet those specifications and still perform their primary function. If there is a 15 ppm cap on motor oils that are to be blended with diesel, the proposed Section 80.448 that reads "that is explicitly based on the addition of motor oil having the greatest sulfur content of any motor oil that is commercially available" is not required and does not make sense. Even if this section does not impose specifications on motor oils, the clause is inappropriate since it will be impractical to determine which commercially available motor oil has the greatest sulfur content, and manufacturers should be allowed to specify which oils can be used in their engines and be able to certify using those specified oils.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 30-31**

Response to Comment 7.5(D):

We are not finalizing that requirement.

(E) ASTM D-5185 should be used as the test method for sulfur in motor oil.

(1) If EPA chooses to require a test method for sulfur in motor oil, it should be ASTM D-5185 since it has the best precision. EPA should not use ASTM D-4927 as the test method for this requirement.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 18**

Response to Comment 7.5(E):

We are not specifying any test requirements for used motor oil.

Issue 7.6: Other Compliance Issues

(A) EPA should adopt a strong in-use compliance and enforcement program for all trucks and buses to ensure that they continue to comply with the standards on the road throughout their useful lives.

(1) Commenters provided no further supporting information or detailed analysis. This comment was made by approximately 7,100 private citizens.

Letters:

American Lung Association (IV-F-161, 192) **p. 8**
American Lung Association of Los Angeles (IV-D-47)
American Lung Association of TN (IV-D-19) **p. 1**
CA PIRG (IV-F- 190) **p. 280**
CO Environmental Coalition (IV-F- 191) **p. 237**
CO Public Interest Research Group (IV-F- 191) **p. 219**
Cassara, Bob (IV-F-65)
Center for Neighborhood Technology (IV-F-11)
Chicagoland Transportation and Air Quality Commission (IV-F-10)
Chuang, Henry (IV-F- 117) **p. 265**
Chung, Payton, et. al. (IV-D-133)
City of Arcata (IV-D-200) **p. 2**
Clean Air Network (IV-F-191) **p. 84**
Clean Air Now Campaign (State PIRGs & citizens) (IV-D-357, 358)
Coalition for Clean Air (IV-F-190) **p. 177**
Coalition on the Environment and Jewish Life (IV-F-184)
Communities for a Better Environment (IV-F-190) **p. 129**
Community Coalition for Change (IV-F-190) **p. 74**
Davidson, Karin, et. al. (IV-D-79)
Dickson, Victoria, et. al. (IV-D-77)
Firestone, Ross (IV-F-4)
Fox, John (IV-F- 191) **p. 75**
Franczyk, Catherine A., et. al. (IV-D-233)
Freechild, Aquene, et. al. (IV-G-60)
GA State Senator (IV-F- 117) **p. 179**
Glendale-La Crescenta Advocates (IV-D-80) **p. 1**
Hackel, Barbara, et. al. (IV-D-14) **p. 1**
Hopkins, Steve, et. al. (IV-G-07)
IL Environmental Protection Agency (IV-D-193) **p. 2**, (IV-D-308) **p. 2**
IL Public Interest Research Group (IV-F-18)
Institute for Global Solutions (IV-F-175)
Kinyon, John, et. al. (IV-G-13)
L.A. County Bicycle Coalition (IV-F-190) **p. 131**
Lu, Rong (IV-F-162)
MD DOE (IV-D-59) **p. 2**
Mayor and citizens of Fort Collins, CO (IV-F-191) **p. 211**

Mexican-American Community Foundation (IV-F-179)
Montgomery, Jack, et. al. (IV-D-78)
NESCAUM (IV-D-315) **p. 9**
NY DEC (IV-D-239) **p. 2**
NY State Assembly (IV-D-266) **p. 2**
NYC Environmental Justice Alliance (IV-F-116) **p. 317**
Natural Resources Defense Council (IV-D-168) **p. 11**, (IV-F-190) **p. 102**
O'Leary, Cathy and John Carey (IV-G-05)
Ozone Transport Commission (IV-D-249) **p. 2**, (IV-F-55)
Packard, Josh (IV-G-54)
Rhubert, Pamela J. (IV-D-15) **p. 1**
Riggles, Ruth, et. al. (IV-D-102)
Rodriguez, Dolores, et. al. (IV-D-91)
Schmitz, Randy, et. al. (IV-D-46)
Schwartz, Steve (IV-D-85)
Sierra Club Rocky Mtn. Chapter (IV-F- 191) **p. 191**
South Bronx Clean Air Coalition (IV-F- 116) **p. 125**
Stuckey, Stephanie (IV-D-182) **p. 2**
Tacha, Athena and Richard Spear (IV-G-06)
Union of Concerned Scientists (IV-F-165)
Village of Oak Park Dept. of Public Health (IV-F-8)
Washington Regional Network (IV-D-18) **p. 1**
Williams, Mary, et. al. (IV-D-122)

Response to Comment 7.6(A)(1):

We agree that a strong in-use enforcement program is necessary to ensure that heavy-duty vehicles will comply with the new standards in use. EPA has promulgated OBD and NTE requirements in the Phase 1 rule in part to improve our ability to enforce the heavy-duty standards in use. We did not propose any manufacturer in-use testing program in this rule. We expect to address these issues in a future rulemaking.

(2) One commenter noted that the NTE limits in the recent Consent Decree between the U.S. and a number of diesel manufacturers, should be codified and that EPA should adopt OBD requirements and implement an in-use testing program and other enforcement mechanisms.

Letters:

City of Seattle (IV-D-297) **p. 2**
MD DOE (IV-D-163) **p. 1**
Natural Resources Defense Council (IV-F-75)

(3) Some specifically noted that both in-use compliance efforts and OBD requirements should be in place for all HDVs by 2007.

Letters:

Consumer Policy Institute (IV-D-186) **p. 7**
International Center for Technology Assessment (IV-D-313) **p. 3**

NJ PIRG (IV-F-116) **p. 314**
NY DEC (IV-D-239) **p. 4**
NY State Attorney General's Office (IV-D-238) **p. 2**
NYC Council (IV-F-80)
WI DNR (IV-D-291) **p. 2**
WI Department of Transportation (IV-D-241) **p. 2**
Wilderness Society (IV-F-117) **p. 217**

Response to Comments 7.6(A)(2) and (3):

We have already codified the NTE limits from the consent decrees into 40 CFR Part 86, with some modifications. We have also adopted OBD provisions for heavy-duty vehicles under 14,000 pounds GVWR. We will be considering adoption of similar OBD provisions for other heavy-duty vehicles and a manufacturer in-use testing program in a future rulemaking.

(4) Commenter suggests a required national I&M program for all affected vehicles to ensure that new controls are effective in-use, on a continuous basis.

Letters:

Fletcher, Robert E. (IV-F-117) **p. 175**

(5) In-use compliance is necessary because otherwise more stringent controls must be imposed on stationary sources, and businesses will be forced to pay to compensate for illegal dirty emissions.

Letters:

CA Air Pollution Control Officers' Association (IV-D-109) **p. 2**

(6) EPA should develop a true emissions short test for States to use to encourage proper maintenance of vehicles.

Letters:

PA DEP (IV-D-100) **p. 3**

Response to Comment 7.6(A)(4), (5) and (6):

See our response to comment 7.6(A)(1).

(B) EPA should examine and address, if possible, the issue of trucks idling unnecessarily for extended period of time, which causes emissions that could easily be avoided.

(1) In order to address this problem, EPA could encourage or require the production of trucks that have a sleeper cab that can be heated or cooled without the engine being on continuously.

Letters:

Instatherm (IV-F- 117) **p. 223**

(2) Commenters provided no further supporting information or documentation.

Letters:

Mathews, Erik, et al (IV-D-24) **p. 1**

(3) The extent to which engines powering interstate trucks are idled without a driver behind the wheel (40 percent of HDDEs total operating time), severely compromises the g/bhp-hr standards as presently proposed. EPA should recognize this extremely deleterious situation by a further lowering of the allowable engine pollution level to accommodate this extended idling at zero bhp. The best available means to achieve this is simply to turn off the engine when it is not propelling the truck. Technology is currently available to sleeper truck manufacturers and to the industry to eliminate the need for trucks to idle and pollute in this manner. Commenter provides additional statistics and urges EPA to address the issue in its proposed rule.

Letters:

Instatherm (IV-D-119) **p. 1-3**

Response to Comment 7.6(B):

We did not propose any changes to the test procedures or emission calculations to address technologies that reduce idling time. Nevertheless, we believe that such technologies may have significant environmental value, and may consider the issue in a future rulemaking.

(C) EPA should adopt appropriate labeling requirements for vehicle manufacturers.

(1) Agrees with the labeling requirement in section 86.007-35(c). This is a necessary step to help prevent misfueling. EPA should clarify that it does not intend to require HDE manufacturers to comply with the labeling requirements since these manufacturers typically supply the engines to the vehicle manufacturers who should be held responsible for ensuring the labeling requirements are met.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 74**

Response to Comment 7.6(C):

We are adopting a requirement that manufacturers notify each purchaser of a model year 2007 or later diesel-fueled vehicle that the vehicle must be fueled only with the low-sulfur diesel fuel meeting the regulations being adopted in this FRM. We are also requiring that model year 2007 and later heavy-duty diesel vehicles must be equipped by the manufacturer with labels on the dashboard and near the refueling inlet that say: "Use Low Sulfur Diesel Fuel Only" or "Low Sulfur Diesel Fuel Only". The regulations do not specify precisely which manufacturer must install the labels. For non-integrated manufacturers, we believe that it would be appropriate for the engine manufacturer to provide such a label to the vehicle manufacturer, since in many cases the engine manufacturer will be more familiar with the regulatory requirements. However, we will allow an engine manufacturer work out other arrangements with the vehicle manufacturer to have the vehicle manufacturer install its own label. In many ways, this requirement is similar to the requirements for manufacturers to specify exhaust systems or cooling systems for their engines, which the vehicle manufacturers install.

(D) EPA should draft rules that would establish appropriate noncompliance penalties for engine and vehicle manufacturers.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

West Harlem Environmental Action/Envr Justice Network (IV-F-76)

Response to Comment 7.6(D):

See response to comment 3.7.3(A)(1).

(E) EPA should consider alternative compliance options to address issues associated with competitiveness.

(1) Competitive issues created by the 2004 rules and unresolved issues from the Consent Decree, will compromise certain manufacturers' ability to compete in the HD diesel engine market-place. Since the 2004 rule was not successfully implemented, Consent Decree companies must now make a choice between attempting to survive almost five years of severe competitive disadvantage or developing two separate produce lines. In its proposed rule, EPA has not acknowledged or addressed the competitive impact that proposed industry-wide regulations (or the lack thereof) have on companies bound by Consent Decrees. Commenter recommends that EPA consider an alternative approach that would address their concerns. Under the commenters' proposal, the 2007 rule would add a voluntary program beginning in 2005, under which volunteers would pull ahead Supplemental Emission Testing requirements (including NTEs) in exchange for reduced emission requirements in 2007, and would move Consent Decree implementation of the testing requirements from October 2002 to October 2003 to maintain the 15-month competitive disadvantage to which the Consent Decree companies agreed. Commenter provides additional discussion on this issue and their proposal to address competitiveness issues.

Letters:

Cummins Inc. and Caterpillar Inc. (IV-G-61), **p. 1-3**

Response to Comment 7.6(E):

See response to comment 3.1.4(F)(8).

ISSUE 8: REFINERY/DISTRIBUTION ISSUES

Issue 8.1: Supply and Distribution

Issue 8.1.1: Fuel Supply Reliability Impacts

(A) The implementation of a 15 ppm diesel fuel sulfur standard is unlikely to cause refiners to close or to stop producing diesel fuel.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Environmental Law & Policy Center of the Midwest (IV-F-6)

(2) Disagree with refiners' argument that some refiners will choose not to make diesel, thereby reducing supply. Fuel supply will be driven by profitability, not cost. Despite the implementation of a low-sulfur standard in California, demand for diesel remains high and many of the most profitable refiners are located in California.

Letters:

Alliance of Automobile Manufacturers (IV-F-9, 59, 190) **p. 114** (IV-F-117) **p. 168** (IV-F-191) **p. 89**

(3) The refining industry has proposed a fuel sulfur level of 50 ppm and the incremental costs associated with reducing the sulfur in fuel from 50 ppm to 15 ppm is minimal. According to the MathPro study, this incremental cost would be approximately 3-5 cents per gallon. In addition, API's own data show that refinery closures have occurred steadily since 1985 but crude oil capacity in the U.S. has increased significantly during that same period, which further supports the assertion that fuel shortages are unlikely to pose a problem. [cites to API Basic Data Book, Section VIII, Table 4].

Letters:

International Truck & Engine Corp. (IV-D-257) **p. 9**

(4) Fuel supply issues are unlikely to be a significant problem in the context of EPA's proposed rule. Refiners have the capability to use zero-sulfur blending to help return any contaminated volume to compliance levels. In addition, EPA should consider the potential fuel savings that would accrue if automakers are successful in introducing the higher efficiency advanced technology diesel vehicles, which have very high fuel efficiencies. The increase market share of light duty diesels with higher fuel efficiencies would reduce overall use of diesel and could help mitigate any future issues associated with reduced diesel supply.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 17**

(B) The 15 ppm diesel fuel sulfur standard will have an adverse impact on the supply of diesel fuels, which may result in price spikes.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

American Farm Bureau Federation (IV-F-5)
Countrymark Cooperative (IV-D-125) **p. 2**
Farmland Industries (IV-F-29)
LA Mid-Continent Oil and Gas Association (IV-D-319) **p. 3**
NY Assoc. of Service Stations & Repair Shops (IV-F-45)
Placid Refining Company, LLC (IV-D-230) **p. 1**

(2) The cost of the capital investments alone will cause some refiners to stop producing diesel, which will further reduce supplies. Some of these commenters noted that meeting the 15 ppm standard will require large capital investments since new, high-pressure hydrotreating units will be required and only a handful of suppliers design and build these units and as a result, refiners will most likely produce a reduced volume of diesel from available straight run stocks and supplies will shrink. One commenter provided as an attachment to their letter, the Turner, Mason & Company study entitled "Costs/Impacts of Distributing Potential Ultra Low Sulfur Diesel" of February 2000, as further supporting documentation.

Letters:

American Bus Association (IV-D-330) **p. 5**
American Petroleum Institute (IV-D-343) **p. *3,*4, 45**
CO Petroleum Association (IV-D-323) **p. 1-2**
Cenex Harvest States Cooperatives (IV-F-191) **p. 102**
Citgo Corporation (IV-D-314) **p. 3, 4**
Conoco (IV-F-191) **p. 154**
Countrymark Cooperative (IV-D-333) **p. 5**, (IV-F-30)
Equiva Services (IV-D-226) **p. 3**
ExxonMobil (IV-D-228) **p. 2-3, 14-16**, (IV-F-800)
Food Marketing Institute (IV-D-283) **p. 3**
Gary-Williams Energy Corporation (IV-F-43)
Independent Fuel Terminal Operators Association (IV-D-217) **p. 3**
Marathon Ashland Petroleum (IV-D-261) **p. 2**, (IV-F-74)
Murphy Oil Corporation (IV-D-274) **p. 13-14**
NATSO (IV-D-246) **p. 8**, (IV-F-17)
National Petrochemical & Refiners Assoc./CITGO (IV-F-117) **p. 101**
National Petrochemical & Refiners Association (IV-D-218) **p. 5, 19, 21**,(IV-F-44, 67), (IV-G-31), **p. 1**
Ports Petroleum Co, Inc. (IV-F- 117) **p. 190**

Remster, John (IV-F-28)
Society of Independent Gasoline Marketers of America (IV-D-328) **p. 4**, (IV-F-191) **p. 196**
U.S. Chamber of Commerce (IV-D-329) **p. 5-7**

(3) Some commenters referred to the National Petroleum Council report "U.S. Petroleum Refining: Assuring the Adequacy and Affordability of Cleaner Fuels" June 20, 2000 and noted that the NPC has called the risk of inadequate supplies as a result of the proposed diesel fuel sulfur standard "significant." Commenters referred to several conclusions in this report regarding the potential for adverse impacts to diesel fuel supply and price due to the proposed fuel standard. One commenter also referred to statements made by the Congressional Research Service (CRS) and noted that the limitations associated with the pipeline infrastructure would magnify any supply disruptions resulting in significant prices increases. This commenter provided significant discussion on the issue of the potential for supply shortages and cited to API's estimate that the implementation of the proposed fuel standard would lead to a decrease in the production of diesel fuel by about 30% from current levels.

Letters:

American Petroleum Institute (IV-D-343) **p. 43**, (IV-F-16, 42, 182, 117) **p. 161** (IV-F-191) **p. 114**
American Trucking Association (IV-D-269) **p. 13-18, 29**
Countrymark Cooperative (IV-D-333) **p. 5**
Murphy Oil Corporation (IV-D-274) **p. 9-10, 13-14**
Sinclair Oil Corporation (IV-D-255) **p. 5**
U.S. Department of Energy (IV-G-28) **p. 5-6**

(4) Commenters cited a Charles River Associates study, "An Assessment of the Potential Impacts of Proposed Environmental Regulations on U.S. Refinery Supply of Diesel Fuels," August 2000, that estimates 20 refiners will produce less on-road diesel, thus significantly affecting diesel supplies. The report estimates a 320 thousand barrel per day shortfall; this on top of lower imports from Europe as a result of more stringent standards will result in price increases. Commenters provide significant discussion on this issue including a graph of supply-demand market equilibrium with full cost recovery and note that the economic impact of expected supply disruptions will be more acute in certain regions such as PADD 4. Commenters suggest EPA consider the potential economic and national security ramifications of its proposed rule.

Letters:

American Petroleum Institute (IV-D-343) **p. 46-50**
ExxonMobil (IV-D-228) **p. 2-3, 14-16**
Marathon Ashland Petroleum (IV-D-261) **p. 45-48**

(5) Some commenters cited to specific estimates of how much the supply of diesel fuel may be reduced as a result of EPA's proposed rule. One

commenter noted that NPRA expects diesel fuel supply capability to be reduced by 320-620 thousand barrels per day, or as much as 10-20% of projected diesel demand in 2006, as a response to EPA's proposed rule. Another noted that API and the NPRA have estimated that the proposed rule will result in a 20 to 30 percent reduction in the U.S. diesel fuel supply over a period of up to four years.

Letters:

National Petrochemical & Refiners Association (IV-D-218) **p. 3**
U.S. Chamber of Commerce (IV-D-329) **p. 6**

(6) Any supply shortages will be exacerbated by the fact that foreign refiners will be unable to provide additional supplies of the low-sulfur diesel. Increased imports are unlikely to be able to fill the gaps in lost production since few foreign refiners will be producing diesel that would meet the low-sulfur standards. The installation of new equipment for foreign refiners to meet increased demand could take several years. Some commenters suggested that EPA move to a 50 ppm standard to be consistent with Europe. One commenter notes that without European supplies, distributors will turn to Midwest diesel to supply Northeast home heating oil in the winter at the same time Midwest farmers are attempting to stockpile supplies for spring planting and to use for home heating. Another commenter notes that much of the diesel fuel used on the East Coast is imported from abroad and the lower the sulfur content standard required, the more difficult it becomes to obtain additional supplies from outside the U.S. This commenter added that if EPA mandates an extreme standard, it will very likely result in tight markets, high prices and physical dislocations and shortages.

Letters:

American Petroleum Institute (IV-F-16, 42, 182, 117) **p. 161** (IV-F-191) **p. 114**
Cenex Harvest States Cooperatives (IV-D-232) **p. 6**
Independent Fuel Terminal Operators Association (IV-D-217) **p. 3-4**
Murphy Oil Corporation (IV-D-274) **p. 10, 14**
National Petrochemical & Refiners Association (IV-D-218) **p. 11**
New England Fuel Institute (IV-D-296) **p. 2-3**
Ports Petroleum Co, Inc. (IV-F- 117) **p. 190**
Society of Independent Gasoline Marketers of America (IV-F-191) **p. 196**
U.S. Chamber of Commerce (IV-D-329) **p. 6**

(7) Increasing fuel specification stringency, coupled with the refining industry's low rate of return on capital, make it more difficult to produce and distribute products. This leads to supply disruptions and price spikes, such as home heating oil last winter and Midwest RFG recently. The commenter cites "The California Conundrum," by P.K. Verleger (March, 2000) which draws analogies between the increase in California gas prices and price spikes in home heating oil in the East, as evidence that strict standards result in price spikes because of the associated difficulty of producing and distributing such

products. Other commenters pointed to recent price spike incidents (such as home heating oil and RFG) as examples of what is likely to occur as a result of a 15 ppm standard. One of these commenters noted that while those spikes tended to be localized in nature, diesel price spikes will affect a broader area geographically and a broader set of industries that rely on the fuel.

Letters:

Agricultural organizations as a group (IV-D-265) **p. 1-2**
Big West Oil, LLC (IV-D-229) **p. 1-2**
Cenex Harvest States Cooperatives (IV-D-232) **p. 11**
National Petrochemical & Refiners Association (IV-F-31)
USDA (IV-D-299) **p. 3**

(8) Some commenters also asserted that contamination at pipeline interfaces or elsewhere in the distribution network will lead to inevitable downgrades, which will subsequently reduce the supply of diesel (or lead to spot outages). Some commenters pointed to the NPC report's conclusions about this concern. One of the commenters stated that there could be initial contamination of low-sulfur fuels unless pipelines, tanks, and other distribution components are thoroughly separated from exposure to higher sulfur products. Complete segregation of low-sulfur diesel is not currently possible since there are not enough dedicated pipelines, and storage, cargo and retail tanks to ensure that higher sulfur fuels will remain completely separate. One commenter noted that some pipelines are estimating that over 20% of the on-highway diesel will have to be downgraded in order to ensure the integrity of the 15 ppm sulfur product on the receiving end.

Letters:

American Petroleum Institute (IV-D-343) **p. 42-44**, (IV-F-16, 42, 182, 117) **p. 161** (IV-F-191) **p. 114**
American Trucking Association (IV-D-269) **p. 13-18**
British Petroleum (IV-D-242) **p. 6**
Cenex Harvest States Cooperatives (IV-D-232) **p. 9**
Citgo Corporation (IV-D-314) **p. 2**
Collier, Shannon, & Scott (IV-F-117) **p. 24**
Countrymark Cooperative (IV-D-333) **p. 4**, (IV-F- 191) **p. 184**
ExxonMobil (IV-D-228) **p. 3, 18**
Marathon Ashland Petroleum (IV-D-261) **p. 3, 50, 94-95**, (IV-F-74)
Murphy Oil Corporation (IV-D-274) **p. 10, 14**
NATSO (IV-F-17)
National Petrochemical & Refiners Assoc./CITGO (IV-F-117) **p. 101**
National Petrochemical & Refiners Association (IV-D-218) **p. 5**, (IV-F-31, 44)
New England Fuel Institute (IV-D-296) **p. 4**
Ports Petroleum Co, Inc. (IV-F- 117) **p. 190**
Society of Independent Gasoline Marketers of America (IV-D-328) **p. 4-5**, (IV-F-191) **p. 196**

U.S. Chamber of Commerce (IV-D-329) **p. 6**
U.S. Department of Energy (IV-G-28) **p. 5-6**
Western Independent Refiners Association (IV-D-273) **p. 3**

(9) The domestic industry has no experience handling low-sulfur fuels, as assessed by Turner, Mason & Co. and presented to EPA in a letter dated Feb. 23, 2000, and will have difficulty maintaining a continuous supply of 15 ppm sulfur fuel. Consequently, a large percentage of fuel will be downgraded from on-highway diesel, resulting in inadequate supplies and supply disruptions and concomitant price spikes. Other delays will be caused when the hydrotreater shuts down and the refinery produces high sulfur diesel; such downtime will be exacerbated by the need to flush the pipelines and product distribution system to avoid contamination of on-highway fuel. Moreover, it is doubtful that field testing equipment for low sulfur fuel will be available to test the product in pipelines, and so delays in product delivery may result as the product is tested in laboratories.

<u>Letters:</u>

American Petroleum Institute (IV-D-343) **p. 43-45**
Citgo Corporation (IV-D-314) **p. 2**
ExxonMobil (IV-D-228) **p. 2, 18**

(10) Even if a refiner can afford to make the investments necessary to install the machinery necessary to make 15 ppm or less diesel fuel, there is no assurance that this refiner can sustain production of diesel fuel with this sulfur level day after day. This would require near perfect operations of all machinery every day and such perfection will not occur in the real world of diesel fuel production. As a result, some portion of the existing production of on-road diesel will fail to meet the 15 ppm standard, thus further reducing supplies.

<u>Letters:</u>

Society of Independent Gasoline Marketers of America (IV-D-328) **p. 5**

(11) Commenter notes several factors that adversely affect supplies. First, LCO and coker distillates have molecules that are hard to desulfurize and therefore likely will not remain as viable distillates for the on-road markets. Second, refiners will have to run all distillates through the sulfur reduction units and not blend some distillate straight into the on-road pool. Third, molecular saturation and hydrocracking of distillates will result in yield losses of about 2 percent, or up to 40,000 B/D, which means that refiners will have to process an additional 120,000 B/D of crude (assuming 30 percent of a crude barrel goes to distillates). Finally, some refiners will find it more economical to crack distillate range molecules to gasoline rather than produce low sulfur diesel.

<u>Letters:</u>

Big West Oil, LLC (IV-D-229) **p. 5-6**

(12) Because diesel production is blended from fewer refinery units than gasoline, refinery diesel production capabilities are more limited than gasoline production capabilities. This results in less flexibility to control and blend sulfur to a level as low as 15 ppm. This will contribute to supply problems.

Letters:

Western Independent Refiners Association (IV-D-273) **p. 3**

(13) Already, as a result of industry consolidations and refiners exiting the motor fuels business, the number of sources of diesel fuel on which an independent marketer can look for supply has been reduced. If the sources of supply or the numbers of suppliers are restricted further, independent marketers will be forced to look towards integrated refiners (which in many cases are independent marketers' strongest competitors), for diesel fuel supply. As integrated refiners become aware that independent marketers have limited supply sources, there will be less of an incentive to be competitive. EPA's diesel fuel sulfur proposal will result in a substantial decrease in the overall supplies of on-road diesel fuel in this country.

Letters:

Society of Independent Gasoline Marketers of America (IV-D-328) **p. 4**

(14) For farmers, the seasonality of diesel supply is critical, and thus farmers can be significantly harmed by short term supply problems or price spikes. That is why farmer co-op refiners were established and why their continued existence is critical for farmers.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 11**

(15) Fuel supply concerns are a national security issue. Instead of developing this type of regulation and Tier 2 that restrict supplies, the U.S. should be establishing programs to foster crude exploration and increased refining capacity.

Letters:

Countrymark Cooperative (IV-D-333) **p. 14**
Marathon Ashland Petroleum (IV-D-261) **p. 48**

(16) To help address these problems, EPA should establish fair and workable variance procedures. Commenter does not recommend specific elements of a variance procedure, but strongly urges EPA to develop a plan that will allow flexibility without compromising environmental benefits or disadvantage refiners who are in full compliance.

Letters:

Chevron (IV-D-247) **p. *2, 7**

(17) Interruptions in fuel supply will cause substantial disruption to the food distribution industry, which depends largely on trucks to transport perishable food products on a regular basis from distribution centers to grocery stores and, therefore, depends on reliable fuel supplies to ensure the quality of the food. One commenter noted that in light of these supply disruptions, EPA's proposed rule is likely to result in an additional 9 percent increase in fuel prices, thereby resulting in an overall increase in excess of 20 percent for diesel fuel for food distributors and supermarkets. EPA should fully evaluate these impacts before finalizing the rule.

<u>Letters:</u>

Food Marketing Institute (IV-D-283) **p. 3**
U.S. Chamber of Commerce (IV-D-329) **p. 6**

(18) A consistent supply of fuel is essential to the concrete industry, and EPA's proposal appears to have the ability to jeopardize the supply of diesel fuel. Businesses in this industry are required to deliver a perishable product on a dependable basis, and supply disruptions may impede their ability to do so.

<u>Letters:</u>

National Ready Mixed Concrete Association (IV-D-271) **p. 2**

(19) Refiners' ability to consistently produce 15 ppm sulfur diesel fuel by the proposed deadline will be compromised by the fact that these refiners are also required to be installing technologies that will reduce the sulfur level of gasoline as well as MTBE. Refiners may not be able to reconfigure their facilities for diesel desulfurization at the same time as they are required to meet these other requirements.

<u>Letters:</u>

U.S. Chamber of Commerce (IV-D-329) **p. 6**

(20) In follow-up comments, an industry association provided quantified estimates of the potential reduction in supply capability that may be caused by the 15 ppm standard. The potential reductions were grouped into reason categories (technical feasibility, hydroprocessing yield loss, energy content loss, refinery sustainability, distribution impacts, and net import loss), and the commenter noted that some of the categories are cumulative while others are interdependent. The total loss in capability is likely to be well over 10 percent and may exceed 30 percent. In addition, the flexibility to add supplies from domestic or foreign sources will be reduced or even eliminated.

<u>Letters:</u>

National Petrochemical & Refiners Association (IV-G-29) **p. 2**

(21) The fuels industry has no applicable experience in the shipment of an ultra clean product in the multi-product petroleum distribution system, and the EPA's RIA addresses this issue by assigning a very small cost to the downgrading of pipeline interface, asserting that "good operational practices" will avoid all problems. Assuring retail supply reliability of an ultra-low sulfur diesel fuel will require the industry to take extraordinary actions, not just "good operational practices." The work performed by Turner, Mason & Company (TMC), as previously submitted to EPA, provides a well-informed basis for understanding what will have to be done and the likely range of costs. However, this is an area where more work needs to be completed and the issue of feasibility and cost of maintaining low sulfur diesel quality after it leaves the refinery needs to be reconsidered in the "technology review."

Letters:

U.S. Department of Energy (IV-G-28) **p. 6**

(C) Although some market upset is likely, there are few options to completely address this issue.

(1) Some disruption is likely regardless of whether EPA selects 15 or 50 ppm. The market will correct itself and attain equilibrium. To minimize initial disruptions, EPA can use a transition period similar to the proposed approach (see commenter's points under Issue 4.3.2).

Letters:

Hart/IRI Fuels Information Services (IV-D-154) **p. 3-4**

Response to Comments 8.1.1(A), (B), & (C):

Comments addressing the ability of the refining industry to produce sufficient volumes of diesel fuel meeting the 15 ppm sulfur cap will be addressed first. This discussion will be followed by a discussion addressing comments on the ability of the pipeline system and the rest of the fuel distribution system to transport sufficient volumes of diesel fuel meeting the 15 ppm sulfur cap. More specific issues raised in these comments (e.g., comment (13)) will be addressed in each of the two broad responses.

Response to Comments Under 8.1.1(A), (B), & (C) on the Supply of 15 ppm Fuel by Refineries

The comments summarized above which express concern that a 15 ppm sulfur cap could create a shortage of highway diesel fuel and associated price spikes basically present the following reasons for their position:

- The requisite desulfurization technology has not been demonstrated commercially and promising new technology will not be ready until after 2006, encouraging refiners to delay compliance, leaving the market short in the early years of the program

- Diesel fuel is lost during the desulfurization process, adding to the shortage of diesel fuel due to other reasons
- Assuming that the projected desulfurization technology will work, refineries face a wide range of costs to meet 15 ppm cap, raising significant concerns that the market will not allow refiners with higher costs to recoup their investment and encouraging those facing higher costs to avoid the investment and leave the highway diesel fuel market
- The required investment to meet the sulfur cap is relatively large and refiners face other environmental program investments in the same timeframe, making it difficult for refiners to be able to find adequate financing and to find the required engineering and construction resources
- The domestic refining system is approaching or already at maximum utilization of capacity; so any inadvertent shutdowns or upsets of the new desulfurization units will impact supply
- Overseas refiners will have difficulty meeting the 15 ppm sulfur cap, cutting off this portion of current diesel fuel supply
- The increased difficulty in avoiding contamination of 15 ppm fuel in pipelines will increase the amount of highway diesel fuel that is downgraded to nonroad diesel or heating oil, again decreasing supply

The comments summarized above which project that the supply of highway diesel fuel will be adequate under a 15 ppm sulfur cap basically make the following points:

- Refiner's investment decisions are driven by profitability, not cost,
- Refiners will face large drop in price to sell diesel fuel in alternative markets
- Desulfurization technology will likely be commercially demonstrated soon after the final rule, the vendors are confident in their technology, and new catalysts are rapidly being developed
- Need for some refiners to build new units makes it convenient and profitable for refiners to move some of their nonroad diesel fuel into the highway market
- Concern for supply shortages argues against low profit margins; high expected profit margins argue for refinery investment and adequate supply
- Refiner margins may be improving, providing more capital for investment
- Higher price spread between highway and nonroad diesel fuel likely to reduce use of highway diesel fuel in nonroad engines and boilers

In addressing these comments, we will start with the factors presented which argue that the new standard will reduce the supply of highway diesel fuel. In addressing, the points made supporting an adequate diesel fuel supply will be mentioned, as appropriate.

The first factor which could affect highway diesel fuel supply is uncertainty in what technology will be required to meet the 15 ppm standard. As discussed in Section 8.1.2 below and in the RIA, uncertainty does exist concerning the requisite desulfurization technology. Most vendors project that two-stage conventional hydrotreating at low to moderate hydrogen pressure will be sufficient to achieve the new standard, even with significant quantities of LCO. Most refiners commenting on the rule, plus 1-2 vendors believe that moderate to high pressures will be needed, accompanied by more aromatic saturation and hydrogen consumption. In addition, Phillips Petroleum just announced that they have developed a new, low pressure process which promises to consume no hydrogen. This process cannot yet be licensed, but Phillips hopes to begin licensing next year. However, a commercial unit utilizing this technology is not projected to start up until 2004.

The uncertainty in current technology which will be necessary to achieve the new standard could encourage some refiners to delay investment until the latest possible time while still allowing time to build their equipment in time for the 2006 implementation date. The promise of lower costs based on refiner's experience meeting the new standard in 2006 or with the new Phillips technology could encourage refiners to delay the construction of new equipment until beyond the 2006 implementation date. The temporary compliance option and small refiner provisions will allow up to 25% of highway diesel capacity (nearly half of the refineries currently producing highway diesel fuel) to delay meeting the 15 ppm cap until 2010, allowing time for Phillips' and other new technologies to be demonstrated. In some cases, particularly refiners located in isolated areas where hydrogen costs are high, the promise of lower long term compliance costs in one to two years could be preferable to the lower revenues obtained from selling highway diesel fuel into the nonroad diesel fuel market in the short term.

Countering the benefit of more lead time with respect to conventional hydrotreating technology is the fact that vendors will have 2-3 years to generate both pilot plant and commercial data to convince refiners of the efficacy of their processes. While no refiners are currently required to meet a 15 ppm cap prior to 2006, numerous two-stage (and low space velocity one-stage) hydrotreating units exist world-wide. Vendors and refiners are likely to utilize these units to demonstrate their catalysts commercially. This is already being done with some units in Europe. Thus, the largest detriment to investing to meet the new standard in 2006 is the potential cost savings associated with novel technologies such as Phillips' SZORB. These technologies are sufficiently different from conventional hydrotreating that refiners are likely to require full-size commercial operation for a year or two prior to investing tens of millions of dollars on their effectiveness. As mentioned above, with the temporary compliance option and small refiner provisions, nearly half of all refiners currently producing highway diesel fuel will be able to delay investment for 3.5-4 years and should be able to utilize the newer technologies, such as SZorb, if this is desirable.

The second factor raises a concern that conventional desulfurization processes both reduce the physical and energy density of diesel fuel. Desulfurization actually increases the volume of diesel fuel produced, but each gallon of diesel fuel contains less energy. Overall, the total amount of energy leaving the hydrotreater in the form of diesel fuel decreases by roughly 1.5%. Vehicular fuel economy is directly proportional to fuel energy density. Thus, in order in to provide the same number of vehicle miles, refineries will need to increase the volume of blendstocks which they process by 1.5%. Our cost projections consider this factor. In terms of supply, the effect is much less. Most of the energy lost to diesel fuel is in the form of naphtha or LPG. This increases the refinery's production of these products. This allows the refinery to make other adjustments, such as its FCC fractionator cutpoints, which increase diesel fuel production at the expense of gasoline, bringing the net production of both products back into balance.

The third factor potentially affecting supply is the range of costs faced by refiners in complying with the diesel sulfur standard. Our refinery by refinery analysis indicates that refineries face a wide range of compliance costs. If each refinery currently producing highway diesel fuel invests to just maintain their current production, costs range from under 3 cents per gallon to over 15 cents per gallon. It is probably unreasonable for a refiner to expect the market to allow a long term increase in the price of diesel fuel of 15 cents per gallon. However, our refinery model also indicates that some refineries can produce 15 ppm diesel fuel from their current nonroad diesel fuel blendstocks more cheaply than many refineries which currently produce highway diesel fuel. In order to minimize refining costs, we currently predict that roughly 6 refineries will increase production of highway diesel fuel using current nonroad diesel fuel blendstocks. These alternative supplies reduce the maximum cost for any specific refinery to 5-7 cents per gallon, depending on the PADD. The phase in has a similar effect, allowing those refiners with the lowest compliance costs to produce 15 ppm fuel in 2006 and allowing other refiners to delay investment until 2010. The cost range within each PADD is only 2-3 cents per gallon. For the purposes of assessing the ability of some refiners to increase production of highway diesel fuel, we assumed some limitation on refiners ability to shift production between PADDs. No shifting was allowed into or out of either PADDs 4 or 5. PADD 3 was allowed to send additional highway diesel fuel to PADD 1 and to the southern portion of PADD 2. It is reasonable that refiners would expect that the market may provide a price increase as high as 5-7 cents per gallon, if average cost is the 4-5 cent per gallon range.

This range of price increase to fully recover costs is still high relative to those associated with previous environmentally driven standards. According to EIA studies, refiners have generally not been able to fully recover the cost of previous environmental programs. Thus, higher compliance costs mean that more money is at risk.

RFG was projected to cost 4 cents per gallon for Phase 1 of the program, with an additional 1 cent per gallon for Phase 2. Gasoline RVP standards, oxy-fuel programs, and the current diesel fuel 500 ppm sulfur cap were all projected to cost much less than 4-5 cents per gallon. One key difference between this rule and the RFG program was that the RFG program did not require all gasoline producing refiners to meet the new standards. The RFG areas were generally small enough geographically that, even near RFG areas, refiners could choose to produce RFG or conventional gasoline or a mix of RFG and conventional gasoline. RFG also only represented roughly one quarter of the national gasoline pool. Here, refiners can choose to produce highway or nonroad diesel fuel, but the highway diesel fuel market represents two-thirds of diesel fuel pool.

The first aspect of this issue with respect to supply is refiners' ability to leave the highway diesel fuel market, directly reducing the supply of highway diesel fuel. Current highway diesel fuel easily meets the specifications for nonroad diesel fuel or heating oil. However, the market for these other distillate fuels is not large enough, nor growing fast enough to absorb much highway diesel fuel. Plus, the highway diesel fuel market is currently in balance, so any decrease in domestic supply would have to made up by imports.

In order to assess the potential for refiners to sell their current highway diesel fuel or some of the blendstocks used to produce highway diesel fuel into alternative markets, EPA contracted with SwRI and Muse, Stancil to assess these other markets. Muse, Stancil found that refiners would have very limited possibilities of disposing of highway diesel fuel or its blendstocks domestically. Only PADD 1 imports significant quantities of nonroad diesel fuel or heating oil. Refiners in PADD 1 could produce more of this fuel and back out imports. However, refineries in other PADDs would have to export their excess production should they decrease production of highway diesel fuel, but maintain total distillate production. Based on historical prices (i.e., highway diesel fuel priced under the 500 ppm sulfur standard), Muse, Stancil estimates that refiners outside of PADD 1 would lose 3-6 cents per gallon in revenue if they shift even 5% of their highway diesel fuel to the nonroad diesel fuel market. These losses increase to 4-20 cents per gallon if they shift over 5% of their current highway diesel fuel to these alternative markets. Refiners in PADDs 2 and 4 would be particularly hard pressed, as they would have to ship their product to the US Gulf Coast prior to export. This adds significant transportation costs, as there are no pipelines flowing from PADDs 2 or 4 to the Gulf. Refiners attempting to shift fuel to the nonroad diesel fuel market would save their current operating cost to meet the 500 ppm sulfur specification (mostly hydrogen costs at 1-2 cents per gallon), but this would not nearly compensate for the lower price to be gotten in the alternative markets.

Should refiners shift highway diesel fuel production to these other markets, it will not only affect the price of the shifted product. The price of all nonroad diesel fuel and heating oil will drop. Refiners trying to sell their highway fuel into these other markets will try to sell it locally prior to exportation, although this will remain an option. These refiners will compete with those currently producing nonroad diesel fuel and heating oil, depressing prices in the entire market. Despite lower prices, fuel demand will not increase substantially, since the use of nonroad equipment is a very weak function of fuel price. (For example, fuel costs are a small portion of the total cost of farming, mining and construction, so one would not expect that the demand for diesel fuel in these sectors of the economy would be very responsive to fuel price.) Thus, refiners planning on shifting their highway fuel to alternative markets will not only have to consider the decrease in market value of the shifted product, but also the drop in value of their existing nonroad fuel and heating oil production. This added cost of a drop in highway diesel fuel production would vary widely from refinery to refinery, since some refineries produce much more nonroad diesel fuel than highway fuel and vice versa.

This loss in market price serves as a discouragement to shift highway diesel fuel to these other markets. It basically provides refiners with a second reward for investing in desulfurization equipment in order to stay in the highway diesel fuel market. First, investment allows the price rise of highway diesel fuel which should accompany the new sulfur standard to be achieved. Second, investment allows the price drop associated with export to be avoided, as well as reduces the potential for a drop in value in existing nonroad diesel fuel production. (This last factor is a function of other refiners' decisions, as well, in this area.) Thus, a refiner should desire to invest in meeting the new standard if he believes that the price increase in highway diesel fuel will be at least the cost of meeting the standard minus the loss associated with export. For example, if it costs up to 7 cents per gallon to meet the 15 ppm standard, then the required price increase in highway diesel fuel price may only need to be 3 cents per gallon for refineries to prefer meeting the 15 ppm standard versus taking a loss in the nonroad market (less operating cost savings) of 5 cents per gallon (ignoring any price drop for existing nonroad diesel fuel production). The lack of a ready domestic alternative market for their product appears to be a strong discouragement to refiners shifting their production away from highway diesel fuel.

The sizeable loss in revenue associated with shifting highway diesel fuel to other markets is a strong argument by itself that refiners will likely project that it is more profitable to invest and stay in the highway diesel fuel market than shift their production to other markets. A further argument is that domestic demand for distillates (including highway, nonroad diesel fuel and heating oil) has outstripped domestic production in recent years. While historically the U.S. imported little of these products, imports now occur and are growing. Imports of gasoline have also been growing significantly. This has led to improved refining margins and record refining profits.

For example, over the past year, refining margins have improved dramatically. Domestic refineries are operating at full practical capacity and are expected to do so for the foreseeable future. Thus, the market may have begun a long term period where refining margins will be strong and reward refiners who invest in additional capacity. Refiners also know that even slight shortages in highway diesel fuel supply would lead to significant price increases and substantial profits for those in the market. Thus, as always there will be a tension between wanting to invest and reap the rewards of a potentially short market and the concern over over-investment and the inability to fully and consistently recover investment. The large investment per unit volume of product (discussed further below) will make this a more difficult situation to balance than in past regulatory requirements. However, the temporary compliance option and small refiner provisions will help counter this difficulty, as they will allow nearly half of all refineries currently producing highway diesel fuel to delay their investment by 3.5-4 years. Thus, refiners who are in a better financial position to take the financial risk involved in such a significant investment can do so, while those which are not in as good a position can wait, buying credits in the meantime. In the past, over capacity in terms of both fuel production and fuel quality has led to relatively poor refining margins which have not allowed refiners to recoup the full cost of environmental standards. Two examples are the 500 ppm sulfur diesel fuel standard and the RFG standards. In both cases, over-investment by the refining industry led to over-supply of these fuels and low prices. This appears unlikely to be the case in the future. Even if refiners over invest in diesel fuel desulfurization capacity, this will be at the expense of nonroad diesel fuel production. While the price differential between the two diesel fuels may be lower in some areas than it would have been if the industry had just the right capacity, the prices of both fuels are likely to be relatively high, still providing reasonable returns.

The fourth factor is related to the previous factor and is the relatively large size of the investment per refinery required to meet this diesel sulfur standard (e.g., it is more than that required to meet the recent Tier 2 gasoline sulfur standard). This is accurate. We projected that it would cost $44 million per refinery to meet the Tier 2 gasoline sulfur standards, while we project that it will cost $50 million per refinery to meet the diesel fuel sulfur cap. In addition, this $50 million figure represents the average of revamped units (which will cost less) and new units (which will cost more). Revamped units (representing roughly 80% of all units) will cost roughly $40 million apiece, while new units will cost $80 million apiece. Thus, we project that roughly 20 refineries will face twice the investment cost to meet this diesel standard as they did to meet the Tier 2 gasoline sulfur standards.

This difference in investment is to be expected. Nearly all of the sulfur in gasoline is contained in the naphtha (material boiling in the gasoline boiling range) produced in the fluidized catalytic cracker (FCC). Generally, FCC naphtha is the only material which needs to be hydrotreated in order to meet the 30 ppm average sulfur standard for gasoline and this material only comprises 35-40% of total gasoline volume. In contrast, essentially all highway diesel fuel will need to be hydrotreated in order to meet the 15 ppm cap. Refiners produce roughly the same volumes of FCC naphtha and highway diesel fuel. However, diesel fuel desulfurization requires much higher temperatures and pressures, and the material must be in contact with the catalyst for longer periods of time. This means that the size of the reactor must be much larger, its walls must be thicker and pumps and compressors must be designed for the higher pressure, as well. Thus, the capital investment per unit volume of treated material is much higher. Finally, because the cost of the FCC naphtha hydrotreater can be spread over all gasoline volume (2.5-3 times more volume than that being treated), the investment per gallon of finished fuel is far more for highway diesel fuel than for gasoline.

Commenters also mention the fact that they will have to finance investments for gasoline desulfurization and possibly MTBE and benzene removal technology in the same timeframe. This issue is addressed in detail in Chapters 4 and 5 of the Final RIA. There, we estimated the engineering and construction resources required by the gasoline and diesel fuel desulfurization projects and found that existing resources were sufficient. EPA has not yet finalized any MTBE or benzene limits, so it is not appropriate to consider those programs here. However, the analyses associated with those rules, should they be proposed or promulgated, will consider the investments associated with the diesel sulfur cap.

We also compared the combined capital investment associated with the gasoline and diesel fuel desulfurization projects to those over the past 15-20 years. The upcoming desulfurization investments are slightly less than those experienced by the refining industry in the early 1990's. Thus, the industry should be capable of handling this investment. One commenter did point out that a number of refineries closed during the period of high capital investment in the early 1990's and indicated that a repeat of these investment levels would lead to the same industry rationalization. Refineries close for many reasons, not just environmental requirements (e.g., an historic source of crude oil no longer being available). A large number of the refinery closures were in California, where a number of smaller refineries closed just prior to California's Phase 2 Clean Burning Gasoline program. As discussed above, we believe that refiners facing higher costs have the capability of shifting their highway diesel fuel to other markets, with other refiners having the capability to move into the market. After such shifts, the range of potential costs of compliance appear to rather narrow, arguing for little incentive for refineries to close in response to this rule.

This higher investment per unit volume of product means that refiners will be putting more investment at risk relative to potential profit in the case of diesel fuel than gasoline. As will be discussed further below, the market sometimes allows refiners to recoup their full cost of meeting environmental standards (operating plus capital costs) and sometimes only allows the recoup of operating costs. The greater level of investment per unit volume of product means that refiners would have to cover 3-4 times the investment cost per gallon of fuel if the market does not reward them with a price increase which allows the recovery of capital plus a reasonable return on this investment. Directionally, this means that refiners will look much more closely at the market situation for diesel fuel before making the investment to meet the 15 ppm standard. In particular, refiners are likely to carefully assess their competitors' actions to ensure that significant overcapacity does not exist, which decreases refining margins.

However, the demand for fuel continues to grow and domestic refinery capacity is growing at only about half the rate of growth in demand. Imports of finished fuel, including highway diesel fuel are increasing. Also, refining margins during the past year have been excellent for most refiners. Integrated oil company profits have also been at record levels. The net income of individual major oil companies over just the 2nd and 3rd quarters of 2000 (e.g., ExxonMobil) was sufficient to fund all of the capital investment associated with this rule. If these refining margins continue for any appreciable amount of time, the availability of capital should not be an issue, even considering other environmental programs facing refiners, such as the Tier 2 gasoline sulfur requirements and NESHAP standards for FCC units, reformers and sulfur plants. We analyzed the combined capital investments associated with all of these programs in Chapter IV of the RIA. There, we found that the level of capital investment per year will be lower than that occurring in the early 1990's, when most of the programs associated with the Clean Air Act of 1990 were being implemented and when refining margins were low. Thus, from an industry wide perspective, the availability of capital should not be a problem. The temporary compliance option helps this situation substantially. Nevertheless, a few individual refiners could have difficulty raising sufficient capital to meet the new diesel sulfur standard. We have included hardship provisions in this rule to accommodate at least some of these situations. In addition, as discussed above, not every refiner currently producing highway diesel fuel will need to continue to do so in order to meet future demand.

This raises the fifth factor, the fact that domestic refiners are currently operating at capacity and any disruption in supply will cause a supply shortage and price spikes. This issue was addressed in detail under Issue 5.8.2 above. In summary, we believe that refiners will invest in a modest amount of over capacity for other reasons which will be available to respond to unexpected shutdowns. Also, the throughput of any given distillate hydrotreater can be increased by increasing temperature, albeit at a cost of shorter catalyst life, so the desulfurization capacity is not exactly fixed, but can be expanded if necessary.

The sixth factor concerns imported highway diesel fuel. Several commenters stated that overseas refiners may not be in as able to produce diesel fuel under the new 15 ppm cap, as they have been under the current 500 ppm cap. The three largest sources of diesel fuel imported into the mainland U.S. are Canada, the Virgin Islands and Venezuela. The Canadian refineries which export to the U.S. are located in the far eastern portion of Canada and perennially send the vast majority of their production to the U.S. The same is true of the largest Virgin Island refinery, which has U.S. ownership. In both cases, these refineries look to the mainland U.S. as their main market, though the fact that their production must enter the U.S. by tanker makes a change in destination logistically easier than that for a truly domestic refinery. Thus, they are as likely to invest to meet the new standard as any domestic refinery. Venezuelan refineries are in a somewhat better position to send their diesel fuel elsewhere and could be less likely than domestic refiners to invest in new desulfurization equipment. At the same time, Europe and Japan are implementing 50 ppm diesel sulfur caps and Europe is already considering a 10 ppm cap. Thus, export oriented refineries world-wide will have to invest to at least meet a 50 ppm cap and will likely prepare for even lower standards, since Europe is already considering imposing a 10 ppm sulfur cap. Even a refinery designed to produce 50 ppm sulfur diesel fuel is capable of producing some 15 ppm fuel using its existing equipment. This may require reducing volumetric throughput or cutting the endpoint of its most difficult to hydrotreat blendstocks. However, such refineries should be able to send diesel fuel to the U.S. even if they do not design to do so on a regular basis. Several overseas refiners are likely to closely observe the investment patterns of U.S. refineries to assess the economics of exporting their diesel fuel under the new standard. Thus, overall, exporting fuel to the U.S. will be more difficult under the new standard, but supplies should be available if necessary. Again, the temporary compliance option helps this situation by allowing importers to import two gallons of 500 ppm fuel for every eight gallons of 15 ppm brought into the country.

The final factor potentially affecting supply is the possibility that 15 ppm diesel fuel produced at a refinery will be contaminated during shipment and becoming unsuitable for use in 2007 and later highway vehicles. As discussed in the RIA, we expect refiners to produce diesel fuel with an average of 7 ppm under the new standard. However, some batches are likely to be higher than this. Pipelines are likely to set their own limits below 15 ppm (e.g., 10 ppm) for highway diesel fuel entering the pipeline. This means that diesel fuel will only be able to pick up perhaps 5 to 8 ppm sulfur during distribution, given the testing allowance provided in the final rule. As also discussed in the RIA and further below in this section, we estimate that current loss of highway diesel fuel to nonroad diesel market of 2.2% will double to 4.4%. This increases the production requirements for 15 ppm diesel fuel, but not for total diesel fuel, since the volume lost during distribution can be used as nonroad diesel fuel or heating oil.

In addition to the broad statements about future supply which were not supported by any technical information, two technical studies were submitted by outside commenters along with the comments. One was a study by the National Petroleum Council (NPC) study and the other was a study performed by Charles River Associates and Baker and O'Brien.

The NPC study evaluated the cost of producing diesel fuel with an average of 30 ppm sulfur. It projected a cost of 6-7 cents per gallon to produce this fuel. NPC also evaluated the ability of the engineering and construction industry to construct the desulfurization units needed to meet both the Tier 2 gasoline and diesel fuel sulfur limits.

As discussed in detail in Chapters IV and V of the RIA, we believe that NPC overestimated the cost of meeting tighter sulfur standards. Also, its projection of engineering and construction requirements for both the gasoline and diesel fuel programs did not reflect the phase in and transition provisions associated with either program. These provisions spread out construction significantly and reduce the maximum demand for these resources substantially at any point in time. Our analysis of the demand for these resources is contained in Chapter IV of the RIA.

The study by Charles River Associates (CRA) and Baker and O'Brien, which was commissioned by API, assessed refiners ability to maintain an adequate supply of highway diesel fuel under the 15 ppm cap. As part of this study, CRA polled refiners concerning their plans under a 15 ppm sulfur cap. Using the results of this survey, as well as other information, CRA projected refiners' costs of meeting the 15 ppm standard, as well as their likely production volumes. CRA concluded that U.S. refiners would likely reduce their highway diesel fuel production by an average of 12 percent, creating significant shortages and price spikes.

CRA's conclusions appear to have been strongly affected by their assumptions, as well as the refiner survey they conducted. For example, CRA assumed that the new sulfur standard would cause 10% more highway diesel fuel to be "lost" in the distribution system compared to today (i.e., downgraded to nonroad diesel fuel). A much more reasonable estimate would be 2%, as outline in the RIA, resulting in 9% (98% versus 90% is a relative gain of 9%) of more 15 ppm fuel being available than CRA estimated. This difference alone accounts for 75 percent of their projected national supply shortfall.

CRA also concluded, with little explanation, that 20 refineries producing highway diesel fuel today would not produce highway diesel fuel under the 15 ppm standard and that many more would reduce production. Given the lack of information provided in the study, it was not possible to evaluate CRA's criteria in selecting these 20 refineries, nor was it possible to determine how much of the shortfall was attributable to this conclusion. While CRA evaluated whether refiners currently producing highway diesel fuel would be likely to leave the market, they did not assess whether any refineries currently not producing highway diesel fuel might enter the market. EPA did conduct such an assessment. We found that one refinery currently not producing highway diesel fuel could build a grassroots hydrotreater and be competitive with other refiners likely to revamp their current hydrotreating units. In addition, we found that at least 17 other refineries could economically increase their production of highway diesel fuel using nonroad diesel fuel blendstocks (e.g., for a cost of less than 5 cents per gallon). The diesel fuel production from these refineries would represent 17% of highway diesel fuel production. Together with a more reasonable estimate of downgrades in the distribution system, this would more than compensate for the lost production, even as estimated by CRA.

CRA also implicitly assumed that the material being removed from the highway diesel market could be sold at a reasonable price. However, CRA did not analyze the impact of this additional supply on the prices which could be obtained in these markets, or even if these alternative markets could physically absorb all of this material. Much of the material which CRA assumed would not be used to produce highway diesel fuel is not even diesel fuel, but poor quality blendstocks, such as light cycle oil or the heavy end of straight run or cracked material. It is not clear that such material could be blended into non-highway diesel fuel and CRA did not analyze this likely problem. Our analyses, supported by a study by Muse, Stancil and Co., indicate that any substantial quantities of highway diesel fuel diverted to other markets will depress prices in those markets substantially. Thus, CRA's analysis, which only considered the cost to desulfurize highway diesel fuel, and ignored the cost of dumping this fuel into other markets must be considered to be flawed in this regard. As pointed out by the Alliance for Automobile Manufacturers, profitability drives investment, not simply cost. If refiners are faced with considerable losses if they have to sell their highway diesel fuel in other markets, this increases their incentive to invest in meeting the 15 ppm standard.

Finally, CRA ignored the fact that roughly 15% of today's highway diesel fuel is consumed in engines and furnaces not requiring this fuel. Any shortage of highway diesel fuel, or increased difference in price, would lead many of these non-essential users to switch to nonroad diesel fuel or heating oil. Only limitations in the fuel distribution system would cause these users to continue to burn highway diesel fuel.

These problems with CRA's analysis, plus the lack of detail available concerning the specifics of the study, lead us to reject the study's conclusions that there will be significant supply shortfalls under a 15 ppm sulfur standard.

Moving on to specific comments which were not addressed above, in responding to comment (6), very little distillate is imported from Europe today, so having different sulfur standards than Europe will not have a significant impact on the ability of the U.S. to receive distillate imports. European refineries produce more gasoline than is consumed there, but do not produce sufficient supplies of diesel fuel and heating oil to meet demand. Therefore, European refineries export gasoline, sometimes to the U.S., but do not export substantial quantities of diesel fuel.

In comment (7), the commenter states that the proposed rule will increase the likelihood and frequency of price spikes. This issue was addressed earlier in detail under Issue 5.8.2. There, we acknowledged that the production of 15 ppm diesel fuel will be contingent on the proper operation of the revamped or new desulfurization equipment. Unexpected shutdowns of this equipment would immediately reduce supply and, if not compensated for, could result in price spikes. However, we also pointed out that the hydrotreater throughput can be increased by raising temperature, while still maintaining product quality. We also pointed out that each refiner would likely invest in more capacity than necessary on a daily basis, in order to be able to reprocess material which did not quite meet the 15 ppm specification. (Our cost projections include this excess capacity.) While some of this excess capacity will be used in reprocessing at any point in time, much of it will not be in use and will provide a buffer to compensate for unexpected outages at other refineries. Likewise, refiners will generally design their new equipment with more capacity than is currently needed in order to handle future growth in production. At any point in time, some refiners will not be operating at their peak production capacity and can also response to outages at other refiners. Thus, we do not expect that price spikes will become either more frequent or severe because of this rule.

Comment (10) states that the desulfurization equipment needed to meet the 15 ppm standard will not operate sufficiently well to be able to meet the standard each and every day of every month, year, etc. Comment (12) states that the same result will occur because of the limited number of diesel fuel blending streams available. As pointed out in the previous paragraph, we expect refiners to plan for occasional off-specification material by building more capacity than necessary for that day's production. We also believe that controls within a refinery allow it to anticipate problems which could affect a distillate hydrotreater. These controls can be both feed forward and feed back in nature.

An example of feed forward control would be the adjustment of hydrotreater operation based on the types, qualities and amounts of the various blendstocks being fed to the unit. Hydrotreater operation will be affected by a number of variables, such as distillate volume, quality, temperature and pressure. However, in a typical refinery, the critical sources of variability will likely be the volume and quality of its light cycle oil or light coker gas oil, since these materials contain the sulfur which is most difficult to remove. The relative volumes of these streams is easily controlled via pump rates. Variability is likely to arise in their quality, which will be primarily a function of their distillation endpoints, which are in turn a function of how the FCC and coker fractionators operate. Refiners will have available real-time data on the operation of these fractionators. When a fractionator is allowing a higher endpoint, either the amount of that blendstock can be reduced, the total through put of the hydrotreater can be reduced, or the temperature of the reactor can be increased. We expect that refiners will initially operate their hydrotreaters conservatively (i.e., at very low sulfur levels) based on the results of pilot plant studies and vendor recommendations to ensure compliance with the 15 ppm cap. However, they will quickly fine-tune their correlation of input variables and product sulfur content to operate continuously at their sulfur target.

We also expect that refiners will install in-line sulfur measurement equipment (i.e., feedback control). As soon as sulfur creeps above the target level, the refiner will adjust the operating parameters mentioned above to compensate. Likewise, when sulfur is too low, the refiner will back off on severity, etc. This is already done with every other piece of equipment in a refinery. We know of no reason why distillate hydrotreater operation will be any different.

Comment (13) believes that this rule would reduce the number of sources that independent suppliers have for diesel fuel, reducing competition and raising prices. EPA has based its primary cost analysis assuming that each refiner currently producing highway diesel fuel continues to do so. In other words, these refiners build or revamp their current hydrotreaters to produce 15 ppm fuel. As pointed out in Chapter 5 of the Final RIA, however, some of these refiners produce very small quantities of highway diesel fuel. This makes the per gallon costs of meeting the 15 ppm cap relatively high (e.g., over 10 cents per gallon). The refiners facing these relatively high costs include both independent refiners and vertically integrated, global oil companies.

Our analysis in Chapter 5 also points out that a number of refiners who currently produce only nonroad diesel fuel could meet the 15 ppm cap at much lower cost. These refiners again include both independent refiners and vertically integrated, global oil companies. If the refiners facing high compliance costs also face generally high costs of production, they may choose not to invest to meet the new sulfur cap and instead market their distillate to the nonroad diesel fuel and heating oil markets. However, if their base costs of production are relatively low, then they may choose to remain in the highway diesel fuel market. Thus, there may or may not be a reduction in the number of suppliers of highway diesel fuel. If there is such a reduction, we expect the reduction to be small and that highway diesel fuel will continue to be produced by both independent refiners and major oil companies.

Comment (14) raises a concern that farmers may not be able to obtain diesel fuel at critical points in their farming operation because spot shortages and price spikes caused by this rule. The issue of price spikes and general fuel supply were already addressed above. There, we concluded that this rule should not increase the frequency nor severity of supply shortfalls of highway diesel fuel nor price hikes.

It should also be pointed out that farming equipment can use nonroad diesel fuel which is not subject to this rule. It is true that farming equipment is sometimes fueled with highway diesel fuel either because the farmer desires this, the prices of the two fuels are the same, or the farmer's particular distributor only carries highway diesel fuel. In the first situation, if the price of highway diesel fuel did rise dramatically, the farmer could simply choose to use nonroad diesel fuel. We expect that the last two situations will become less frequent with the onset of this rule, as the price differential between highway and nonroad diesel fuel is likely to increase significantly. Consumers of nonroad equipment will increase their demand for nonroad diesel fuel, due to its lower price. This will encourage more distributors to carry it.

Regarding comment (15), as presented in the main discussion of supply issues above, we do not believe that this rule will cause any shortages in diesel fuel supplies. Thus, it should not cause any related national energy nor security issues. Concerns over crude oil exploration and refinery capacity are more appropriately addressed to other agencies in the government.

With respect to comment (B)(16), the final rule contains a number of provisions that will assist refiners in complying with the 15 ppm diesel fuel standard, as well as mechanisms for them to offset any shortfall. As discussed in Section IV and VII of the preamble, today's final rule contains small refiner hardship provisions, GPA refiner provisions, and general hardship provisions. The general hardship provisions apply to all refiners and consist of two types of hardship relief. First, in cases of extreme unforeseen circumstances such as natural disasters, refiners may apply for and EPA may approve provisions for compliance that would be unique to each individual refiner's circumstances. Second, in cases of extreme, typically economic, hardship, the final rule contains provisions for refiner's to apply to the Agency for relief and gain approval for a unique compliance plan that, among other things could allow them additional time in complying with the final standards. These general hardship provisions are very similar to and would be implemented in a similar manner to the provisions recently finalized in the Tier 2 gasoline sulfur rulemaking.

In addition to these hardship provisions, today's final rule contains additional flexibility for refiners during the startup of the program. The final rule contains a temporary compliance option for all refiners that allows them to delay compliance of up to 20% of their production with the 15 ppm standard on an annual basis for the first few years of the program. Should a refiner want to exceed this amount, the program includes ABT provisions that would allow them to purchase credits from other refiners. If they in good faith fall short of their production plans, the rule contains provisions that will allow them to make up shortfalls of up to 5% the following year without penalty, and if greater than 5 % to purchase credits on the open market in the two months following the end of the calendar year. Finally, unlike in the gasoline program, where if a refiner is unable to comply with the standard, there is no other outlet for the production, the diesel market contains other outlets. If a refiner is unable to comply for a short period of time with the 15 ppm highway diesel fuel requirement, the off highway diesel market represents a very viable outlet for their diesel fuel production.

Comments (17) and (18) raise concerns about the impact of price spikes and shortages on the trucking industry an the industries it serves. As discussed above, we do not believe that this rule will result in supply shortages, nor increase the frequency nor severity of price hikes. Thus, these industries should not be affected.

Comment (19) raises the issue of refiners having to comply with other EPA regulations at the same time that they have to meet the diesel fuel sulfur cap. This issue is addressed in Chapters 4 and 5 of the Final RIA. There, we analyze the design and construction requirements of the diesel sulfur cap and other applicable EPA regulations and demonstrate that sufficient industry resources exist to provide all the services needed by the refining industry.

Response to Comments Under Issue 8.1.1. (A), (B), & (C) on the Ability of the Fuel Distribution System to Transport Sufficient Volumes of 15 ppm Highway Diesel Fuel:

The comments summarized under issues 8.1.1 A, B,&C which project that our sulfur program will create a shortage of highway diesel fuel due to difficulties in maintaining a 15 ppm cap on sulfur content throughout the distribution system basically make the following points:

- Limiting sulfur contamination during the distribution of highway diesel fuel meeting a 15 ppm sulfur cap will be the greatest challenge ever faced by the distribution system in limiting contamination. There is no relevant experience to compare this challenge.
- Absent the use of dedicated equipment for the distribution of highway diesel fuel, contamination from high sulfur products (such as off highway diesel fuel) left in pipes, truck hoses, in storage tanks will cause highway diesel fuel that uses the same equipment to exceed 15 ppm sulfur.
- EPA is incorrect in its assertion that careful and consistent observation of current industry practices to limit contamination will be sufficient for operators of tank trucks and tank wagons.

- Additional evaluation of the distribution system's ability to limit contamination during the distribution of highway diesel fuel meeting a 15 ppm sulfur cap is needed. This should including sending test batches of 15 ppm highway diesel fuel through the distribution system to evaluate the level of contamination which results at each link in the system. EPA should conduct a formal technology review of the ability of the distribution system to limit contamination prior to the implementation of its diesel sulfur program.
- The implementation of a 15 ppm cap on highway diesel fuel would result in the generation of unacceptably high volumes of highway diesel fuel that must be downgraded to a lower value product, or must be returned to the refinery for reprocessing (transmix). This could result in fuel shortages, outages, and price spikes. Some pipeline operators have estimated that they would need to downgrade as much as 20 percent of the 15 ppm highway diesel fuel they ship to a lower value product (compared to 10 percent today).
- Downstream parties will not be able to blend out of specification batches of highway diesel fuel back into compliance using fuel that is substantially below the 15 ppm sulfur cap.
- Field testing equipment needed to evaluate the sulfur content of highway diesel fuel at terminals and pipelines as a result of our program will not be available when our program is implemented.
- An allowance for test tolerance should be included when evaluating compliance with the 15 ppm cap on the sulfur content of highway diesel fuel.
- EPA should adopt variance provisions to allow batches of highway diesel fuel that exceed 15 ppm in sulfur content due to contamination to be used as highway diesel fuel. These provisions should be designed to prevent an adverse environmental impact.
- Contamination in the distribution system will force refiners to produce highway diesel fuel substantially below the 15 ppm cap. If contamination can not be adequately limited, refiners will be forced to produce near zero sulfur diesel fuel.

As discussed in section IV.D. of the RIA, we concluded that with relatively minor modification and at modest costs, the current distribution system will be able to adequately limit sulfur contamination during the distribution of highway diesel fuel meeting a 15 ppm cap without the adverse impacts described in the above comments. The distribution industry has experience in maintaining product integrity of a range of different products that can be drawn upon. Although our sulfur program represents a significant new challenge to the industry with respect to limiting contamination, the changes that will need to be made to meet this challenge are extensions and expansions upon existing methods. We believe that issue regarding the distribution of highway diesel fuel is not one of feasibility but rather is one of cost. Such cost issues are detailed in section V.C.3. of the RIA. Although a modest additional volume of highway diesel fuel will need to be downgraded to a lower value product in the distribution system as a result of our program, we believe that this can be accommodated without market disruptions. The distribution system will continue to be capable of distributing a sufficient volume of highway diesel fuel. As discussed in the preceding response to comments under 8.1.1(A), (B), & (C) related to the supply of adequate volumes of highway diesel fuel under our program, we believe that refiners will be capable of supplying sufficient quantities of highway diesel fuel to compensate for the modest additional volume that must be downgraded to a lower value product.

The following discussion outlines our evaluation of the various issues which support our conclusions regarding the distribution of highway diesel fuel meeting a 15 ppm cap on sulfur content. For a detailed discussion of the measures we expect the distribution industry will need to take to adequately limit sulfur contamination during the distribution of 15 ppm highway diesel fuel meeting a 15 ppm sulfur cap, please refer to section IV.D. of the RIA.

Although our program may encourage the existing trend towards dedicating storage tanks, tank trucks, and barges to highway diesel fuel use, it will not force significant additional segregation of highway diesel fuel. We continue to believe that tank truck and tank wagon operators can adequately limit sulfur contamination through careful and consistent observation of existing practices to prevent contamination from high sulfur product left in storage tanks and delivery systems. Such practices are sufficient to ensure that residual high sulfur products in vehicle storage tanks and delivery systems on such vehicles is adequately purged prior to their use for highway diesel fuel. These practices are detailed in the RIA to this rule and include leveling the vehicle to ensure that it can drain completely, allowing sufficient time for the tank compartment to drain completely, and filling the delivery system with highway diesel fuel prior to making the delivery. Most importantly, we believe that most tank truck, tank wagon compartments, and tank wagon delivery systems used to distribute highway diesel fuel are already dedicated to this purpose. Thus, instances where such equipment will need to be cleaned when switching to use for highway diesel fuel purposes will be the exception rather than the rule.

We also concluded that most stationary storage tanks used to store highway diesel fuel are dedicated to this purpose. Thus, instances where stationary storage tanks will need to be cleaned when switching to use for highway diesel fuel purposes will be the exception rather than the rule. For those storage tanks that are periodically switched from storing high sulfur products to highway diesel fuel, we expect that existing procedures will be sufficient in most cases to purge the tank of high sulfur products. Some additional highway diesel fuel may be needed to flush such tanks prior to being filled with highway diesel fuel. Under limited circumstances, certain older stationary storage tanks with irregular flat bottoms may present more of a challenge with respect to switching from storing a high sulfur product to 15 ppm highway diesel fuel. While this practice will continue to be possible, we anticipate that our program may encourage such tanks to either be dedicated to highway diesel fuel use or relegated to storing other products. We concluded that this change could be made without significant impact to the regulated parties. In addition, we attributed significant costs to the construction of additional storage tanks to handle two grades of highway diesel fuel during the initial four years of our program when the temporary compliance option is available. This will more than compensate for whatever costs might be associated with the need to dedicate additional storage tanks to highway diesel fuel use.

It may be reasonable to presume that barges are equipped with sumps from which the residual product can be completely removed. If this were the case, one might conclude a barge cold be made ready to carry 15 ppm highway diesel fuel by allowing sufficient time for fuel to drain into these sumps and to be removed by pumps. If this were not sufficient, flushing the barge with 15 ppm diesel fuel might provide the necessary cleaning action. If this were so, the situation would be similar to that discussed above for stationary storage tanks, for which we concluded that sulfur contamination from residual product should not be a significant concern.

Due to existing contamination concerns, most tank compartments in marine vessels used to transport highway diesel fuel are already dedicated to this purpose and there is an increasing trend toward such dedication. Some barges plying the eastern seaboard may on occasion switch seasonally between highway diesel and heating oil. However, this is the exception rather than the rule. Consequently, we expect that there would be few instances when this concern would arise, and that such concerns were they do exist, would decrease over time. To the extent that such instances might occur, we believe that the associated tank cleaning costs would not substantially add to the cost of our program. In addition, the volume of heating oil shipped under such circumstances is a small fraction of the total volume shipped by barge. Hence, any impact would be insignificant in the context of our entire program.

During the three month transition period between the time when refiners are required to produce 15 ppm highway diesel fuel and when it is required downstream, we anticipate that distributor's stationary storage tanks will gradually be blended down so that any residual product is removed. Thus, we expect that contamination from residual high sulfur fuel will not be a significant concern for dedicated stationary storage tanks. Similarly for barges, we believe there will be sufficient cycles to ensure that sulfur contamination from residual high sulfur product is not a significant concern.

The pipeline system will continue to be capable of distributing the current range of products. To limit contamination during the distribution by pipeline, an additional volume of highway diesel will need to be downgraded to a lower value product. We adjusted our estimate of the downgrade volume based on the comments received on the NPRM. The upper bound in range of estimates provided by pipeline operators of the volume of highway diesel fuel that they must currently downgrade is 10 percent of the highway diesel fuel they ship. A number of pipeline operators stated that they expect the amount of highway diesel fuel they downgrade would double as a result of our sulfur program. Based on this information, some pipeline operators will need to downgrade up to 20 percent of the 15 ppm highway diesel fuel they ship to a lower value product due to mixing with high sulfur products in the distribution system. However, this represents the worst case situation and is not representative of the industry as a whole. Taking into account the diversity in the characteristics of pipeline owner's operations that the Association of Oil Pipelines (AOPL) related was linked to the wide range in the estimates of the current downgrade volumes that they received from their members, we estimated that on average pipeline operators currently downgrade 2.2 percent of the highway diesel fuel supplied (see the RIA to this rule for additional discussion on how we made this estimate). Based on input from several commenters, we estimated that this amount would double as a result of our program. Our rationale for this making this estimate is described in section IV.D.2. of the RIA. Thus, an additional 2.2 percent of highway diesel fuel supplied will need to be downgraded to a lower value product as a result of our sulfur program. This additional volume is relatively modest and can be accommodated by the market without significant disruption. We attributed additional costs to make this downgrade.

The fuel distribution industry will move quickly to optimize the system to limit contamination. Thus, we believe that there will not be a significant increase in the number of highway diesel fuel batches that are found to not comply with the sulfur standard. We anticipate that the batches of highway diesel fuel that are discovered to exceed the 15 ppm sulfur cap will be coped with as follows:

- When possible, by blending highway diesel fuel that is below the 15 ppm cap with the out of specification batch to bring the resulting mixture into compliance. This practice will be more difficult than it is currently because the amount of fuel needed to blend the out of specification batch into compliance may increase. However, we expect it to continue to be the method of choice for handling out of specification highway diesel whenever possible.

- By downgrading the batch either to off highway diesel fuel or to 500 ppm highway diesel during the initial four years of our program when the temporary compliance option is available.

- By reprocessing the batch to meet the 15 ppm cap, but only in those infrequent instances where the previous options do not exist.

We do not believe that the cost of handling out-of specification highway diesel batches will increase significantly as a result of our sulfur program.

We believe that there will not be significant additional volumes of transmix generated as a result of our program. We expect that no changes will be needed in the choice of products that abut highway diesel fuel in the pipeline. We recognized that the interface between a batch of highway diesel fuel and jet fuel or kerosene can no longer be cut into the highway diesel fuel batch when the highway diesel fuel is required to meet a 15 ppm cap on sulfur content. However, we believe that it will be possible to downgrade this interface to off highway diesel fuel rather than to treat it as transmix (see section V.C.3.e. of the RIA). Therefore, we believe that no significant additional volume of transmix associated with pipeline interface will be generated as a result of our program (such as might arise from shipping additional batches of highway diesel fuel adjacent to gasoline).

It is possible that sources of sulfur contamination which did not hitherto represent a significant concern may need to be reevaluated to assess their potential impact on maintaining the 15 ppm cap on the sulfur content of highway diesel fuel. Although all of these potential minute sources of sulfur contamination in the distribution system may not have currently been identified and quantified, we believe that the total contamination from such sources, while made more significant by the implementation of the 15 ppm sulfur cap, is not of a sufficient magnitude to impact to any significant degree the feasibility of distributing 15 ppm sulfur highway diesel fuel. The changes needed to the distribution system to limit sulfur contamination in highway diesel fuel under our program are logical outgrowths and extensions of existing hardware and procedures.

In gearing up to comply with our program, we expect that industry will conduct an evaluation of whether changes are needed in addition to those that we have specifically identified. The changes needed in the distribution system as a result of our sulfur program will be readily apparent once industry focuses on meeting the challenge of limiting sulfur contamination during the distribution of 15 ppm highway diesel fuel. Therefore, we believe that a technical review of the ability of the distribution system to limit sulfur contamination in 15 ppm highway diesel fuel is not needed.

We anticipate that the distribution system will conduct an evaluation of the potential sources of contamination to ensure that each segment in the system has a satisfactory margin of compliance below the 15 ppm cap. As a result of this evaluation, we anticipate that industry may take measures to help adequately limit sulfur contamination in addition to those specifically identified at this time. However, we anticipate that these measures will be the exception rather than the rule. We do not anticipate that such additional measures will result in an unacceptable burden to the fuel distribution industry.

We also anticipate that distributors will gain some experience in reducing sulfur contamination in the distribution system through complying with the recently finalized Tier 2 low sulfur gasoline requirements (65 FR 6698, February 10, 2000). Furthermore, we fully anticipate that some refiners will take advantage of the early credit provisions in the final rule and begin producing 15 ppm diesel fuel early, and in so doing provide valuable experience in distributing 15 ppm fuel nationwide prior to the June 1, 2006 start date for the program.

In response to the comment under 8.1.1.(B).9. regarding the lack of availability of field testing equipment to measure the sulfur content of highway diesel fuel, we believe that such equipment will not be required at terminals and pipeline facilities as a result of our program. Terminals can continue to use laboratory test methods when they need to evaluate the sulfur content of highway diesel fuel in their possession. The time required for such testing will not represent a substantial impediment to their operations.

Pipeline operators currently rely on physical parameters (e.g. changes in fuel density, presence of red dye in off highway diesel fuel) to discern the interface between fuel batches in the pipeline. In cases where pipeline operators have difficulty in locating the interface between batches today, they will sometimes inject dye at the beginning of a batch of fuel to help identify the interface downstream. Pipeline operators currently do not test the sulfur content of fuel batches in the pipeline to locate the interface between fuel batches. We believe that our sulfur program will result in changes to highway diesel fuel that will make it more difficult to identify the interface between fuel batches. Therefore, we believe that the current physical methods used to identify the interface between batches can continue to be used once our sulfur program is implemented, and pipeline operators will not need to conduct in-line measurements of highway diesel fuel sulfur content. See the RIA to this rule for additional discussion of the methods used by pipeline operators to discern the location of the interface between different batches of fuel in the pipeline and their continued applicability once our sulfur program is implemented.

We agree with commenters' request that an allowance for test tolerance should be included when evaluating compliance with the 15 ppm cap on highway diesel fuel sulfur content. As suggested in the comments, we believe this downstream allowance will substantially ameliorate concerns regarding the ability to comply with the 15 ppm sulfur standard downstream of the refinery. We believe this allowance will not impact the expected average level of fuel sulfur in-use. Therefore, providing this measurement tolerance will not reduce the emissions benefits of our program.

With respect to the comment under 8.1.1.B.16, we do not believe that variances to allow out of specification batches of 15 ppm highway diesel fuel to be sold into the highway diesel fuel market is either necessary or appropriate. As discussed above, there will not be a significant increase in the number of batches of highway diesel fuel found to exceed the 15 ppm sulfur cap. Those that are found to exceed the cap can be dealt with as they are today. Providing such variances would increase the average in use sulfur level. This could adversely impact the functionality of the sulfur sensitive emissions control technology that we anticipate will be needed to meet the emissions standards under our program.

Under our sulfur program, we expect that highway diesel fuel designated as meeting the 15 ppm cap on sulfur content will leave the refinery with an average sulfur concentration of approximately 7-10 ppm. Consequently, for highway diesel fuel to comply with the 15 ppm sulfur standard, sulfur contamination could contribute no more than 5 - 8 ppm to the final sulfur of the fuel. Pipeline operators will set a specification on the maximum sulfur content of highway diesel fuel they accept for shipment based on these criteria. Our inclusion of a tolerance on the measurement of fuel sulfur will provide additional flexibility in the maximum sulfur level that can be accepted by a refiner to ensure that the 15 ppm sulfur cap is maintained downstream. The means to limit sulfur contamination during the distribution of highway diesel fuel outlined above (and detailed in section IV.D of the RIA to the final rule for our sulfur program) will be sufficient to ensure that highway diesel fuel leaving the refinery at the projected levels can meet the 15 ppm sulfur throughout the distribution system to the end user.

Issue 8.1.2: Technological/Logistical Considerations

(A) The proposed 15 ppm diesel sulfur standard will not be difficult for the refiners to achieve and is technologically feasible.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

Hart/IRI Fuels Information Services (IV-D-154) **p. 2**, (IV-F-190) **p. 254**
Syntroleum (IV-D-260) **p. 2**

(2) Commenters noted that several other countries have already successfully implemented low-sulfur requirements and that diesel sold in the European Community will be capped at 50 ppm in 2005 and will move toward 10 ppm by 2008.

Letters:

Natural Resources Defense Council (IV-F-75)

(3) One commenter noted that Sweden also has a 50 ppm cap and is moving towards a 10 ppm cap but 90% of diesel fuel sold in Sweden is already at the 10 ppm level due to an effective incentives program. Another commenter added that refiners in Sweden and elsewhere are currently producing the 5 ppm fuel - this is evidence that it can be done at U.S. refineries as well.

Letters:

Alliance of Automobile Manufacturers (IV-F-9, 59,190) **p. 114** (IV-F-117) **p. 168** (IV-F-191) **p. 89**
Natural Resources Defense Council (IV-F-75)

(4) Refiners already have the technological ability to reduce sulfur levels. Oil companies (such as BP Amoco, Equilon and ARCO) are already making 15 ppm diesel fuel, including in parts of California. ARCO has developed a low-sulfur diesel fuel called Emission Control Diesel (EC-D) that is produced from

typical crude oil using a conventional refining process [cites to EC-Diesel Technology Validation Program Interim Report, 2000-01-1854]. TOSCO has expressed its support for a nationwide 15 ppm fuel requirement by 2006. One commenter cites to a study by MathPro Inc. (as performed for EMA) that demonstrates that a 5 ppm fuel is well within current technological capabilities.

Letters:

Alliance of Automobile Manufacturers (IV-F-9, 59, 190) **p. 114** (IV-F-117) **p. 168** (IV-F-191) **p. 89**
American Lung Association (IV-D-270) **p. 19**
DaimlerChrysler (IV-F-15, 116) **p. 292** (IV-F-117) **p. 96** (IV-F-191) **p. 173**
Environmental Defense (IV-D-346) **p. 11**
International Truck & Engine Corp. (IV-D-257) **p. 6-8**, (IV-F-27, 34, 180, 117) **p. 109** (IV-F-191) **p. 99**
NESCAUM (IV-F-63)
Natural Resources Defense Council (IV-F-75, 191) **p. 68**
STAPPA/ALAPCO (IV-D-295) **p. 10-11**

Response to Comment 8.1.2(A)

We agree with the commenters that meeting a 15 ppm sulfur cap standard is technologically feasible to achieve. Hydrocrackers and ring opening technologies are examples of processes which are reducing the sulfur levels of diesel fuel to very low levels today. We provide a rich discussion of these technologies in Chapter IV of the RIA. However, these are somewhat expensive processes to operate. A number diesel desulfurization technology vendors have published technical papers and explained to us during our meetings with them that a severe desulfurization process, using a route of reaction called hydrogenation which saturates polyaromatic compounds to monoaromatics, can achieve a 15 ppm cap standard and it is a lower cost technology than hydrocracking or ring opening. We expect that refiners will readily choose this technology for meeting the 15 ppm cap standard and we based our cost estimate on this technology. Refiners could also choose among several different emerging technologies if they are sufficiently confident in these technologies. A detailed discussion on the hydrogenation and emerging technologies is also contained in Chapter IV of the RIA.

While we are confident that refiners can desulfurize their highway diesel fuel to under 15 ppm sulfur, we believe that refiners will have to take extra steps to consistently meet the cap standard on a daily basis. First, refiners will need to ensure that their heat exchangers for their diesel hydrotreaters have no leaks, and if there are leaks they may either have to weld the tubes to the tube sheets, or replace them altogether (any refiners putting in grassroots units would put in new heat exchangers as part of that installation). Even if a small amount of the feedstock, which contains about 10,000 ppm sulfur, leaks through to the product, the product can quickly exceed the 15 ppm sulfur cap standard. Next, refiners will need to control the amount or fraction of sterically hindered compounds in the diesel hydrotreater feedstock. A vendor confidentially shared diesel desulfurization information with us which showed that variances in the endpoint, especially the endpoint of the LCO present in their feed, which translates in variances in the amount of sterically hindered compounds, resulted in significant variances in the sulfur level of the product. Thus, refiners are expected to focus on better controlling the endpoint of their light cycle oil (LCO) from their fluidized catalytic cracker unit which would allow the refinery to meet the cap sulfur standard on a consistent basis. Finally, we believe that refiners will install an online sulfur analyzer in the product stream from their diesel hydrotreater which would allow them to continually monitor the sulfur level of their highway diesel to ensure that they are staying under the cap. This strategy for meeting the 15 ppm cap standard is discussed in Chapters IV and V of the RIA.

We agree that the actions or commitments by certain refiners and other countries supports that it is feasible and cost-effective to desulfurize highway diesel fuel to meet the 15 ppm sulfur cap standard. This includes the very low sulfur diesel already being provided by BP-Amoco and ARCO, and the commitment by Tosco to desulfurize their diesel fuel to meet this program's requirements early. Furthermore, Sweden's highway diesel fuel is already under 10 ppm and other European countries are expected to follow suit. If desulfurizing diesel fuel was not feasible nor cost-effective, these companies and these other countries would not have taken such proactive steps.

(B) Achieving the 15 ppm standard is not technologically feasible for refiners.

(1) The technology to consistently produce diesel with a sulfur content below 15 ppm is problematic. Commenters asserted that there has been no demonstration, technological or otherwise, that the 15 ppm sulfur level is achievable or sustainable across the current diesel pool and/or that there is no existing technology to remove sufficient sulfur from certain diesel blendstocks. One commenter noted that a refiner has only two options: undercut the dibenzothiophenes from the treated pool, or replace the distillate desulfurization catalyst every two to four months--and both of these options have limitations and could have an adverse impact on diesel supply and production costs. Others noted that refiners will need to produce highway diesel fuel at 7 to 10 ppm in order to consistently meet the 15 ppm cap, even though no U.S. or foreign refiner has been able to produce this kind of ultra-low sulfur diesel in large quantities. Achieving the proposed standard will be particularly difficult for U.S. refiners because of the relatively high-sulfur petroleum feedstocks typically available in the U.S. EPA discusses several promising desulfurization technologies, including biodesulfurization, but acknowledges that these technologies are several years from being commercially available. Refiners should not be asked to make multimillion dollar investments and gamble the future of their companies based on technologies that are "promising."

<u>Letters:</u>

Countrymark Cooperative (IV-D-333) **p. 6**
Marathon Ashland Petroleum (IV-D-261) **p. 41-42**
National Petrochemical & Refiners Assoc./CITGO (IV-F-117) **p. 101**
National Petrochemical & Refiners Association (IV-F-31, 44)
Ports Petroleum Co, Inc. (IV-F- 117) **p. 190**
Reusable Industrial Packaging Association (IV-D-129) **p. 1**
Society of Independent Gasoline Marketers of America (IV-F-191) **p. 196**
U.S. Chamber of Commerce (IV-D-329) **p. 3-4**

Response to Comment 8.1.2(B)(1):

We disagree that there is no existing technology for desulfurizing highway diesel fuel to meet the 15 ppm sulfur cap standard. As described above in Chapter IV and V of the RIA and reiterated in response to comments (A) (1), (2), (3), and (4) above, hydrocracking and ring opening technologies have already been demonstrated to meet a 15 ppm cap standard. However, refiners are expected to use a desulfurization process called hydrogenation. While the hydrogenation process has not been demonstrated commercially, vendors have demonstrated this technology in their pilot plants. We believe that refiners will use hydrogenation to meet the 15 ppm cap standard.

We also disagree that no technology can remove sulfur from certain diesel blendstocks such as dibenzothiophenes. Once again hydrocracking and ring opening technologies have already been demonstrated to desulfurize dibenzothiophene compounds. However, vendors of diesel fuel desufurization technology have also assured us that the hydrogenation process for desulfurizing diesel fuel will also desulfurize dibenzothiophene compounds as well. In fact, they provided us guidelines and information for desulfurizing diesel fuel which contains dibenzothiophenes which allowed us to estimate the cost of desulfurizing diesel fuel for both a combined set of refinery streams and individual refinery streams incrementally (i.e., light cycle oil, coker distillate and straight run). If refiners choose to undercut the dibenzothiophene compounds out of their highway diesel fuel, it is because they have another fuel in which to place that blendstock which is economically beneficial for the refiner. For example, refiners which can cut their dibenzothiophenes out of their highway diesel fuel will treat them in their hydrocracker or can arrange to treat them in a neighboring refinery's hydrocrackers, or they can blend them in off highway diesel fuel or home heating oil. If refiners do cut the dibenzothiophenes out of their highway diesel fuel, they would likely balance their mix of distillate products to satisfy their highway diesel fuel market by shifting some straight run compounds out of nonhighway and heating fuel into the highway diesel pool.

However, if refiners have only their residual pool to put their cut dibenzothiophenes into, we don't believe that refiners would readily take that action. This is because our analysis shows that it costs between 6 and 7 cents per gallon to desulfurize their dibenzothiophenes, while residual fuels are generally valued at least 25 cents per gallon less than highway diesel fuel.

We believe that cycle lengths will not be shorter if refiners choose to desulfurize their dibenzothiophene along with the rest of their highway diesel fuel based on what vendors explained to us about meeting a 15 ppm sulfur standard. This is because diesel desulfurization is expected to take place in two stages and the second stage will be less severe. The first stage for most all refineries will be today's diesel hydrotreater which treats untreated distillate down to about 350 ppm. This first stage will remove most all the sulfur, nitrogen and metals. Then the hydrogen sulfide will be scrubbed out before the second stage will desulfurize that 350 ppm product down to under 15 ppm. Since the second stage will not see much less sulfur nitrogen and metals, and because the reaction equilibrium for desulfurization favors a lower operating temperature, we believe that the second stage will have longer cycle lengths than the first stage. Since today's diesel hydrotreater is essentially the first stage of the hydrotreater which will deliver highway diesel fuel which will meet the 15 ppm sulfur cap standard, we believe that today's cycle lengths will persist. This assumption is likely conservative since new, more active catalyst technologies are expected to be introduced over time which will more easily remove sulfur and other contaminants, thus cycle lengths could very will improve.

As described in Chapter IV of the RIA, there is the possibility that some refiners will be able to meet the 15 ppm cap standard by not installing new capital, but instead by improving the desulfurization capability of their existing diesel hydrotreater with improvements such as more active catalysts, better reactor internals, purifying their hydrogen and by operating their diesel hydrotreater at a higher temperature which improves the catalyst desulfurization activity. Because of increasing the reactor temperature, these refiners would suffer shorter cycle lengths, however, they would choose to do so because it would be more economical to do so than making a capital investment in a high pressure stripper and a second stage reactor.

EPA discussed several different emerging technologies which could be used by refiners to meet the 15 ppm sulfur cap standard. We expect that refiners will only use such technologies if their review of those technologies finds them more cost-effective and as capable as conventional desulfurization technologies.

(2) The NPC has concluded that reducing sulfur much below 30 ppm average will not be practical and that most units will not be capable of achieving the 15 ppm standard.

<u>Letters:</u>

ExxonMobil (IV-F-800)

<u>Response to Comment 8.1.2(B)(2)</u>

We disagree with the conclusions made by the NPC study that desulfurization of highway diesel fuel to under 30 ppm is not practical and that most units would not be able to meet a 15 ppm cap standard. The NPC study made such conclusions despite the submissions made by Akzo Nobel, Criterion, Haldor Topsoe and UOP which show that 10 ppm can be achieved, and that the costs are reasonable. Furthermore, studies made later on by API and DOE presumes that every refinery can meet a 15 ppm sulfur cap standard except for those refiners which in a survey claimed that they would no longer participate in the highway diesel sulfur market. Our own discussions with vendors and a number of refiners and the actions and commitments by refiners described above in our response to comments (A) (1), (2), (3) and (4) of this section convinced us also that refiners can meet a 15 ppm sulfur cap standard.

(3) A fluctuation in desulfurization performance of less than 0.4% could disrupt the 15 ppm standard.

<u>Letters:</u>

National Petrochemical & Refiners Association (IV-D-218) **p. 3, 9**

<u>Response to Comment 8.1.2(B)(3)</u>

We agree that a small decrease in the desulfurization efficiency of diesel desulfurization units could cause the product to exceed the 15 ppm sulfur cap standard. This is why we believe that refiners must exercise the steps summarized in response to comments (A) (1), (2), (3) and (4) above which would ensure that they can meet the sulfur standard on a continual basis.

(4) There are constraints on revamping existing units that at best will result in reduced production capacity. Reactor internals need to be reviewed and probably changed to minimize catalyst bypassing. Reactor distribution issues while trying to produce 5 ppm diesel (at the refinery to meet a 15 ppm retail cap) will cause units to have shortened runs, perhaps 50% shorter. Also, feed filters may be needed, as well modified reactor loading schemes and other changes. All of these changes adversely affect capacity.

Letters:

Big West Oil, LLC (IV-D-229) **p. 4-5**
Citgo Corporation (IV-D-314) **p. 4**
Marathon Ashland Petroleum (IV-D-261) **p. 3**

Response to Comment 8.1.2(B)(4)

We agree that refiners will want to use the best reactor internals when they revamp their diesel hydrotreaters as part of a strategy for meeting the 15 ppm cap standard. Refiners may choose to filter the feed to the diesel desulfurization unit, if they do the unit feed pumps can be modified to feed the same volume of feed to the hydrotreater, if the existing pumps are currently capable not capable of doing so. In response to the comment that diesel hydrotreater units will experience shorter run lengths, we disagree and point the reader to our response to comments (B) (1) in this section. We don't believe that the requirements would affect capacity as claimed by the commenters.

(5) A 15 ppm cap will result in delays for refineries returning to normal operations following turnarounds and unplanned upsets. The downtime will be extended to fully flush the products distribution system to avoid sulfur contamination.

Letters:

Citgo Corporation (IV-D-314) **p. 3**

Response to Comment 8.1.2(B)(5)

We don't believe that refiners will have to extend their turnaround times by flushing out their product lines since their product lines will normally see very low sulfur product. When starting their diesel hydrotreaters after a turnaround, we expect refiners to recycle the diesel in their hydrotreaters until their diesel hydrotreaters are up to normal operating temperature and the diesel under 15 ppm. Thus, the product lines should not see high sulfur diesel fuel. Refiners may have to flush their process lines the very fist time they start up the unit, and we include startup costs for addressing this issue. Furthermore, we believe that refiners will produce some offspec product while they operate their revamped and grassroots diesel desulfurization units and we included cost for the storage capacity, the treating capacity and the operating the diesel hydrotreater for desulfurizing that offspec material.

(6) EPA's preamble acknowledges that there is no operating experience in the U.S. with typical U.S. diesel fuel feedstocks of using high pressure hydrotreating units to reduce sulfur to the 7-10 ppm range at the refinery gate.

Letters:

Murphy Oil Corporation (IV-D-274) **p. 12**

Response to Comment 8.1.2(B)(6)

We acknowledge that there is not extensive commercial experience using hydrogenation as the desulfurization technology which we expect will be used to meet the 15 ppm cap standard. However, vendors have demonstrated this technology many times over in their pilot plants, and they will continue to do so as they continue to test refinery diesel fuel hydrotreater feedstocks to provide refiners cost estimate information. We believe that the diesel desulfurization vendors have extensive experience in applying their technology to commercial situations which gives us confidence in their projections.

(7) Commenter provided a detailed discussion of the chemistry of sulfur compounds and the hydrodesulfurization mechanism to explain why production of ultra-low sulfur diesel is problematic.

Letters:

Marathon Ashland Petroleum (IV-D-261) **p. 42-43**

Response to Comment 8.1.2(B)(7)

We agree that desulfurizing diesel fuel to very low sulfur levels can be difficult. The difficulty lies in desulfurizing the sterically hindered compounds in diesel fuel, which predominantly come from light cycle oil (LCO). In Chapter IV of the RIA, we present our understanding of that difficulty. However, we also describe how vendors have configured their technology to optimize the desulfurization of these compounds.

(C) EPA's proposed rule will not lead to any significant distribution problems.

(1) Implementation of the national fuel standard as proposed by EPA would not present distribution problems and would solve some of the regional distribution and supply issues created by the specialty fuels sold only in California. CARB reformulated gas raised distribution concerns because economies of scale were lost and monopolies were created; but a national standard would eliminate these problems.

Letters:

CA Trucking Association (IV-D-309) **p. 6**
Interstate Claims (IV-F-190) **p. 66**

(2) Disagrees with the assumption related to trucking contained in the Cost/Impacts of Distributing Potential Ultra Low Sulfur Diesel as submitted by

API on February 23, 2000. Clean products are currently moving through the pipelines and are efficiently transported to market. The introduction of low sulfur diesel fuel nationwide will actually have a long-term, positive economic impact since it will prohibit the regional use of boutique fuels, which present a larger long-term challenge for supply and spot outages.

Letters:

CA Trucking Association (IV-D-309) **p. 6**

(3) The industry already has various specialty fuels traveling the same pipelines, with little or no contamination.

Letters:

CA Trucking Association (IV-F-190) **p. 21**

Response to Comment 8.1.2(C):

Please refer to the response to comments 8.1.1(A), (B), & (C) and the Regulatory Impact Analysis (RIA) to the final rule for a discussion of our assessment of the ability of the distribution system to handle highway diesel fuel meeting a 15 ppm cap on sulfur content. We agree with the commenter that the implementation of our nationwide highway diesel fuel sulfur standard will lessen the burden associated with the distribution of a special diesel fuel in California.

(D) Contamination and cost increases may be limited by reducing the sulfur differences with other fuels.

(1) Significant distribution costs can occur when excessive transmix is generated or when large fuel product downgrading is generated. The sulfur level of adjacent products will influence the amount of product downgrade at a distillate interface. Reducing the nonroad fuel sulfur level would lower the potential impact of cross-contamination.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 22**

Response to Comment 8.1.2(D)(1):

We estimated that the amount of additional highway diesel fuel that must be downgrade is 2.2 percent of the total volume of highway diesel fuel supplied. We concluded that this downgrade can be accommodated by the market without significant disruption. We have also concluded that there will be no significant increase in the volume of transmix generated as a result of our program. Please refer to the response to comments 8.1.1(A), (B), & (C) and the Regulatory Impact Analysis (RIA) to the final rule for a discussion of how we arrived at these conclusions.

We agree that reducing the sulfur level of off highway diesel fuel would tend to limit the potential for sulfur contamination during the distribution of highway diesel fuel meeting a 15 ppm sulfur cap. However, our consideration of such an action is not within the scope of this rule and is not necessary to ensure that sulfur contamination during the distribution of highway diesel fuel meeting a 15 ppm sulfur cap can be adequately limited. Please refer to the response to comments 8.1.1(A), (B), & (C) and the Regulatory Impact Analysis (RIA) to the final rule for a discussion of this assessment.

(2) The few nations planning to lower sulfur content are moving only to a standard of 50 ppm. The greater the difference between foreign diesel sulfur standards and U.S. diesel sulfur standards, the more difficult it becomes to import and blend down the product.

Letters:

Independent Fuel Terminal Operators Association (IV-D-217) **p. 3-4**

Response to Comment 8.1.2(D)(2):

Please refer to the response to comments 8.1.1(A), (B), & (C) regarding the continued ability to import highway diesel fuel once the 15 ppm cap on sulfur content is implemented.

Contrary to the commenter's assertion, other countries are in fact looking at diesel fuel sulfur standards as low as, or even lower than the 15 ppm standard finalized today. Sweden has been at 10ppm for many years. Germany and the entire European Union are considering reducing their sulfur level to 10 ppm as well. Canada, a source of much of the current imports into the U.S. of highway diesel fuel has already expressed a desire to harmonize with our diesel fuel sulfur standard. Furthermore, in many respects it is easier for foreign refiners to comply with this new diesel fuel sulfur standard since they do not have to meet the standard on all of the diesel fuel they produce and can selectively choose those distillate feedstocks that can be desulfurized at the least cost.

(E) There are logistical constraints to ensuring that the 15 ppm standard is maintained throughout the distribution process.

(1) Commenters provided no supporting information or detailed analysis.

Letters:

American Petroleum Institute (IV-F- 191) **p. 114**
Cenex Harvest States Cooperatives (IV-D-232) **p. 7**, (IV-F- 191) **p. 232**
Collier, Shannon, & Scott (IV-F-117) **p. 24**
Conoco (IV-F-191) **p. 154**
Farmland Industries (IV-F-29)
Gary-Williams Energy Corporation (IV-F-43)
Sinclair Oil Corporation (IV-D-255) **p. 8**

Response to Comment 8.1.2(E)(1):

The challenge of limiting sulfur contamination during the distribution of highway diesel fuel meeting a 15 ppm cap can be met with modest changes and associated costs. Please refer to the response to comments 8.1.1(A), (B), & (C) and the Regulatory Impact Analysis (RIA) to the final rule for a discussion of our assessment of the ability of the distribution system to handle highway diesel fuel meeting a 15 ppm cap on sulfur content.

(2) Because the pipeline shipments are typically long and the fuel could be contaminated at any point in the distribution process, refiners must reduce their sulfur levels in diesel far below the standard, to ensure that the sulfur level will meet the 15 ppm standard at the retail level. Commenters stated that the actual ppm level for refiners will be less than 10 ppm (a range of values was provided). One commenter specifically noted that EPA's estimate of a 3 ppm increase in the sulfur level between the refinery gate and the retail location is underestimated and that a 5 ppm sulfur fuel will need to be produced to ensure compliance at the retail level. One commenter recommended that EPA conduct trial runs or tests to determine whether the distribution of a 15 ppm diesel fuel can be transported long distances without significant contamination.

<u>Letters:</u>

American Petroleum Institute (IV-D-343) **p. 45**
CO Petroleum Association (IV-D-323) **p. 2**
Countrymark Cooperative (IV-D-333) **p. 4**, (IV-F-30, 191) **p. 184**
Marathon Ashland Petroleum (IV-D-261) **p. 3, 45-46, 50-53**, (IV-F-74)
National Petrochemical & Refiners Assoc./CITGO (IV-F-117) **p. 101**
National Petrochemical & Refiners Association (IV-F-31, 44)
Tesoro Petroleum (IV-F-191) **p. 26**
U.S. Department of Energy (IV-G-28) **p. 5**
Ultramar Diamond Shamrock Corporation (IV-F-191) **p. 136**

<u>Response to Comment 8.1.2(E)(2):</u>

While no data was provided supporting the 5 ppm compliance margin claimed in the comments to be necessary, the Agency also believes that refiners will have to produce diesel fuel consistently below the 15 ppm cap in order to ensure compliance day-in and day-out not only at the refinery but all the way through to retail as well. Consequently, while the standard is a 15 ppm cap, EPA assumed, consistent with the commenters, in our cost and feasibility analyses in the RIA that refiners would on average need to produce diesel fuel at a 7-8 ppm level in order to ensure consistent downstream compliance.

While no test runs of the distribution system using 15 ppm diesel fuel have yet been completed, as discussed in the response to comments 8.1.1 (A), (B), and (C) and the RIA, we remain convinced that it is feasible to distribute 15 ppm using the current distribution system at a minimal additional cost. We anticipate that distributors will quickly optimize their practices to avoid sulfur contamination. We also anticipate that distributors will gain some experience in reducing sulfur contamination in the distribution system through complying with the recently finalized Tier 2 low sulfur gasoline requirements (65 FR 6698, February 10, 2000). Furthermore, we fully anticipate that some refiners will take advantage of the early credit provisions in the final rule and begin producing 15 ppm diesel fuel early, and in so doing provide valuable experience in distributing 15 ppm fuel nationwide prior to the June 1, 2006 start date for the program.

(3) Commenter provides the results of a pipeline survey that provides several insights into this issue. First, owners of pipelines will try to accommodate shipper needs, and will continue to carry higher sulfur products if possible. However, if ULSD becomes the product of choice, pipelines may decide not to carry the higher sulfur products because those products compound the difficulty in ensuring ULSD product quality. Second, pipelines anticipate setting receipt specifications from 5-15 ppm, but at this point the commenter cannot state with certainty where in that range the actual specifications are likely to fall. Owners of pipelines do believe that the test tolerance (which EPA indicates is +/- 4 ppm) should be included in the acceptable sulfur level. If not, then the acceptable level for a pipeline to accept will be no higher than 11 ppm. Third, the pipeline owners consider the transition to ULSD as more complex than previous fuel specification transitions, such as leaded to unleaded gasoline. The complexity stems from the limited tolerance cushion, the lack of visual clues of a batch transition, and the inability to blend interface. Fourth, owners of pipelines will try to minimize contamination by wrapping the ULSD with low sulfur (500 ppm) diesel or gasoline. The interface (transmix) would be downgraded and have to be re-refined. At this time, there is no experience that enables an accurate guess at the level of downgrading that will be necessary. Fifth, owners of pipelines will have difficulty finding the cuts between product batches. There are no visual clues (color differentiation) or specific gravity changes to use. An alternative is to dye the ULSD fuel, which raises its own set of issues for contaminating other products with the dye, such as jet fuel. Sixth, the survey results indicate that only in PADD I do pipelines uniformly carry high sulfur diesel product. A number of pipelines in PADD II do not carry the high sulfur product, and this may be true of PADDs III, IV and V as well. Finally, pipeline owners have insufficient knowledge to respond to issues raised about the potential impacts of bio-diesel.

<u>Letters:</u>

Association of Oil Pipelines (IV-D-325) **p. 2-4, att.**

(4) There are a number of procedures that will need to be followed in order to prevent contamination of 15 ppm diesel fuel throughout the distribution system. Commenter provides a description of the cleaning and other maintenance procedures that need to be completed to prevent contamination at numerous points during distribution (i.e. barges, tank trucks, storage tanks, and test equipment). Commenter adds that very small amounts of high sulfur fuel - 2 to 7 barrels - left along pipes, hoses or in trucks, could completely contaminate a 50,000 barrel batch of ultra-low sulfur fuel. Therefore, with a 15 ppm sulfur standard, either separate distribution equipment or strict and continuous prevention procedures will be required to avoid contamination, which aside from being very costly, would have several other adverse effects; the distribution facilities would be more limited overall, marketers would be prevented from using transportation grade diesel as a heating fuel during the winter as necessary, and some marketers would choose to abandon the

business of selling on-highway diesel.

Letters:

Independent Fuel Terminal Operators Association (IV-D-217), **p. 5-9**

Response to Comments 8.1.2(E)(3) and (4):

After our review of the comments and all the information available to us, we remain convinced that the challenge of limiting sulfur contamination during the distribution of highway diesel fuel meeting a 15 ppm cap can be met with modest changes and associated costs. The provision in the final rule to allow for an adjustment to downstream measurements to take into consideration test variability will further serve to address the concerns raised. Please refer to the response to comments 8.1.1(A), (B), & (C) and the Regulatory Impact Analysis (RIA) to the final rule for a discussion of our assessment of the ability of the distribution system to handle highway diesel fuel meeting a 15 ppm cap on sulfur content.

Highway diesel fuel meeting a 15 ppm cap on sulfur content will continue to be suitable for use as heating fuel as necessary. The changes to the composition of highway diesel fuel that will result from our program will not affect its suitability for use as heating oil.

(F) The distribution system cannot transport multiple products without some level of contamination and loss of higher quality product volume; and such contamination will increase significantly with a 15 ppm sulfur cap.

(1) Commenter urges EPA to conduct tests of the distribution system to determine whether 15 ppm sulfur fuel can be delivered in a fungible pipeline system while still maintaining sulfur integrity; and if it is possible, at what cost and how much fuel will have to be downgraded to achieve that delivery. API references Attachment 6 to its letter, a study by NPC expressing the high risk of pipeline contamination. Commenter further cites a TM&C assessment of the costs and impacts of distributing ultra low sulfur fuel which concludes that the lack of experience in dealing with such a product will lead to difficulties maintaining a continuous supply, and spot outages would result. The large differences in sulfur content between on-road diesel and home heating oil (15 vs. 5000 ppm) will create a significant amount of pipeline interface to ensure product integrity. Some pipelines estimate that 20% of on-highway diesel will have to be downgraded at the receiving end to maintain product integrity. Consequently, refiners will have to produce an additional 20% of on-road diesel than demand requires. Although there may be many different pathways from refiner to end-user, the pipeline distribution system is the most complex with respect to potential contamination, and by far the most prevalent one in terms of delivery of product. EPA overly simplified the pipeline distribution system in Section IV-46 of the Draft RIA. The product, particularly in larger systems such as the Colonial Pipeline, goes through numerous steps and travels long distances. In Houston, the pipeline will have to be flushed with 15,000 barrels of 15 ppm diesel before pumping the main batch into the mainline. Contamination could also occur from leakage from valves or fuel trapped in valve bonnets, in common manifolds, or from slight

miscalculations. To protect against contamination, refiners can issue even lower sulfur product into the pipeline or dedicate part of the delivery system to only 15 ppm fuel. Neither choice is feasible. The first because it would require great capital investment to reduce sulfur to near zero, and would result in inadequate diesel supply; and the second because of the number of products required in the market today. Contamination could occur at any point along the distribution system, and with a 15 ppm standard there is no margin for error.

Letters:

American Petroleum Institute (IV-D-343) **p. 46**
Citgo Corporation (IV-D-314) **p. 2, 3**
ExxonMobil (IV-D-228) **p. 18**
Marathon Ashland Petroleum (IV-D-261) **p. 50-51**
National Petrochemical & Refiners Association (IV-D-218) **p. 10, 20**

(2) Commenter notes that contamination problems will be difficult to remedy because of the volumes need to blend down the sulfur. Thus, the likely scenario will be to try to find a refinery to rerun the off-spec product (as well as increased transmix products), but capacity limits will make this difficult.

Letters:

Big West Oil, LLC (IV-D-229) **p. 2**

(3) A 50 ppm or 15 ppm diesel fuel sulfur standard will present a serious problem with respect to both the distribution system and ensuring that the fuel is not contaminated during transport. The existing distribution system is incapable of meeting the standard on a regular basis because of contact with other products in the system. Unless each of the pipelines, barges, bulk storage terminals and tank trucks are cleaned immediately prior to the introduction of low sulfur diesel, the residual product will contaminate the new fuel. If it is not EPA's intent to require segregation, the EPA should thoroughly assess how its proposal will work in the real world without significant product contamination.

Letters:

National Association of Convenience Stores (IV-D-279) **p. 2**

Response to Comment 8.1.2(F):

After our review of the comments and all the information available to us, we remain convinced that the challenge of limiting sulfur contamination during the distribution of highway diesel fuel meeting a 15 ppm cap can be met with modest changes and associated costs. The provision in the final rule to allow for an adjustment to downstream measurements to take into consideration test variability will further serve to address the concerns raised. Please refer to the response to comments 8.1.1(A), (B), & (C) and the Regulatory Impact Analysis (RIA) to the final rule for a discussion of our assessment of the ability of the distribution system to handle highway diesel fuel meeting a 15 ppm cap on sulfur content.

While no test runs of the distribution system using 15 ppm diesel fuel have yet been completed, we remain convinced that it is feasible to distribute 15 ppm using the current distribution system at a minimal additional cost. We anticipate that distributors will quickly optimize their practices to avoid sulfur contamination. We also anticipate that distributors will gain some experience in reducing sulfur contamination in the distribution system through complying with the recently finalized Tier 2 low sulfur gasoline requirements (65 FR 6698, February 10, 2000). Furthermore, we fully anticipate that some refiners will take advantage of the early credit provisions in the final rule and begin producing 15 ppm diesel fuel early, and in so doing provide valuable experience in distributing 15 ppm fuel nationwide prior to the June 1, 2006 start date for the program.

(G) Limitations in the petroleum distribution and storage system of rural America will force rural retailers to make decisions that would limit the availability of fuels to their customers, which would force rural customers and agribusiness to purchase an unrequired, higher-priced fuel.

(1) Rural retailers, due to their limited storage systems, will be forced to designate their storage tanks to only one fuel, probably the ultra-low sulfur fuel. This will force all rural customers to purchase a higher priced fuel or will force the rural retailers to install additional storage tanks. Some commenters stated that the installation of these additional tanks would be too costly and could also increase the potential environmental threat of USTs. Commenters suggest that EPA withdraw the rule in order to accurately assess the impact to agribusiness.

<u>Letters:</u>

Agricultural Retailers Association (IV-D-178) **p. 2**
Agricultural organizations as a group (IV-D-265) **p. 1-2**
North American Equipment Dealers Association (IV-D-194) **p. 2-3**

<u>Response to Comment 8.1.2(G):</u>

The standards finalized today require all highway diesel fuel to meet the 15 ppm sulfur standard, with the exception of that fuel continued to be produced to the current 500 ppm standard under the temporary compliance option and small refiner hardship provisions during the first few years of the program. We are aware that for various reasons, including those mentioned by the commenter, that today up to 15% of highway diesel fuel production is consumed in nonroad uses. In our cost analysis in Chapter V of the RIA we have assumed that this “spillover” of highway diesel fuel into the nonroad market would continue, and have factored this cost into our analysis of the program. However, there are a number of reasons to believe that this spillover will be reduced in the future as the various entities in the refining and distribution system revisit their decisions in the wake of today’s final rule. To the extent this spillover is reduced, it will lessen the overall cost of the program.

(H) Refining industry concerns that diesel fuel will be contaminated by higher sulfur gasoline in pipelines and storage systems is unfounded.

(1) As a matter of industry practice, the contact between diesel fuel and gasoline in distribution pipelines is minimized and there is a current need to protect diesel fuel from gasoline contamination in ways that virtually assure that any sulfur cross-contamination will not be an issue. For example, diesel fuel cannot be sold unless it has a "flash point" of 125 degrees F, a requirement that would be violated if even a small amount (1%) of gasoline is allowed to mix with the diesel. Since it would take a higher percentage of gasoline to contaminate the sulfur level in diesel fuel, these concerns are unfounded.

<u>Letters:</u>

International Truck & Engine Corp. (IV-D-257) **p. 10**

<u>Response to Comment 8.1.2(H)</u>:

We agree with the commenter that although limiting sulfur contamination in highway diesel fuel meeting a 15 ppm cap on sulfur content will represent a substantial new challenge to the fuel distribution industry, that this challenge can be successfully managed with modest changes to the existing system and at acceptable costs. We agree that sulfur contamination of highway diesel fuel by contact with gasoline will continue to be effectively managed by the distribution system. Please refer to the response to comments 8.1.1(A), (B), & (C) and the Regulatory Impact Analysis (RIA) to the final rule for a discussion of our assessment of the ability of the distribution system to handle highway diesel fuel meeting a 15 ppm cap on sulfur content.

(I) EPA's reliance on catalyst vendor information and the MathPro study failed to account for real world processing options and feed quality, and therefore overestimated the ability of refiners to achieve the 15 ppm standard.

(1) Commenter notes that the vendors pointed out to EPA, MathPro and the commenter that the assumed feed quality was not consistent with refiners' processing options. One of the vendors stated that the MathPro cases are not representative of what most refiners face. The same vendors have concluded that with current feedstocks, more aggressive aromatic saturation or hydrocracking will be necessary, which is not technically practical or economically feasible in some cases. Thus, even one of the vendors has recognized that feed downgrading, especially by cutting LCO endpoint, is likely. These technical issues pose further risk of supply shortages (see Issue 8.1.1).

<u>Letters:</u>

National Petrochemical & Refiners Association (IV-G-29) **p. 3**

<u>Response to Comment 8.1.2(I):</u>

For the Final Rule, we estimated each refinery's cost for meeting the 15 ppm sulfur cap standard. For a more robust analysis, we estimated the mix of refinery streams (i.e., LCO, other cracked stocks and straight run) which comprise each refinery's distillate presuming that the mix of refinery streams is the same for the refinery's highway diesel fuel. We then incrementally estimated the cost of desulfurizing each refinery stream assumed to comprise the feed to the highway diesel hydrotreater based on desulfurization information which we obtained from vendors. A complete discussion on our cost estimation methodology is contained in Chapter V of the RIA. We are confident that our analysis is complete and our cost estimates are sound.

We also heard one vendor's claim that the Mathpro feeds, which vendors provided cost information for, do not represent actual highway diesel fuel quality because the endpoints are too low. We evaluated the Mathpro feeds and compared them to NIPER (National Institute for Petroleum and Energy Research) survey data for several different years. NIPER surveys diesel fuel quality at the point of retail sale all across the country. The NIPER surveys reveal that the average T-90 point for highway diesel fuel is about 600 F. The Mathpro feed intended to represent average diesel fuel quality is feed #1 and it is assumed to contain 23 percent LCO, 8 percent coker distillate, and 69 percent straight run (in our analysis we name this feed as "typical"). Mathpro assigned this particular feed a T-90 point of 610 F, which is more severe than the average diesel fuel, not less. Thus, the vendor's claim that Mathpro's feed does not represent average highway diesel fuel quality does not hold true. We believe that the vendor's basis for claiming that the Mathpro's feeds are too light stems from their work with refiners for meeting the 500 ppm sulfur cap standard implemented in 1993. To meet the 500 ppm cap standard, some refiners retrofitted existing VGO hydrotreaters to meet the sulfur standard, while others put in grassroots units. A likely explanation could be that those refineries with the lightest, easiest to treat feeds ended up retrofitting existing VGO units on their own while those with the heaviest, most difficult to treat feeds were addressed by the vendors putting in grassroots units, so the vendors only saw the more difficult feeds.
Vendors which we spoke to explained to us that highway diesel fuel, even those fuels with a large fraction of sterically hindered compounds from cracked stocks, can be desulfurized using desulfurization. Thus, hydrocracking and ring opening would not be necessary. We don't think that refiners will put in these units to meet this program's requirements. If they do then they likely have economic reasons beyond meeting the requirements of this rule for doing so (i.e., upgrading residual fuel to a much higher quality highway diesel fuel). We understand that refiners are currently using their existing hydrocracker to treat some of their cracked stocks, and this practice could expand in the future as refiners optimize the processing of their refinery streams and the blending of blendstocks for meeting product quality constraints, including this requirement.

Issue 8.1.3: Lead-time Required

(A) There will be a shortage of the engineering and construction resources necessary to meet the 2006 deadline, particularly given the overlap with Tier 2 gasoline desulfurization requirements.

(1) Commenters provided no supporting information or detailed analysis.

<u>Letters:</u>

CO Petroleum Association (IV-D-323) **p. 2-3**
Cooperative Refining, LLC (IV-D-300) **p. 3**
Countrymark Cooperative (IV-D-333) **p. 5**

ExxonMobil (IV-F-800)
Marathon Ashland Petroleum (IV-F-74)

(2) The high pressure, high temperature and high alloy units needed to meet the standards require highly specialized engineering contractor support as well as high quality craftsmen such as welders. Also, many of the fabrication and manufacturing shops for the vessels are located overseas which complicates the construction process. The same is true for the necessary piping. The time pressure and volume to be supplied could lead to poor construction and put workers at risk. Thus, there needs to be separation of time between the gasoline and diesel desulfurization requirements.

Letters:

Big West Oil, LLC (IV-D-229) **p. 2-3**

(3) This is a significant concern, especially in Rocky Mountain area. Also, a significant level of the resources available to farmer refiner co-ops may be engaged in ethanol refining plants, based on the planned construction activity cited in the comments.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 6-7**

(4) There are a limited number of manufacturers for the necessary high pressure reactors and compressors -- fabrication of this new equipment could be a limitation on the industry's ability to meet the proposed fuel standard.

Letters:

ExxonMobil (IV-F-800)
Marathon Ashland Petroleum (IV-D-261) **p. 41**
National Petrochemical & Refiners Association (IV-D-218) **p. 3**

(5) The need for higher pressure HDS units to ensure compliance with the standard, instead of the lower pressure HDS strategy assumed by EPA's will contribute to the financial, engineering and construction resource limitations related to the fuel change. These limitations will make it unlikely that refiners will be able to meet the proposed standard by 2006.

Letters:

U.S. Department of Energy (IV-G-28) **p. 4**

Response to Comment 8.1.3(A)

EPA evaluated the engineering and construction resources needed to design and build the desulfurization equipment needed for the Tier 2 gasoline sulfur standards and the 15 ppm diesel fuel sulfur cap. The analysis is presented in Chapter 4 of the Final RIA.

There, we found that the need for these resources is well below those available, indicating that existing resources should be more than sufficient to fulfill the needs of these two rules.

(B) The six year lead time is adequate.

(1) The 2006 deadline allows for a full two years of planning and then the ability to fit upgrades into normal turnaround schedules. Although skilled labor will be at a premium, everyone will be trying to get work done simultaneously, and permits will be a chore. None of those concerns are atypical for refinery operations. The experience with RFG, which was a much more difficult job, shows that a 3-4 year period is feasible; so the six year period for this rule is more than adequate.

<u>Letters:</u>

Hart/IRI Fuels Information Services (IV-D-154) **p. 3**

(2) Commenter notes that API stated that a 4-year lead time is required for refiners, and this rule would provide them with 5.

<u>Letters:</u>

PA DEP (IV-D-100) **p. 2**

<u>**Response to Comment 8.1.3(B)**</u>

The oil refining industry has typically requested at least 4 years lead time between promulgation and the implementation date of a new fuel quality standard. Examples of this were industry comments to the Federal reformulated gasoline (RFG) program and the Tier 2 gasoline sulfur control program. Also, the lead time analysis performed by EPA in support of the Tier 2 sulfur standards and summarized in the Final RIA for that program confirm that 4 years lead time is more than sufficient. Thus, the five and a half year lead time provided prior to the onset of the new diesel fuel sulfur cap is more than sufficient time for the industry to design and build their desulfurization equipment. Also, it should be noted that the timing of this program provides four and a half years before the date when early sulfur credits can be generated without restrictions on the use of the 15 ppm diesel fuel. Thus, sufficient lead time for all refiners is being provided even for generating early credits.

Issue 8.1.4: Diesel Fuel Additives Issues

(A) EPA should modify the proposed rule to permit downstream use of static dissipater additives.

(1) Often, during tank truck loading, and in particular during switch loading from gasoline to diesel, there are flammable vapors present that can ignite if charges accumulate and sparks occur. Static dissipater additives prevent the possibility of electrostatic ignition during tank truck loading because they prevent charge accumulation. The commenter noted that the downstream use of static dissipater additives will minimize the amount that is necessary and that even though available static dissipater additives contain >15 ppm,

normal use concentration is low (1-3 ppm). Commenter adds that the concentration of the additive can be monitored using ASTM D2624. This commenter recommends that EPA allow the downstream use of these additives under conditions that will assure that low-sulfur diesel content is not increased by more than 0.2 ppm. Commenter adds that an allowable increase of 0.2 ppm sulfur to diesel fuel as a result of using static dissipater additives, will not compromise EPA's goals and will essentially be undetectable by ASTM D2622.

<u>Letters:</u>

Octel America (IV-D-174) **p. 1-4**, (IV-F-46)

(2) All commercially available static dissipater additives have a significant sulfur content, and while the proposed regulation will allow use of these additives at the refinery, it is the current practice to add these additives at pipeline terminals prior to tank truck loading, which is where the electrostatic hazard exists. Downstream addition, as opposed to refinery addition, would reduce the amount of sulfur added to the fuel. Commenter provides significant discussion on this issue, noting that these additives are essential for preventing electrostatic ignition during tank truck loading and that the prohibition of their use downstream will result in fires during tank truck loading. Commenter refers to an API study that documents the frequency of ignitions at terminal loading facilities (see "Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents," API Recommended Practice 2003, Fourth Edition, March 1982) and to Canada's regulations requiring the use of static dissipater additives (see CAN/CGSB-3.16, Mining Diesel Fuel, CAN/CGSB-3.6, Automotive Diesel Fuel, CAN/CGSB-3.517, Automotive Low Sulfur Diesel Fuel, CAN/CGSB-3.3, Kerosene, and CAN/CGSB-3.2, Heating Fuel Oil). Commenter adds that recent incidents have resulted in use of these additives in many European countries and that in one incident a refiner has speculated that low conductivity, due to a severe level of hydrogen treating to achieve 10 ppm sulfur for Class I Swedish Diesel Fuel, was a causative factor. Commenter provides as attachments to their letter the following supporting documentation: Stadis 450, Static Dissipater Additive (Conductivity Improver Additive), Octel Starreon LLC; Henry, Cyrus P., Jr., E.I. DuPont de Nemours & Co., "Electrostatic Hazards and Conductivity Additives," Fuel Reformulation, Jan/Feb 1993; ASTM D4865-97, Standard Guide for Generation and Dissipation of Static Electricity in Petroleum Fuel Systems, Octel America; "Electrostatic Ignitions During Diesel Fuel Loading," Octel America, Additives Brief No. 91-01. These documents contain significant discussion and information regarding the use, effectiveness, and necessity of these additives.

<u>Letters:</u>

Octel America (IV-D-174) **p. 1-4, +all**

(B) There is no need to impose a 15 ppm sulfur cap on diesel additives in order to ensure that the sulfur content of finished diesel fuel meets the proposed

standard.

(1) The American Chemistry Council Fuel Additives Task Group (FATG) suggests an alternative triple-option approach that would achieve EPA's environmental objective without causing unnecessary disruption or imposing unjustified costs on producers and users of diesel additives. Under this proposal, an additive that is sold or transferred for blending into motor vehicle diesel fuel downstream of the refinery would have to meet one of three alternatives (to be chosen by the additive producer). These include producing the additive at 15 ppm or less, producing the additive with a sulfur content that would not cause the resulting diesel fuel to have a sulfur content greater than 15 ppm (only for additives sold to persons other than the ultimate consumer), and producing the additive with a sulfur content that would not contribute more than 0.5 ppm to the sulfur content of the resulting diesel fuel. The commenter reviews the Product Transfer Document (PTD), labeling, blending, and testing/sampling requirements associated with the proposed alternatives.

Letters:

American Chemistry Council (IV-D-183) **p. 5-8**

(2) A 15 ppm requirement imposed on diesel additives is unnecessary and would increase the cost of additives to refiners and blenders. EPA's RIA assumes that except for increase use of lubricity additives, no increased costs will be incurred in producing and distributing diesel additives that comply with a 15 ppm sulfur cap. This assumption is unrealistic and it underscores the importance of ensuring that the rule imposes the lowest possible costs and paperwork burdens on additive manufacturers consistent with achieving the 15 ppm cap.

Letters:

American Chemistry Council (IV-D-183) **p. 2-3**

(3) EPA should let market mechanisms determine the level of sulfur that can be present in diesel additives, so long as the sulfur limit in finished diesel fuel is not exceeded. This would be consistent with the Gasoline sulfur requirements which do not impose any limits on the sulfur content of additives. In addition, low sulfur alternatives to certain diesel additives are not currently available and could be difficult and costly to produce.

Letters:

American Chemistry Council (IV-D-183) **p. 3-4**
New England Fuel Institute (IV-D-296) **p. 7**

(4) Since they are typically blended in at a treat rate of 0.1% or less, additives make a negligible contribution to the overall sulfur level in finished diesel fuel. Commenter provides an example to illustrate this point and notes that the use

of additives can be accommodated easily within the 7 ppm sulfur tolerance margin that EPA estimates will characterize diesel fuel when it leaves the refinery.

Letters:

American Chemistry Council (IV-D-183) **p. 4**

(C) EPA should not control the sulfur content of fuel additives.

(1) Requiring additives to meet the 15 ppm standard would further complicate suppliers' capabilities to produce and distribute diesel fuels. EPA should fully evaluate the unintended consequences of such a course of action.

Letters:

American Petroleum Institute (IV-D-343) **p. 53**
Independent Fuel Terminal Operators Association (IV-D-217) **p. 12-13**
Marathon Ashland Petroleum (IV-D-261) **p. 56**

Response to Comments 8.1.4(A), (B), & (C):

In response to these comments, we are allowing the use of diesel fuel additives with a sulfur content greater than 15 ppm provided their use does not result in an exceedance of the 15 ppm cap on the sulfur content of highway diesel fuel.

Our review of data submitted by additive and fuel manufacturers to comply with EPA's Fuel and Fuel Additive Registration (F&FAR) requirements (40 CFR Part 79), which is summarized below, indicates that additives to meet every purpose (including static dissipation) are currently in common use which meet a 15 ppm cap on sulfur content. The ability of industry to provide additives for use in 15 ppm highway diesel fuel is further supported by the fact that diesel fuel meeting a 10 ppm cap on sulfur content has been marketed in Sweden for some time, and ARCO Petroleum recently began marketing fuel meeting a 15 ppm sulfur cap in California. Even if low sulfur additives were not yet available for certain purposes, we believe that it is reasonable to assume that they would become available before our sulfur program is implemented in 2006. The summary of the data in the F&FAR database also indicates that the industry could adapt to use only additives that contain less than 15 ppm sulfur. However, we agree that it is not necessary to force the additives that contain greater than 15 ppm sulfur to be retired. By allowing their continued use under certain conditions, we avoid any significant impacts from our sulfur program related to diesel fuel additives.

Summary of Information Contained in the F&FAR Database on Diesel Fuel Additives

- Most sulfur containing additives registered with the EPA currently meet the 15 ppm cap.

- There are approximately 3500 diesel additives registered with the EPA.

  - Of the diesel additives registered with EPA, 463 additives contain sulfur.

- Of the sulfur-containing additives, 176 additives (38 of such additives) have a sulfur content greater than 15 ppm
- There are 226 sulfur-containing additives that have a sulfur content less than 5 ppm.

• In 1999, 5.5 percent of the total volume the additives used in diesel fuel contained sulfur.

• In 1999, 47 percent of the diesel fuels registered by fuel manufacturers had sulfur containing additives listed (of all purposes in-use). These fuel formulations represent 65 percent of the total diesel fuel volume.

• Several dozen different additives registered with EPA have anti-static (static dissipater) listed as a purpose in-use (PIU). EPA data shows that there are 40 additives that list anti-static as a PIU.

  - 64 percent of these additives have an elemental sulfur level greater than 15 ppm.
  - Nearly a dozen different anti-static additives registered with the EPA have zero amount of sulfur in their formulations.

Since such low-sulfur additives are currently in widespread use side-by-side with high-sulfur additives, it is reasonable to conclude that there is not a significant difference in their cost.

The unusually high sulfur content of a few additives may discourage their use in diesel fuel that meets a 15 ppm sulfur cap. However, it will generally continue to be possible for additive manufacturers to market additives that contain greater than 15 ppm sulfur for use in highway diesel fuel. Such additives can also continue to be used in off highway diesel fuel. Additive manufacturers that market such additives and blenders that use them in highway diesel fuel will have additional requirements to ensure that the 15 ppm sulfur cap on highway diesel fuel is not exceeded. Although our sulfur program may encourage the gradual retirement of additives that do not meet a 15 ppm sulfur cap for use in highway diesel fuel, we do not anticipate that this will result in disruption to additive users and producers or a significant increase in cost. Additive manufactures commonly reformulate their additives on a periodic basis as a result of competitive pressures. We anticipate that any reformulation that might need to occur to meet a 15 ppm sulfur cap will be substantially accommodated within this normal cycle.

In some cases, blenders may not find it feasible to conduct testing, or otherwise obtain information on the sulfur content of the fuel either before or after additive blending, without incurring substantial cost. Without such information, a blender would not have documentation with which to evaluate what impact the use of an additive which exceeds 15 ppm would have on the fuel's final sulfur content. We anticipate that blenders will manage the risk associated with the use of additives above 15 ppm in sulfur content under such circumstances with actions such as the following:

• selecting an additive with minimal sulfur content above 15 ppm that is used at a low concentration, recognizing that any additive with a sulfur content above 15 ppm must be blended at less than one volume percent (of the resulting mixture) and

- working with their upstream suppliers to provide fuel of sufficiently low sulfur content to accommodate the small increase in sulfur content which results from the use of the additive.

This is similar to the way distributors will manage contamination from their distribution hardware (tank trucks, etc.). Distributors will not necessarily test for fuel sulfur content after each opportunity for contamination, but rather will rely on mechanisms set up to minimize the contamination, and to obtain fuel sufficiently below the standard to accommodate the increase in sulfur content from the contamination.

Our program requires that additives that exceed which exceed 15 ppm in sulfur content may only be added to highway diesel fuel at concentrations less than one volume percent. This provides some limit on the potential impact on the sulfur content of highway diesel fuel from the use of such additives.

(D) EPA should clarify whether the sulfur content limits of the rule are intended to apply to "aftermarket" additives that are sold in small containers to individual consumers for occasional use in their vehicles.

(1) Sections 80.441(a) and 80.447(c) of the proposed rule suggest that the sulfur content limitations of the rule apply to small cans of diesel additives sold at retail service stations or auto supply stores to individual consumers who occasionally may add a small amount of the additive to their vehicle fuel tanks. However, those provisions may be referring to sales to wholesale-purchaser consumers who blend more substantial volumes of additives into large quantities of diesel fuel being stored in tanks from which fleet vehicles are fueled. EPA should clarify this issue.

Letters:

American Chemistry Council (IV-D-183) **p. 9**

Response to Comment 8.1.4(D):

We clarified the requirements applicable to aftermarket diesel fuel additives under our program. Additives that exceed 15 ppm in sulfur content may not be used as aftermarket additives for use by the ultimate consumer once our diesel sulfur requirements go into effect. The use of aftermarket additives that exceed 15 ppm in highway diesel fuel by consumers would result in significant harm to the sulfur sensitive the emissions control that we anticipate will be needed to meet the emissions standards under our program.

(E) EPA should clarify the regulations that would govern the addition of additives to low-sulfur fuel.

(1) Commenter provides no further supporting information or detailed analysis.

Letters:

American Public Transportation Association (IV-D-275) **p. 4**

Response to Comment 8.1.4(E):

We clarified the regulations that will govern the addition of additives to highway diesel fuel under our program. Please see the responses to comments 8.1.4.(A), (B), and (C) and to comment 8.1.4.(D).

(F) EPA should allow for the use of additive packages or products that could be blended with conventional diesel fuel to meet the sulfur standard and reduce emissions.

(1) The PuriNO$_x$ Performance System is a proprietary blending process and additive package that produced PuriNO$_x$ fuel, a low emission diesel fuel that can reduce emissions of NO$_x$ by up to 30 percent and PM by up to 50 percent when compared to commercial diesel fuel. This fuel is a stable fuel emulsion made by blending the PuriNO$_x$ additive package, diesel fuel and water in an automatic unit; can be used in existing and new diesel engines, and works well with low-sulfur diesel fuel. When looking at emissions reductions from a systems viewpoint, PuriNO$_x$ fuel can contribute additional cost-effective emission reductions to those achieved through engine design optimization and emission control technologies for both on-road and nonroad diesel engines.

Letters:

Lubrizol Corporation (IV-G-49), p. 1-4, 6

Response to Comment 8.1.4(F):

Our program will not prevent the use of the additive packages described by the commenter in highway or off highway diesel fuel to achieve emissions benefits under EPA market incentive emissions reduction programs. The use of additives under these programs is beyond the scope of our highway diesel fuel program.

The focus of our diesel fuel program is to control of highway diesel sulfur content to the level necessary to allow the use of the sulfur sensitive emissions control hardware which we believe will be needed to meet the emissions standards under our program. We determined that this approach is the most cost effective means to achieve the requisite emissions reductions from diesel fueled vehicles. We do not believe that it would be appropriate or cost effective for some portion of the highway diesel fuel pool to be permitted to continue to have a high sulfur content once our sulfur program becomes fully effective so that such fuel with the addition of additive packages or products could be used by current vehicle technology in an attempt to meet the emission standards under our program. The continued existence of high sulfur diesel fuel once our sulfur program becomes fully effective designated for additization with specified additives prior to its use in a limited subset of vehicles would add a burdensome level of complexity to our program. Such an approach would also introduce unacceptable risk that vehicles that require 15 ppm sulfur fuel (model year 2007 and later vehicles) could be misfueled with high sulfur fuel. Such misfueling would render the emissions control hardware on these vehicles inoperative and jeopardize the emissions benefits of our program.

(G) Supports a requirement that refiners supply only low sulfur kerosene, and that all number one kerosene meet the 15 ppm standard.

(1) The absence of such a requirement on refiners and importers could lead to errors in labeling and tankage and/or fuel additives that mistakenly exceed EPA's standards.

Letters:

Motor and Equipment Manufacturers Association (IV-D-258), **p. 8**

(H) EPA should not control the sulfur content of number one kerosene to the on-highway limit.

(1) The market will drive supply of low-sulfur kerosene for those areas and times when the product is necessary for blending with on-road fuel. A requirement that all number one kerosene meet on-road limits could have serious supply implications for aviation fuel, as well.

Letters:

American Petroleum Institute (IV-D-343) **p. 53**
Independent Fuel Terminal Operators Association (IV-D-217) **p. 12-13**
Marathon Ashland Petroleum (IV-D-261) **p. 56**

Response to Comments 8.1.4(G) and (H):

Kerosene is commonly added to highway diesel fuel to reduce fuel viscosity in cold weather. Our diesel sulfur program will not limit this practice. Our program requires that kerosene that is used, intended for use, or made available for use in 15 ppm sulfur highway diesel fuel is itself required to be classified as "motor vehicle diesel fuel" and meet the 15 ppm standard, as well as the standards for aromatics and cetane (see Section 80.2(y) of the regulations).

To help ensure that only distillates that comply with the 15 ppm highway diesel fuel standard are blended into highway diesel fuel, our program requires that kerosene meeting the 15 ppm standard, and distributed for use in motor vehicles, must be accompanied by product transfer documents (PTDs) accurately stating that the product meets the 15 ppm sulfur standard and cetane and aromatics requirements or that the blender has test data demonstrating such compliance. Similarly, any kerosene distributed for blending into 500 ppm highway diesel fuel must be accompanied by PTDs stating that the product meets the 500 ppm highway diesel fuel standard and that it may not be blended into 15 ppm highway diesel fuel.

Our program does not require refiners or importers of kerosene to produce or import kerosene meeting the 15 ppm sulfur standard. Only kerosene meeting the definition of motor vehicle diesel fuel must meet the 15 ppm standard. We believe that refiners will produce low sulfur kerosene in the same refinery processes that they use to produce low sulfur highway diesel fuel, and that the market will drive supply of low sulfur kerosene for those areas where, and during those seasons when, the product is needed for blending with highway diesel fuel.

The additional cost of producing sufficient quantities of kerosene meeting a 15 ppm cap on sulfur content has been included in our analysis of the costs of our program. We believe that the PTD requirements described above will be sufficient to prevent the mistaken use of high sulfur kerosene in 15 ppm highway diesel fuel. Therefore, we believe that the approach outlined above will ensure that the use of kerosene in highway diesel fuel will not jeopardize compliance with the 15 ppm cap on the sulfur content of highway diesel fuel under our program. Consequently, we believe that requiring all kerosene to meet a 15 ppm cap on sulfur content is unnecessary and that the accompanying additional costs would be unjustified.

Issue 8.2: Testing and Sampling Requirements

(A) Retailers should not be required to test every batch of fuel delivered but instead should be permitted to establish a potential sulfur level violation defense through specific documentation of the product delivered to the retailer's outlet.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Collier, Shannon, & Scott (IV-F-117) **p. 24**

Response to Comment 8.2(A):

The Agency agrees with this commenter's request that retailers should not be required to test every batch of delivered fuel. The Agency does not believe such a requirement is appropriate for retailers. Consequently, this requirement is not imposed on retailers under the final regulation, either as an affirmative duty or as an affirmative defense element that would be necessary for the retailer to establish when it is attempting to rebut a presumption of liability.

The Agency cannot agree, however, with this commenter's second suggestion that retailers be permitted to rebut a presumption of liability for a discovered violation merely by providing documentation indicating compliance of the delivered product. To establish an affirmative defense, retailers must demonstrate that they did not cause the violation, as well as that product transfer documents account for the fuel and indicate it was in compliance. Our experience under similar fuel control programs such as the volatility and RFG programs, leads us to believe that in most instances, the establishment by a retailer of conforming product transfer documents does result in the successful rebutting of presumptive liability for that retailer.

However, this is not always the case. For instance, there are those situations in which it is not clear which party actually caused the fuel nonconformity violation. In such situations, the Agency does not generally believe that a retailer can successfully establish its lack of causation of the violation merely through establishing the existence of conforming transfer documents. This is because it is possible that a retailer may cause fuel nonconformity in spite of the existence of such documents, such as through the retailer's possible addition of non-documented high sulfur fuel to low sulfur fuel, after the retailer's receipt of the low sulfur fuel with transfer documents indicating that fuel's sulfur compliance.

In such instances, the Agency does not consider the mere provision of conforming transfer documents to be adequate to successfully establish a retailer's affirmative defense to liability. The retailer may, under such circumstances, provide additional evidence that indicates that it did not cause the violation, e.g., other business records indicating lack of causation.

(B) Refiners should not have to test every batch of low sulfur fuel.

(1) Commenter provides no further analysis on this point.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 16**

Response to Comment 8.2(B):

The Agency agrees with this commenter's argument that refiners should not have to test every batch of low sulfur diesel fuel. We have not included such an every batch, refiner testing requirement as an affirmative duty under the final rule. However, because the final rule does permit the continued production of 500 ppm sulfur highway diesel fuel during the rule's initial implementation period, a significant risk of fuel nonconformity exists because such high sulfur highway fuel will continue to be available. Since this greater potential for nonconformity exists, the Agency has included in the final rule a mandatory quality assurance sampling and testing program for branded refiners who choose to produce 500 ppm fuel. Such branded refiners are required to do representative sampling and testing of the low sulfur fuel at their branded retail outlets, in order to ensure that the low sulfur fuel that is sold at these branded outlets has not been contaminated by the legally permitted, higher sulfur product.

Further, the final rule does impose on refiners a separate, conforming test results element for the affirmative defense that a refiner would be required to establish in order to rebut a presumption of liability arising if a violation involving the refiner's fuel is discovered. The need for conforming test results exists under the final rule because of the greater risk of fuel nonconformity that results from refiners' ability to produce 500 ppm sulfur fuel, as well as the production of other high sulfur diesel products. Due to this risk, the Agency believes it is necessary to impose an affirmative defense testing requirement on refiners as an added assurance that refiners will produce conforming fuel. The creation of this affirmative defense element does not mean, however, that refiners have an affirmative duty to conduct every batch testing, as previously discussed in this Response. Instead, the requirement to produce conforming test results would only arise as a necessary affirmative defense element if a violation were discovered, and refiners do have the option of choosing not to conduct batch testing if they don't believe it is important for them to do so. For instance, refiners may believe that their fuel will not likely be the subject of a violation, so they may choose not to prepare for the possible establishment of affirmative defenses through batch testing.

(C) Since enforcement is targeted at retail locations instead of the refinery gate, refiners would be forced to produce less than 10 ppm sulfur diesel to account for test tolerances and reproducibility.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

National Petrochemical & Refiners Assoc./CITGO (IV-F-117) **p. 101**
National Petrochemical & Refiners Association (IV-F-31)

(2) EPA should set downstream tolerance levels that are equal to the proven reproducibility of the standard test method plus some consideration for nominal degradation during shipping. The NPRM suggests a sulfur level as low as 5 or 6 ppm (as would be required to maintain a 15 ppm standard downstream) is inappropriate from a cost/benefit point of view.

Letters:

Koch Industries (IV-D-307) **p. 11-12**

Response to Comment 8.2.(C)

EPA's analysis of the feasibility of the 15 ppm sulfur cap considers the need to produce complying diesel fuel at refineries which contains less than 10 ppm sulfur on average. Our projected refining costs assume that complying diesel fuel meets an average sulfur level of 7-8 ppm. This margin of safety is intended to allow for both variability in refining operation and allowances for pipeline specifications which may be less than 15 ppm. We accounted for this in our analysis of the feasibility and cost of producing and distributing highway diesel fuel that meets a 15 ppm cap on sulfur content. We included a 2 ppm downstream adjustment to account for the reproducibility of the test method that will be used to measure the sulfur content of highway diesel fuel. We do not believe that it is necessary or appropriate to include an additional downstream adjustment above the 15 ppm standard as a consideration for sulfur contamination during shipping. We selected the 15 ppm cap on highway diesel fuel sulfur content because it is necessary to enable the emission control technology that will be needed to meet the vehicle emissions standards under today's rule. We also believe that the amount of sulfur contamination during distribution can be adequately limited so the margin below the 15 ppm cap provided by the refiner will be sufficient to allow the 15 ppm sulfur cap to be maintained throughout the distribution system to the end user.

(D) ASTM D 2622 has limitations and disadvantages, and ASTM D 5453 is a viable and more accurate alternative.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Antek Instruments, Inc. (IV-D-32) **p. 1**
Cenex Harvest States Cooperatives (IV-F- 191) **p. 232**

(2) Experience in California in the mid-1990's shows that an alternative to 2622 should be used to accurately assess sulfur levels below 10 ppm.

Letters:

ASTM Subcommittee D 203 (IV-F-96)

(3) ASTM D 5453, a sulfur by UV technique, is a method that has the analytical range to provide equivalent sulfur results in higher concentration and can readily analyze diesel samples down to 1 ppm.

Letters:

ASTM Subcommittee D 203 (IV-F-96)
Alliance of Automobile Manufacturers (IV-D-262) **p. 18**
Phillips Petroleum Company (IV-D-250) **p. 7**

(4) Data from the ASTM cross-check program and the findings of an ASTM research report (attached to written testimony) confirms and reinforces the conclusions of the Western States Petroleum Association and the CA Air Resources Board that ASTM 5453 is equivalent to ASTM 2622 for higher sulfur levels, but that 5453 is superior when measuring sulfur levels below 15 ppm.

Letters:

ASTM Subcommittee D 203 (IV-F-96)
Koch Industries (IV-D-307) **p. 14**

(5) ASTM 5453 uses a sample combustion technology that is very selective and free from the carbon/hydrogen ratio and oxygenate interference that can affect the current primary sulfur regulatory method. The instrument calibration for this method is not biased by the hydrocarbon matrix of the calibration material.

Letters:

ASTM Subcommittee D 203 (IV-F-96)

(6) Many labs already employ the use of 5453 analyzers but this method is not allowed for regulatory reporting. However, some regulatory agencies have already approved its use in determining sulfur levels. It is a very economical alternative to 2622 and has a lower initial and operational cost. The necessary equipment for this test is also a good deal smaller in size than the 2622 equipment.

Letters:

ASTM Subcommittee D 203 (IV-F-96)

(7) D5453 should be chosen as the designated test method, and D2622-98, D4045 and D3120 should be alternatives within the scope of their applicability. CARB recognizes D5453 as the preferred method for low level sulfur in gasoline and the same performance characteristic is expected for diesel. EPA should provide data to support its statement that D2622-98 will

have acceptable precision at sulfur levels below 15 ppm despite the fact that it currently does not have test repeatability for fuels with sulfur levels below 60 ppm. EPA should submit its modifications to D2622-98 to ASTM Subcommittee D02.03 Elemental Analysis for study, ruggedization and round robin testing. Commenters provide significant discussion on this issue and API provides specific and detailed comments and questions in the context of certain portions of EPA's proposal [i.e. 40 CFR 80.461(a)(2)(I), (ii), (iv), (vi), and (vii)] on this issue. API also cites to ASTM's CS92 crosscheck program which shows that D5453 is a superior method and notes that ASTM 2622-98 currently does not include biodiesel in its scope.

Letters:

American Petroleum Institute (IV-D-343) **p. 51, 59-64**
ExxonMobil (IV-D-228) **p. 20**
Marathon Ashland Petroleum (IV-D-261) **p. 64-67**

(8) The appropriate testing method for levels of sulfur in biodiesel or diesel/biodiesel blends is ASTM D 5453, not ASTM D 2622-98. At a recent meeting of ASTM Committee D-2 on Petroleum Products and Lubricants, where committee members discussed the application of method D 2622 versus D 5453 for measure sulfur levels in biodiesel, ASTM concluded that the former provided a falsely high bias (30 to 50 ppm too high) due to the oxygen content in biodiesel. EPA should adopt testing method D5453 for sulfur level in biodiesel and biodiesel blends, as well as petrodiesel. Commenter provides additional discussion on this issue, including the attachment "Sulfur Testing Standard for Biodiesel."

Letters:

National Biodiesel Board (IV-D-288) **p. 3**

(E) EPA should provide flexibility in selecting test methods for certification at the refinery and for downstream quality assurance testing.

(1) EPA should provide additional flexibility in selecting test methods by including an equivalence statement for D5453, D4045 and D3120 applicable at low sulfur levels, just as EPA did for D4294 at higher sulfur levels.

Letters:

American Petroleum Institute (IV-D-343) **p. 63-64**
Marathon Ashland Petroleum (IV-D-261) **p. 67-68**

(F) It is unlikely that field testing equipment will be readily available for pipelines and terminals to ensure compliance with the diesel fuel sulfur standard.

(1) A recent NPC study stated that testing would have to be performed in laboratories that have more sophisticated equipment and trained technicians, which will result in product delays and supply disruptions.

Letters:

American Petroleum Institute (IV-D-343) **p. 44**
Citgo Corporation (IV-D-314) **p. 3**

(2) Commenter provides results of a pipeline survey to support this point. The lack of in-line testing will make it difficult to determine batch contamination, and may affect the amount of transmix that will be treated as downgraded product. Commenter also notes that pipelines tend to use ASTM D-4294 or ASTM D-5453 in a lab setting, and none of the pipelines use ASTM D2622. The ASTM D-4294 standard only applies for sulfur levels >150 ppm, while D5453 has a published reproducibility of +/- 2.7 ppm at 155 ppm, but is not rugged enough for field use and is very costly.

Letters:

Association of Oil Pipelines (IV-D-325) **p. 3-4, att.**

(G) Aromatic content should not be determined by the FIA method (D1319).

(1) Repeatability and reproducibility are poor, and subject to great operator error. Infra-red and SFC are both superior to the FIA procedure.

Letters:

Koch Industries (IV-D-307) **p. 14**

(H) EPA should not limit industry to end-window type scanning instruments.

(1) There is no reason to abandon the use of side-window x-ray tubes and there is no evidence that they introduce any significant degree of variability in results at the 0 to 50 ppm level. End-window tubes may produce somewhat more sulfur intensity but side window x-ray tubes produce sufficient sulfur intensity at 0-50 ppm levels; and the cost of replacing them is around $200,000 each. There is a body of RFG round robin data with a fair number of low level samples and the results have been excellent.

Letters:

American Petroleum Institute (IV-D-343) **p. 63**
Marathon Ashland Petroleum (IV-D-261) **p. 67**

(I) Commenter concerned about the technical ability to reliably use ASTM D 2622-98 as the sole compliance method at low sulfur levels when alternative methods such as D 5453 are already available and widely used.

(1) Commenter requests that EPA provide data to support a number of claims in the preamble about D 2622-98: (1) precision at sulfur levels < 15 ppm; (2) correlation of test results with industry labs on samples in 1-20 ppm sulfur range; (3) +/- 4 ppm reproducibility in 1-20 ppm range; (4) rationale behind

blank diluent prepared for mixing 8 hydrocarbons; and (5) side-window versus end-window XRF configurations (given that industry overwhelmingly uses side-window instruments and would incur up to $100,000 each to obtain the necessary equipment). The commenter notes that XRF experts have serious misgivings about the ability to obtain the required precision at low sulfur levels. Commenter notes that once EPA provides the detailed support for its claims, the ASTM committee will check the real world performance at multiple labs with multiple low sulfur samples.

Letters:

ASTM (IV-D-123) **p. 1-2**

Response to Comments 8.2(D), (E), (F), (G), (H), & (I):

Most comments from the industry (Issue 8.2: Testing and Sampling requirements (D), (E), and (J)) were due to the concern that ASTM D2622-98 (Standard Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-Ray Fluorescence Spectrometry) would be the designated test method for diesel fuel meeting the 15 ppm standard. Whereas ASTM D2622-98 will remain as the designated test method for motor vehicle diesel fuel meeting the 500 ppm standard, ASTM D6428-99 (Test Method for Total Sulfur in Liquid Aromatic Hydrocarbons and Their Derivatives by Oxidative Combustion and Electrochemical Detection) is the designated test method for diesel fuel meeting the 15 ppm standard. In addition, for both the motor vehicle diesel fuel meeting the 15 and 500 ppm standards, there are several alternative test methods that industry may use with appropriate correlation to the designated test methods.

For motor vehicle diesel fuel meeting the 15 ppm standard, ASTM D6428-99 (Test Method for Total Sulfur in Liquid Aromatic Hydrocarbons and Their Derivatives by Oxidative Combustion and Electrochemical Detection) is the designated test method. EPA selected ASTM D6428-99 because its stated analysis range was the most appropriate for the sulfur concentration range expected in commerce as a result of this rule. In a brief parallel-testing program comparing ASTD D6428-99 with other methods, EPA has found that ASTM D6428-99 has equivalent or better statistical response and concluded that ASTM D6428-99 is the most logical choice as the designated test method.

Numerous commenters suggested that ASTM D5453-99 should be adopted as the designated method. However, the Agency is concerned that this method may not accurately measure all sulfur-containing compounds such a some found in diesel fuel additives. ASTM D6428-99does not appear to have this drawback and consequently was deemed preferable.

ASTM D5453-99 (Standard Test Method for Determination of Total Sulfur in Light Hydrocarbons, Motor Fuels and Oils by Ultraviolet Fluorescence), ASTM D2622-98 (Standard Test Method for Sulfur in Petroleum Products by X-Ray Spectrometry, and ASTM D3120-96 (Standard Test Method for Trace Quantities of Sulfur in Light Liquid Petroleum Hydrocarbons by Oxidative Microcoulometry) are the alternative test methods which may be used as long as the results obtained by these methods are correlated to those obtained by the designated test method. Technical suggestions and guidance for parties who would like to use ASTM D 2622-98 as an alternative test method for motor vehicle diesel fuel meeting the 15 ppm standard are provided in a memorandum to the docket (IV-B-22). We are providing this information because many laboratories are already utilizing ASTM D 2622 for determining the sulfur content of both motor vehicle diesel fuel (subject the 500 ppm standard) and gasoline. We believe these modifications will aid in correlating test results with ASTM D 6428-99. These technical suggestions and guidance address the technical concerns regarding the use of this method ASTM D2622-98 expressed in the above comments. We believe that the provision in today's rule for the alternate use of ASTM D5453-99, ASTM D2622-98, and ASTM D3120-96 addresses the comment regarding the need for flexibility in the test methods that may be used to measure diesel fuel sulfur content while at the same time ensuring measurement reliability. ASTM test procedure D4045 is capable of measuring the sulfur content of diesel fuel only at levels below 10 ppm. Since the sulfur cap under today's rule is 15 ppm, the use of a test procedure that is not capable of measuring fuel sulfur levels of 15 ppm is not appropriate. Consequently, we did not allowed the use of ASTM D4045 as an alternative test method.

ASTM D6428-99 (Test Method for Total Sulfur in Liquid Aromatic Hydrocarbons and Their Derivatives by Oxidative Combustion and Electrochemical Detection) is also appropriate for measuring the sulfur content of biodiesel and biodiesel blends(D-8).

For motor vehicle diesel fuel meeting the 500 ppm standard, ASTM D2622-98 (Standard Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-Ray Fluorescence Spectrometry) is the designated test method. ASTM D5453-99 (Standard Test Method for Determination of Total Sulfur in Light Hydrocarbons, Motor Fuels and Oils by Ultraviolet Fluorescence) and ASTM D6428-99 (Test Method for Total Sulfur in Liquid Aromatic Hydrocarbons and Their Derivatives by Oxidative Combustion and Electrochemical Detection) are the alternative test methods which may be used as long as the results obtained by these methods are correlated to those obtained by the designated test method.

While EPA did not propose and is not finalizing changes to the aromatics standard and consequently did not propose any changes to the aromatics content test method, we nevertheless did receive comment on this test method. For aromatic content measurement in diesel fuel, we will evaluate the currently available test methods, including Infrared and SFC (Supercritical Fluid Chromatography) in the near future. Until then, D1319 (Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption) remains as the official test method for aromatic content measurement in diesel fuel (G).

Side-window x-ray tubes as well as end-window x-ray tubes may be used in measuring the sulfur content of highway diesel fuel meeting a 15 ppm standard using the modified ASTM procedure D2622-98, provided that the test results using the modified ASTM D2622-98 procedure (in the side window configuration) can be correlated with those using the designated test method, ASTM procedure D6428-99. Side-window x-ray tubes as well as end-window x-ray tubes may be used in measuring the sulfur content of highway diesel fuel meeting a 500 ppm standard using the ASTM D2622-98 procedure.

Please refer to section VII.D.1. in the preamble to today's rule for additional discussion regarding the diesel fuel testing requirements and test methods.

Issue 8.3: Permitting Issues

(A) The time frame is too short to complete the permitting process.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Ergon & Lion Oil Co. (IV-F- 117) **p. 183**

(2) EPA may not have the resources and the capability to properly process diesel-sulfur related permit applications, particularly since this will occur in generally the same time frame as gasoline sulfur related permit applications.

Letters:

CO Petroleum Association (IV-D-323) **p. 3**
Countrymark Cooperative (IV-D-333) **p. 5-6**
ExxonMobil (IV-F-800)
National Petrochemical & Refiners Association (IV-F-31, 44)

Response to Comments 8.3(A)(1) and (2):

EPA expects many refineries to "net out" of major NSR requirements by utilizing emissions reductions opportunities at their plants to offset emissions increases. Refineries that utilize netting opportunities can obtain minor NSR permits that are simpler and generally issued more quickly than major NSR permits. In addition, for the reasons stated below, in conjunction with the fact that the new Diesel rules provide more than 5 years lead time, as well as several years to transition into the fuel program, EPA believe*s* that there will be sufficient time for those refineries who must obtain major NSR permits to do so well in advance of the compliance deadlines for producing low sulfur diesel fuel.

In most States, the responsibility for issuing NSR permits belongs primarily with State and local permitting agencies. Most state and local air pollution control agencies review applications and issue NSR permits via programs approved by EPA as part of the applicable State Implementation Plan or via federally-delegated authority to implement the Federal NSR program. Relatively few jurisdictions, including approximately 10 States and Puerto Rico, have programs in which NSR permits are issued by EPA. The Clean Air Act provides that a PSD permit should be issued within one year of the receipt of a complete application. EPA has found that most permits, regardless of the issuing agency, are approved well within this time limit.

Comments submitted by STAPPA and ALAPCO indicate that the State and local programs are committed to expedite the processing and issuance of required NSR permits. To help ensure expeditious review, it is also important that refiners submit their permit applications for proposed refinery modifications in a timely manner. Also, EPA remains committed to providing technical assistance to help ensure that permit issues are resolved quickly and in ways that can be applied consistently by different permitting programs. EPA is also preparing public outreach material to help concerned communities learn more about the benefits of the Diesel rules and the permitting process to which refineries may be subject.

(3) EPA's proposed rule may contribute to regulatory bottlenecks that could result in adequate supplies of low sulfur diesel. Commenter cites to the NPC report, which provides significant discussion on this issue and notes that the fuel

standard raises "significant concern about the ability of regulatory agencies to review and approve the significant number of environmental permits necessary to deliver the product quality changes." In addition, there are other issues such as environmental justice claims and new NSR requirements that could slow the permitting process even further. EPA and other regulatory agencies should streamline the permitting process, resolve environmental justice claims promptly, and should not retroactively reinterpret NSR requirements.

Letters:

American Trucking Association (IV-D-269) **p. 22-23**

Response to Comment 8.3(A)(3):

EPA is committed to working with State air permitting authorities and refineries so that any necessary permit modifications can be made without delays. EPA agrees that environmental justice claims should be resolved promptly and is committed to facilitating communication among permit applicants, permitting authorities and community members in the hope that community concerns can be expressed and resolved as early as possible in the permitting process.

The commenter's statement about EPA retroactively reinterpreting the NSR requirements refers to the allegation that an ongoing EPA enforcement initiative affecting some refineries is based on a reinterpretation of NSR applicability provisions. EPA disagrees with the commenter's statement and submits that a consistent interpretation of the relevant applicability provisions has been maintained. Further, enforcement actions being taken do not prohibit refineries from making changes needed to comply with the new Diesel desulfurization rules. Rather, they address prior activities that should have been subject to proper NSR permitting.

(4) First, Title V backlogs may delay state/local action on any NSR permits that are required. Also, environmental justice issues or complaints could delay permit issuance. To overcome permit delay concerns, EPA should state in the rule that mobile source reductions attributable to sulfur reduction projects are used in determining overall project impacts, provide a sulfur compliance date extension for permit-related delays, and commit to a procedure for quickly processing/deciding environmental justice complaints.

Letters:

Murphy Oil Corporation (IV-D-274) **p. 14-15**

Response to Comment 8.3(A)(4):

While the Diesel rules provide for compliance extensions under certain unique circumstances, EPA does not believe that the regulations contemplate allowing such extensions for permit-related delays. Further, EPA does not believe that the Title V permitting process will delay any NSR permits that refiners must obtain to comply with the new Diesel Rules, because there are opportunities to synchronize the NSR and Title V processes so as not to significantly affect the overall time line for compliance with the Diesel Rules. Moreover, States have indicated that they will make the issuance of NSR permits a top priority to ensure the timely availability of low sulfur diesel fuel. Also, as mentioned in our response to an earlier comment, the rules provide significant lead time (over 5 years) as well as several years to transition into the fuel program so that there should be sufficient time for permit issuance, especially when permit applications are submitted in a timely manner, and since EPA expects that many or most refineries will net out of major NSR.

Furthermore, we do not anticipate that environmental justice concerns will delay action on any permit. Neither the filing of a Title VI complaint nor the acceptance of one for investigation by EPA's Office of Civil Rights stays the permit at issue. In addition, we are encouraging permitting authorities and industry to engage the public in a permitting process which identifies environmental justice-related concerns early and allows for the informal resolution of these issues well in advance of permit issuance. To the extent resources are available, EPA has committed to provide support for such informal resolution efforts.

(B) EPA should address the same permitting issues in the final diesel rule that were addressed in the gasoline sulfur rule.

(1) EPA should address a number of permitting issues many of which have been addressed in the context of the gasoline sulfur rule. EPA should work with industry to develop BACT/LAER guidance for states and local permitting agencies for sulfur removal facilities; allow states to use sulfur reductions from vehicles to offset refinery emission increases from installing diesel sulfur removal facilities; work with agencies and refiners to insure permits for diesel desulfurization facilities are received in a timely manner; identify how environmental justice issues will be resolved in a timely manner to ensure refiners can meet compliance dates; and provide for variance procedures should refiners be unable to comply due to factors beyond their control. EPA should continue to work with the refiners to ensure that the proper permits are obtained in a timely manner. (cites to NPC study, pg 131-141 and requests that EPA review this portion of the study).

<u>Letters:</u>

American Petroleum Institute (IV-D-343) **p. 58-59**
ExxonMobil (IV-D-228) **p. 21-22**
Marathon Ashland Petroleum (IV-D-261) **p. 62**

<u>Response to Comment 8.3(B):</u>

EPA does plan to provide guidance and support similar to that offered for the Tier 2/gasoline sulfur control rules to help expedite processing of permit applications from refineries making changes to comply with the new Diesel Rules. The BACT/LAER guidance being developed for the Tier 2/sulfur control program has application for the Diesel desulfurization program also. EPA will continue to review the guidance to see that it remains relevant and useful to refinery modifications under the Diesel rules. Guidance for using Tier 2 motor vehicle emission reductions to offset emissions from refineries has also been drafted and has been made available for public comment. After evaluating public comments on the draft guidance, we will make a decision in the future whether such guidance would be appropriate and useful for purposes of complying with both the Tier 2/Sulfur Control Rules and the new Diesel Rules. We also remain committed to providing assistance to both refiners and permitting authorities to help ensure the timely issuance of the required permits. Also, we are actively working to provide important public outreach materials and would be available to meet with States and local community groups to help develop means to alleviate the concerns that local citizens may have. States, too, have indicated that they intend to make the timely issuance of permits to refineries a top priority.

Regarding the comment pertaining to variance procedures for factors beyond a refiner's control, the final program does provide an opportunity for refiners to apply for a temporary waiver based on extreme unforeseen circumstances (such as a natural disaster or refinery fire). This provision is intended to provide refiners short-term relief in unanticipated circumstances, and is similar to provisions in the reformulated gasoline and gasoline sulfur programs. We do not believe it is appropriate to provide broader relief.

(C) EPA should undertake every option available to minimize the permitting burden on refineries and on States.

(1) Emission increases around the refineries will require PSD permit applications and review, which will place a substantial burden on State Departments of Environmental Quality, and on the industry. EPA should expand the guidance to allow emission reductions from vehicles to satisfy both the NSR and PSD offset requirement for refiners. EPA should eliminate the need for the PSD permit or eliminate provisions relating to Class II and Class I increment analysis and Class I area visibility analysis. One commenter noted that EPA should deny filings of any environmental justice claims on the permits necessary to implement this rule since any federal rule is subject to EO 12898 and therefore it is assumed that EPA has determined that there would be no adverse impacts to any affected party. Another commenter noted specifically that refiners should be granted flexibility in meeting the compliance deadlines if agencies, environmental justice issues or other regulatory actions prevent timely permitting and construction.

Letters:

LA Mid-Continent Oil and Gas Association (IV-D-319) **p. 2-3**
Marathon Ashland Petroleum (IV-D-261) **p. 6**

Response to Comment 8.3(C):

As indicated in the response to a prior comment, State and local permitting authorities are committed to expediting the permit review process for affected refineries. EPA is also committed to providing technical assistance as appropriate throughout the permitting process. EPA is preparing guidance on BACT/LAER to assist States in evaluating permit applications submitted by refiners complying with the Tier 2/sulfur control requirements. This guidance, with any needed updates, will also apply and be useful for issuing permits to comply with the new Diesel rules. EPA permitting teams also are available to assist with any issues that may arise during the permitting process. EPA does not, however, have the authority to suspend specific statutory requirements such as the PSD increment analysis or Class I area impact analysis for sources who are otherwise subject to the applicable NSR/PSD requirements, nor does EPA believe that suspension would be justified even if it were available. These requirements ensure that industrial growth does not compromise air quality.

With respect to potential environmental justice issues, EPA remains committed to supporting community outreach programs to educate the public about the benefits of the changes needed at refineries to produce the low sulfur diesel fuel. The EPA cannot, however, deny a citizen's right to petition the Agency to review a permit for alleged environmental justice violations (see, e.g., Section 505(b) of the Clean Air Act). Environmental justice complaints may also be addressed through Title VI of the Civil Rights Act of 1964 (Public Law 88-352, 78 Stat. 241 (codified as amended in scattered sections of 42 U.S.C.)), which prohibits discrimination based on race, color, or national origin under any program or activity of a Federal financial assistance recipient. As a result, permits that are intentionally discriminatory or have a discriminatory effect based on race, color, or national origin are prohibited. Persons who believe Federal financial assistance recipients (i.e., state or local permitting agencies) are administering their programs in a discriminatory manner have the right to file administrative complaints with the EPA pursuant to Title VI and the EPA's Title VI implementing regulations at 40 C.F.R. Part 7. These complaints must be filed subsequent to a particular action taken by a recipient (such as the issuance of a permit) that the complainants allege has a discriminatory purpose or effect.

(D) Opposes use of mobile source emission reductions as NSR offsets.

(1) Commenter vigorously opposes an approach that is in any way similar to the one recently drafted by EPA in association with the Tier2/low sulfur gasoline program for the "Use of Emission Reductions from Motor Vehicles Operated on Low-Sulfur Gasoline as New Source Review Offsets for Tier 2/Gasoline Sulfur Refinery Projects in Nonattainment Areas."

<u>Letters:</u>

STAPPA/ALAPCO (IV-D-295) **p. 26-27**

<u>Response to Comment 8.3(D):</u>

We would like to clarify that EPA has not released final guidance concerning the use of Tier 2 motor vehicle emission reductions as offsets for emission increases at refineries. Draft guidance was made available for comment in July of 2000. We are currently evaluating public comments that were received on the draft guidance on the use of Tier 2 reductions as refinery offsets. When EPA identifies the appropriate resolution for the Tier 2 context, we will plan to apply a similar approach for diesel desulfurization projects as well.

(E) The time frame is adequate to complete the permitting process.

(1) The issuance of permits is not likely to disrupt implementation of the proposed program, since the amount of lead-time provided is more than adequate. The use of model permits, increased technical assistance and stakeholder processes can be used to help facilitate the permitting process. Commenter notes that they will make the issuance of permits to ensure the timely availability of fuel a top priority.

Letters:

STAPPA/ALAPCO (IV-D-295) **p. 26-27**

Response to Comment 8.3(E):

EPA agrees with the commenter that the new Diesel rules provide ample time for refineries to obtain any needed construction permits. As described above, we intend to provide guidance and assistance to States and refiners, in much the same ways that they are being provided for the Tier 2/sulfur control program, to help expedite the permitting process. We believe it is appropriate for State and local permitting authorities to give priority to the issuance of permits to refineries making changes to produce low sulfur diesel fuel, and emphasize the importance of timely permit application submittals by the industry.

(F) On top of these actions, EPA has made NSR review and enforcement a priority for the petroleum sector which leaves refiners uncertain about their ability to expand plant capacity to meet demand. All of these regulatory burdens make it increasingly difficult for refiners to offset the costs involved.

Letters:

CO Petroleum Association (IV-D-323) **p. 2**

Response to Comment 8.3(F):

EPA disagrees with the commenters allegation that the enforcement initiative, as it affects certain refineries, hinders their ability to expand plant capacity to meet fuel demands.

The enforcement initiative does not change EPA's interpretation of its NSR applicability requirements and should not alter the appropriate permitting actions of individual facilities or permitting authorities. Moreover, NSR does not prohibit the continued expansion of petroleum refinery capacity as alleged by commenter; it merely requires that such expansion take place in an environmentally responsible manner. EPA, as always, is available to assist industry and permitting authorities with any questions they may have regarding the applicability of NSR to an particular refinery, or aspects of a permit.

With regard to cost-related issues, please refer to EPA's responses under Issue 5.8.

Issue 8.4: General Refiner/Distributor Issues

Issue 8.4.1: Reporting and Recordkeeping

(A) EPA should allow blenders to rely on product transfer documents rather than having to perform analytical testing, in order to demonstrate compliance with the rule.

(1) As the rule currently is structured, requiring blenders to perform analytical tests to demonstrate compliance would not be possible as a practical matter

since blenders have to conduct a quality assurance program - including periodic sampling and testing of the diesel fuel - in order to establish an affirmative defense to presumptive liability. Product transfer documents (PTDs) for the fuel and the additive presumably can constitute "relevant evidence or information" as referenced in Section 80.471(a) of the proposed rule, since they show pre-blending sulfur content of the two components of the "additized" diesel fuel. The sulfur content of the fuel once the blending has been completed can be calculated from these documents.

Letters:

American Chemistry Council (IV-D-183) **p. 4-5, 8**

Response to Comment 8.4.1(A):

This commenter asserts that EPA should permit blenders of additives into diesel fuel to rely on product transfer documents, instead of analytical testing, to demonstrate compliance. In response, we first note that the final diesel rule does not require blenders - or any other party except certain refiners subject to mandatory QA testing if they produce 500 ppm sulfur fuel - to perform analytical tests in order to comply with the sulfur control program. For most parties, there is no affirmative duty to test. It is only if the existence of a diesel fuel violation has been determined, that parties subject to presumptive liability for the violation would have to successfully assert an affirmative defense in order to rebut their presumption of liability. If a blender of diesel fuel additives into diesel fuel wishes to establish a successful affirmative defense, then one of the elements the regulation demands is that the blender must establish either a periodic sampling and testing program, or the existence of conforming test results, depending on whether the additive is above 15 ppm sulfur.

In either situation, the use of sampling and testing is required for a successful establishment of this element of the blender's affirmative defense. The Agency specifies the use of affirmative defense testing because a party's use of sampling and testing provides the greatest assurance that party's fuel actually complies with the regulatory requirements, both on an individual batch basis and generally. Merely providing product transfer documents indicating low sulfur levels of the unblended components of the final fuel, does not provide the same degree of certainty of compliance as would test results of the finished product which establish the fuel's complying sulfur level. Testing of the finished product would catch more instances of noncompliance than would the PTDs because, after the PTDs are received by the additive blender, the fuel might become noncomplying through a variety of means, including improper blending of a high sulfur additive into the fuel or the blending of other, undocumented high sulfur components into the fuel. The required use of testing for affirmative defense purposes is thus an important enforcement tool to ensure compliance, as well as the means of establishing particular batch compliance.

(B) Supports a requirement that PTDs be labeled to ensure conformity with the 15 ppm standard.

(1) Commenter (Motor and Equipment Manufacturers Association and Automotive Chemical Manufacturers Council) notes that the absence of a requirement to ensure PTD labeling, could lead to fuel additive products that mistakenly exceed EPA standards. If it can be assured that all the input

materials contain the appropriate sulfur content, then it would be unnecessary to regulate finished diesel fuel additives sold in the aftermarket.

Letters

Motor and Equipment Manufacturers Association (IV-D-258), **p. 8-9**

Response to Comment 8.4.1(B):

The Agency agrees with this commenter that diesel aftermarket additives sold in cans to ultimate consumers should contain labels indicating their sulfur content, so that the consumer can purchase the correct additive for his motor vehicle. The Agency has included in the final diesel rule a requirement that aftermarket diesel fuel additives sold in containers must have a warning label on the container, notifying the consumer that the additive complies with EPA sulfur requirements for motor vehicles, or that it doesn't. The Agency does not agree, however, with the commenter's second argument that the existence of such labeling requirements does away with the need for EPA to regulate such additives. The Agency believes that aftermarket additive labels must accurately reflect the additive's sulfur content, so that the consumer will know which additive it is safe to use in his diesel motor vehicle. The addition of a high sulfur additive, such as a nonroad additive, into a consumer's diesel motor vehicle, could potentially cause significant damage to that vehicle's emission controls. This would be just the damage that the diesel rule was intended to prevent. Therefore, the Agency believes that we must regulate aftermarket diesel fuel additives to ensure the accuracy of their labeling information, and their proper usage.

Issue 8.4.2: Compliance/Enforcement Issues

(A) Testing and enforcement of the 15 ppm sulfur standard should apply only at the retail level.

(1) The actual value up to that point could vary above and below the standard at various points in the distribution system. The only point where the value must meet the cap is at the point of sale. Commenter also disagrees with EPA's suggestion that pipelines might set more stringent refiner specifications to account for test variability and contamination. Refiners may want to deliberately ship off-spec fuel to blend with on-spec fuel at a distant terminal. Commenter notes that it does this now with seasonal gasoline vapor pressure blending. The commenter also appears to state that enforcement of a lower cap at the refinery is expected, and that a 10 ppm cap may be appropriate.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 8, 15**

(2) EPA should test for sulfur at retail locations and should not consider testing sulfur at all points in the distribution system. EPA suggests that the proposed sulfur standard should apply to the diesel fuel at the point of sale to the ultimate consumer, but goes on to confuse the issue by discussing blending of additives and the likely requirement that all parties in the distribution system could be prohibited from causing or allowing the introduction of

highway diesel fuel whose sulfur content exceeds the proposed sulfur cap. For the new sulfur standard to foreclose on the opportunity of a fuel manufacturer, refiner or end user to simply blend no-sulfur biodiesel with conventional diesel fuel, whether to reduce sulfur or to gain other emissions or economic benefits, would effectively take away useful flexibility currently exhibited by biodiesel as a renewable alternative fuel.

Letters:

Ag Environmental Products (IV-D-179) **p. 2**
Griffin Industries (IV-D-221) **p. 2**
MN Soybean Growers Association (IV-D-337) **p. 2**
ND Soybean Growers Association (IV-D-311) **p. 2**
National Biodiesel Board (IV-D-288) **p. 3**
OH Soybean Association (IV-D-277) **p. 2**
OH Soybean Council (IV-D-278) **p. 1**
West Central (IV-G-40) **p. 1**
World Energy Alternatives (IV-D-336) **p. 2**

Response to Comment 8.4.2(A):

EPA does not agree that the retail outlet is the only point in the diesel distribution system at which compliance with the sulfur standard is important. In its many other fuels programs, such as the RFG, volatility, and prior diesel programs, the Agency has consistently ensured compliance of fuel at the retail level by setting standards for the fuel throughout the distribution system, with a presumptive liability scheme. The Agency has found that such an approach is effective since all parties then have a stake in ensuring compliance.

The Agency does not agree with this commenter's additional position that setting a lower standard at the refinery level than at the retail level is necessary. Under today's rule, the Agency has chosen to account for testing variability not by creating two standards, but by providing a 2 ppm test result adjustment factor based on testing variability, to apply to EPA sulfur compliance testing of fuel at locations downstream of the refinery. Applying this adjustment factor downstream should address legitimate concerns about test variability, while not forcing refiners to produce unnecessarily low sulfur level fuel at their facilities.

The Agency also believes that this commenter's additional concern is unfounded, that the rule's application of the sulfur standard to all levels of the fuel's distribution system will preclude the current refiner practice of shipping off-spec diesel fuel to distant terminals for further blending. The rule will not prohibit this practice because it permits diesel fuel that does not comply with the stricter highway fuel standards, to appropriately be identified, and shipped, as nonroad fuel. The nonroad diesel fuel can then be blended at another terminal with other diesel fuel or diesel products to produce highway fuel if the terminal chooses, provided that the mixture, if re-designated as highway fuel: (1) properly meets the standards for the specified category of highway fuel; and (2) complies with any applicable fuel downgrading requirements of the rule. Thus, the practice of shipping off-spec diesel fuel can continue under the provisions of the final rule.

The agency does not agree with the additional assertion that the imposition of the rule's sulfur standard at all points in the distribution system precludes parties in the distribution from blending no-sulfur biodiesel into conventional diesel fuel (presumably into the motor vehicle diesel fuel which is regulated under the rule). The rule does permit parties to blend diesel fuel blendstocks or other diesel fuel - which could include biodiesel - into motor vehicle diesel fuel at any point in the distribution system. Parties who choose to do so are regulated parties under the rule, and are subject to the rule's requirements for that fuel - such as compliance with the sulfur standard and product transfer document requirements - that are imposed. Provided these ordinary requirements of the rule are complied with, the blending of diesel blendstocks or other diesel fuel into motor vehicle diesel fuel is acceptable.

(B) EPA should clarify certain violation provisions in the proposed rule.

(1) In Section 80.470(f), the phrase "downstream of the refinery" should be added in two places after the words "distribution system."

Letters:

American Chemistry Council (IV-D-183) **p. 9**

Response to Comment 8.4.2(B)(1):

EPA does not agree with this commenter’s request that the prohibition against causing violating fuel or additive to be in the distribution system should be modified to specifically apply only to diesel fuel downstream of the refinery. In reality, this prohibition will almost always address fuel which is downstream of the refiner, since it concerns nonconforming fuel that has been released into the distribution system, which typically means downstream of the refiner. However, inserting this downstream location qualification might conceivably impair the Agency’s ability to hold parties liable whose conduct should be covered under the prohibition. For instance, a refiner transfer of finished, but noncomplying, highway diesel fuel to another refiner. If this commenter’s suggested downstream qualification were included in this prohibition, it might be argued that such a lateral shipment between refineries should not be considered “downstream” of the first refiner, so that, under the downstream qualifier, the first refiner would not be subject to this prohibition. Such an exclusion was not intended.

(2) In Section 80.473(c), EPA should make clear that a person subject to presumptive liability for a violation of Section 80.473(a)(1) can show that the violation was caused by someone else by providing or possessing the appropriate PTDs, acting consistently with the information contained in the PTDs and, where applicable, conducting a quality assurance and testing program in accordance with Section 80.473(d).

Letters:

American Chemistry Council (IV-D-183) **p. 9**

Response to Comment 8.4.2(B)(2):

This commenter requests that EPA consider a party subject to presumptive liability for a fuel violation, to have established conclusively its lack of causation affirmative defense element by the party's: (1) possession of PTDs indicating the fuel's compliance at the party's facility; (2) compliance with the information on the PTD; and (3) conduct of a quality assurance program complying with the rule's affirmative defense QA program requirements. In response, the Agency agrees that for many downstream parties, such a showing will typically be successful in establishing their lack of causation affirmative defense element. However, we cannot assume that this will always be the case. For instance, where the actual cause of a fuel's noncompliance is unknown, yet each of the presumptively liable parties is successfully able to provide the defense information addressed by the commenter, then the Agency would not be able to conclude that each party has successfully established its lack of causation defense element. It is clear that someone must have caused the violation, even though each party can establish these other required defense elements. Thus, under such a scenario, parties may be required to do more than merely produce complying PTDS and evidence of a Q/A program, in order to establish lack of causation.

(3) In Section 80.473(d)(1), the reference to "paragraph (a)(2)" should be to "paragraph (a)(3)."

Letters:

American Chemistry Council (IV-D-183) **p. 9**

Response to Comment 8.4.2(B)(3):

The Agency corrected the citation.

(4) In Section 80.473(d)(1)(ii)(A), the reference to "storing" non-complying product should be deleted since a person who is storing diesel fuel or additive that is found not to be in compliance with the applicable standards cannot "immediately" cease storing it. No environmental harm will result from continuing to store the non-complying product until appropriate arrangements can be made.

Letters:

American Chemistry Council (IV-D-183) **p. 10**

Response to Comment 8.4.2(B)(4):

The Agency agrees with this commenter's assertion that parties who are storing fuel or additives which are shown to be noncompliant under their affirmative defense QA programs, cannot always promptly dispose of the noncomplying product or take the blending or other physical steps necessary to make the product complying. We disagree, however, with the commenter's request that parties who find themselves in this situation should not be required to immediately cease storing such product as part of their QA affirmative defense requirements. The Agency believes that a party discovering such noncompliance can and should immediately re-classify the fuel to a status in which it is complying, such as to 500 ppm fuel or nonroad status, as applicable. Through the re-classification, the party can comply with the affirmative defense requirement of ceasing to store noncomplying fuel, while creating for itself the time it needs to decide how best to handle the fuel in the future.

(5) Section 80.474(C) should incorporate the same 25-day presumption regarding presence in the distribution system as Section 80.474(b).

Letters:

American Chemistry Council (IV-D-183) **p. 10**

Response to Comment 8.4.2(B)(5):

The commenter suggests that the final rule should apply the same 25-day penalty presumption for the determination of number of days that noncomplying fuel remains in the system when the violation is a standard or "causing the presence" violation, to those violations involving the blending of noncomplying additive into diesel fuel. We agree that the same presumption should apply, since the penalty determination for both sets of violations is based on the continued presence in the distribution system of the same product - the noncomplying diesel fuel. The final rule incorporates this change.

(6) EPA should place a limit on the "separate-day-of-violation" provision of Section 80.474(d), which addresses violations other than those involving non-complying product. Section 80.474(d) presumably could apply when a person fails to provide an appropriate PTD or fails to create and maintain a required record for a period of five years. With no limit on the separate days of violation, the penalty for furnishing a single incorrect PTD or failing to provide a PTD for a single sale could easily run into the tens of millions of dollars and there is no justification for such potentially enormous liability in these circumstances. EPA should add the phrase "up to a maximum of 25 days." at the end of Section 80.474(d).

Letters:

American Chemistry Council (IV-D-183) **p. 10**

Response to Comment 8.4.2(B)(6):

The Agency does not agree to this commenter's request that a maximum number of 25 days should be imposed on the number of days that a non-standard violation may continue, for the purposes of calculating penalties for non-standard violations. We acknowledge this commenter's concern that failing to impose such a maximum number of days could theoretically subject a violator to very large penalties. However, the Agency does not believe that imposing an artificial maximum number of days for these violations is warranted. First, the 25 day presumption of the continuation of standard violations is based on data about the amount of time fuel remains in the system. The Agency is not aware of similar data that could be used to realistically establish the amount of time PTD or other record violations typically remain uncorrected, so that reasonably assigning a maximum number is not possible. Further, in spite of this commenter's fears of the possibility of huge penalties being imposed absent a stated maximum, the Agency's experience in our other fuels programs has shown that record violations are consistently subject to much lower penalties than standard violations, based on the lower relative environmental impact of the different type of violations. Our experience further establishes that both the Agency and the courts impose reasonable penalties for fuels program violations, and we have no reason to believe that this will not continue under this program.

(C) EPA should include a temporary relief provision in the final diesel rules similar to 80.270 that was adopted in the gasoline rules.

(1) This type of provision is important for any refiner, large or small, as a safety net to ensure that unusual circumstances do not result in undue hardship to an individual refiner.

Letters:

Placid Refining Company, LLC (IV-D-230) **p. 4-5**

Response to Comment 8.4.2(C):

The Agency agrees with this commenter that it would be appropriate in the diesel rule to create a temporary relief provision for refiners similar to such a relief provision found in the Tier 2 gasoline sulfur rule. Temporary relief provisions for refiners are found in §§ 80.560 and 80.561 of the final diesel rule.

(D) Disagrees with EPA's presumptive liability scheme.

(1) A fuel can change from on-spec to off-spec (and back again) at various points in the distribution chain. The only requirement should be that at the point of sale the fuel meets the required specification. A refiner can have no legal say in a retailer's decision to market the fuel.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 16**

(2) The refiner does not have control of the fuel once it leaves the refinery gate. Therefore, refiners should not be held responsible for violations of the standard that are found downstream of the refinery (for fuel that was determined to be in compliance at the time it was produced and released for distribution by the refiner).

Letters:

Williams Energy Services (IV-D-167) **p. 5**

Response to Comment 8.4.2(D):

The Agency disagrees with the comment that since refiners lose control over fuel once it leaves their facilities, they shouldn't be liable for violations that are discovered downstream. That comment ignores the obvious fact that a violation found downstream could have been caused by upstream parties, including refiners. Our presumptive liability approach imposing potential liability on all parties in the distribution system has been shown in other EPA fuels program to increase the likelihood of identifying which parties actually cause violations and should be held responsible. Our experience has shown that those persons who handle the fuel are in the best position to identify the cause of a violation, and that a refutable presumption of liability provides an incentive for parties to be forthcoming with information regarding the cause of the violation. In addition to identifying the party that caused the violation, providing evidence to rebut a presumption of liability also serves to establish a defense for the parties who are not responsible. Presumptive liability is familiar to both industry and to EPA, and we believe that this approach makes the most efficient use of EPA's enforcement resources to resolve violations. For these reasons, the final diesel rule includes the typical presumptive liability scheme with liability extending to all parties in the distribution system, unless successfully rebutted by each individual party.

The Agency also disagrees with the comment that since fuel composition is constantly changing in its distribution, it is only important that compliance be enforced at the retail level. The Agency holds the contrary position: that the existence of fuel content fluctuations is actually a compelling reason supporting the imposition of the sulfur standard at all points in the fuel distribution system. Our experience in other fuels programs establishes that the potential imposition of liability at all points in the distribution system results in the situation under which all parties feel the need to control fuel fluctuations. Upstream parties would not have such an incentive if liability was only imposed downstream, and fuel compliance would suffer.

(E) EPA should exclude from the rule Sections 80.470(e) & (f) and 80.472(a)(1)(iii), (a)(2) and (b)(2) because they prohibit a person from "causing" another to violate the rule.

Response to Comment 8.4.2(E):

The Agency disagrees with the commenter's suggestion that we exclude liability under the diesel program for causing another party to commit a violation. Many other EPA fuel programs, such as the RFG, volatility, lead control, and the prior diesel fuel programs, contain presumptive liability enforcement structures which impose liability on parties who, through their actions, could logically have caused the fuel nonconformity. The final diesel rule's presumptive liability scheme is thus consistent with the liability schemes of typical prior fuels programs. While EPA has issued notices of violations to multiple parties for violations under these fuels regulations, the Agency believes it is appropriate to clarify that the act of causing another party to violate the regulations is itself a prohibited act. Therefore, the regulatory language in the final diesel rule explicitly addresses this issue. For further support for the imposition of causation liability in the final diesel rule, and for examples of actions that could give rise to causation liability, see the discussion on this issue in the preamble to the final Tier 2 gasoline rule, 65 FR 6813 and 6814, February 10, 2000.

(1) Alternatively EPA should enumerate the actions it believes would constitute "causing" another to violate the rule. The proposal to prohibit conduct that is not defined is arbitrary and capricious, will lead to confusion, and is not needed to implement the rule.

Letters:

Koch Industries (IV-D-307) **p. 15-16**

<u>Response to Comment 8.4.2(E)(1):</u>

The Agency does not believe it is either necessary or worthwhile to provide examples of what behavior could be considered a cause of another's violation of the diesel rule. Neither the Agency nor anyone else could possibly create an inclusive list of all the myriad actions that could be construed as causing another's infractions. Further, since "to cause" is a common verb, we believe it does not need explanation, as indicated by the fact that it has been used in previous statutes to proscribe behavior, without explanation. [See 42 U.S.C. § 7522(a)]

(F) EPA should not include a "credible evidence" provision.

(1) As a result of such a provision, neither the industry nor EPA will be able to rely on measurements taken using the prescribed methodology. Such a provision casts the validity of the standards into uncertainty because the stringency of the standards is determined in part by the test methods for determining compliance. API provides comment on why it believes that the legal basis for including a credible evidence provision in the regulations is doubtful.

<u>Letters:</u>

American Petroleum Institute (IV-D-343) **p. 64-65**
Marathon Ashland Petroleum (IV-D-261) **p. 67-68**

<u>Response to Comment 8.4.2(F):</u>

The Agency does not agree with the comment that the rule should exclude the evidentiary provision permitting the use of a variety of evidence. We believe that the ability to use various forms of evidence is essential to the effective enforcement of our regulations. We have often used a variety of evidence to establish non-compliance with the requirements imposed under our fuels regulations. Test results of the content of fuel have been used to establish violations, both in situations where the sample has been taken from the facility at which the violation occurred, and where the sample has been obtained from other parties' facilities when such test results have had probative value of the fuel's characteristics at points upstream or downstream. The Agency has also commonly used documentary evidence to establish non-compliance or a party's liability for non-compliance. Typical documentary evidence has included PTDS identifying the fuel as inappropriate for the facility it is being delivered to, or identifying parties having connection with the non-complying fuel.

The ability to use a variety of evidence does not mean, however, that the use of the designated regulatory test method has been downgraded under the regulation. On the contrary, the diesel rule provides that compliance with the standards is to be determined using the approved test methodologies, which, for sulfur, include the designated method and the approved alternative methods. While other information may be used, including test results using different test methods, such other information may only be used if it is relevant to determining whether the sulfur level would meet applicable standards had compliance been properly measured using the designated test method. Contrary to this commenter's argument, this provision ensures that the stringency of the rule's sulfur standard is based on the regulatory test method, so that compliance with the rule's sulfur standard can be accurately determined. Thus, the regulation adopted today does not result in a situation where any and all evidence carries equal weight in an enforcement action. Rather than causing more confusion regarding compliance with the sulfur standard as this commenter asserts, our evidentiary provision provides assurance that the regulatory test method defines compliance.

The Agency also disagrees with the comment that we lack the legal authority under the Clean Air Act to permit the use of non-regulatory test method evidence to establish standard compliance under the final diesel rule. The Agency believes the Clean Air does provide the authority for inclusion of this provision. Our arguments in support of this position can be found in the preamble to the final Tier 2 gasoline rule, at 65 FR 6815 and 6816, February 10, 2000, in that preamble's discussion of the statutory authority for the same evidentiary provision as in found in the final diesel rule.

(G) EPA should draft rules that would establish appropriate noncompliance penalties for refiners.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

West Harlem Environmental Action/Envr Justice Network (IV-F-76)

Response to Comment 8.4.2(G):

EPA believes that the penalty provisions of the diesel rule and the authorizing Clean Air Act provisions provide sufficient guidance to enable us to establish penalties under the diesel program in a reasonable manner. However, the Agency is not against the creation of a penalty policy to assist us in determining appropriate penalties under the diesel rule program. Such a document may be created at some point in the future, after we develop a greater understanding of criteria useful in establishing penalties, such as the costs of compliance under this program and the economic gains to be made from noncompliance.

(H) Terminals should be able to import foreign diesel fuel and blend it to meet the U.S. low sulfur specification.

(1) EPA's sulfur standard should apply not when the product enters the U.S. but when the terminal operator (importer) enters the product into commerce - when it leaves the terminal gate. This would provide flexibility and increase the supply of the ultra-low sulfur diesel fuel. This concept is already applied in the reformulated gasoline program.

Letters:

Independent Fuel Terminal Operators Association (IV-D-217), **p. 10**

Response to Comment 8.4.2(H):

Under the regulation, a party who imports motor vehicle diesel fuel is subject to the provisions of the rule pertaining to importers. After the fuel has been imported, if a party desires to blend blendstocks to the fuel or otherwise change the sulfur, cetane or aromatics content of the fuel, it is then additionally subject to the provisions of the rule applicable to refiners, as well as those provisions pertaining to downstream parties. Under the provisions of the rule, a party who acts as both an importer/blender-refiner may blend blendstocks or finished diesel fuel to the imported fuel if all the requirements of the rule are complied with. This includes the additional provisions for imported fuel in § 80.620, and the limitations on downgrading fuel under § 80.527. The provisions under the Reformulated Gasoline (RFG) rule address various gasoline standards and parameters and are intended to address circumstances specific to that rule. This rule only affects the sulfur standard for diesel fuel. The approach under this rule is similar to that for conventional gasoline.

Issue 8.4.3: Other Refiner/Distributor Issues

(A) The refining industry is facing more than 12 major regulatory actions over the next ten years, which are largely uncoordinated and will prove to be an unmanageable burden on refiners and fuel distributors.

(1) Commenter provided chart of the actions to document this concern.

Letters:

National Petrochemical & Refiners Association (IV-F-31, 44)

Response to Comment 8.4.3(A)(1):

In their testimony, NPRA states that the oil industry's efforts to comply with the proposed diesel sulfur cap would fall in the middle of 13 other regulatory programs which are being implemented in a largely uncoordinated fashion. NPRA presents a timeline chart showing the approximate time of each program's implementation.

NPRA does not present any information about the impacts of these programs, it just provides the timeline. The time shown is that for implementation efforts (e.g., planning, designing and construction of new equipment, if necessary) and is very approximate. NPRA assumes that every program will involve 3 years of implementation efforts prior to the initial implementation date of the program and continuing through the last implementation dates for programs with a phase in. Thus, programs such as EPA's Tier 2 gasoline sulfur program are shown to have an impact from January 1, 2000 through January 1, 2006 (i.e., 6 full years), even though the impact of this program in any one year has been dramatically reduced due to the phase in provisions which EPA included in the final program. Thus, the overlap of the implementation of this diesel fuel program with some of the other programs may involve an overlap of implementation efforts, or may not. The degree of overlap in terms of actual economic impact was not addressed by NPRA.

(2) On top of these actions, EPA has made NSR review and enforcement a priority for the petroleum sector which leaves refiners uncertain about their ability to expand plant capacity to meet demand. All of these regulatory burdens make it increasingly difficult for refiners to offset the costs involved.

Letters:

CO Petroleum Association (IV-D-323) **p. 2**

Response to Comment 8.4.3(A)(2):

EPA disagrees with the commenter's allegation that the enforcement initiative, as it affects certain refineries, hinders refiners' ability to expand plant capacity to meet fuel demands. The enforcement initiative does not change EPA's interpretation of NSR applicability requirements and should not alter the appropriate permitting actions of individual facilities or permitting authorities concerning plant expansions necessary to produce these new fuels. Moreover, NSR does not prohibit the continued expansion of petroleum refinery capacity as alleged by commenter; it merely requires that such expansion take place in an environmentally responsible manner. Also, in the context of the enforcement initiative, EPA has engaged in global settlement discussions with several refining companies and recently lodged consent decrees affecting two of them. Among other things, it is expected that these decrees and agreements will simplify and expedite permitting for new or modified units that may be needed to produce the fuels required by this rule. EPA, as always, is available to assist industry and permitting authorities with any questions they may have regarding the applicability of NSR to an particular refinery, or aspects of a permit.

With regard to cost-related issues, please refer to EPA's responses under Issue 5.8.

Issue 8.5: Small Refiners

Issue 8.5.1: Small Refiner Definition

(A) Certain small refiners that do not qualify for the exemption or the phase-in program will be particularly hard hit by this rulemaking.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Ergon & Lion Oil Co. (IV-F-117) **p. 183**

(2) The geographic phase-in under the gasoline rule successfully provided relief to all of the small refineries serving the Rocky Mountain region. The small diesel refinery definition in this proposal fails to provide similar relief.

Letters:

Sinclair Oil Corporation (IV-D-255) **p. 10-11**

Response to Comments 8.5.1(A)(1) and (2):

In designing the structure of the low sulfur diesel program, we considered the impact that it would have on all refiners that currently produce highway diesel fuel and would therefore be subject to the rule which takes effect in 2006. We believe that the temporary compliance option within the program, coupled with flexibility for GPA refiners, the menu of options available to small refiners, and the general hardship provision will make low sulfur diesel fuel available in the market as soon as possible for the vehicles that need it (beginning in 2007) while minimizing the economic impact of the program on all refiners, including small refiners.

Any refiner, regardless of size, may participate in the temporary compliance option within the program. Under this option, a refiner may continue producing up to 20 percent of its highway diesel fuel at the existing 500 ppm sulfur standard until the end of 2009. The remaining 80 percent of the highway diesel fuel produced at that refinery during the year must meet a sulfur standard of 15 ppm. As part of this temporary compliance option, a PADD-based averaging, banking, and trading (ABT) program will be available. Through the ABT program, we project that up to half of all refineries could delay capital investments during the transition period.

Today's program also includes special provisions for small refiners. Since small businesses in particular face hardship circumstances, we are adopting temporary provisions that will provide refineries owned by small businesses additional time to meet the ultimate 15 ppm sulfur cap or balance investments of this program with those related to the Tier 2/Gasoline Sulfur program. This approach allows us to achieve the earliest implementation date for advanced technology diesel vehicles (i.e., the 2007 model year) and the needed emission reductions they will bring. The emissions benefits of the low sulfur diesel program are needed as soon as possible–to allow the implementation of new emission reduction requirements on heavy-duty engines and vehicles and, thus, to reduce ozone, particulate matter, and other harmful air pollutants.

In addition, refiners that produce highway diesel fuel as well as gasoline for use in the Geographic Phase-in Area have an option that allows them to stagger their investments for the two low sulfur fuel programs. In the low sulfur gasoline rule, we established the Geographic Phase-in Area (GPA) provision which provides temporarily less stringent standards for gasoline sold in certain parts of the West and Alaska. However, because of the extremely sulfur-sensitive nature of the aftertreatment devices with which 2007 and later model vehicles will be equipped, we could not accommodate a similar provision in today's program. That is, we could not accommodate an area of the country with a higher diesel sulfur cap.

Instead, under the gasoline/diesel compliance date option for GPA refiners, those that comply with the low sulfur diesel fuel standard by June 1, 2006 for all of their highway diesel fuel production may receive a two-year extension of their interim GPA gasoline standards for 2006, that is until December 31, 2008. In addition to allowing refiners the opportunity to spread out their desulfurization investments, we believe this provision will encourage the production of 15 ppm diesel fuel by some refiners in and near the GPA, which will further help to ensure the new fuel is widely available for new vehicles throughout the area.

(3) EPA's proposed definition of small refiner is problematic, particularly the component that defines how the number of employees will be determined. Establishing the number of employees of a small refiner based on its own employees, the employees of any subsidiary companies, any parent companies, any subsidiaries of the parent company (of which the parent company has at least a 50 percent ownership interest), and any joint venture partners, is inequitable and poor policy. Commenter notes that their refinery

located at Come-by-Chance in Newfoundland has only 700 employees but would be prevented from taking advantage of any benefits or flexibility provisions provided to small refiners since the number of employees under both the parent company (Vitol) and its subsidiaries would exceed the 1500 employee limit as proposed. Commenter notes that these subsidiaries include a smelter in Siberia with a high number of employees due to cheap labor and argues that since they will not be able to operate without small refiner benefits, EPA's definition would effectively disqualify the only small refiner serving the U.S. market from abroad.

Letters:

North Atlantic Refining Ltd (IV-G-51) **p. 1-4**

Response to Comment 8.5.1(A)(3):

See Response to Comments 8.5.1(B)(1) and (2) and (C), below.

(B) The rule should define a small refiner on the basis of throughput only.

(1) The number of employees is not indicative of the size of the refiner's refining operations or its ability to absorb the capital costs of compliance.

Letters:

Consumer Policy Institute (IV-D-186) **p. 6**
Giant Industries, Inc. (IV-D-248) **p. 1-2**

(2) The proposed definition is inconsistent with section 410(h) of the Act, which establishes congressional intent of a small "diesel" refinery. EPA should use that definition, which is based on throughput of a refinery, and the total throughput of all refineries owned by a corporate entity. The use of the number of employees, especially since it includes non-refinery employees, is inappropriate. In addition, commenter notes that several small refineries in PADD IV have closed, which indicates that the size of the refinery, not necessarily the refiner, is the critical consideration in determining which entities need relief.

Letters:

Sinclair Oil Corporation (IV-D-255) **p. 11-12**

(C) Definition of small refiner should match the definition set forth by SBA.

(1) However, the use of crude capacity less than 155,000 B/D also seems reasonable.

Letters:

Placid Refining Company, LLC (IV-D-230) **p. 3**

Response to Comments 8.5.1(A)(3), (B)(1) and (2), and (C):

The low sulfur diesel program is designed to provide regulatory relief to those refiners that may experience disproportionately higher burdens in complying with the regulations, and by providing temporary relief the majority of the program can begin in 2006. Some commenters recommended that small volume refineries (based on throughput) owned by large companies be accorded the same treatment as refineries owned by small businesses, as defined by the Small Business Administration (SBA). However, one unique factor affecting small businesses that own refineries is their relative difficulty in raising the capital needed to make significant refinery modifications. Large companies that own small volume refineries are not in the same situation, since they may have other refineries, or other operations, that can be used to generate capital. Even if the large companies choose to make decisions about investments on a refinery-specific basis, their situation is not the same as small businesses who do not have the option of looking to other operations for capital.

The SBA size standard (North American Industry Classification System code 324110), for the purposes of regulation, specifies that for a petroleum refining company to qualify as a small business, it must have no more than 1500 employees corporate-wide. The standard also states that, "*for purposes of Government procurement, the firm may not have more than 1,500 employees nor more than 75,000 barrels per day capacity of petroleum-based inputs, including crude oil or bonafide feedstocks. Capacity includes owned or leased facilities as well as facilities under a processing agreement or an arrangement such as an exchange agreement or a throughput. The total product to be delivered under the contract must be at least 90 percent refined by the successful bidder from either crude oil or bona fide feedstocks*." Since our use of the size standard for Regulatory Flexibility Analysis purposes did not concern procurement, we only used the 1,500 employee limit to define a small refiner.

In the lead phase-down program for gasoline, we used a definition of "small refinery" that Congress adopted in 1977 specifically for the lead phase-down program. The definition was based on crude oil or feedstock capacity at a particular refinery (less than or equal to 50,000 barrels per calendar day (bpcd)), combined with total crude oil or feed stock capacity of the refiner that owned the refinery (less than or equal to 137,500 bpcd). In 1990, the lead phase-down program was complete and Congress removed this provision from the Act.

Shortly before the Act was amended in 1990, we set standards for sulfur content in diesel fuel, including a two-year delay for small refineries. We used the same definition of small refinery as we used in the lead phase-down program. This two-year delay, like many of the small business flexibilities in the low sulfur gasoline and diesel programs, was aimed at problems that small refineries faced in raising capital and in arranging for refinery construction.

In the 1990 amendments to the Clean Air Act, Congress rejected this small refinery provision, and instead allocated allowances to small diesel refineries under the Title IV Acid Rain program. (See CAA Section 410(h).) This approach was also aimed at helping small refineries solve the problem of raising the capital needed to make investments to reduce diesel sulfur. Congress provided allowances to small refineries that met criteria similar to that used in the lead phase-down provision – based on the crude oil throughput at a particular refinery, combined with the total crude oil throughput of the refiner that owned the refinery.

As mentioned above, the CAA definition was based on crude oil or feedstock capacity at a particular refinery (less than or equal to 50,000 bpcd), combined with total crude oil or feed stock capacity of the refiner that owned the refinery (less than or equal to 137,500 bpcd). However, given the mergers, acquisitions, and other changes that have transpired throughout the refining industry in the past few years, we believe the appropriate boundary today is a corporate crude oil capacity less than or equal to 155,000 bpcd.

All fuel actions prior to the Tier 2/low sulfur gasoline rule were done only in the context of the CAA. The RFA as amended by SBREFA introduced a new approach for assessing and mitigating impacts on small businesses. This is the approach we used under the low sulfur diesel fuel program. We believe that defining a small refiner as having no more than 1,500 employees and 155,000 bpcd will provide relief only to those refiners who are truly challenged by the regulations without compromising the environmental goals of the program. The regulations state that, for purposes of determining the number of employees and corporate crude oil capacity, the refiner must include the employees and crude oil capacity of any subsidiary companies, any parent company, subsidiaries of the parent company, and any joint venture partners. We interpret this regulation to require refiners to include employees and crude oil capacity at any and all subsidiaries, as well as employees and crude capacity of any joint venture partners. *See* § 80.225(a)(2). We interpret a subsidiary of a company to mean any subsidiary in which the company has a 50 percent or greater (i.e., the majority) ownership interest. Although we assessed other measures to identify small entities (for example, unique refining operations, low diesel fuel volume, or low crude oil capacity), none could be implemented without undermining the environmental goals or creating anti-competitive issue in local areas.

We are adopting other flexibility and hardship provisions that will assist many small volume refiners who would not be defined as small businesses. The temporary compliance option may provide refiners additional time to produce low sulfur diesel fuel. In addition, the gasoline/diesel compliance date option will help many small volume refineries that are located in and market to the geographic phase-in area to spread out their capital investments while concurrently providing a highway diesel fuel “safety valve.” Finally, all refiners are eligible for the general hardship provision of the rule, where, on a case-by-case basis, they may obtain regulatory relief, if appropriate. Therefore, while we are not modifying the definition of small refiner to include small volume refineries owned by large companies, such refineries will receive other flexibility under the final rule.

(D) Supports the approach discussed in the preamble of allowing any refiner to qualify as a small refiner for the diesel rule if the refiner is approved under the Tier 2 rule as a small refiner.

(1) Unless EPA adopts this approach, the benefits of being classified as a small refiner for gasoline rules will be frustrated by not meeting the classification under the diesel rules.

<u>Letters:</u>

Murphy Oil Corporation (IV-D-274) **p. 1, 7-8**

Response to Comment 8.5.1(D):

As discussed in the preamble, the gasoline sulfur standards and the diesel sulfur standards will impact small refiners in approximately the same time frame. For this reason, we will consider any refiner that we approve as meeting the small refiner definition under the low sulfur gasoline program (40 CFR 80.235) to be a small refiner under today's program as well provided they are a producer of highway diesel.

(E) EPA needs to adjust the definition of small refiner to account for farmer co-ops.

(1) The definition should: (1) treat all refiner co-ops as separate refiners/refineries, and (2) allow each refiner co-op to have a limit of 155,000 bpd because farmer co-ops would be disadvantaged using the 75,000 bpd SBA limit. Commenter urges EPA to look at relative rankings in the industry as SBA used to. Based on a "bottom percentile' approach, farmer co-ops could be addressed.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 17-18**

Response to Comment 8.5.1(E):

As discussed in Section IV of the preamble, we concluded that it is not necessary or appropriate to provide separate treatment for farmer cooperative refiners as a class. This includes the approach suggested by the commenter (i.e., treatment of farmer cooperative refiners as small refiners). However, any farmer cooperative refiner that meets the two criteria of the small refiner definition will be considered eligible for the small refiner compliance options, and any farmer cooperative refiner that supplies gasoline to the GPA is eligible for flexibility under the GPA refiner provisions. Furthermore, all farmer cooperative refiners are eligible for the general hardship provision of the rule, where, on a case-by-case basis they may obtain regulatory relief, if appropriate.

Issue 8.5.2: General Impacts/Need for Flexibility

(A) Establishing additional flexibility for small refiners is unnecessary given the long time frame in which refiners are allowed to implement the standard.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

GA Public Interest Research Group (IV-F-117) **p. 43**
Koch Industries (IV-D-307) **p. 5**
Kotgal, Kalpana (IV-F-192) **p. 17**
U.S. PIRG (IV-F-190) **p. 185**

(2) Even so-called "small refiners" can make the $30 million average investment, and small refiners would likely need much less to make the conversion.

Letters:

Consumer Policy Institute (IV-D-186) **p. 6**

Response to Comment 8.5.2(A):

Although we are not required by the CAA to provide special treatment to small refiners, the Regulatory Flexibility Act (RFA) as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA) requires us to carefully consider the economic impacts that our rules will have on small entities and balance that with the environmental benefits. Specifically, the RFA requires us to determine, to the extent feasible, our rule's economic impact on small entities, explore regulatory options for reducing any significant economic impact on a substantial number of such entities, and explain our ultimate choice of regulatory approach. In our analysis of the cost and feasibility of compliance with the sulfur standards, we concluded that small refiners will, in general, need more time than large companies to comply, based on their unique circumstances. Small businesses generally lack the resources available to large companies which enable the large companies (including those large companies that own small volume refineries) to raise capital for investing in desulfurization equipment. The small businesses are also likely to have more difficulty in securing loans, competing for engineering resources, and completing construction of the needed desulfurization equipment in time to meet the standards adopted today which begin in 2006. Rather than delaying the overall sulfur program to allow for concurrent compliance by all refiners, we have adopted a menu of temporary provisions for small refiners. However, significant reductions in sulfur levels for all highway diesel fuel will be required in the long-term.

In addition, the implementation of the low sulfur diesel program will occur in the same general time frame as the implementation of the low sulfur gasoline program, since many of those small refiners that are covered by the interim standards under the Tier 2/Gasoline Sulfur program (40 CFR Part 80, Subpart H) are also covered by today's diesel fuel sulfur program.

The emissions benefits of the low sulfur diesel program are needed as soon as possible–to allow the implementation of new emission reduction requirements on heavy-duty engines and vehicles and, thus, to reduce ozone, particulate matter, and other harmful air pollutants. Since our analysis showed that small businesses in particular face hardship circumstances, we are adopting temporary provisions that will provide refineries owned by small businesses additional time to meet the ultimate 15 ppm sulfur cap or balance investments of this program with those related to the Tier 2/Gasoline Sulfur program. This approach allows us to achieve the earliest implementation date for advanced technology diesel vehicles (i.e., the 2007 model year) and the needed emission reductions they will bring.

(B) Opposes providing preferential treatment to any class of refiners because such options do not level the playing field or offer equitable flexibility for meeting program goals.

(1) If EPA intends to provide exemptions or special provisions for small refiners, API recommends that EPA level the playing field by using an economic penalty assessed on all highway diesel fuel that exceeds the new standard.

Letters:

American Petroleum Institute (IV-D-343) **p. 67**
Marathon Ashland Petroleum (IV-D-261) **p. 71**

(2) Opposes any exemption for any refiners.

Letters:

ExxonMobil (IV-D-228) **p. 20**

(3) The concerns expressed in the Report of the Small Business Advocacy Review Panel (3-24-00) can be accommodated by either an industry-wide phase-in or a free market approach. Either approach eliminates the need to define a small refiner because there are no special exemptions; eliminates the need to debate the appropriate hardship waivers or exemptions; eliminates the need to debate how small refiners can meet both gasoline and diesel requirements; eliminates the debate over whether small refiners should be given a 50 ppm cap; and it eliminates the need for policing small refiners.

Letters:

Koch Industries (IV-D-307) **p. 12-13**

Response to Comment 8.5.2(B):

As discussed in our response to comment 8.5.1(A), above, we considered the impact that the low sulfur diesel rule would have on all refiners that currently produce highway diesel fuel and would therefore be subject to the rule which takes effect in 2006. We believe that the temporary compliance option within the program, coupled with flexibility for GPA refiners, the menu of options available to small refiners, and the general hardship provision will make low sulfur diesel fuel available in the market as soon as possible for the vehicles that need it (beginning in 2007) while minimizing the economic impact of the program on all refiners, including small refiners.

Any refiner, regardless of size, may participate in the temporary compliance option within the program. Under this option, a refiner may continue producing up to 20 percent of its highway diesel fuel at the existing 500 ppm sulfur standard until the . Refiners that produce more than the required amount may generate credits that they can then use within their own company for compliance purposes or they may sell them to another refiner within the PADD that is not able to meet the required volume. Under this approach, refiners must either invest to produce 15 ppm diesel fuel or they must purchase credits to continue producing (i.e., more than 20 percent of their highway diesel product) 500 ppm diesel fuel.

Even with the program's compliance flexibility, small refiners, as a class, will likely have much more difficulty in meeting the low sulfur diesel standard than other refiners. Small businesses generally lack the resources available to large companies which enable the large companies (including those large companies that own small volume refineries) to raise capital for investing in desulfurization equipment. The small businesses are also likely to have more difficulty in securing loans, competing for engineering resources, and completing construction of the needed desulfurization equipment in time to meet the standards adopted today which begin in 2006. For these reasons, we have provided small refiners with an additional menu of compliance options. However, we do not believe these options will cause competitive disadvantages within the highway diesel fuel market.

(C) Small refiners may be unable to raise the necessary capital and absorb the increased operating costs associated with desulfurization, which in many cases may result in the closure of the refinery.

(1) Commenters supplied no further detailed information or analysis.

Letters:

Harold Dickey Oil Corp. (IV-D-43) **p. 1**

(2) Support the concept of providing flexibility to small refiners that are subject to both the gasoline and diesel sulfur requirements but assert that additional measures are necessary to minimize the adverse economic impact to small refiners. Commenters also note the importance of providing a number of flexibility options because no one option will be the appropriate choice for each small refiner.

Letters:

Countrymark Cooperative (IV-D-333) **p. 7-8, 12**, (IV-F-191) **p. 184**
Frontier Oil Corporation (IV-F- 116) **p. 204** (IV-F- 191) **p. 93**
Gary-Williams Energy Corporation (IV-D-252) **p. 2**, (IV-F-43, 191) **p. 193**
Golden Bear Oil Specialists (IV-D-111) **p. 1-2**
Remster, John (IV-F-28)
Western Independent Refineries Association (IV-F-190) **p. 144**

(3) Small refiners cannot achieve the economies of scale that large integrated refiners can achieve.

Letters:

Countrymark Cooperative (IV-D-333) **p. 6**
Ergon & Lion Oil Co. (IV-F-117) **p. 183**
Frontier Oil Corporation (IV-F-191) **p. 93**
Western Independent Refiners Association (IV-D-273) **p. 2-8**

(4) Small refiners require more time to engineer, construct, finance and train workers to operate the new refinery units. One commenter added that small refiners operate under different, less flexible process scenarios than do large refiners.

Letters:

Chevron (IV-D-247) **p. *2, 4**

Countrymark Cooperative (IV-F-30)
Kern Oil & Refining Co. (IV-D-310) **p. 6**
Remster, John (IV-F-28)

(5) One commenter noted that Gary-Williams refinery (a 50,000 BPD crude oil refinery) will close if the rule stands as proposed, since there are no options that would allow profitable business to continue. The additional capital investments will require an investment of approximately $46 million with $5 to $6 million in increased operating and maintenance costs. This commenter added that without some type of tax credits, loan guarantees and other incentives, small refiners will be unable to access the technology required to install desulfurization equipment, and that since the investment needed to comply with the Tier 2 gasoline sulfur requirements coincides with the diesel sulfur requirements, it will be more difficult to find the necessary capital to ensure compliance. In written comments, the commenter expanded upon this hearing testimony and provided further detailed estimated costs. Another commenter noted similar concerns and provided estimates of the capital and operating costs that would be required. Similarly, a commenter argued that moving from a 30 ppm to a 15 ppm standard results in costs that are 7 times greater, and that even a 30 ppm standard would mean costs for small refiners that are 50% greater than costs for large refiners. Commenter notes how its continued operation is important for regional competitiveness, and thus how important it is that EPA design a rule that allows small refiners to remain in business. The commenter describes the control options it would face to meet a 15 ppm cap to document why the standard would force it out of business. Another commenter raised similar concerns for its small refinery, and noted the high costs associated with having to meet the gasoline, on-road (and possibly nonroad) diesel requirements in the same timeframe. The commenter also noted the importance of its refinery in the local region for supply and competitiveness, and the lack of need for emission reductions in its local region, both in terms of low interstate truck traffic and good air quality. The commenter provided detailed information on these concerns, including cost information.

Letters:

Countrymark Cooperative (IV-F-30)
Gary-Williams Energy Corporation (IV-D-252) **p. 2-4**, (IV-F-43)
Kern Oil & Refining Co. (IV-D-310) **p. 2-5**
Murphy Oil Corporation (IV-D-274) **p. 1-7**

(6) One commenter asserted that diesel regulations in California have resulted in the elimination of all small refiners in that state. This contributed to a lack of competition and price spikes. Small refineries should be treated differently under the rulemaking to enable them to survive the transition to low sulfur diesel.

Letters:

Western Independent Refineries Association (IV-F-190) **p. 144**

(7) Many of the types of crude oil presently available to and processed by small refiners will no longer be able to be processed economically because of their higher sulfur content. Small refiners often depend on these crudes to produce specialty asphalt products. The 15 ppm sulfur cap puts asphalt-producing small refiners in a difficult position since it will be much more difficult to eliminate the sulfur from diesel fuels produced from such crude oils.

Letters:

Western Independent Refiners Association (IV-D-273) **p. 3**

(8) Commenter provides detailed explanation of the unique constraints it faces as a lubricating base oil refiner as opposed to a typical fuels refiner. Commenter notes that the ability to sell the diesel fuel that naturally distills from the refiner's crude charge is critical to maintain profitability. Commenter also notes especially that the rule could restrict availability at reasonable cost of hydrogen that the refiner must purchase both to hydrotreat their primary base oil products but also for desulfurization.

Letters:

Golden Bear Oil Specialists (IV-D-111) **p. 1-2**

Response to Comments 8.5.2(C)(1)-(8):

In addition to the temporary compliance option and general hardship provision which are available to all refiners under today's program, small refiners have a menu of compliance options from which to choose. These three options have evolved from concepts on which we requested and received comment in the proposal. In most cases, we believe that small refiners will find these options preferable to either the broader diesel fuel temporary compliance option or the GPA provision (as applicable) discussed in the preamble.

500 ppm Option. A small refiner may continue to produce and sell diesel fuel meeting the current 500 ppm sulfur standard for four additional years, through May 31, 2010, provided that it reasonably assures the existence of sufficient volumes of 15 ppm fuel in the marketing area(s) that it serves.

Small Refiner Credit Option. A small refiner that chooses to produce 15 ppm fuel prior to 2010 may generate and sell credits to other refiners under the broader diesel temporary compliance option. Since a small refiner has no requirement to produce 15 ppm fuel under this option, any volume of fuel it produced at or below 15 ppm sulfur will qualify for generating credits.

Diesel/Gasoline Compliance Date Option. For small refiners that are also subject to the Tier 2/Gasoline sulfur program (40 CFR Part 80), the refiner may choose to extend by three years the duration of its applicable interim gasoline standards, provided that it also produces all its highway diesel fuel at 15 ppm sulfur beginning June 1, 2006.

These provisions will provide small refiners with additional and sufficient time to secure capital, engineering and construction resources, and, where applicable, to stagger their gasoline and diesel investments. While a number of other possible means of providing flexibility to small refiners were raised in comment, we believe that this menu sufficiently addresses the needs of the broad range of small refiners. Other options, such as a higher cap for small refiners, would have raised much more serious air quality impact concerns, or go beyond our legal authority.

(D) Indicates general support for flexibility options for small refiners.

(1) Commenters provided no further supporting information or detailed analysis.

<u>Letters:</u>

National Automobile Dealers Association (IV-D-280) **p. 3**
Petroleum Marketers Association of America (IV-F-67)
WI Department of Transportation (IV-D-241) **p. 2**

(2) Even though the commenter may not be able to take advantage of each particular option, the commenter supports all of the options because different small refiners will need different options.

<u>Letters:</u>

Petro Star Inc. (IV-D-216) **p. 3**

(3) State environmental agency notes the nationwide benefits of the proposal, but argues that certain areas that will not benefit significantly (such as Montana) will face unusually high costs because small refiners are critical to their fuel supply. Closure of these refineries will not only adversely affect fuel supply, but will cause economic dislocation as well. Commenter provides detailed analysis of the potential effects in Montana, of why small refiners are especially important in the State, and of the reasons why small refiners are disadvantaged by the rule.

<u>Letters:</u>

MT DEQ (IV-D-254) **p. 1, 3-7**

(4) Without any flexibility this proposal could significantly reduce competition in the highway diesel fuel market. Assuming the long-run direct price elasticity of demand for highway diesel fuel is around -0.5, average retail prices could increase almost 10 percent if all the small refiners representing 4 percent of the market exit as a result of the rule.

<u>Letters:</u>

U.S. Small Business Administration (IV-G-20) **p. 1-3**

(5) Agrees that small refiners do not have the economies of scale to compete with large refiners in updating their desulfurization technology but notes that EPA's proposed rule does not reconcile the different options proposed by small refiners and marketers. Some of the flexibility options that could be provided to small refiners, such as a phase-in option, could have an adverse impact on other small businesses such as fuel marketers and retail stations.

Letters:

National Federation of Independent Business (IV-D-243) **p. 2**

Response to Comments 8.5.2(D)(1)-(5):

Generally, these comments provide added justification and support for our small refiner provisions. As we explained in the preamble, we believe that small refiners, if not offered some respite, would have difficulty in meeting the standards in the 2006 timeframe. Based on our discussions with and information received from small refiners during and after the SBREFA process, and comments received on the proposal, we concluded that it would be an extreme hardship for small refiners to comply with the 15 ppm diesel sulfur standard in the same time frame as the larger refining companies. Furthermore, based on this information, we concluded that the menu of compliance flexibilities afforded in the rule was sufficient to alleviate their hardship.

While providing relief to small refiners, we are not doing so in a way that will place extreme regulatory burden on other small entities in the fuel distribution system. We are not adopting any retailer availability requirements under the low sulfur diesel fuel program. In other words, we are not requiring that diesel retailers sell the 15 ppm fuel. Rather, retailers may sell 15 ppm sulfur diesel fuel, 500 ppm sulfur diesel fuel, or both. We believe the low sulfur diesel fuel program for refiners and importers will ensure that adequate supplies of low sulfur diesel fuel are available throughout the nation. The voluntary compliance and hardship provisions have been designed with a required level of production that we believe will ensure that 15 ppm fuel is distributed widely through pipelines and at terminals throughout the country without the need for a retailer availability requirement.

(E) EPA should provide investment tax credits, loan guarantees, excise tax relief, accelerated depreciation, credits for expensive qualified environmental expenditures, acid rain credits, or other forms of economic assistance to help cover the associated costs of the new rule.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Countrymark Cooperative (IV-F-30, 191) **p. 184**
Farmland Industries (IV-F-29)
Frontier Oil Corporation (IV-F-116) **p. 204** (IV-F-191) **p. 93**
Gary-Williams Energy Corporation (IV-F- 191) **p. 193**
Kern Oil & Refining Co. (IV-D-310) **p. 2, 6**, (IV-F-173)
OR DEQ (IV-F- 191) **p. 164**
U.S. Oil & Refining Co. (IV-F-190) **p. 159**

Western Independent Refineries Association (IV-F-190) **p. 144**

(2) Although EPA does not have the authority to provide these financial assistance tools, the Administration can publicly endorse legislative initiatives to provide this assistance.

Letters:

Countrymark Cooperative (IV-D-333) **p. 8**
Gary-Williams Energy Corporation (IV-D-252) **p. 7-8**
MT DEQ (IV-D-254) **p. 1, 7-8**

(3) In addition to tax credits or other tax restructuring, two other options would be a state-level revolving loan fund or a diesel surcharge at the pump. Although a loan fund could be used to generate funds to allow recovery of small refiners' capital costs, the loan fund would require a significant amount of funding that is not available at the state level. Based on estimated small refiner costs, a surcharge of less than 2 cents/gallon would allow investments to be recouped within six years and would level the playing field for small refiners that do not enjoy the large refiners' economies of scale.

Letters:

MT DEQ (IV-D-254) **p. 7-8**

Response to Comments 8.5.2(E)(1)-(3):

EPA does not have statutory authority to create any of the financial assistance mechanisms as requested in the comments. The approach recommended by the commenters would require an Act of Congress to implement. In regard to acid rain credits, we don't have authority to extend that provision beyond 500 ppm sulfur diesel, which is currently constrained under section 410(h) of the Act.

(F) Suggests a geographic phase-in area and a special relaxed implementation schedule for small refiners.

(1) One commenter suggests EPA aid small refiners in Rocky Mountain area to ensure that the proposed rule does not threaten that region's oil industry.

Letters:

CO Petroleum Association (IV-F-191) **p. 275**

(2) Small refiners in the Rocky Mountain GPA would face simultaneous gasoline and diesel changes. The continued viability of these refineries demands that this timing overlap problem be resolved. If a geographic phase-in and a relaxed implementation schedule for small refiners are not incorporated into EPA's proposed rule, many small refiners will be forced to close, and regional fuel prices will rise.

Letters:

Chevron (IV-D-247) **p. *2, 4**
WY Refining Company (IV-F-191) **p. 58**

(3) EPA recognized the appropriateness of a phase-in for certain western states in the gasoline rule and should apply the same, consistent approach in this rule in recognition of the unique market in this area.

Letters:

Giant Industries, Inc. (IV-D-248) **p. 1-2**

Response to Comments 8.5.2(F)(1)-(3):

In the low sulfur gasoline rule, we established the GPA provision which provides temporarily less stringent standards for gasoline sold in certain parts of the West and Alaska. However, because of the extremely sulfur-sensitive nature of the aftertreatment devices with which 2007 and later model vehicles will be equipped, we could not accommodate a similar provision in today's program. That is, we could not accommodate an area of the country with a higher diesel sulfur cap.

However, we do recognize that refiners that produce or import both gasoline and diesel fuel for use in the GPA will have unique challenges given that the introduction of low sulfur highway diesel fuel in June 2006 overlaps with the conclusion of the interim low sulfur gasoline standards for GPA refiners. Furthermore, refineries supplying the GPA tend to be disproportionately challenged compared to other refiners with respect to capital formation, the availability of engineering and construction resources, and the isolated nature of many of the markets.

In response to the commenters' concerns, we are allowing refiners that produce both gasoline and highway diesel fuel and are subject to the Tier 2/Gasoline Sulfur program to stagger their desulfurization investments for the two fuels. Refiners that comply with the low sulfur diesel fuel standard by June 1, 2006 for all of their highway diesel fuel production may receive a two-year extension of their interim GPA gasoline standards for 2006, that is until December 31, 2008 (refer to Section IV.B.2. of the preamble for more information). This provision should provide these refiners with sufficient relief from the low sulfur gasoline and diesel fuel programs by balancing their needs with the air quality and enforceability needs of the program.

(G) EPA should provide small refiners an ongoing exemption from the diesel rule until the aftertreatment technologies and the ability of the distribution system to deliver 15 ppm fuel at retail have been proven commercially viable.

(1) Small refiners should receive five years from proof of commercial viability to meet the 15 ppm standard. The commenter believes this would likely provide small refiners until 2013 at least to meet the 15 ppm limit. This approach would ensure that if, for example, it becomes clear that the aftertreatment technology can handle 50 ppm fuel, small refiners would not face stranded investments in desulfurization projects.

Letters:

Murphy Oil Corporation (IV-D-274) **p. 11**

Response to Comment 8.5.2(G):

Based on all information available to us, we believe that diesel aftertreatment technologies, albeit extremely sulfur-sensitive technologies, will be available for 2007 and later model heavy-duty engines and vehicles to comply with the new emission standards that phase-in beginning in 2007. By 2009, all new engines and vehicles will be required to meet these standards. The structure of the low sulfur diesel fuel program complements the design of the heavy-duty engine and vehicle program. Under the low sulfur diesel fuel program, both 500 ppm sulfur diesel fuel for older vehicles and 15 ppm sulfur diesel fuel for new vehicles (beginning with the 2007 model year) will be available until 2010. One option under today's program provides small refiners the ability to continue producing 500 ppm sulfur highway diesel fuel through May 31, 2010, provided that it reasonably ensures the existence of sufficient volumes of 15 ppm fuel in the marketing area(s) that it serves. We do not believe that a longer extension to meet 15 ppm sulfur diesel fuel, such as an extension or exemption until 2013 as the commenter suggested, would be appropriate.

As described in Section IV.D.3. of the preamble, we believe that with relatively minor changes and associated costs, the existing distribution system will be capable of adequately managing sulfur contamination during the transportation of 15 ppm highway diesel fuel from the refinery to the end-user. Furthermore, we believe that the existing system is capable of handling two grades of highway diesel fuel (500 ppm and 15 ppm sulfur cap) in a limited fashion during the transition period of the sulfur program at acceptable cost with the addition of storage tanks at a fraction of distributor facilities. The voluntary compliance and hardship provisions have been designed with a required level of production that we believe will ensure that 15 ppm fuel is distributed widely through pipelines and at terminals throughout the country without the need for an availability requirement.

Issue 8.5.3: Sale of 500 ppm Fuel

(A) Supports a provision that would allow small refiners to continue selling 500 ppm fuel.

(1) Small business refiners need the ability to continue to manufacture and sell on-road diesel at the current 500 ppm standard for as long as there is a market for the fuel. Some of these commenters noted, however, that this may not be as helpful to the refiner since at some point most retailers are likely to purchase only the lower sulfur fuels. One commenter also noted that the transportation segregation requirements of the 500 ppm diesel may limit distribution to locations near the refinery. This commenter argued that there is no need for EPA to limit the duration of this option as the markets will effectively dictate when the 15 ppm fuel is the fuel of choice.

Letters:

Frontier Oil Corporation (IV-F-116) **p. 204** (IV-F- 191) **p. 93**
Gary-Williams Energy Corporation (IV-F- 191) **p. 193**

Murphy Oil Corporation (IV-D-274) **p. 8-9**
Placid Refining Company, LLC (IV-D-230) **p. 2-3**
U.S. Oil & Refining Co. (IV-F-190) **p. 159**
Western Independent Refineries Association (IV-D-273) **p. 7**, (IV-F-190) **p. 144**

(2) Commenter urges that this option be one of multiple options available to a small refiner. Commenter also opposes any restrictions on how the fuel is transported as EPA's downstream testing requirements are adequate to ensure that the 15 ppm fuel is not contaminated. The commenter agrees that proper pump labeling and tank filler modifications may be needed but does not believe that production limits are necessary (although the proposed 105% limit appears reasonable, and the use of volume of highway diesel fuel produced from crude oil on average calendar year basis is also acceptable). The commenter does not believe that allowing this small refiner flexibility will adversely affect the supply of 15 ppm fuel and notes that in its PADD region, its product competes with product from several large refiners.

Letters:

Placid Refining Company, LLC (IV-D-230) **p. 2-3**

Response to Comments 8.5.3(A)(1) and (2):

Under the low sulfur diesel fuel, small refiners have three special compliance options available to them. One option, the 500 ppm Option, is available for any refiner that qualifies as a small refiner. Under this option, small refiners may continue selling highway diesel fuel with sulfur levels meeting the current 500 ppm standard for four additional years, provided that they supply information showing that sufficient alternate sources of 15 ppm diesel fuel in their market area will exist for fueling new heavy-duty highway vehicles. Specifically, through May 31, 2010, small refiners may supply 500 ppm highway diesel fuel for use in vehicles with older (pre-2007) technology. In other words, small refiners that choose this option may delay production of highway diesel fuel meeting the 15 ppm standard for four years.

As described above in Response to Comments 8.5.2(D)(1)-(5), we are not placing extreme regulatory burden on other small entities in the fuel distribution system. We are not adopting any retailer availability requirements under the low sulfur diesel fuel program–distributors may carry and retailers may sell 15 ppm sulfur diesel fuel, 500 ppm sulfur diesel fuel, or both. However, distributors and retailers choose to carry/sell both fuels must segregate the two grades of fuel to ensure product integrity.

(3) At a minimum, small refiners should be given seven years (until 2013) to continue to market current 500 ppm fuel.

Letters:

Murphy Oil Corporation (IV-D-274) **p. 9**

Response to Comment 8.5.3(A)(3):

Refer to Response to Comment 8.5.2(G), above.

(4) Labeling should be adequate to prevent misfueling, although using dyes to differentiate fuel may be appropriate as well. The biggest deterrent to prevent misfueling is that engine/vehicle manufacturers will make clear to purchasers of vehicles that need the ultra-low sulfur fuel that the wrong fuel can result in engine failure.

Letters:

Murphy Oil Corporation (IV-D-274) **p. 9**

Response to Comment 8.5.3(A)(4):

To ensure the integrity of the low sulfur diesel fuel as it is transported from the refinery gate to the end-user, all parties in the distribution system are required under today's program to maintain product transfer documents, which will indicate whether the diesel fuel meets the 15 ppm or 500 ppm standard as well as the volume of such fuel.

In addition, today's program establishes pump labeling requirements. For any multiple-fuel program like the temporary compliance option adopted today, clearly labeling diesel fuel pumps is vital for end users to distinguish between the two grades of fuel. We received comments on the NPRM that concurred with our assessment in the proposal that pump labels, in conjunction with vehicle labels, would also have the effect of helping to help prevent misfueling of motor vehicles with high sulfur diesel fuel. Section VI.G. of the preamble describes the labels that manufactures will place on vehicle and information that will be provided to vehicle owners. Today's rule also adopts pump labeling requirements for retailers and wholesale purchaser-consumers similar to those we proposed, but with modifications to account for the availability of diesel fuel subject to the 500 ppm sulfur standard for use in pre-2007 motor vehicles. The text of the labels appears in Section VII.C.2.c. of the preamble; the specific requirements for label size and appearance are found in the regulatory language for this rule.

As discussed in the Section VII of the preamble, we believe that additional measures may be useful in preventing accidental misfueling, and will work with industry to develop such measures.

Today's rule does not modify the current dye requirement for tax-exempt highway diesel fuel or for nonroad fuel. Furthermore, for the reasons discussed in Section VII.C.2.c of the preamble, it does not establish any nozzle or filler inlet requirements.

(5) Small refiners that serve limited markets that have the ability to continue to sell 500 ppm fuel could be required to provide facilities to store and deliver ultra low-sulfur fuel. This would ensure that local market retailers would have access to ultra-low sulfur fuel. This requirement for small refiners to support distribution of the ultra-low sulfur fuel would last as long as the small refiner has the right to produce and distribute on-road diesel at 500 ppm.

Letters:

Murphy Oil Corporation (IV-D-274) **p. 9**

Response to Comment 8.5.3(A)(5):

As described above in Response to Comment 8.5.2(G), small refiners may supply 500 ppm highway diesel fuel for use in vehicles with older (pre-2007) technology through May 31, 2010. This option effectively allows small refiners to delay production of highway diesel fuel meeting the 15 ppm standard for four years, provided they ensure the existence of sufficient volumes of 15 ppm fuel in the marketing area(s) that they serve. However, this option does not require small refiners to carry both fuels themselves. If a small refiner cannot ensure that low sulfur diesel fuel will be sufficiently available in its marketing area, then it must choose another compliance option such as the Small Refiner Credit Option or the Gasoline/diesel Compliance Date Option, as described in Section IV.C.1.c.

(6) This flexibility should be provided to farmer co-ops as well. Also, commenters oppose any limitation on distribution by pipeline or barge of the 500 ppm fuel because farmer co-ops rely heavily on pipeline systems for distribution of their product. Given that the pipelines already will be carrying nonroad fuel at 500 ppm, this restriction would not make sense. Also, one of the commenters states that because farmer co-ops sell 500 ppm nonroad, they should have no availability requirement regardless of whether EPA includes an availability requirement as part of providing this flexibility to small refiners. Commenter agrees that the limited distribution system inherent to most small refiners will limit concerns about misfueling and that this same argument applies to farmer co-ops.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 17**
National Council of Farmer Cooperatives (IV-D-351) **p. 6-7**

Response to Comment 8.5.3(A)(6):

Refer to Issue 8.5.7, below

(B) EPA's proposed option to allow small refiners to continue selling 500 ppm highway diesel may not be helpful to the refiner.

(1) There is unlikely to be a price differential between the high and low sulfur fuel and retailers would not have an incentive to keep purchasing the higher sulfur diesel. In follow-up written comments, commenters added that this approach definitely would be inappropriate as the only or major source of small business relief, although it could be included as one option. One of the commenters also strongly opposed a 500 ppm phase-in for the industry as a whole because it would result in three fuels (including the commenter's high sulfur nonroad diesel), which their pipeline system could not carry.

Letters:

Countrymark Cooperative (IV-D-333) **p. 11**

Gary-Williams Energy Corporation (IV-D-252) **p. 8**, (IV-F-43)

(2) Small refiners will need to be in the ultra low sulfur market as soon as possible. Selling 500 ppm will be a short term fix at best and is unlikely to provide an opportunity to raise capital or to be profitable in the long run.

Letters:

Countrymark Cooperative (IV-D-333) **p. 9**, (IV-F-191) **p. 184**

Response to Comments 8.5.3(B)(1) and (2):

As described above in Response to Comment 8.5.2(C), today's program includes a menu of compliance options for small refiners that will provide them with additional and sufficient time to secure capital, engineering and construction resources, and, where applicable, to stagger their gasoline and diesel investments.

As described in Section IV.D.3. of the preamble, we believe that with relatively minor changes and associated costs, the existing distribution system will be capable of adequately managing sulfur contamination during the transportation of 15 ppm highway diesel fuel from the refinery to the end-user. Furthermore, we believe that the existing system is capable of handling two grades of highway diesel fuel (500 ppm and 15 ppm sulfur cap) in a limited fashion during the transition period of the sulfur program at acceptable cost with the addition of storage tanks at a fraction of distributor facilities.

As discussed above under Issue 6, we believe that the sulfur credit program will bring the prices of 15 and 500 ppm fuels close together at the refinery gate. We do not expect the entire distribution system to handle the 500 ppm fuel, but only that necessary to dispense the fuel (which we believe should cover less than half the nation), even in 2009, as much of the fleet will require use of the 15 ppm fuel. One of the criteria which refineries will use in determining whether they will continue to produce 500 ppm fuel will be the ability to distribute this fuel. Much of each refinery's fuel can be transported directly by truck from the refinery's rack. The rest will likely have to utilize pipelines in order to be economically distributed. While we do not expect every pipeline to carry both 15 and 500 ppm fuels, we do expect that the major pipelines, such as Colonial, Plantation and TEPPCO will do so. We also expect that refiners desiring to produce 500 ppm fuel will be able to purchase credits at an acceptable price. We expect that the refiners producing 15 ppm fuel will be those with the lower or lowest compliance costs and those producing 500 ppm to face higher compliance costs. This difference in cost of meeting the 15 ppm standard should provide a range of potential credit prices which allows both buyer and seller to win (i.e., the credit price can be simultaneously more than the cost for one refiner to produce the excess 15 ppm fuel and less the other refiner's cost of producing the 15 ppm fuel).

(C) EPA should not provide any exemption from the fuel sulfur requirements for small refiners.

(1) Fuel with a 500 ppm sulfur level would have a devastating effect on the aftertreatment systems and operation of engines and vehicles designed to operate on ultra low sulfur fuel. Commenter provides significant discussion on the issue of the adverse impact to the effectiveness of control technologies

of higher sulfur levels. Commenter asserts that even small refineries have low-cost options available for reducing sulfur, such as the new desulfurization catalyst, incremental purchases of hydrogen, elevation of hydrogen partial pressure to the unit's design maximum and increased residence time. Those options along with low cost government loans could be a workable solution for small refiners. EPA should investigate the possibility of low-cost loans or other means to minimize the financial burden on small refiners.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 29-30**
International Truck & Engine Corp. (IV-D-257) **p. 12**

Response to Comment 8.5.3(C)(1):

We agree with the commenters that 500 ppm sulfur diesel fuel would have a devastating effect on diesel aftertreatment systems. However, given that not all heavy-duty vehicles on the road in 2007 will need 15 ppm sulfur diesel fuel, we believe it is appropriate to provide the refining industry with some compliance flexibility in producing the low sulfur diesel fuel. Small refiners, in particular, are challenged–they generally have limited additional sources of income beyond refinery earnings for financing the equipment necessary to produce low sulfur diesel. In addition, small refiners are disadvantaged by the economies of scale that exist for the larger refining companies–capital costs and per-barrel fixed operating costs are generally higher for small refiners.

We are confident that the program’s structure will ensure that low sulfur diesel fuel is sufficiently available nationwide in 2007 for the vehicles that need it. Furthermore, we believe that the program contains sufficient safeguards, such as product transfer documents for tracking purposes and fuel pump labeling requirements, to mitigate the potential for misfueling as discussed in Section VII of the preamble.

EPA does not have statutory authority to create any of the financial assistance mechanisms as requested in the comments. The approach recommended by the commenters would require an Act of Congress to implement. However, some funding such as loans may be available through the SBA.

(2) Special treatment for any refiner would create market distortions and increase the likelihood of misfueling with subsequent loss of emission benefits. Non-exempt refiners competing in the same market may be forced to withdraw from the market, placing at risk adequate fuel supplies. Exempting or relieving those that have not met the standard is inconsistent with the goals of the program and punishes those that meet the challenge. One commenter noted that EPA should avoid any flexibility approach that would perpetuate a difference between small and large refiners in terms of sulfur levels or timing of implementation. The commenter states that the only meaningful flexibility is to delay the timing of either the diesel rules (nationwide) or the gasoline rules in the Rockies GPA to remove the overlapping schedules that small refiners are facing.

Letters:

British Petroleum (IV-D-242) **p. 4**
Chevron (IV-D-247) **p. 4**
Phillips Petroleum Company (IV-D-250) **p. 2**

Response to Comment 8.5.3(C)(2):

As described above in Response to Comments 8.1.1(A), (B), & (C), the temporary compliance option, which is available to all refiners, allows refiners to continue producing a limited amount of 500 ppm until 2010. The intent of this provision is to serve as a supply "safety valve" for highway diesel fuel by providing refiners with compliance flexibility in the early years of the program. Because small refiners as a class are challenged due to lack of access to capital, engineering and construction resources, and poorer economies of scale, we believe additional compliance options for them are appropriate.

(3) If differential treatment is adopted, commenter recommends that an economic penalty be assessed on all on-highway fuel exceeding 15 ppm sulfur in order to maintain a level playing field and thus an adequate fuel supply.

Letters:

British Petroleum (IV-D-242) **p. 4**

Response to Comment 8.5.3(C)(3):

We disagree with the commenters recommendation to impose an economic penalty on diesel fuel exceeding 15 ppm sulfur. Such a penalty would negate the purpose of allowing both grades of diesel fuel which is to provide relief for severe hardship.

(4) Commenter asserts that a phase-in approach could reduce the impact on small refiners, negating the need for allowing small refiners to offer higher-sulfur diesel to the market.

Letters:

Koch Industries (IV-D-307) **p. 5**

Response to Comment 8.5.3(C)(4):

Refer to Comment Response to Comments 8.5.1(A)(1)-(2) and 8.5.3(C)(2), above.

(5) If EPA decides to grant such special treatment, it should be limited to the genuine small business refiners, which account for only about 4% of U.S. diesel production.

Letters:

Tosco (IV-D-304) **p. 6**

Response to Comment 8.5.3(C)(5):

The temporary compliance option as described above in Response to Comments 8.1.1(A), (B), & (C), which is available to all refiners, allows refiners to continue producing a limited amount of 500 ppm until 2010. Only genuine small business refiners (those that meet the corporate employee and crude oil capacity criteria described in Section IV.C.1.b of the preamble and specified in the regulations) may avail themselves of the menu of small refiner options.

(6) Pockets of high sulfur fuel would not only result in higher sulfur emissions, but also contaminate the control devices. EPA should not provide flexibility that could delay the introduction of controls that require low sulfur fuel. It may be possible to allow farmer cooperatives to continue the sale of 500 ppm fuel by limiting its use to nonroad applications for farming equipment, but that should not extend to on-road applications. There are many national park units across the nation that are in nonattainment areas for ozone and that are subject to adverse nitrogen deposition or face visibility impairment. The on-road standards proposed by EPA are an important part of the overall solution to these problems.

Letters:

National Park Service (IV-D-180) **p. 3-4**

Response to Comment 8.5.3(C)(6):

Refer to Response to Comment 8.5.3(C)(1), above.

(D) Supports a special provision for Alaska small refiners to continue to produce and market diesel fuel that meets current specifications (i.e. subject to current 500 ppm exemption) for as long as a market exists (or at least for a period of five years).

(1) Commenter understands that many lower 48 refiners do not believe that this flexibility will assist them, but commenter believes that this will be of help to Alaska small refiners. This approach also would not interfere with retail availability of the low sulfur fuel because most of the highway diesel in Alaska is produced by the two large refineries in Alaska. Placarding and separate island requirements would prevent misfueling.

Letters:

Petro Star Inc. (IV-D-216) **p. 3-4**

Response to Comment 8.5.3(D):

Unlike the rest of the nation, Alaska is currently exempt from the 500 ppm sulfur standard for highway diesel fuel and dye requirements. Since the beginning of the 500 ppm highway diesel fuel program, we have granted Alaska exemptions from meeting the sulfur standard and dye requirements, because of its unique geographical, meteorological, air quality, and economic factors. Because of these unique factors, we are establishing in today's action an alternative option for implementing the low sulfur fuel program in Alaska.

We are providing the State of Alaska an opportunity to develop an alternative low sulfur transition plan. We intend to facilitate the development of this plan by working in close cooperation with the state and key stakeholders. This plan must ensure that sufficient supplies of low sulfur diesel fuel are available in Alaska to meet the demand of any new 2007 and later model year diesel vehicles. Given that Alaska's demand for highway diesel fuel is very low and only a few new diesel vehicles are introduced in Alaska each year, it may be possible to develop an alternative implementation plan for Alaska in the early years of the program that provides low sulfur diesel only in sufficient quantities to meet the demand of the new diesel vehicles. This provision gives all Alaska refiners, including those that are small, more flexibility during the transition period because they will not have to desulfurize the entire highway diesel volume. In addition, small refiners in Alaska will also be eligible for the same menu of options as all other small refiners. Our goal in offering this additional flexibility is to transition Alaska into the low sulfur fuel program in a manner that minimizes costs, while still ensuring that the new vehicles receive the low sulfur fuel they need. We expect that the transition plan will begin to be implemented at the same time as the national program, but the state will have an opportunity to determine what volumes of low sulfur fuel must be supplied, and in what timeframes, in different areas of the state.

Issue 8.5.4: Hardship Waiver

(A) EPA should clarify and define in detail how hardship criteria will be defined for small refiners.

(1) EPA's process for determining whether a hardship waiver is necessary is arbitrary.

<u>Letters:</u>

Gary-Williams Energy Corporation (IV-F-43, 191) **p. 193**
Tosco (IV-F-157)

(2) EPA needs to establish criteria for financial standards, engineering, planning and permit requirements, and construction hardships that justify a waiver. EPA also needs to set the time frame for action. Commenter opposes EPA suggestion that EPA decide on a waiver within one year after submission -- a 3 month timeframe is appropriate. These changes are necessary so that lenders will have certainty before making capital available. Commenter notes that this option is likely to be the most important flexibility option for small refiners.

<u>Letters:</u>

Countrymark Cooperative (IV-D-333) **p. 9-10**, (IV-F-191) **p. 184**

(3) The only relevant and appropriate criterion is that the refiner produces both gasoline and diesel. If so, an automatic hardship waiver should apply. If EPA is concerned about geographical air quality impacts associated with this type of automatic exemption, then EPA could require that small refiner gasoline

exempted from the original Tier 2 deadlines not be sold in nonattainment areas.

Letters:

Gary-Williams Energy Corporation (IV-D-252) **p. 5**

Response to Comment 8.5.4(A):

The low sulfur diesel fuel program offers two types of hardship provisions: small refiner hardship and general hardship. The small refiner hardship provision is described in detail in Section IV.C.1 of the preamble and Chapter VIII of the RIA. We define a refiner that meets certain corporate employee and crude oil capacity criteria as a “small refiner” for the purposes of the low sulfur diesel fuel program. Note that this definition is based closely on our small refiner definition in the Tier 2/Gasoline Sulfur rule.

The general hardship provision which is available to all refiners is discussed in Section IV.C.3 of the preamble. Within this provision, there are two main types of general hardship: 1) extreme unforeseen circumstances, such as a natural disaster, and 2) extreme hardship circumstances, such as extreme financial hardship. The requirements for obtaining temporary relief from the requirements due to extreme unforeseen circumstances are described under Section 80.561 of the regulations. The requirements for obtaining temporary relief due to extreme hardship circumstances are described under Section 80.560 of the regulations. Because every refiner has unique circumstances which may warrant hardship relief, we do not believe it would be appropriate to specify exact financial standards, engineering, construction, planning, or permit requirements as one commenter suggested. We believe refiners will benefit from a more open-ended, less constraining process.

(B) The hardship waiver should be automatically granted when the final rule is published (or at least three full years before the 2004 Tier 2 deadline) since clarification of hardship status will be crucial to the investment and operational changes currently being determined by small refiners.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Frontier Oil Corporation (IV-F-191) **p. 93**
Gary-Williams Energy Corporation (IV-F-43)

(2) Commenters note that Tier 2 interim standards compliance will improve substantial capital costs and annual operating expenses (up to $20 million in capital and $2.5 million in incremental annual operating costs), so commenter needs clarification of their hardship status immediately when the rule is published.

Letters:

Countrymark Cooperative (IV-D-333) **p. 9**
Gary-Williams Energy Corporation (IV-D-252) **p. 5**

Response to Comment 8.5.4(B):

The interim low sulfur gasoline program for small refiners lasts for four years, 2004 through 2007, and the refiner can apply for an extension of up to two years. After the interim program expires, small refiners must produce the same low sulfur gasoline as other refiners.

Today's diesel sulfur program takes effect in the same time frame as the small refiner interim program for low sulfur gasoline. To avoid the need for simultaneous investments in both gasoline and diesel fuel desulfurization, several small refiners subject to both programs raised the concept of allowing those investments to be staggered in time. Because of the relative difficulty small refiners will face in financing desulfurization projects, especially for both diesel and gasoline desulfurization in the same time frame, we agree that this concept has merit and have adopted it for this rule. Under this concept, small refiners may extend the duration of their gasoline sulfur interim standards and, thus, potentially postpone some or all of their gasoline desulfurization investments while they work to achieve the low sulfur diesel standard "on time" in 2006.

Specifically, this option provides that a small refiner can receive a three year extension of a refinery's interim gasoline standard, until January 1, 2011, if it meets two criteria: 1) it produces both gasoline and diesel fuel at a refinery and chooses to comply with the 15 ppm diesel fuel sulfur standard by June 1, 2006 for all its highway diesel production at that same refinery, and 2) it produces a minimum volume of 15 ppm fuel at that refinery that is at least 85 percent of the average volume of highway diesel fuel that it produced at that refinery during calendar years 1998 and 1999.

We believe that the additional three-year extension of the interim gasoline sulfur standards, which small refiners otherwise need to request on a case-by-case basis under the gasoline sulfur program, is warranted without any further action by small refiners, provided that they assume the financial burden of full low sulfur diesel compliance in 2006 (i.e., instead of choosing the flexibility of the broader program). The diesel and gasoline desulfurization investments for those refiners can thus be staggered in time.

(C) Supports concept of case-by-case hardship waivers.

(1) EPA should apply this flexibility to farmer co-ops as well as small refiners.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 18-19**

(2) An appropriate time frame for submitting the initial application would be within 9-12 after rule promulgation. EPA, however, should act on applications within 6-9 months so the refiner can react to the decision. Repeated applications should be allowed for cause based on subsequent knowledge as refiners move down the 9-year conversion timeframe. Finally, because the gasoline rules are linked with these rules, the timeframe for an application under the gasoline rules should be changed to February 2001.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 19**

Response to Comment 8.5.4(C):

Any refiner, including farmer cooperative refiners, may apply for temporary relief from the requirements of the low sulfur diesel fuel rule under the general hardship provision.

Once all hardship applications have been received, we will consider the appropriate process to follow in reviewing and acting on applications, including whether to conduct a notice and comment decision-making process.

We believe the June 1, 2002 application deadline is appropriate–refiners must have sufficient time to prepare all the necessary information required in the application. While we will review and act on applications as expeditiously as possible, we believe a six-to-nine month timeframe for this process would be too constraining; we may need time after all applications have been submitted to clarify certain information or request additional information. Because we will consider the joint impact of the low sulfur diesel fuel and low sulfur gasoline rules through this hardship application process, we do not believe it is necessary or appropriate to delay the gasoline hardship application deadline (of September 1, 2000) until February 2001.

(D) Opposes any hardship waiver for small refiners.

(1) At most, small refiners may be given an extension on the gasoline sulfur standards if they demonstrate intent and capability to meet the diesel standards on schedule.

Letters:

Tosco (IV-D-84), (IV-F-157)

(2) Koch favors a true free market approach for fuel distribution. Supply should be accomplished by those able to supply the product at lowest cost.

Letters:

Koch Industries (IV-D-307) **p. 5**

(3) EPA should more objectively define "hardship"; otherwise widespread use of the option to address local or temporary problems could undermine the integrity of the program and lead to a patch-work of dual fuel scenarios. If EPA decides to include these provisions, they should be narrowly construed.

Letters:

Tosco (IV-D-304) **p. 6**

Response to Comment 8.5.4(D):

See our response to comment 8.5.2(B), above.

Issue 8.5.5: Gasoline Sulfur Extension

(A) Small refiners that manufacture both gasoline and diesel fuel should be granted an extension of Tier 2 gasoline sulfur requirements if they meet the diesel standards in the 2006 timeframe.

(1) Commenters suggested a range of years. Most suggested four years.

Letters:

Countrymark Cooperative (IV-F-117) **p. 74**
Frontier Oil Corporation (IV-F-116) **p. 204** (IV-F-191) **p. 93**

Gary-Williams Energy Corporation (IV-D-252) **p. 4-5**, (IV-F-191) **p. 193**
National Council of Farmer Cooperatives (IV-D-351) **p. 6**
WY Refining Company (IV-F-191) **p. 58**

(2) The extension should be for both the interim and final standards, not simply extending the interim period. This approach is needed because of the high costs of meeting the initial interim standards. One commenter added that if EPA will not extend the interim standard, there should be targeted relief for small refiners with low 1997/98 baselines as a result of operational issues during that particular timeframe, such as allowing adjustment of the interim standard to 90% of the baseline.

Letters:

Countrymark Cooperative (IV-D-333) **p. 9**
Gary-Williams Energy Corporation (IV-D-252) **p. 4-5**

(3) The four-year extension for meeting the final gasoline sulfur requirements needs to be automatic and known as soon as possible so that small refiners can use the extension to gain access to financing. The commenter believes this flexibility is the most important for small refiners. Also, EPA needs to ensure that there is no market resistance in the 2008-2012 period to the higher sulfur gasoline fuel by stating explicitly that there is no prohibition on commingling the small refiner fuel with the fuel meeting the final gasoline standards.

Letters:

Placid Refining Company, LLC (IV-D-230) **p. 3-4**

Response to Comment 8.5.5(A)(1)-(3):

As described in Section IV of the preamble and Chapter VIII of the RIA, today's diesel sulfur program takes effect in the same time frame as the small refiner interim program for gasoline sulfur. To avoid the need for simultaneous investments in both gasoline and diesel fuel desulfurization, several small refiners subject to both programs raised the concept of allowing those investments to be staggered in time. Because of the relative difficulty small refiners will face in financing desulfurization projects, especially for both diesel and gasoline desulfurization in the same time frame, we agree that this concept has merit and have adopted it for this rule. Under this concept, small refiners may extend the duration of their gasoline sulfur interim standards by three years and, thus, potentially postpone some or all of their gasoline desulfurization investments while they work to achieve the diesel sulfur standards "on time" in 2006. This provision is automatic under the provisions of today's rule, in response to commenters concerns about needing certainty as soon as possible. To the extent that small refiners choose this Diesel/Gasoline Compliance Date option, this provision will benefit the overall diesel program because it will increase the availability of 15 ppm diesel fuel in the small refiner's market area.

While the Agency also considered granting an extension for small refiners to meet or skip entirely their interim gasoline sulfur standards, the much greater environmental impact associated with the very high gasoline sulfur baselines caused us to dismiss such an approach. Furthermore, it was not at all clear that additional relief beyond an extension for complying with the final gasoline sulfur standards was warranted. Finally, a three year gasoline extension was deemed more than sufficient to allow small refiner to stagger their diesel and gasoline investments.

(4) Alternatively, small refiners could be allowed to supply highway diesel with 50 ppm sulfur for a reasonable period beyond the 2006 deadline.

Letters:

Tosco (IV-D-304) **p. 6**

Response to Comment 8.5.5(A)(4):

See response to comments 8.5.6(A), (B), and (D), below.

(5) Commenter states this option should apply to farmer co-ops as well, and that if there is any extension to the diesel fuel deadline, the gasoline extension should run from that extended date, not 2006.

Letters:

National Council of Farmer Cooperatives (IV-D-351) **p. 6**

Response to Comment 8.5.5(A)(5):

See response to comment 8.5.1(E), above.

(B) Does not believe an extension on meeting the gasoline requirements will be useful.

(1) All California refiners either no longer refine gasoline, or make low-sulfur

gasoline already. Thus, commenter opposes this option.

Letters:

British Petroleum (IV-D-242) **p. 5**

(2) Even though this provision may be useful to certain small refiners (commenter expresses their support on this issue), it is unlikely to be useful for western refiners since most either already make ultra low sulfur gasoline or choose not to manufacture finished gasoline at all.

Letters:

Western Independent Refineries Association (IV-D-273) **p. 7**, (IV-F-190) **p. 144**

(3) EPA's option to allow trade-offs between compliance with the gasoline and diesel sulfur programs appears to be inequitable, and would require that EPA re-visit the Tier 2 program through a notice and comment rulemaking. EPA would be required to thoroughly review the implications that an amendment regarding small refiner compliance would have on other aspects of the Tier 2 rule, such as the emissions benefits received under the Tier 2 program. Such trade-offs were not contemplated in the Tier 2 rulemaking and could further complicate the compliance and supply issues for diesel.

Letters:

American Petroleum Institute (IV-D-343) **p. 67**
Marathon Ashland Petroleum (IV-D-261) **p. 71**

Response to Comment 8.5.5(B):

In the diesel proposal, we sought comment on a gasoline/diesel compliance trade-off for small refiners and farmer cooperative refiners. In addition, we received comment on this issue with respect to small refiners as well as GPA refiners. However, because the option is voluntary, it is difficult to project the extent to which refiners will take advantage of it. Nevertheless, we attempted to project which refiners would benefit most from this flexibility and evaluated the environmental impact in the same manner as we did for the Tier 2/low sulfur gasoline rule. The impact of this flexibility is incorporated into our overall environmental impact analysis for today's diesel program. These losses from this flexibility amount to only a very small fraction of the diesel program benefits over time. Furthermore, this flexibility is necessary in order to provide for the earliest possible implementation of the program. Without this flexibility, the start of the program may have to be delayed, resulting in a much, much greater loss in environmental benefits.

While this option will not benefit all small refiners, neither will others. Hence, we believe it is important to provide refiners with a choice of three different compliance flexibility options. This option may not benefit California refiners that are not subject to the federal low sulfur gasoline program. However, they may still take advantage of the other two small refiner compliance options (500 ppm option and small refiner credit option) as well as the temporary compliance option and general hardship provision that are available to all refiners.

(C) Supports generally the concept of allowing small refiners to stagger the implementation of gasoline and diesel desulfurization.

(1) Staggering the compliance dates will allow small refiners to spread their costs out over time and ensure that contractors are available to put the desulfurization equipment in place. One commenter provided detailed analysis of these concerns, and added that potential nonroad diesel desulfurization concerns further complicated the possible financing and construction cost considerations for small refiners. This commenter also adds that any relief provided by the small refiner provisions under Tier 2 will be undone if the small refiner must meet the diesel requirements by 2006. This commenter suggests that the small refiner be allowed to meet the Tier 2 gasoline requirements in 2008 as allowed under Tier 2, and then have on-road and nonroad diesel desulfurization requirements delayed until sometime after that date.

Letters:

Giant Industries, Inc. (IV-D-248) **p. 2**
Murphy Oil Corporation (IV-D-274) **p. 2-5, 8, 14**

Response to Comment 8.5.5(C)(1):

In general, commenters provided added support and justification for the Gasoline/Diesel Compliance Date Option available to small and GPA refiners under today's program. This option as it applies to small refiners is described above in Response to Comments 8.5.5(A)(1)-(3) and Section IV.C.1 of the preamble. The option for GPA refiners is described above in Response to Comment 4.1(E)(18) and in Section IV.B.2 of the preamble.

(2) Commenter argues that farmer co-ops need maximum flexibility on both rules, and that a longer gasoline timetable should not be linked to the refiner co-op meeting the 2007 diesel timeline. Instead, refiners should be given the maximum flexibility under the diesel rule (until 2009) and then a further extension for gasoline. EPA even notes that it has more flexibility on the gasoline timetable because gasoline does not raise the same serious concerns about negative impacts on exhaust controls or driveability.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 15, 18**

Response to Comment 8.5.5(C)(2):

Refer to Response to Comments under Issue 8.5.7 on Farmer Cooperatives, below.

Issue 8.5.6: Higher Sulfur Cap

(A) Supports the use of a 50 ppm cap (or average) for small refiners.

(1) Allowing a 50 ppm average for some time period would reduce capital and operating costs for small refiners. Given that not all engines/vehicles would require ultra low sulfur fuel at first, this approach may not cause concerns for meeting the new emission standards. There may be some concern about the ability to blend the 50 ppm average fuel with other fuels to meet the 15 ppm cap, which suggests the better alternative may be an overall delay in the diesel fuel standards until it is clear what level the emission control technologies will require.

Letters:

Countrymark Cooperative (IV-F-191) **p. 184**

(2) To work, this option must not require that the small refiner fuel be blended down to the 15 ppm level because the small refiners would have to contract with the large refiners and the large refiners would extract much of the economic value of the flexibility in the process. Also, because the small refiners would produce a small percentage of the overall volume, there is no need to impose limitations on the marketing of the 50 ppm fuel.

Letters:

Placid Refining Company, LLC (IV-D-230) **p. 4**

(3) If this is adopted for small refiners, EPA should adopt it for farmer co-ops as well.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 19**
National Council of Farmer Cooperatives (IV-D-351) **p. 6-7**

(B) EPA should adopt a permanent sulfur standard that is slightly higher than the proposed sulfur standard for small refiners.

(1) Because small refiners represent such a relatively small share of the diesel fuel market, small refiner diesel fuel is likely to be diluted in the course of distribution. If a slightly higher standard is imposed for smaller refiners, the potential for contamination is low since these refiners represent such a small portion of market share. Commenter does not recommend any specific "slightly higher" level that should be imposed on small refiners. However, this commenter notes that cost increases dramatically and production capacity declines dramatically below 30 ppm and urges EPA to set a standard at or above this level.

Letters:

Western Independent Refiners Association (IV-D-273) **p. 6-7**

(2) Commenter believes that a 25 ppm cap/15 ppm average for small refiners would provide significant cost relief to small refiners. Commenter recognizes that EPA may be concerned about circumstances where the small refiner is the major distributor for an area or for a particular end user, but notes that its product supplies only about 2% of the total diesel distribution handled by its pipeline carrier over a wide geographic area.

Letters:

Gary-Williams Energy Corporation (IV-D-252) **p. 8-9**

Response to Comments 8.5.6(A) and (B):

Given the sulfur sensitivity of 2007 and later model year vehicles and their need to operate on 15 ppm sulfur diesel fuel, it is not possible to allow for a subset of the fuel to be produced and sold higher than the 15 ppm sulfur cap indiscriminately with fuel meeting the 15 ppm cap. Based on our analysis of the distribution of diesel fuel we believe that, with relatively minor changes and associated costs, the existing distribution system will be capable of adequately managing sulfur contamination during the transportation of 15 ppm highway diesel fuel from the refinery to the end-user. We also believe that the existing system is capable of handling two grades of highway diesel fuel (500 ppm and 15 ppm sulfur cap) in a limited fashion during the transition period of the sulfur program at acceptable cost with the addition of storage tanks at a fraction of distributor facilities. Furthermore, we believe that the other safeguards within the program, such as product transfer documents for tracking purposes and fuel pump labeling requirements, will mitigate the potential for misfueling of 2007 and later model year vehicles with high sulfur diesel fuel.

(C) Small refiners should not be required to produce the lower sulfur fuel at any time.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Frontier Oil Corporation (IV-F-116) **p. 204**

Response to Comment 8.5.6(C):

Under today's program, small refiners have a menu of compliance options available to them. One option allows them to continue producing and selling diesel fuel which meets the current 500 ppm sulfur standard for four additional years, through May 31, 2010. However, as a necessary condition of this option, small refiners that choose it must reasonably assure the existence of sufficient volumes of 15 ppm fuel in the marketing area(s) that they serve. Additional relief beyond this, such as leaving the end date open, is not necessary to address these hardship circumstances. Furthermore, it causes continued concerns regarding the enforceability and environmental impact of allowing 500 ppm diesel fuel to linger in the marketplace.

(D) Allowing small refiners to produce 50 ppm diesel for a period of time as opposed to 15 ppm diesel may not be helpful since significant capital expenditures would also be required to reach 50 ppm.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Gary-Williams Energy Corporation (IV-F-43)

(2) Although this could be included as one option, commenter strongly opposes the use of this approach as the only or major form of small refiner relief.

Letters:

Countrymark Cooperative (IV-D-333) **p. 11**
Gary-Williams Energy Corporation (IV-D-252) **p. 8**

Response to Comment 8.5.6(D):

Refer to Response to Comments 8.5.6(A) and (B), above.

Issue 8.5.7: Farmer Cooperatives

(A) Farmer cooperatives need additional flexibility to ensure that they may comply with the requirements in a feasible and affordable manner.

(1) The cumulative impact of the gasoline and diesel standards may drive farmer-owned cooperatives out of business. EPA should provide them with maximum flexibility and more time for implementation of the proposed rules. One commenter recommended that farmer co-ops should be able to choose which desulfurization program to undertake first (gasoline or diesel). This would require an extension of time for both the gasoline and diesel rules.

Letters:

Agricultural Retailers Association (IV-D-178) **p. 4**
Cooperative Refining, LLC (IV-D-300) **p. 2**
Farmland Industries (IV-F-29)
North American Equipment Dealers Association (IV-D-194) **p. 3**

(2) Small farmer-owned cooperative refiners can operate at a profit only in the absence of unreasonable regulatory restrictions.

Letters:

Remster, John (IV-F-28)

(3) Farmer co-ops will have difficulty in obtaining engineering and construction assets to meet the rule. First, large refiners have increased access to these assets because of their market power. Also, this problem is magnified in small, rural areas where farmer co-ops are located because the E&C providers prefer to concentrate efforts in large markets with multiple jobs with small distances.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 6-7**

(4) Farmer co-ops should receive maximum compliance flexibility and be able to use any of the flexibilities provided to small refiners.

Letters:

Agricultural organizations as a group (IV-D-265) **p. 2**
Cooperative Refining, LLC (IV-D-300) **p. 2**
National Council of Farmer Cooperatives (IV-D-351) **p. 3-4**

(5) Suggested that since the compliance costs for cooperatives and small refiners would be significant - particularly when compared to the amount of assets and expected profits - cooperatives and other small refiners should be able to delay full implementation of the sulfur standards by up to five years.

Letters:

Countrymark Cooperative (IV-F-117) **p. 74**

Response to Comments 8.5.7(A)(1)-(5), and (B) and (C):

Section IV.C.2 of the preamble describes our rationale for not providing special treatment for farmer cooperative refiners as a class. In summary, we concluded that, although farmer cooperatives are unique in some respects, especially in their corporate organization, they are not fundamentally different from other refiners in their ability to comply with the diesel fuel sulfur program.

Several commenters state that cooperative refiners are unique. We agree that refiners that are also cooperative businesses are significantly different from other refiners in several respects. The key aspect is that several avenues for accessing capital used by many other refiners (in this case, the capital needed to carry out diesel fuel desulfurization projects in their refineries) are not available to, or are not practical for, cooperative refiners. In particular, farmer cooperatives, unlike publicly-held corporations, are generally not permitted to raise equity capital in the securities markets (that is, by selling stock). At the same time, the equity financing provided by the membership, usually a modest amount assessed from each member as a condition of membership, provides a return for the members only to the extent that the members purchase the products or services of the cooperative. Conventional investors that do not regularly patronize the cooperative have little incentive to provide investment from the outside, since their investment will not appreciate in value.

For farmer cooperatives, money for capital projects is generally raised internally as equity from members and as loans from banks or other financial institutions. In this sense, farmer cooperative refiners are similar to privately-held refining companies, which are also unable to raise capital by selling public stock. In the case of farmer cooperatives, equity capital is raised either by assessment of the members or, more often, by retaining a portion of the cooperative's earnings that would otherwise be distributed to the members (on the basis of how much business they have done with the cooperative). The amount of equity available to the cooperative, as well as the earning prospects of the cooperative, usually determine whether financial institutions will lend additional capital, how much money will be lent, and what terms the cooperative will have to agree to. For example, when a cooperative's equity is low and/or the farm economy is stressed (and thus the prospects for strong earnings performance by the cooperative are diminished) cooperatives can have difficulty competing among other potential borrowers for loans for large capital projects.

While the unique structural and financial characteristics of farmer cooperative refiners can present special challenges to these refiners, their status as cooperatives can also provide advantages not shared by other refiners. The same federal and state laws and regulations that place limitations on the financial avenues available to cooperatives also tend to include special provisions only available to cooperatives. These include special treatment for cooperatives under securities laws, antitrust laws, contractual marketing laws, and restrictive corporate entity laws, some or all of which may come into play in efforts to capitalize refinery desulfurization projects.

Also, the relatively large regionally-based cooperatives that own two of the cooperative refineries have a variety of other business interests as well. This broader business base, which involves not only the refining, distribution, and marketing of fuels but also a variety of other agricultural supply, processing, and related operations, may provide an advantage to these larger cooperative refiners as compared to competing refiners that often have little or no business beyond refining and fuel marketing. Finally, the three larger farmer cooperative refiners have developed several economic relationships among one another (including joint refinery ownership, a joint refinery operating agreement, and a joint fuel distribution and marketing organization) that together create greater options for financing than are available to many other refiners.

Commenters express concern about some refiners having difficulty accessing engineering and construction (E&C) resources. We have designed the diesel sulfur program to address this concern. For refiners in the Geographic Phase-in Area in the western U.S., where E&C concerns would have been expected to be the most serious, we are providing special relief provisions. More generally, our analyses in Chapter 4 of the RIA show that our program as designed tends to minimize the likelihood of serious difficulties in contacting for E&C resources.

In balancing these factors, we have not been able to clearly distinguish a unique economic burden that today's program will place on farmer cooperative refiners, as a class, apart from other refiners, especially other refiners of similar size and/or those that are privately-held companies. However, we expect that the options we have incorporated into the overall diesel sulfur program will be valuable to many refiners, including farmer cooperative refiners.

(6) EPA should support financial assistance measures for farmer co-ops, should assist these co-ops with securing financial assistance, and should ensure that agricultural producers can receive tax credits to offset diesel fuel price increases. One commenter expressed support for a delay in the rule until the Administration can develop financial incentive plans similar to those used in Europe to help refiners move to a 50 ppm standard. For example, the federal tax on on-road fuel could be dropped or reduced for gallons produced by co-ops, especially since those gallons are used on local roads primarily and not the highway system the tax supports.

Letters:

Agricultural organizations as a group (IV-D-265) **p. 2**
Cenex Harvest States Cooperatives (IV-D-232) **p. 3, 17**
ID Barley Commission (IV-D-312) **p. 2**
National Council of Farmer Cooperatives (IV-D-351) **p. 5**

Response to Comment 8.5.7(A)(6):

EPA does not have the authority to offer financial assistance measures that might subsidize farmer cooperative refiner investments in desulfurization. However, the U.S. Department of Agriculture (USDA) has indicated an interest and willingness to review its existing authorities for the potential mechanisms to provide financial assistance to refiner cooperatives that invest in desulfurization programs.

(B) Farmer co-ops have unique concerns about the ability to raise capital that justify providing these co-op refiners special flexibility.

(1) Co-ops are prohibited from issuing stock, and cannot take on outside non-co-op investors. Also, the farmers get no return on the investment, and it takes away scarce funds from projects designed to enhance farm income. Also, the farmers are both the owners and the customers, which means they pay twice in the form of higher fuel price and reduced patronage from the co-op as owners that have to make the capital expenditures. As a demonstration of the concerns with this type of regulation on farmer co-ops, commenter notes that in 1979 there were 8 farmer co-op refiners and that by 1983, largely because of environmental regulation of refiners, there were only 4. Commenter notes that refiner co-ops: have different business structures; are treated differently legislatively with special protections; are treated separately in regulatory contexts, such as the tax code; have received separate judicial treatment (such as a case involving refunds of crude oil resales); are governed democratically in a closed membership setting; and are recognized politically as an integral part of rural America.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 7, 16-17**
National Council of Farmer Cooperatives (IV-D-351) **p. 4-5**

Response to Comment 8.5.7(B)

See response to comments 8.5.7(A)(1)-(5).

(C) A benefit cost analysis needs to consider negative impacts on farmer co-ops that are dependent on petroleum revenues to stay in business.

(1) Small co-ops earn nearly 50% of their total farm supply sales from petroleum products and even the largest co-ops earn an average of 27%.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 9**

Response to Comment 8.5.7(C):

See response to comments 8.5.7(A)(1)-(5).

(D) EPA needs to address concerns that there will be fuel dumping on the nonroad market that will reduce margins for farmer co-ops, depress earnings, reduce patronage, and potentially make farmer co-ops economically non-viable.

(1) Refiners may be tempted or forced to dump fuel on the nonroad market to delay converting to ultra-low-sulfur fuel, to avoid altogether the capital costs of producing ULSD, or to handle an off-spec batch of fuel. In addition, small refiners (or large refiners under a phase-in approach) that have the ability to continue to produce 500 ppm fuel for on-road use may decide to dump that fuel on the nonroad market. Farmer co-ops would then face reduced margins and have less ability to pay for converting to ULSD. (See also Issue 8.5.8, Point (A).)

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 8-9, 15**

Response to Comment 8.5.7(D):

See Response to Comments 8.5.8(A)(1) through (4).

(E) Some farmer co-ops agricultural organizations expressed concern over the effects on agriculture of supply disruptions and price spikes.

(1) Commenters provided no supporting information or detailed analysis.

Letters:

Cenex Harvest States Cooperatives (IV-F-191) **p. 102**
Countrymark Cooperative (IV-D-125) **p. 2**, (IV-F-30)
Farmland Industries (IV-F-29)
Remster, John (IV-F-28)

(2) Farmers need fuel at a fair market price, and at secure product volumes at particular times of the year. The difficulty of achieving 15 ppm fuel all of the time puts farmers at risk, and farmers already struggle to maintain economic viability. Farmer co-ops will struggle to meet the proposal and continue to serve farmers' seasonal needs for a secure fuel supply because of the high desulfurization costs, the difficulty of consistently refining below the 15 ppm cap, the inevitable reduction in supplies from diverting hard to treat feedstocks and off-spec product, and the uncertainties about the desulfurization control technologies.

Letters:

Countrymark Cooperative (IV-D-333) **p. 12-13**

(3) EPA's requirements for ultra low sulfur diesel could have an adverse impact on farmers since the proposal could increase the threat of supply disruptions in rural areas and force refiners to produce more costly low sulfur fuel for farm and other nonroad uses due to distribution limitations. The indirect costs to farmers would also be high due to their reliance on trucking to market products.

Letters:

Agricultural Retailers Association, et. al. (IV-D-148) **p. 1**
ID Barley Commission (IV-D-312) **p. 1**
NE Farm Bureau Federation (IV-D-153) **p. 1**
National Grange of the Order of the Patrons of Husbandry (IV-D-181) **p. 1**

Response to Comment 8.5.7(E):

The commenters express concern about supply disruptions and price spikes, especially in rural areas. In our analyses of the feasibility and costs of the diesel fuel sulfur program (Chapters 4 and 5 of the RIA), we provide our rationale for concluding that under the program as designed, refiners will make sufficient supplies of low sulfur diesel fuel available in all parts of the country at reasonable prices. We thus do not expect that other problems related to supply shortages, like spikes in fuel prices, will occur.

Furthermore, the commenter appears to be inconsistent in expressing concern about a shortage in the fuel supply to farmers. The commenter suggests on the one hand that there could be a shortage of highway diesel fuel due to “dumping” into the nonroad fuel market while also suggesting a shortage of the nonroad diesel farmers rely on for their agricultural operations.

(F) The proposed rule will be financially burdensome to small refiner co-ops that specialize in fuels for the agricultural industry, and as a result, will force added costs onto the agricultural sector.

(1) Due to the distribution system being able to only handle one type of diesel, the co-op refiners will be forced to invest significant resources to produce the ultra-low sulfur fuel or face high costs in duplicating their systems for the production of different types of diesel fuel. Even if refiners and retailers finance a dual distribution system, pump prices will increase dramatically and the small co-op refiners would face huge capital expenditures and a potential loss of revenue, customers, and farmer/owners. Some commenters suggested that EPA withdraw the rule until the agency has had time to consider the effects of this proposal on small refiner co-ops. Another commenter suggested that allowing refiner co-ops to continue selling 500 ppm fuel may help avoid having to provide dual fuels. The commenter notes that farmers buy HDV and HD equipment that lasts 25-30 years, far longer than on-highway HDV. Thus, there is a need for farmer co-ops to maintain the current nonroad diesel and farm fuel distribution system for a long period of time. This also justifies giving these co-ops more time to comply.

Letters:

Agricultural Retailers Association (IV-D-178) **p. 3**
Agricultural Retailers Association, et. al. (IV-D-148) **p. 1**
Cenex Harvest States Cooperatives (IV-D-232) **p. 11-12**
Countrymark Cooperative (IV-D-125) **p. 2**
North American Equipment Dealers Association (IV-D-194) p. 3

(G) EPA's suggestion that refiners which ensure that low sulfur diesel is available at retail could sell a larger percentage of 500 ppm fuel as on-road fuel, provides farmer co-ops no additional flexibility because those co-op refiners already are set up as a complete system from refiner through consumer.

(1) Commenter provides no further analysis on this point.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 14**

Response to Comments 8.5.7(F) and (G):

Under the highway diesel fuel sulfur program as designed, we agree with the commenters that some refiners may choose to produce some 500 ppm fuel while others will choose to produce only 15 ppm fuel, depending on the economic interests of the organization at the time. As discussed in Chapter 5 of the RIA, we expect the costs to be reasonable (4-5 cents per gallon). Regarding the comment that it could be beneficial for refiners (specifically farmer cooperative refiners) to avoid producing two grades of diesel fuel by being allowed continue to produce and sell 500 ppm diesel fuel, we agree. The temporary compliance option allows a refiner to seek credits to comply and delay production of 15 ppm for some time. Regarding the comment that farmer cooperative refiners need to maintain the current nonroad diesel distribution system, the diesel sulfur program allows this to be done since nonroad diesel fuel is not covered by the program.

As discussed in the response to Comments 8.5.7(A)(1)-(5), we recognize that the program will create economic challenges, but we do not believe these challenges will be disproportionately greater for cooperative refiners than for other refiners.

Similarly, the diesel fuel sulfur program allows parties in the distribution system to decide whether they can most economically distribute one or the other grade of diesel fuel, or both, during the early years of the program.

(H) Disagrees with EPA's analysis of the relationship between price increases, cost savings, and pressures to convert to a single low sulfur diesel, particularly as it applies to farmer co-ops.

(1) First, price markups result in profits, not cost savings. Profits made at each level of production/distribution could be used for capital investment at that part of the system, but would not be distributed. Second, local co-ops would not enjoy any benefits out of this process. The farmer is the owner of both the refinery and the distribution system, and is the buyer of the product. To mark up prices to pay for investments is a double penalty to farmers. Finally, commenter disagrees with EPA's assumption that if the cost savings were not sufficient "the entire system would convert to low sulfur diesel." More realistically, a number of refiners will opt to produce just for the nonroad market, and if too many choose this option, the fuel dumping will work to the detriment of the farmer co-op.

<u>Letters:</u>

Cenex Harvest States Cooperatives (IV-D-232) **p. 10-11**

<u>Response to Comment 8.5.7(H):</u>

The issues raised by the commenter are incorporated in our economic analyses in Chapter 5 of the RIA. Our analyses recognize the refiners will be making decisions on whether to produce some 500 fuel or pursue a single fuel strategy. Similarly, we recognize the fact that downstream parties, including local cooperatives that sell diesel fuel, have the option of providing one or two grades of diesel fuel. Our economic conclusions about the program consider these and many other factors. Regarding “dumping” of diesel fuel into the nonroad diesel market, see our response to comments 8.5.8(A)(1) through (4).

Issue 8.5.8: Other Small Refiner Issues

(A) EPA should ensure that small refiners are allowed to continue sales of higher sulfur diesel fuel to the nonroad market.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

American Farm Bureau Federation (IV-F-5)

(2) Commenters asserted that small refiners that have historically made predominately nonroad diesel, will be facing closure if larger oil companies choose to dump or produce large quantities of diesel fuel for the nonroad market. EPA should prohibit dumping into the nonroad market. In written comments, one commenter suggested that one option would be to limit sales of high sulfur diesel into the nonroad market to a refiner's current volume or some appropriate baseline. Any additional sales would have to be of 15 ppm fuel supplied to the nonroad market. Small refiners would be exempt from this requirement. This option would preserve an nonroad market for small refiners and ensure that the large refiners provide adequate supply to the on-road market. In follow-up written comments, the commenter further noted the need for this type of provision given the strong possibility of refiners choosing to dump light cycle oil (LCO) into the nonroad market. The commenter notes that, based on the amount of LCO stocks, over 12% of current on-road diesel could be shifted to the nonroad market plus shifts associated with increased pipeline transmix. This result will cause severe disruptions in the on-road market while driving down prices in the nonroad market so that small refiners who rely on the nonroad market are driven out of business. In the follow-up comments, the commenter also stated that, based on legal advice it had received, EPA should be able to include this type of provision in the final rule as a logical outgrowth of the proposal, and that the CAA is broad enough to allow for this type of provision as part of setting a fuel standard. A second option would be to regulate nonroad diesel to the on-road specification as soon as possible and in one step, and then exempt small refiners from that requirement for a period of time. As an example, the nonroad spec could be set at 15 ppm in 2008, with small refiners exempt until 2012. If this example was used, some form of an anti-dumping option would be needed in the 2006-2008 time period. Finally, the commenter notes that the nonroad change needs to be a single step because the pipelines cannot handle ultra low sulfur on-road plus two different nonroad diesel grades.

Letters:

Cenex Harvest States Cooperatives (IV-F-191) **p. 102**
Countrymark Cooperative (IV-D-333) **p. 10-11**
Frontier Oil Corporation (IV-F-116) **p. 204** (IV-F-191) **p. 93**
Gary-Williams Energy Corporation (IV-D-252) **p. 6-7**, (IV-G-25) **p. 1-2**
U.S. Oil & Refining Co. (IV-F-190) **p. 159**
Western Independent Refineries Association (IV-F-190) **p. 144**

(3) Commenters suggested a higher nonroad diesel standard should be maintained to minimize fuel costs to farmers and to provide refiners with flexibility.

Letters:

Countrymark Cooperative (IV-F-117) **p. 74**
Gary-Williams Energy Corporation (IV-F-43)

(4) Commenter states that instead of the 500 ppm option, a limit on the amount of nonroad diesel large refiners could produce would enable small refiners to market all of their diesel to the nonroad market. This approach could be enhanced by providing incentives to government entities, such as the military, to purchase nonroad diesel from small refiners.

Letters:

Placid Refining Company, LLC (IV-D-230) **p. 3**

Response to Comment 8.5.8(A):

As discussed under Comments 8.1.1(A)-(C), we think a comprehensive view of the likely actions that refiners will take in response to the diesel sulfur program indicates that refiner economics will avoid any excessive "dumping" of diesel fuel into the nonroad diesel market. We expect there will be some downgrading of highway fuel due to contamination and that there will be some shifting of production from highway diesel to nonroad diesel. To the extent these occur, other refiners will shift from nonroad diesel into highway diesel production. These shifts will be an natural result of the market optimizing itself to comply with the standards at the least cost. However, as discussed in our response to Comments 8.1.1(A)-(C), the markets for both highway and nonroad diesel production will stay in balance.

Because of this conclusion, we have not considered regulatory provisions to prevent these dynamics. Regarding the comments relating to regulating off-road diesel fuel, this rule only applies to highway diesel fuel and does not affect off-road fuel.

Issue 8.6: Other Small Business Issues

(A) Higher diesel fuel costs will have an adverse impact on small businesses.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

American Petroleum Institute (IV-F-182, 117) **p. 161**
National Federation of Independent Business (IV-D-243) **p. 2**

(2) The slim profit margins in the trucking industry, and the large number of miles driven, mean that a small change in fuel costs can have a large impact on viability of a trucking business. EPA has estimated a 4 cents/gallon impact, but recent experiences with RFG document that price increases associated with regulatory requirements can be far greater than EPA estimates. One commenter (ATA) provided significant discussion of

this issue including data on the revenues and profit margins of smaller carriers, and the potential impact of higher fuel costs to these small businesses. Another commenter also raised concerns about price spike impacts on small business truckers, and noted that even short term spikes can have disastrous consequences for these truckers.

Letters:

American Truck Dealers Line Representative Committee (IV-F-191) **p. 126**
American Trucking Association (IV-D-269) **p. 24-25**, (IV-F-191) **p. 42**
Big West Oil, LLC (IV-D-229) **p. 2**

Response to Comment 8.6(A):

Refer to Response to Comments 4.1(E)(2), (16), and (17), above, and Chapter V of the RIA regarding cost information. We are confident that the menu of options available to small refiners, as well as the broader program flexibilities available to all refiners, under today's program will provide sufficient assistance to small refiners with program compliance (see Response to Comments 8.5.2, above). Furthermore, these options are necessary in order to provide for the earliest possible implementation of the program. Without this flexibility, the start of the program may have to be delayed, resulting in a much, much greater loss in environmental benefits.

(B) If emissions reduction technologies degrade powertrain performance, truckers will be more likely to drive their older vehicles longer, which may have an adverse economic impact on new-truck dealers.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

American Truck Dealers Line Representative Committee (IV-F-191) **p. 126**

Response to Comment 8.6(B):

The aftertreatment is not expected to result in a fuel economy or power disbenefit. The devices, by themselves, will not have a significant impact on engine power output. We anticipate that any fuel economy cost due to the aftertreatment systems will at least be offset by engine modifications, if not improved over non-aftertreatment engines. The extremely high NO_x reduction efficiency of the NO_x adsorber will allow the fuel injection timing to be advanced to a point where at least a 100 percent fuel economy benefit will be realized. Please refer also to our responses to issues 5.4(A) and 5.4(B).

(C) EPA should provide grants and funds to small businesses leading the development of evolving technologies.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Transportation Techniques (IV-F-191) **p. 246**

Response to Comment 8.6(C):

While we offer grants for research and development purposes, corporate grants such as these are already possible through other programs funded by the federal government through SBA, DOE, USDA, and other agencies.

(D) EPA fails to recognize the enormous burden and cost to small dealers that will be incurred as a result of operational issues and the potential contamination of low sulfur diesel supplies.

(1) EPA states that to prevent contamination, dealers would have to drain tank trucks completely of higher sulfur fuel and purge delivery hoses prior to their use for the ultra-low sulfur fuel. These practices along with the inevitable contamination concerns may prove to be an excessive burden to small dealers. To minimize contamination, dealers could be forced to purchase new vehicles, hoses and other equipment. EPA should examine this issue more closely and should recognize that small businesses in the distribution sector face many of the same problems as small refiners.

Letters:

New England Fuel Institute (IV-D-296) **p. 4**

Response to Comment 8.6(D):

We believe that by careful and consistent observation of current industry practices to limit contamination, tank truck operators will be capable of adequately limiting sulfur contamination during the distribution of 15 ppm highway diesel fuel. These practices include leveling the truck prior to draining, allowing sufficient time for the tank to drain completely, and purging the delivery hose of residual product prior to the delivery of 15 ppm highway diesel fuel. Given that these practices are not new, we do not believe that there will be significant costs associated with ensuring that they are properly observed. Tank truck operators may need to instruct their employees regarding that necessity of observing these practices. However, this could be readily accomplished at minimal cost. Although our program may encourage the existing trend towards the use of dedicated tank compartments and delivery systems on tank trucks for the delivery of highway diesel fuel, it will not force the use of such dedicated equipment. Given this, we believe that there are no unique concerns related to the impact of our program on small businesses in the distribution sector. Please refer to section IV.D.3 in the RIA for additional discussion regarding the additional measures we expect tank truck operators will need to take to limit sulfur contamination during the distribution of 15 ppm highway diesel fuel.

ISSUE 9: RELATIONSHIP TO TIER 2 RULE

(A) EPA's July 2006 compliance date for the fuel standard should be advanced to coincide with the phase-out of the higher test bins in the Tier 2 program.

(1) Commenters provide no further supporting information or detailed analysis.

Letters:

DaimlerChrysler (IV-D-284) **p. 4**

(B) Clean diesel fuel for the 2004 MY is a prerequisite to meet the Tier 2 standards and therefore, clean diesel fuel should be made available in the marketplace much sooner than 2006. (See related comments in Issue 4.3.1.)

(1) Tier 2 generally requires all light duty diesel products to meet the same emission standards as gasoline vehicles beginning in 2003. However, with the July 2006 introduction date for cleaner fuel, light-duty diesel vehicles are excluded from the U.S. market because of the certainty of poisoning of emission control hardware.

Letters:

DaimlerChrysler (IV-D-284) **p. 4**

(2) EPA cannot determine the feasibility of achieving its Tier 2 standards with advanced control technology by evaluating only the level and timing of diesel sulfur fuel changes for heavy duty applications. The HDE standards would be effective for the 2007 model year and the low sulfur diesel fuel necessary to achieve those standards would be required by mid-2006 and EPA has maintained that for Tier 2 vehicles, there is no need to make ultra-low sulfur diesel available prior to 2006 given the flexibilities provided by the phase-in schedule. However, in its final Tier 2 Rule, the only support that EPA references for its position that the Tier 2 interim standards are feasible within the bin structure of the rule and without further reduction in diesel fuel sulfur levels is that Cummins Engine Company has publicly agreed with EPA's assessment. EPA has failed to satisfy its burden under the CAA to demonstrate that the level and timing of its proposed fuel change will render its Tier 2 standards feasible by enabling advanced exhaust emissions control technology to achieve those standards. EPA should implement the cleaner diesel fuel program beginning in 2004. This would allow manufacturers to qualify light duty diesel vehicles under Tier 2 standards and to produce sufficient vehicles in the lower bins to yield acceptable fleet emission averages.

Letters:

Volkswagen (IV-D-272) **p. +5-6**

(C) The availability of ultra low sulfur diesel fuel capped at 5 ppm is necessary to ensure that Tier 2 light duty diesel engines and vehicles can comply with the

standards.

(1) Without significant sulfur reductions, the Tier 2 standards cannot be achieved with diesel-fueled engines. The NO_x and PM standards in the highest bin under the Tier 2 rule are not even approachable for diesel engines without the availability of this ultra low sulfur fuel.

<u>Letters:</u>

Engine Manufacturers Association (IV-D-251) **p. 14-15**

(2) EPA's proposed sulfur limit is only the first step toward "enabling" highly efficient advanced technology for light duty diesel vehicles. EPA has noted the level above which sulfur content would be disabling or significantly impairing to the emission control technology. However, EPA has not demonstrated the feasibility of its 15 ppm sulfur cap for purposes of enabling those technologies to meet its Tier 2 standards. The Tier 2 standards pose significant challenges for light duty diesel vehicles and the fundamental problem will be achieving the NO_x and PM standards at the same time. EPA's analysis fails to demonstrate that, with a 15 ppm sulfur level, the high efficiencies necessary to comply with the Tier 2 standards can be maintained for the useful life of the technologies.

<u>Letters:</u>

Volkswagen (IV-D-272) **p. +3-4**

(3) The use of light duty diesel trucks is expected to rise significantly in the coming years. The number of diesel engines installed in light duty trucks was up nearly four-fold between the 1998 and 1999 model years and will soon surpass a half million annually if current trends continue. These trends underscore the importance of ensuring that ultra low-sulfur diesel fuel is available nationwide, which would allow these vehicles to meet the Tier 2 standards and would contribute to improved fuel economy.

<u>Letters:</u>

UAW (IV-D-215) **p. 6-7**

<u>Response to Comments 9(A), (B), and (C):</u>

As discussed in the preamble, the basis for the diesel fuel sulfur provisions of this rule is the need for heavy-duty diesel engines with new emission control systems to meet and maintain the new emission standards. Although the fuel will also be available for light-duty diesel vehicles, the availability of low sulfur diesel fuel for these vehicles, or the feasibility of these vehicles meeting the Tier 2 standards, are not relevant to this rule.

Our feasibility analyses as presented in the Tier 2 rule (65 FR 6697, February 10, 2000 remain our policy regarding light-duty diesel vehicles. We have not reexamined or reopened the issues regarding the Tier 2 standards in this rule. See also our Response to Issue 12.2(F). We note that we are modifying the test fuel regulations in §86.113-07 to allow some low sulfur diesel test fuel to be used prior to 2007.

(D) Supports the early introduction of low sulfur diesel to accommodate light duty diesel vehicles under Tier 2.

(1) The early introduction of low sulfur diesel is similar to a phase-in but focuses on the period before the regulatory target, stimulates the market, and helps to establish demand for the new fuel. To encourage early introduction, EPA should allow States to require clean fuels before 2006, encourage public and private fleet managers to specify ultra-clean fuels for their diesel powered vehicles, undertake a high visibility public education campaign prior to 2004, and encourage consumers to ask for and use cleaner fuels before 2006 by requiring stations to label fuel quality at the pump.

Letters:

Alliance of Automobile Manufacturers (IV-D-262) **p. 10**

Response to Comment 9(D):

Our diesel fuel program offers credits to encourage the early production and use of low sulfur diesel fuel. We believe this provision, in addition to the market pressure that the introduction of new technology diesel engines will create, offer sufficient encouragement for the production of low sulfur diesel fuel as early as possible. There are indications today that refiners will be producing low-sulfur fuel earlier than required. For example, BP/Amoco is providing 15 ppm fuel on a limited basis today in California as a part of the ARCO EC-D demonstration program.

(E) EPA must set an effective date for implementing the new diesel standards that does not coincide or overlap with the period in which refiners are making major modifications to accommodate the Tier 2 requirements.

(1) One commenter suggests a regional approach to eliminate the overlap between gasoline and diesel rules, and the emissions impacts of such an approach can be offset by other means. All refineries in an area must be given additional time to avoid the overlap between gasoline and diesel standards, regardless of their size, affiliation or small business status.

Letters:

Chevron (IV-D-247) **p. *2, 5**

(2) Overlapping schedules for the gasoline and diesel projects will increase the costs of both programs, as many of these projects will compete for scarce resources. A major issue will be the procurement of reciprocating compressors required for the new hydrotreaters from the five companies worldwide that make them, because these companies will need to simultaneously supply them for low sulfur projects in Europe and both the Tier 2 and diesel rule in the U.S. The same holds true for the design and procurement of thick-walled reactor vessels. One commenter noted that the NPC Study predicts "disaster" to stem from scheduling the low sulfur diesel

fuel to begin during the gasoline sulfur phase down period. If diesel fuel sulfur reductions follow gasoline sulfur reductions in a timely manner, the resources of the process industries can be employed in an efficient manner without excessive costs and risk of either major system disruption or the necessity to weaken the integrity of the environmental planning and investment system by granting special emergency waivers.

Letters:

American Petroleum Institute (IV-D-343) **p. 55-58**
Citgo Corporation (IV-D-314) **p. 6**
ExxonMobil (IV-D-228) **p. 3, 17**
Koch Industries (IV-D-307) **p. 4**
National Petrochemical & Refiners Association (IV-D-218) **p. 2, 15**
Phillips Petroleum Company (IV-D-250) **p. 5**
Western Governors' Association (IV-G-41) **p. 2**

Response to Comment 9(E):

Our diesel fuel sulfur program is designed to minimize adverse interactions between this program and the gasoline sulfur program that may occur for a refiner. By adopting these diesel fuel requirements now, we allow the refining industry significant lead time to accommodate changes to both gasoline and diesel fuel production in an efficient, coordinated manner. The implementation date of the diesel program is set more than 2 years after the start date of the gasoline program. We expect that refiners will make full use of the gasoline program phase-in provisions and the diesel fuel temporary compliance option to organize the scheduling their desulfurization projects in their best economic interest.

As discussed elsewhere in this document and in the preamble, we believe that the dates of the requirements and the options available to refiners to stagger their diesel and gasoline projects will permit a smooth introduction of low sulfur gasoline and low sulfur diesel fuel. In Chapter 4 of the RIA, we specifically analyzed the capital, engineering, and construction demands of the gasoline and diesel program together, incorporating the various options in both programs, to conclude that the burden on refiners will not be excessive.

In addition, refiners that are granted small refiner status and refiners marketing gasoline in the Geographic Phase-in Area have additional options in the scheduling of their gasoline and diesel programs. As described in the preamble and elsewhere in the rulemaking documents, these refiners may choose to extend their interim gasoline sulfur standards if they produce all of their diesel fuel at 15 ppm by 2006.

ISSUE 10: [RESERVED]

ISSUE 11: NONROAD FUEL/VEHICLE STANDARDS

(A) EPA should apply the proposed fuel and engine/vehicle standards to nonroad sources as well, since they contribute significantly to ozone and PM emissions.

(1) Commenters provided no supporting information or detailed analysis. Approximately 60 private citizens made this comment.

Letters:

20/20 Vision (IV-F-58)
American Truck Dealers Line Representative Committee (IV-F-191) **p. 126**
CA Air Resources Board (IV-F-190) **p. 13**
CA Environmental Protection Agency (IV-F-190) **p. 18**
CA Natural Gas Vehicle Coalition (IV-F- 190) **p. 135**
CO Public Interest Research Group (IV-F-191) **p. 219**
Chuang, Henry (IV-F- 117) **p. 265**
Chung, Payton, et. al. (IV-D-133)
Citizens for a Better Environment (IV-F-3)
Clean Air Agency (IV-D-207) **p. 2**
Coalition for Clean Air (IV-F-190) **p. 177**
Coalition on the Environment and Jewish Life (IV-F-184)
Community Coalition for Change (IV-F-190) **p. 74**
Consumer Policy Institute, NY (IV-F-116) **p. 305**)
DaimlerChrysler (IV-D-284) **p. 6**
Economic & Social Justice (IV-F-117) **p. 236**
Engine Manufacturers Association (IV-F-33, 174, 116) **p. 43** (IV-F- 117) **p. 39** (IV-F-191) **p. 39**
Environmental Defense (IV-F-56, 117) **p. 81**
Environmental Law & Policy Center of the Midwest (IV-F-6)
Fletcher, Robert E. (IV-F- 117) **p. 175**
Flowers, Bobbie (IV-G-67)
Freechild, Aquene, et. al. (IV-G-60)
GA Public Interest Research Group (IV-F- 117) **p. 268**
IL Public Interest Research Group (IV-F-18)
Mayor and citizens of Fort Collins, CO (IV-F-191) **p. 211**
NH DES (IV-D-150) **p. 1**
NY DEC (IV-F-52)
NY DEP (IV-F- 116) **p. 73**
NY State Attorney General's Office (IV-F-61)
Natural Resources Defense Council (IV-F-75, 190) **p. 102** (IV-F-191) **p. 68**
Ozone Transport Commission (IV-F-55)
PA DEP (IV-D-100) **p. 1**
Packard, Josh (IV-G-54)
Pandey, Stacey (IV-F-117) **p. 274**

Pecoraro, Elizabeth (IV-F-117) **p. 117**
Riggles, Ruth, et. al. (IV-D-102)
Smith, Bryan R., et. al. (IV-D-105)
South Coast Air Quality Management District (IV-F-185)
TN Environmental Council (IV-F- 117) **p. 154**
Tseng, Joyce, et. al. (IV-D-03)
WI Department of Transportation (IV-D-241) **p. 1**
Wilderness Society (IV-F-117) **p. 217**
Williams, Mary, et. al. (IV-D-122)

(2) Commenters recommended that EPA accelerate its program development strategies for nonroad diesel engines and fuels and adopt engine standards and a sulfur cap for nonroad heavy-duty diesels and fuel that are equivalent to those for on-road heavy duty diesels. The commenters noted that EPA should use the 2001 technology review to strengthen the nonroad diesel program.

<u>Letters:</u>

CA Air Pollution Control Officers' Association (IV-D-109) **p. 2**
CA PIRG (IV-F- 190) **p. 280**
CT DEP (IV-D-142) **p. 1**
City of Portland (IV-D-198) **p. 2**
City of Seattle (IV-D-297) **p. 2**
IA Department of Natural Resources (IV-D-201) **p. 1**
IL Environmental Protection Agency (IV-D-193) **p. 2**, (IV-D-308) **p. 2**
MD DOE (IV-D-163) **p. 1**
Metropolitan Washington Air Quality Committee (IV-D-34) **p. 2**
NY DEC (IV-D-239) **p. 3**
NY State Attorney General's Office (IV-D-238) **p. 1**
NYC DEP (IV-D-209) **p. 2**
OR DEQ (IV-F- 191) **p. 164**
Ozone Transport Commission (IV-D-249) **p. 3**
STAPPA/ALAPCO (IV-D-295) **p. 27-28**, (IV-F-32, 78, 117) **p. 29** (IV-F- 191) **p. 32**
Stuckey, Stephanie (IV-D-182) **p. 1**
TX Natural Resource Conservation Commission (IV-G-3) **p. 3**
Tri-Met (IV-D-96) **p. 1**
WI DNR (IV-D-291) **p. 2**

(3) One commenter suggested that the same emission goals can be met if both on road and off road diesel are simultaneously brought into compliance in 2008.

<u>Letters:</u>

WY Refining Company (IV-F-191) **p. 58**

(4) One commenter requested that EPA clean up the ships and trains that are

responsible for a large percentage of diesel emissions in the Los Angeles Basin.

Letters:

Stewart, Jim (IV-F-170)

(5) One commenter noted that the relatively reasonable cost estimates of the proposed rule speak in favor of extending the standards to nonroad diesels.

Letters:

Environmental Defense (IV-F-169)

(6) The technological advances that will occur in order to meet future, more stringent highway heavy-duty diesel standards will carry over to nonroad equipment, but only if very low sulfur diesel fuel is available for this sector as well.

Letters:

NESCAUM (IV-D-315) **p. 12**

(7) Nonroad diesel engines contribute as much as 40% to total diesel particulate emissions.

Letters:

American Lung Association (IV-D-270) **p. 26**
Consumer Policy Institute (IV-D-186) **p. 3**

(8) Commenter noted that nonroad heavy duty diesel engines emit the same total amount of pollution and should be controlled to a similar degree.

Letters:

Northwest District Association (IV-D-117) **p. 2**
OR Toxics Alliance (IV-D-175) **p. 2**

Response to Comments 11(A)(1) through (8):

We agree that nonroad sources are significant contributors to ozone and PM emissions. We have promulgated two final rules for nonroad diesel engines (See 59 FR 31306, June 17, 1994 and 63 FR 56968, October 23, 1998) and will be reviewing these standards in the 2001 technology review. In particular, we will be reviewing the need for and appropriateness of more stringent PM standards for these engines and the need for more stringent sulfur limitations on nonroad diesel fuel. We have made no decisions on these issues, which are not raised in this rule. We believe that any new requirements for nonroad diesel engines and fuel would need to be carefully considered in the context of a proposal specifically addressing nonroad diesel engine emission standards.

We have also promulgated standards for marine engines (see e.g. 64 FR 73300, December 29, 1999) and locomotive engines (63 FR 18978 April 16, 1998) and will continue to review emissions from such engines in the future. We have also worked with California to attempt to address emissions from those engines in Los Angeles.

We neither proposed nor will we promulgate at this time any regulations on nonroad engines or fuel. The many issues connected with any rulemaking for nonroad engines and fuel warrant serious attention, and we believe it would be premature today for us to attempt to raise potential resolutions to them.

(B) EPA should promptly address the need for low sulfur nonroad diesel fuel.

(1) EPA appears to be planning to implement a Tier 3 nonroad regulatory program that will drive 2004 like on-highway engine technologies to the nonroad market. EPA should assure that nonroad engines operate in-use on the same or better fuel quality as the corresponding on-highway engines with the same or similar technologies. Nonroad engines that use EGR systems to control emissions will require low sulfur diesel fuel to ensure the effectiveness of emission reductions. EPA and CARB representatives have indicated an interest in moving to aftertreatment forcing emission limits and skipping the intermediate step of EGR forcing emission limits. If this approach is taken, then the importance of requiring the availability of low sulfur nonroad fuels is underscored even further. Given these concerns, EPA should establish a clear roadmap for the future of nonroad engine regulations and the nonroad diesel fuel sulfur level.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 18-19**

(2) EPA should lower the sulfur level in nonroad diesel fuel to help reduce the potential contamination and enforcement concerns associated with managing the distribution of two types of diesel fuel.

Letters:

Association of International Automobile Manufacturers (IV-D-259) **p. 2**
Engine Manufacturers Association (IV-D-251) **p. 22**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 37**

(3) Any clean fuel standard promulgated in this rulemaking should be extended to nonroad diesel fuel as well. It would be more costly and inefficient to reduce sulfur in on-road and nonroad diesel in two separate steps. The application of this standard to nonroad fuel will facilitate technological development in emission control similar to that occurring for onroad sources and would lead to significant environmental benefits.

Letters:

Environmental Defense (IV-D-346) **p. 13-14**

International Truck & Engine Corp. (IV-D-257) **p. 12**
National Automobile Dealers Association (IV-D-280) **p. 3**

(4) Commenter asserts that without knowing the sulfur level for nonroad fuel, commenter cannot quantitatively assess the total refining costs, other than to state that EPA's prediction of the costs for on-road diesel are a factor of 2-3 times too low.

Letters:

British Petroleum (IV-D-242) **p. 6**

(5) Nonroad diesel emissions are significant, and an integrated on and nonroad rule will help communities sustain air standards.

Letters:

MD DOE (IV-D-59) **p. 1**
Metropolitan Washington Air Quality Committee (IV-D-58) **p. 2**

Response to Comments 11(B)(1)-(5):

See Response to Issue 11(A) and Response to Issue 8 regarding contamination issues. The distillate fuel stream is currently divided into on-highway diesel fuel and nonroad/other distillate fuel. This rule does not change this division.

(C) EPA needs to apply the same requirements to nonroad sources and diesel fuel to ensure fair and equitable treatment between different diesel engine sources.

(1) Commenter provides no further supporting information or detailed analysis.

Letters:

American Trucking Association (IV-F-191) **p. 42**

(2) EPA's action violates the APA since it is arbitrary and capricious and since it lacks a rational basis. EPA has not provided a rational basis for the proposed disparate treatment of onroad and nonroad sources. EPA's proposal regulates onroad sources while ignoring similarly powered nonroad sources that are significant contributors to criteria pollutants. The same issues regarding costs, leadtime, environmental impacts and impacts on competitive relationship in the marketplace apply equally to the regulation of onroad vehicles. Commenter provides significant discussion regarding the legal issues and logistics associated with subjecting onroad and nonroad sources to different requirements and asserts that the record simply does not support the conclusion that a dual regime is technically possible since the low sulfur diesel (15 ppm) is likely to become contaminated by the presence of much higher sulfur nonroad diesel fuel. EPA should amend the proposed rule to incorporate requirements for onroad and nonroad diesel emission sources.

Letters:

American Trucking Association (IV-D-269) **p. 7-12**

Response to Comments 11(C)(1) and (2):

We are not required under the APA to regulate all emission sources at the same time. In fact, prior to 1990, we were not even permitted to promulgate new engine standards for nonroad engines. We acknowledge that nonroad engines are a significant source of pollution and, as discussed above, have instituted several rulemaking to control emissions from these engines in the past ten years, including stringent standards for locomotive engines. However, nonroad engines are regulated under a different section of the Clean Air Act (section 213, rather than section 202), and there are unique issues associated with these engines that generally require us to regulate these engines separately from on-highway engines. Indeed, we have needed to promulgate regulations for various different categories of nonroad engines separately from one-another because of the special issues associated with each category of engine and the differences between particular categories of nonroad engines. For example, several categories of nonroad engine use different test cycles, which are different from the federal on-highway diesel test cycle. Also, nonroad engines are used in different types of equipment which create different implementation and feasibility issues.

Our current rule no more discriminates against on-highway engines than our rules regulating nonroad engines discriminate against those nonroad engines. Indeed, under the commenter's analysis, any time we regulate any single type of source, we are required to regulate all sources. This would lead to an irrational administrative paralysis, because such a rulemaking would be inordinately large and unwieldy.

This rule is clearly justified under the provisions of the Clean Air Act and we have shown this rule to be a cost-effective method of reducing emissions of ozone precursors and PM. We will be reviewing the need regulations for further regulation of nonroad engines in the context of the 2001 feasibility review.

Regarding the commenter's concern for contamination of highway diesel fuel by nonroad fuel, as noted above, highway and nonroad diesel fuels have needed to be segregated for several years because highway diesel fuel is already lower in sulfur than nonroad diesel fuel. Moreover, as discussed further in chapter VIII of the RIA and section 7(C) of the preamble, the rule includes enforcement and compliance provisions to assure that highway diesel rule subject to the15 ppm sulfur limit is not contaminated with high sulfur products like nonroad diesel fuel.

(D) EPA should regulate locomotives as part of this effort or as a separate effort to reduce overall emissions since they are a significant contributor.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Tseng, Joyce, et al (IV-D-3)

Response to Comment 11(D):

EPA already regulates emissions from locomotives under 40 CFR parts 85, 89, 92. The Agency issued a final rule on emission standards for locomotives and locomotive engines two years ago (63 FR 18977, April 16, 1998). However, the Agency does not currently regulate locomotive fuel.

(E) EPA should clarify whether nonroad diesel will be subject to the proposed sulfur standard as soon as possible.

(1) Commenters provide no further supporting information or detailed analysis on this point (but see further summary on related issue under Issue 8.5.8(A)).

Letters:

Frontier Oil Corporation (IV-F-116) **p. 204**
Gary-Williams Energy Corporation (IV-F-43)

(2) Since such a small portion of Alaska's fuel is used on-highway, EPA must clarify exactly when and how nonroad fuel will be regulated. This information is critical for Alaska refiners to be able to make a decision regarding whether to exit the market for on-highway diesel. Alaska refiners will not invest in desulfurization equipment if it is unlikely that low sulfur standards will be applied to nonroad diesel, which comprises 95 percent of the diesel fuel market in the State. EPA should also address what will be included under the definition of regulated nonroad diesel (i.e., will it include fuel for fishing boats, power generation, construction, etc.?). It is critical that EPA disclose what it intends to do regarding all types of diesel or, at the very least, publish a timeline of when it intends to make such decisions known.

Letters:

Williams Energy Services (IV-D-167) **p. 4**

(F) EPA should make decisions on nonroad diesel sulfur requirements at the same time, especially, many commenters note, to improve refiners' ability to plan desulfurization decisions.

(1) Commenter provides no further supporting information or detailed analysis.

Letters:

CA Air Resources Board (IV-D-203) **p. 5**
Environmental Defense (IV-D-346) **p. 13**
San Joaquin Valley Air Pollution Control District (IV-D-56) **p. 2**
Tesoro Petroleum (IV-F-191) **p. 26**

(2) Refiners cannot determine what facility changes will be necessary without knowing what sulfur level will be specified for nonroad diesel. Changes to the

distribution system to accommodate low sulfur diesel will be influenced by the nonroad diesel requirements. One commenter recommends nonroad diesel rules in 2001 with a 50 ppm sulfur level. Another commenter notes that combining on- and nonroad regulations might eliminate the need for any phase-in or special treatment for small refiners.

Letters:

American Petroleum Institute (IV-D-343) **p. 54**
Big West Oil, LLC (IV-D-229) **p. 3**
ExxonMobil (IV-D-228) **p. 10**
Koch Industries (IV-D-307) **p. 2**
Marathon Ashland Petroleum (IV-D-261) **p. 3, 56-57, 89-90**
National Petrochemical & Refiners Association (IV-D-218) **p. 16**
Phillips Petroleum Company (IV-D-250) **p. 6**
Sinclair Oil Corporation (IV-D-255) **p. 7-8**
Western Governors' Association (IV-G-41) **p. 1**

(3) This is another reason to withdraw and reconsider the proposal.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 19**

(4) Commenter notes that this does not mean that the desulfurization schedules should necessarily overlap.

Letters:

CO Petroleum Association (IV-D-323) **p. 3**

(5) Disparities in sulfur levels create economic incentives for consumers to use less expensive, high sulfur fuels. Also, air quality and visibility benefits are missed if high sulfur fuels are not controlled. Therefore, a coordinated strategy should be used.

Letters:

Sinclair Oil Corporation (IV-D-255) **p. 8**
Western Governors' Association (IV-G-41) **p. 1-2**

Response to Comments 11(E) and (F):

This program covers only highway diesel engines and highway diesel fuel. However, our potential plans for nonroad diesel engines, and especially the sulfur content of nonroad diesel fuel, including jet fuel, are related.

We believe that any new requirements for nonroad diesel fuel would need to be carefully considered in the context of a proposal for further nonroad diesel engine emission standards. For the nonroad program, we expect to use the same systems-based approach as we used for the Tier 2/Gasoline Sulfur program and today's highway diesel fuel and heavy-duty engine standards program. This is because of the close interrelationship between fuels and engines–the best emission control solutions appropriately balance fuel modifications and engine improvements. This is especially significant given that engine manufacturers and diesel fuel refiners would need to address potential challenges such as capital cost, leadtime, and engineering and construction resources, of simultaneously meeting the highway standards under this program with the nonroad standards that may be implemented. Thus we need to address issues in both the fuel and engine arenas together.

The many issues connected with any rulemaking for nonroad engines and fuel warrant serious attention, and we believe it would be premature today for us to attempt to raise potential resolutions to them. We plan to initiate action in the future to determine whether and to what extent proposals covering further regulation of both nonroad diesel fuel and engines is appropriate.

Given the severe damage to the engine that could occur if nonroad diesel fuel is used in a heavy-duty vehicle subject to today's standards, we believe that there will be little temptation for users of such engines to use nonroad fuels in these engines.

(G) A 50 ppm sulfur cap for both on- and nonroad diesel fuel would have a larger pollution improvement at lower cost than the proposed rule.

(1) Commenter provides no further supporting information or detailed analysis.

<u>Letters:</u>

Cenex Harvest States Cooperatives (IV-F- 191) **p. 232**

<u>Response to Comment 11(G):</u>

As described below, we are not regulating the sulfur content of nonroad diesel fuel under today's action. For the reasons described in Issues 3 and 4, above, a 50 ppm cap on the sulfur content of highway diesel fuel will not allow highway diesel engines to meet the emission standards adopted today given the severely sensitive nature of the aftertreatment technologies for controlling diesel engine exhaust. These technologies will be necessary for attaining the air quality goals of today's program.

(H) EPA should evaluate the potential effects that the ultra-low sulfur diesel will have on nonroad equipment. (See also Issue 4.6, Point (H).)

(1) Since it is apparent that this rule will exacerbate current supply and distribution problems and as a result, will force the use of on-highway fuel in nonroad equipment, EPA should study the effects of using the ultra-low sulfur diesel in this equipment. Some commenters specifically recommend that EPA work with the U.S. Department of Agriculture and the Department of Energy to ensure that the final rule addresses concerns about farm engine performance by conducting an analysis of the technological requirements and availability, price, and farm engine performance implications of moving to an ultra-low standard. The USDA states that EPA appears to believe that there

are no engine/equipment issues other than lubricity, but EPA fails to provide scientific test data on lubricity or any other engine performance concern to bear out its opinions. USDA also notes the need to consider nonroad agricultural engines in considering maintenance benefits reported in the RIA.

Letters:

Agricultural Retailers Association (IV-D-178) **p. 3**
Agricultural organizations as a group (IV-D-265) **p. 3**
National Council of Farmer Cooperatives (IV-D-351) **p. 7**
North American Equipment Dealers Association (IV-D-194) **p. 3**
USDA (IV-D-299) **p. 2**

(2) EPA needs to evaluate the cost impacts on agricultural machinery. Commenter also notes that EPA's B/C analysis appears to be based on miles traveled, which is not an appropriate metric for consumption of on-road diesel in farm machinery. Commenter suggests that EPA also evaluate cost/benefits in terms of fuel consumption. Commenter notes that 3 of 4 farmer co-ops sell almost exclusively on-road diesel to farmers.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 8-9**

Responses to Comment 11(H):

There is really little distinction between nonroad engines and the existing fleet of highway engines with respect to fuel effects. We have no evidence to support the comment that fuel quality that is acceptable for highway engines, such as low sulfur diesel fuel, will be unacceptable for nonroad engines. In fact, nonroad and harvest equipment are frequently fueled with federal highway diesel fuel and California low sulfur/low aromatics diesel fuel today without problems.

Any potential problems related to lubricity are resolvable through the use of diesel fuel additives as discussed in section IV of the preamble, chapter IV of the RIA, and elsewhere in this document. A variety of commonly used (in the U.S. and around the world) lubricity additives exist today which are highly effective. We have included the cost for these additives in today’s rule. We intend to work with ASTM and the refiners to ensure that they complete the process they have already begun to define a lubricity test and standard for diesel fuel.

Problems with leaking seals due to California low aromatics diesel fuel during the early 1990's were addressed by new materials for replacement parts. This issue is not expected to resurface since highway engines and nonroad engines have essentially all been made compatible with low aromatics diesel fuel by now.

We believe that any other potentially negative impacts on existing engines would have surfaced by now given the wide variety of real world experience with low sulfur diesel fuels. Since 1993, all highway diesel fuel in the U.S has had to be at a maximum of 500 ppm sulfur, down from approximately 3000 ppm. Much of the fuel used in nonroad applications is also less than 500ppm in many parts of the country (e.g., the Midwest where some farmer cooperative refiners supply only 500 ppm sulfur diesel fuel and in PADD4 where much of the pipeline system only transports 500 ppm diesel fuel). In addition, since 1993, California has required all highway diesel fuel and all fuel used in many nonroad applications to be at 500 ppm sulfur in addition to meeting a low aromatics specification. The result in California has been an average sulfur level of approximately 140 ppm, with some refiners producing diesel fuel with sulfur levels as low as 30 ppm. Since 1992, the majority of the highway diesel fuel in Sweden has contained less than 10 ppm sulfur as well as very low aromatics. In the 1990s, the tax subsidy in Sweden was extended to nonroad fuel. Thus, fuel used in nonroad applications in Sweden for the last several years has also been low sulfur/low aromatics diesel fuel. This provides real world, as opposed to test laboratory, experience with low sulfur fuels used in nonroad engines to provide confidence that problems are highly unlikely to surface. While not specific to nonroad engines, other parts of the world, including Great Britain and Germany have already moved to sulfur levels of 50 ppm or less for use in highway diesel engines, also indicating that these low sulfur fuels are compatible with the diesel engines produced today. (Refer to Chapter IV.C.3 of the RIA for more information on this subject.)

Conversely, low sulfur diesel fuel should provide a maintenance, reduced engine wear, and durability savings due to a reduction in the generation of sulfuric acid in the engine and exhaust system, leading to longer oil change intervals, and/or longer engine and exhaust system lives.

(I) Opposes the potential use of a "10 times" on-road/nonroad sulfur ratio as the basis for setting an nonroad sulfur standard.

(1) Commenter notes that EPA uses the "10 times" ratio to describe the current on-road to nonroad ratio (500 to 5000 ppm). Commenter argues that this is merely a mathematical exercise, not a scientifically-based ratio. Any change in the nonroad sulfur requirements should be based on appropriate scientific considerations.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 7-8**

Response to Comment 11(I):

We only used the “10 times” factor to describe the sulfur level of highway diesel fuel in comparison to nonroad diesel fuel. Any nonroad diesel fuel sulfur standard that may be established in the future would not be based on a ratio–we would determine the standard using the same procedures and methodolgies (i.e., air quality need, technological feasibility, safety, and cost) we used for establishing the highway diesel fuel standard under today’s action.

(J) EPA's proposed product transfer document (PTD) system for heating oil and other nonroad diesel fuel is unnecessary.

(1) Heating oil and other nonroad distillates are already dyed and are accompanied by substantial paperwork, including a legend on the bill of lading required by the IRS, which states that the fuel cannot be used on-road. Current regulations more than adequately inform all parties that heating oil and other nonroad diesel cannot be used in highway vehicles.

Letters:

Independent Fuel Terminal Operators Association (IV-D-217) **p. 15-16**
New England Fuel Institute (IV-D-296) **p. 8**

Response to Comment 11(J):

Today's rule retains the previously established Product Transfer Document requirement regarding the identification of dyed, tax-exempt highway diesel fuel. This provision is useful for wholesale purchaser-consumers that need to know that the diesel fuel they purchase is appropriate for tax exempt motor vehicle use despite the presence of red dye.

(K) EPA should develop policies that create economic incentives for programs to retrofit existing nonroad diesel engines such as programs that would allow stationary sources to earn NO_x or particulate emission reduction credits as a result of investing in retrofits of nonroad engines.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

Environmental Defense (IV-D-346) **p. 14**

Response to Comment 11(K):

We are reviewing possibilities to encourage retrofits of highway and nonroad engines, but these activities are being handled separately from this rule.

(L) EPA inappropriately suggests in an example that a pump which is used by nonroad and on-road sources must carry low sulfur diesel. This basically directs nonroad equipment to comply; instead, EPA should focus on the fuel, not the pump.

(1) Commenter provides no further analysis on this point.

Letters:

Cenex Harvest States Cooperatives (IV-D-232) **p. 15-16**

Response to Comment 11(L):

Diesel fuel that is available for sale as motor vehicle diesel fuel must be accurately labeled as 15 ppm sulfur or 500 ppm sulfur diesel fuel as described under Section VII.C.2.c of the preamble. Nonroad diesel fuel must also be labeled appropriately.

Under any multiple-fuel program like today's program with the temporary compliance option and hardship provisions, clearly labeling fuel pumps is vital for end users to distinguish between the various grades of fuel available. We received comments on our proposal that concurred with our assessment that pump labels, in conjunction with vehicle labels, would help to prevent misfueling of motor vehicles with high sulfur diesel fuel. However, in the proposal, we also sought comment on more complex and costly approaches to discouraging misfueling such as unique pump nozzles and filler inlet sizes. (The unleaded gasoline program used fuel filler inlet restrictions and pump nozzle sizes as a mechanism to discourage misfueling.)

Despite the potential for some inadvertent misfueling under the optional compliance and hardship provisions of our diesel fuel sulfur program, we have decided not to set any nozzle/interface requirements (for the reasons described in Section VII.C.2.c of the preamble). If additional information arises that warrants reconsideration of the need for unique nozzles and inlet restrictors, we would plan to work with the industry to develop a workable solution that addresses their concerns.

In addition to the required labels on diesel fuel pumps (as described in more detail in Section VII the preamble), we believe that the use of color-coded nozzles to distinguish the grades of diesel fuel might be useful in preventing accidental misfueling. While we are not finalizing any requirements today, we plan to work with the industry over the next several years to develop a system for color-coding the nozzles that is consistent with current industry practices and other regulatory requirements.

(M) Agrees that nonroad diesel should continue to meet red dye requirements.

(1) Commenter provides no further analysis on this point.

<u>Letters:</u>

Cenex Harvest States Cooperatives (IV-D-232) **p. 16**

<u>Response to Comment 11(M):</u>

Today's rule does not affect the dye requirement for nonroad (also known as off-highway or off-road) diesel fuel. The existing dye requirements remain in effect.

In addition, today's action also grants Alaska's request for a permanent exemption from the dye requirement of 40 CFR 80.29 and 40 CFR 80.446 for the entire state. The costs of complying with the low sulfur (both the current 500 ppm sulfur and new 15 ppm sulfur) diesel fuel requirements could be reduced significantly if Alaska were not required to dye the non-highway fuel. Dye contamination of other fuels, particularly jet fuel, is a serious potential problem. This is a serious issue in Alaska since the same transport and storage tanks used for jet fuel (which is more than half of Alaska's distillate market) are generally also used for other diesel products, including off-highway diesel products which are required to be dyed under the current national program. This issue is discussed further in the RIA (Chapter IX).

(N) EPA should maintain a higher nonroad diesel fuel standard in order to minimize costs to farmers and small refiners.

(1) Commenter provided no additional supporting information or detailed analysis.

Letters:

Agricultural Retailers Association, et. al. (IV-D-148) **p. 1**
American Farm Bureau Federation (IV-F-5)

Response to Comment 11(N):

See response to 11(E) and (F).

(O) There are unlikely to be adverse effects on off-road equipment resulting from the use of ultra-low sulfur diesel.

(1) Commenter notes that they have discussed the issue of low sulfur diesel fuel with numerous key organizations in Sweden (including contractors' and agricultural equipment suppliers) and that beyond some initial problems with fuel pumps (which was quickly resolved by using a lubrication additive), there have been no increase in service problems or engine malfunctions as a result of the use of low-sulfur fuel.

Letters:

MTC AB (IV-G-42), **p. 1**

Response to Comments 11(O):

Refer to Response to Comments 11(H).

(P) The production of low-sulfur off-road diesel should be addressed by incentives rather than command and control.

(1) The state of the agricultural economy is such that it cannot withstand additional costs. An incentive structure would help introduce low sulfur diesel universally without imposing a financial burden on the agricultural community.

Letters

Western Governors' Association (IV-G-41) **p. 1**

Response to Comment 11(P):

See response to comments 11(E) and (F).

ISSUE 12: ADMINISTRATIVE, PROCEDURAL AND LEGAL REQUIREMENTS

Issue 12.1: SBREFA

(A) The SBREFA process does not meet the legal requirements of 5 USC 609(b)(1).

(1) SBREFA requires that, prior to the publication of the Initial Regulatory Flexibility Analysis (IRFA), EPA must notify the Chief Counsel for Advocacy of the SBA and provide information on the potential impacts of the proposed rule on small entities. EPA failed to comply with Section 609(b)(1) since it did not provide the Chief Counsel with adequate information on the potential effects of the proposed rule on small businesses. The report issued by the Panel convened by the Chief Counsel to receive information on the rule indicates that "....EPA was unable to provide to the Panel its own assessment on the appropriateness of the standard in the 5-40 ppm range." This report indicates that the Panel was not able to evaluate the potential for less sulfur sensitive aftertreatment technology to be developed that might allow for a higher sulfur cap. What little information was provided to the Panel was inadequate for completing an accurate evaluation of the impact to small businesses.

<u>Letters:</u>

Western Independent Refiners Association (IV-D-273) **p. 4-5**

(2) The data supplied by EPA to the SBREFA Panel were inadequate. The Panel report indicates that EPA analyzed the costs of the proposed rule on small refineries by relying on a 30 ppm standard, which is irrelevant and useless for accurately determining the impact to small refiners of a 15 ppm standard. As a result, the cost impacts to small refiners are vague as illustrated by EPA's statement in the RIA, which acknowledge that a typical small refiner cost could be as much as 50 percent higher than the projected estimates.

<u>Letters:</u>

Western Independent Refiners Association (IV-D-273) **p. 5-6**

(3) Because the SBREFA Panel never received meaningful comment from the small businesses the Act was designed to protect, the SBREFA process has been subverted. Given EPA's failure to provide the essential information to the Panel, it was impossible for small business representatives to offer advice and recommendations as to the potential impacts of the proposed rule. EPA must conduct the SBREFA process again and reconvene a Panel.

<u>Letters:</u>

Western Independent Refiners Association (IV-D-273) **p. 6**

<u>Response to Comments 12.1(A)(1), (2) and (3):</u>

Commenter believes that EPA failed to provide essential information to the SBREFA

Panel, and as a result it was impossible for small business representatives to offer advice and recommendations on the potential impacts of the proposed rule. Since the panel never received meaningful comment from the small businesses, EPA must reconvene a panel and conduct the SBREFA process again. The commenter objected to the adequacy of information submitted on the sulfur sensitivity of diesel engine afertreatment technology, and on the cost of sulfur control for small refiners.

Section 609(b) of the Regulatory Flexibility Act calls for EPA to "provide the Chief Counsel with information on the potential impacts of the proposed rule on small entities and the type of small entities that might be affected," and for the Panel to "review any material the agency has prepared in connection with [the Regulatory Flexibility Act]." EPA provided a significant amount of information to the Chief Counsel, and to both the panel and small business representatives, on the issues raised by the commenter, as well as other relevant issues. EPA provided, for example, several reports prepared by the manufacturers of emissions control equipment which gave an overview of various diesel aftertreatment technologies and the effect of sulfur. EPA also provided additional information comparing and contrasting various types of emissions control technology, and provided a substantial amount of information in meetings and dialogues with panel members and small business representatives. EPA also provided a study on refinery costs performed for the engine manufacturers, as well as EPA's own initial analysis of refinery costs. In combination this provided information on a variety of scenarios, including a 30 ppm cap as well as an estimate of the incremental costs to go further to lower sulfur levels.

All of this and other information was made available to the Panel members and to the small business representatives. Since EPA had not yet determined what level of sulfur control it intended to propose, EPA did not provide an analysis directly aimed at a 15 ppm sulfur level. However an appropriate and valid purpose of a SBREFA panel is to obtain advice and recommendations to aid EPA in reaching such a decision on a proposal, and that is what occurred in this circumstance. EPA provided information that was available at the time, and that information was significant and fairly informed all parties involved on the issues affecting small refiners. The result was a panel process and resulting report that reflects significant and important advice and recommendations to the agency. As evidenced by the proposal issued by the agency in June 2000, and the final rule adopted today, the Panel process and Report was an important step in developing a menu of options that are available to small refiners to minimize the burdens from this rule while still achieving the emissions benefit expected from the engine emissions and sulfur content standards adopted in the final rule.

The commenter questioned the ability of small refiners and the panel to provide advice and recommendations on a 15 ppm sulfur level, since EPA's cost analysis addressed a 30 ppm level. However, EPA consistently discussed with the Panel and small business representatives that a range of 5 to 40 ppm was under consideration. EPA's analysis discussed 30 ppm. A survey to small business representatives asked information on various sulfur level standards, and information was received from various small business representatives about the costs of different levels of sulfur control, including 15 ppm. See, e.g., Panel Report at Section 7.4.1. The IRFA and proposal were based in part on the variety of information, advice and recommendations obtained from small business representatives on these matters. The panel also recognized that issues of the level of the sulfur standard and the sensitivity of engine technology were still being evaluated by EPA, and that EPA would address these issues in the proposal and all parties, including small business representative, would be able to comment fully at that time. See Panel Report at Section 3.2.

The fact that EPA still had issues to resolve prior to issuing a proposal, and therefore considered a range of options in the SBREFA process and had not fully resolved all technical and other issues does not subvert the SBREFA process. Instead, EPA provided small business representatives and the Panel a significant amount of information and a important opportunity to provide meaningful advice and recommendations that would help EPA to evaluate small business concerns in making these decisions on the specific elements of a proposal. The Panel and small business representatives did in fact provide important advice and recommendations, as reflected by the contents of the proposal and the final rule adopted today. EPA fully complied with the requirements of 5 U.S.C. § 609(b).

(4) The SBREFA Panel's report was untimely. This report was to be provided to EPA within sixty days of the convening of the Panel on November 12, 1999. However, the report was not issued until March 24, 2000.

Letters:

Western Independent Refiners Association (IV-D-273) **p. 6**

Response to Comment 12.1(A)(4):

The Panel report was issued to EPA on March 24, 2000. This was more than adequate time for EPA to fully consider it in developing its proposal. It was also made part of the public record for this rulemaking. All interested parties had a full opportunity to comment on it and the IRFA during the public comment period.

EPA is not required to publish the IRFA in the Federal Register under 5 U.S.C. 603(a). The IRFA was made available for public comment through notice in the Federal Register of it's inclusion in the public docket. A summary was also published in the Federal Register. EPA fully complied with the notice and availability requirements of § 603.

(B) EPA failed to publish the IRFA in the Federal Register at the same time as the proposed rule.

(1) The IRFA for this rule was not published in the Federal Register but merely referenced in a footnote that explained the IRFA was available in the Docket supporting the proposed rule.

Letters:

Western Independent Refiners Association (IV-D-273) **p. 6**

Response to Comment 12.1(B):

See response to comment 12.1(A)(4).

(C) EPA should ensure that there is adequate compliance equity between facilities covered under SBREFA and other similar facilities.

(1) There are compliance equity concerns between SBREFA refineries and the other small refineries in the western region. There must be compliance equity between the classes of facilities EPA has created --this has been successfully addressed in the gasoline rule using the GPA approach. If this issue is not addressed, there would be a strong compliance disincentive for the small non-SBREFA refiners.

Letters

Western Governors' Association (IV-G-41) **p. 3**

Response to Comment 12.1(C):

EPA has evaluated the issues raised by refiners providing diesel and gasoline to the GPA area. As discussed in the Preamble and RIA, this group of refiners face many of the same problems faced by small refiners in transitioning to the new low sulfur diesel requirements. EPA has adopted a provision that will allow GPA refiners additional time to meet the low sulfur gasoline requirements, where they produce low sulfur diesel fuel starting June 1, 2006, i.e. with no extension of the low sulfur diesel requirements. The reasons and basis for this provision are discussed in the Preamble and RIA.

Issue 12.2: Other Administrative/Legal Issues

(A) EPA has failed to meet its requirements under section 202(a)(1) to demonstrate that HDDE significantly and adversely affects public health or welfare.

(1) EPA has failed to demonstrate that HDDE emissions significantly and adversely impact public health or welfare; and has failed to quantify the air quality benefits of the proposed rule. The available evidence does not support a finding that emissions from HDDEs meet the statutory criterion (in CAA Section 202(a)(1)) that such emissions can "reasonably be anticipated to endanger public health and welfare." EPA's assertion that it is authorized to take air quality into consideration under section 202(a)(3)(B) in deciding whether to modify standards under 202(a)(3)(A) is not well founded since subsection (A) makes no reference to air quality in defining the criteria to be used in setting an emission standard, which should be set only after a finding has been made under section 202(a)(1) that the pollutants of concern are reasonably anticipated to endanger public health or welfare. Commenters provided significant discussion on this issue as well as the accuracy of EPA's estimates of HDDE emissions. [see also Issue 2.2]

Letters:

American Petroleum Institute (IV-D-343) **p. 3**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 4-6**

Response to Comment 12.2(A):

The final preamble and RIA for this rule, as well as this Response to Comments document, (in particular, Issue 2 of this document), discusses in detail the reasons for EPA’s belief that emissions from heavy duty diesel engines "cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare." Emissions from these engines significantly and adversely impact public health and welfare in numerous ways, including their contribution to ozone, PM, CO, air toxics, regional haze and acid deposition. We have provided substantial data and other information explaining the nature and significance of this impact. We have also provided the reductions in pollutants expected from this rule, and where available, information on expected reductions in the health and welfare impacts of emissions from heavy duty engines.

Regarding the commenter's discussion of our reliance on section 202(a)(3)(B), the commenter's analysis is incorrect on its face. Subparagraph (B) clearly authorizes EPA to modify standards provided for under subsection (A) in order to address the circumstances the commenter claims would occur (i.e., "the continual promulgation of stricter emission standards as technology improved without regard to whether there was any air quality need or justification for the standards."). In addition, the available evidence clearly shows that this rule is authorized whether EPA relies on section 202(a)(3) or 202(a)(1) for its determination regarding air quality.

(B) EPA failed to propose emissions standards that are technologically feasible or cost-effective as required under section 202(a)(3)(A) of the CAA. [see also Issue 3.2.1]

(1) Section 202(a)(3)(A) requires EPA to propose standards which are technologically feasible and cost-effective; yet EPA has failed to fully consider the feasibility of the NO_x, PM, NTE and SSS standards. Commenters provided significant discussion on this issue citing to case law and other relevant sections of the CAA to support their assertion.
Letters:

American Petroleum Institute (IV-D-343) **p. 86-87**
Cummins, Inc. (IV-D-231) **p. 50-51**

Response to Comment 12.2(B)(1):

EPA disagrees with the comments. The final preamble and RIA for this rule, as well as this Response to Comments document, (in particular, Issue 3 of the RtC), provides considerable explanation regarding the technological feasibility of these standards, including investigation of emission control devices, emissions testing, and detailed engineering analyses. Several commenters also provided information supporting EPA's view that the final standards are feasible. In fact, even a Cummins employee has provided testimony indicating that NO_x adsorber technology were capable of achieving the ninety percent reductions EPA expects them to achieve to meet the standards under this rule.[86] Given the considerable advances that have already been achieved, the steps in development expected, and the long lead time provided by this rule, EPA is confident that the standards promulgated are technologically feasible in the lead time provided.

In addition, EPA disagrees with Cummins regarding its analysis of the requirements

[86] See Memo to Docket, A-99-06, II-E-25.

of section 202(a)(3)(A). The Act requires that EPA take costs into consideration in promulgating standards, and EPA has done that. The standards are primarily designed to provide the greatest emission reduction achievable in the time provided, and cost-effectiveness is not addressed in the statute. Nevertheless, as indicated in numerous documents in this docket, the requirements of this rule do not impose inordinate costs, and in fact are quite cost-effective compared to other potential measures. We have reviewed the expected costs of the rule, taking the comments into account in our final analysis.

Regarding the comment that users will delay purchases of new engines rather than buy newer more expensive engines, the commenter provides no evidence to indicate that such a delay will occur or that it has occurred in the past. Moreover, even if a few individual purchase decisions are changed based on these rules, the long-term effect of these rules will be the continuing and growing use of low-emitting engines in user fleets.

(2) None of the required data has been included in the record showing that the "de-facto" NTE standard is feasible for MY 2004 or MY 2007. The proposed rulemaking does not even identify what the NTE standard would be. The proposed NTE is defective as a matter of law and fact.

Letters:

International Truck & Engine Corp. (IV-D-87) **p. 1-3**

Response to Comment 12.2(B)(2):

The comment regarding MY2004 standards is not relevant; this rulemaking does not establish NTE standards, or any other standards, for MY2004 engines.

Further, the NTE standard is not the “de-facto” 2007 standard. As discussed in the RIA for this final rule, the same emission control technologies will be used to meet the FTP, SET, and NTE standards, though the calibration requirements necessary to meet the various test procedures may vary. The FTP test cycle contains engine operation (low load and low speed operation) which is not covered by the NTE test, and the SET contains low load, high speed operation which is not covered by the NTE test. An engine calibrated to meet the NTE standard only will not necessarily comply with the FTP or SET standard, and vice versa. Therefore, we disagree with the statement that the NTE standard is the de-facto standard.

The proposal did identify the NTE standard that EPA was proposing. The NTE standard contained in the proposal was very clear, see 65 FR 35463 (“*As proposed, the specified value under which emissions must remain is 1.25 times the FTP standard. .... Today’s document proposes to apply the heavy-duty diesel NTE and supplemental steady-state test provisions intended to be finalized as part of the 2004 standards rulemaking. The October 29, 1999, proposal for that rule contained the description of these provisions.*”). The NTE standard promulgated in this final rule is also very clearly identified, in the regulations as well as in the preamble, as being equal to 1.5 times the FTP emission standards.

Finally, the rulemaking record contains significant data and analysis regarding the technological feasibility of the NTE standards contained in this final rule. Specifically, Chapter 3 of the RIA discusses the relevant data on which we have made our determination that the 2007 NTE standard is feasible. This includes, but is not limited to, test data collected in our EPA NVFEL NO_x adsorber and CDPF evaluation program, during which we achieved emission reductions for both PM and NO_x emissions greater than 90 percent across the majority of the NTE control zone.

(3) Section 202(a)(3) of the CAA gives EPA the authority to establish vehicle emission standards which "reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology." EPA has failed to show that the technologies necessary to meet the fuel sulfur standard and the engine and vehicle emission requirements will be available within the proposed timeframe. EPA must wait until these technologies can be more certainly demonstrated before proceeding with this rulemaking.

Letters:

U.S. Chamber of Commerce (IV-D-329) **p. 3-5**

Response to Comment 12.2(B)(3):

As discussed above, the evidence and analysis provided shows that the technologies capable of meeting the engine and vehicle standards (and, as discussed elsewhere, the fuel standards) will be available in the time frame provided. This determination is based on data and analysis, including information received from commenters, regarding the specific technologies expected to be used to meet the standards, the specific hurdles to overcome to meet the standards, and how those hurdles can be overcome.

(C) EPA has failed to provide adequate lead time or the minimum period of stability for the introduction of the new standards as required by the CAA.

(1) In the SOP and in the preamble to the 2004 rule, EPA committed to providing engine manufacturers with more than the minimum three years' period of stability as required by the CAA. EPA should provide more than three years' stability in the implementation of standards as stringent as those finalized for the 2004 rule and the proposed rule.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 42, 85**

Response to Comment 12.2(C)(1):

EPA has provided the period of stability required under the Act. EPA has shown that the standards promulgated today are feasible and appropriate within the time frame permitted, considering costs and other factors. Though the 1995 SOP established a framework for a specific proposed rulemaking, it did not create any binding commitments on any party; indeed, it did not even address leadtime for later rules. Delaying the rule would mean delaying the important public health and welfare benefits achieved by this rule and the commenter has not provided evidence of technological or cost or other factors that would warrant foregoing these health and welfare benefits.

(2) Under the lead time provisions of the CAA, new emissions standards applicable to HD trucks or engines may take effect "no earlier than the model year commencing 4 years after such revised standard is promulgated." The emissions standards recently signed on July 31, 2000, but which have not yet been officially promulgated and published in the FR, must provide the four-year lead time required under CAA 202(a)(2)(C),which would expire during the 2004 model year at the earliest and may not be lawfully enforced before the 2005 model year. In addition, the three year period of stability provision under CAA 202(a)(2)(C) requires that any standards must remain in effect for at least three years. Therefore, the CAA's four year lead time requirement and the three year period of stability requirement precludes EPA from enforcing the proposed standards for heavy-duty gasoline engines and vehicles before model year 2008.

<u>Letters:</u>

Engine Manufacturers Association (IV-D-251) **p. 48-49**
Ford Motor Company (IV-D-293) **p. 7-8**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 34-35**

<u>Response to Comment 12.2(C)(2):</u>

As commenters note, EPA's mandatory Phase 1 standards for heavy-duty gasoline engines and vehicles that were finalized on July 31, 2000 will not go into effect until the 2005 model year. As the commenters state, these standards should remain stable for three model years. Therefore, the Phase 2 standards for heavy duty gasoline engines and vehicles proposed to commence in the 2007 model year will instead be phased in beginning in the 2008 model year.

(3) Even though EPA's 2004 emission standards contain two optional programs that allow manufacturers to certify HDEs to the emission standards in model years 2003 and 2004, participation in these optional programs does not "waive" the lead time or stability requirements with respect to when the proposed standards can become effective.

<u>Letters:</u>

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 34-35**

<u>Response to Comment 12.2(C)(3):</u>

Our final Phase 2 heavy duty gasoline standards do not differentiate between manufacturers based on which program a manufacturer participates in under the Phase 1 rule. All manufacturers will have until the 2008 model year to begin phasing into the Phase 2 requirements.

(4) Opposes phase-in of NO_x standard because it fails to provide an adequate period of stability as required under Section 202(a)(3)(C). [see also

discussion in Issue 3.1.4] EPA's proposed phase-in violates the 3-year stability requirement for engine standards; nor can the SSS and NTE standards applicable to engines meeting the NO_x standard in 2007 be revised in 2008 or 2009 without violating the stability requirement.

Letters:

American Petroleum Institute (IV-D-343) **p. 21**
Cummins, Inc. (IV-D-231) **p. 54**
Engine Manufacturers Association (IV-D-251) **p. 85**
Marathon Ashland Petroleum (IV-D-261) **p. 17**

Response to Comment 12.2(C)(4):

We believe that a phase-in of heavy duty engine standards by percentage of a manufacturer’s production does not violate the stability requirement of section 202(a)(3)(C). On the contrary, a phase-in requires that the engine families in each specified percentage of production be changed only a single time to meet the new standard. That standards for that percentage of production then remain stable. A phase-in merely gives a manufacturer the flexibility to change only a portion of its engine families in any given year, which can lessen the manufacturer’s burden in the initial years of any phase-in. The stability requirement is designed to allow manufacturers to avoid multiple technological changes of the entire production within a short period and to recoup expenditures. A phase-in does not require any particular vehicle or engine family to undergo multiple changes within a three year period, but merely allows the manufacturer to spread out the single technological change over more than one year.

We do, however, agree that the combination of the 100% initiation of the supplemental standards in the 2007 model year, required by the Phase 1 rule, with the phase-in of new NO_x standards for the supplemental tests over the 2007-2010 time frame (particularly in the 2008 and 2009 model years) appears inconsistent with the provision for standard stability. However, for a variety of reasons, we have revised the NO_x phase-in schedule to require a 50% phase-in in the 2007 model year and the remaining 50% phase-in no later than the 2010 model year. Under this approach, the supplemental standards being implemented in the 2007 model year will remain unchanged for all engine families until at least the 2010 model year.

(D) EPA's requirement that manufacturers demonstrate compliance with supplemental test procedures under expanded ambient conditions violates CAA requirements applicable to high altitude standards.

(1) The application of supplemental test procedures to the 2007 standards presents significant issues of technical feasibility and would require a manufacturer to demonstrate compliance up to an elevation of 5500 feet. Section 202(f)(2) of the CAA, as applied to HDEs, only allows EPA to set standards applicable in high-altitude areas if they require proportional reductions (i.e. standards requiring no greater a percentage reduction in vehicle emissions at high altitude than the percent reduction required at low altitude) and in this context, requires EPA to evaluate economic impacts, technical feasibility, and air quality benefits. EPA has proposed an "all

altitude" standard for purposes of demonstrating compliance with the supplemental test procedures and in so doing has failed to follow the clear requirements of the CAA and has exceeded its statutory authority.

Letters:

Cummins, Inc. (IV-D-231) **p. 54**

Response to Comment 12.2(D):

The commenter misreads the statute. Section 202(f)(2) is limited to the "future regulations" discussed in section 202(f)(1), which are limited to engines manufactured before model year 1984.

(E) EPA has failed to meet the requirements under section 211(c)(1) of the CAA.

(1) Under section 211(c)(1), EPA may only regulate sulfur content of diesel fuel if the emissions may reasonably be anticipated to endanger the public health and welfare. However, the medical and scientific evidence relied on by EPA does not support the need to reduce exposure to PM10. To count as benefits, those reductions in attainment areas is contrary to section 211(c). In addition, it is unclear whether the sulfur content would reduce the health effects associated with exposure to fine particulate matter. Also, the uncertainties in existing health risk assessments make it impossible to determine a significant difference in health benefits resulting from a 15 versus a 50 ppm sulfur cap.

Letters:

American Petroleum Institute (IV-D-343) **p. 87-91**

Response to Comment 12.2(E)(1):

EPA has concluded that the emissions products of sulfur in diesel fuel contribute to ambient levels of particulate matter that can reasonably be anticipated to endanger pubic health or welfare. The sulfur in diesel fuel contributes to the particulate emissions of heavy-duty trucks, which are an important contributor to ambient PM levels. The impact of sulfur on particulate emissions from trucks, the contribution of particulate emissions from trucks to ambient PM levels, and the risks to public health and welfare from current and projected levels of PM10, fine PM, as well as the cancer related risk to exposure of diesel PM and other components of diesel exhaust are discussed in detail in Section II of the preamble, Chapter 2 of the RIA, as well as in other sections of this Response to Comments document and Appendix A of the RIA. This information includes consideration of all of the medical and scientific information available to the agency, including information presented in public comments. The contribution of sulfur in diesel fuel to emissions of PM from heavy-duty trucks, and the risk to public health and welfare from ambient levels of PM, are considered significant enough to warrant control of the sulfur content under section 211(c)(1)(A). In addition, EPA considered and has reasonably rejected more stringent controls of motor vehicles under § 202 as an alternative to regulating diesel sulfur. See Section III of the preamble, Chapter III and Appendix A of the RIA.

Commenters appear to argue that the lack of evidence of expected benefits from reducing sulfur to either 50 or 15 ppm, or the lack of a demonstrated difference in expected benefits between a 15 ppm cap and a 50 ppm cap indicate that EPA has failed to making this required showing under section 211(c)(1). However concern with the effectiveness of the fuel level actually adopted by EPA, or with a difference in effect between possible controls, relates to the reasonableness of the level of control adopted by EPA. It does not relate to whether emissions from engines operating with the current levels of sulfur in diesel fuel (which are significantly above either 15 or 50 ppm) present the kind of contribution to air pollution that authorizes EPA to consider and adopt a fuel control under section 211(c)(1). In addition, EPA has shown that there will in fact be significant reductions in PM emissions from this rule, with significant benefits to public health and welfare at a reasonable cost. These benefit include those from the reductions in PM related to the sulfur content of the fuel.

(2) EPA's proposed rule is for emissions from HD engines and all of EPA's analysis and rationale should be based on these engines. In the context of requiring a special diesel fuel for light-duty vehicles, commenter notes that it would be unlawful to EPA to implement a policy goal of encouraging a new light-duty diesel vehicle market to emerge by disregarding the criteria under section 211 of the CAA. On this issue, it is interesting to note that while EPA insists that emissions from diesel engines are harmful to public health, EPA appears to support regulations that would encourage the growth of a light-duty diesel market. In doing so, EPA would require the oil industry to invest in a new product that would involve significant refining, distribution, and infrastructure changes.

Letters:

American Petroleum Institute (IV-D-343) **p. 90-91**

Response to Comment 12.2(E)(2):

The adoption of controls on the sulfur content of diesel fuel is based on EPA’s analysis involving heavy-duty trucks and engines. EPA is not relying on the use of diesel light-duty trucks to justify this rule under § 211(c). While today’s rule will mean that low sulfur diesel fuel will be available for light-duty diesel cars or trucks in the future, EPA is not relying on this as a basis for this rule. It is an expected impact, but the rule is not based on it.

(3) EPA cannot lawfully make the finding required under 211(c)(1)(B) that the emission control devices or systems that are expected to be used to meet the proposed standards are "in general use" or have "been developed to a point where in a reasonable time [they] would be in general use were such regulation to be promulgated." EPA may regulate fuels only if it determines that the emission products of the fuel will significantly impair emission control systems in general use or which would be in general use were the fuel control to be adopted. The technology EPA relies on is not "in general use" nor has it been developed to a point where it would be in general use were such regulation promulgated. One of the commenters provides significant discussion on this issue noting that "testing" and "in general use" stages are clearly not the same, and that EPA and the regulated industry have acknowledged that there are uncertainties regarding the technology that will

be used to meet the standards. Commenter cites to statements made by the auto manufacturing industry as well as to case law to support their position on this issue.

Letters:

American Petroleum Institute (IV-D-343) **p. 5, 87-90**
ExxonMobil (IV-D-228) **p. 9**

Response to Comment 12.2(E)(3):

The preamble and RIA discuss in great detail the feasibility of PM and NO_x aftertreatment technology to be available to meet the model year 2007 emissions standards adopted today. EPA has concluded that given the fuel control adopted today and the lead time provided for model year 2007, that the PM aftertreatment and NO_x adsorber technologies needed to meet the emissions standards will be in general use by that time. Compliance with the requirements of § 211(c)(1) and (2) is also discussed in Appendix A to the RIA.

EPA interprets the phrase "would [or will] be in general use" as used in § 211(c)(1)(B) and (c)(2)(B) to be forward looking, and focusing on general use at the time vehicle emissions standards go into effect. This is consistent with the focus of § 202(a)(3)(A), which provides that EPA is to base its emissions standards on "technology which the Administrator determines will be available for the model year to which [section 202] standards apply."

This is consistent with the decision in Amoco Oil Co. v. Environmental Protection Agency, 501 F.2d 722 (D.C. Cir. 1974). There, the court considered what technology would be "in or near general use in the 1975 or 1976 model years." Amoco at p.739. It focused on availability of emissions control technology for the time period when the emissions standards would go into effect, not for the earlier time when EPA adopted the emissions standards. In that rulemaking, EPA reasonably concluded that catalytic converters would be in general use in the model years 1975 and 1976, that auto makers would rely on catalytic converters for another five years, and that in the spring of 1973 other technologies that might not need control of lead levels in gasoline were still in a testing stage and would not be generally available for model years 1975 and 1976. In that case, it was reasonable for EPA to determine that no technologies other than catalytic converters were in or near general use for purpose of model year 1975 and 1976. Amoco at p.738-9.

The claim that NO_x adsorbers are currently in a testing stage and are not at this time in or near general use is not the important issue under § 211(c)(1) and (2). The question before EPA is whether NO_x and PM aftertreatment technology will be in or near general use for model year 2007. EPA has determined that such aftertreatment technology will be available for general use for that model year. Based on this, EPA has authority to adopt the emissions standards under § 202(a)(3)(A) for that model year and to adopt a fuel control under § 211(c)(1)(B) to limit a fuel component, sulfur, that substantially impairs the emissions control technologies that would be in general use in that time frame, given an appropriate control on the fuel component.

Commenters also object that the current stage of technology development precludes EPA from making the comparison of technologies called for under § 211(c)(2)(B), and therefore EPA cannot take action under § 211(c)(1)(B) until it is able to determine that a technology or technologies are in or near general use. As discussed above, EPA has determined that certain technologies will be in general use for model year 2007. EPA evaluated several technologies, and believes that PM aftertreatment technology, and NO_x adsorber aftertreatment technology, will be in general use in model year 2007, given the level of sulfur control adopted today.

Other technologies, such as compact SCR, would also require control of sulfur in fuel to allow the NO_x and PM standards to be met. The sulfur control adopted today would be required for compact SCR to meet the PM emissions standards. Significant control of sulfur would also be required to achieve NO_x reductions approaching those needed to meet the NOX emissions standards adopted today. In addition, compact SCR is not expected to be in or near general use by model year 2007, given the significant and widespread infrastructure changes that would need to be made for that to occur. There are also significant unresolved issues about how the use of urea would be ensured in-use, so that compliance with the emissions standards could be ensured in-use.

EPA has evaluated what technologies are reasonably expected to be in general use for model year 2007, and whether they are also significantly impaired by the sulfur level in diesel fuel. EPA has reasonably determined that all potential or likely control technologies would require control of sulfur to meet the NO_x and PM emissions standards. In addition, all potential or likely control technologies would require the level adopted today to meet the PM standards. For compact SCR EPA has identified significant problems that indicate that it is not reasonably expected to be in general use by model year 2007, even with a control on sulfur levels, although with the sulfur control adopted in this rule it may find use in some market areas, for example some centrally fueled fleets.

The requirements of § 211(c)(2)(B) are focused on making a threshold determination of whether regulation of sulfur in diesel fuel is appropriate, as compared to no regulation of fuels. It is not aimed at determining the actual level or type of control adopted by the agency, among various potential levels or types of fuel controls. Amoco at pp.736-9. Here, as in the case of unleaded gasoline, all of the technologies that will be in general use in model year 2007 require control of sulfur to meet the model year 2007 emissions standards adopted today. In addition, they require it at the level adopted today. The alternative technologies evaluated by EPA, such as compact SCR, also require control of sulfur, and also require it at the level adopted today. In addition, compact SCR is not expected to be in general use in model year 2007, with or without the sulfur control adopted today. Certain commenters have suggested that additional or different fuel controls would be needed to address concerns over fuel infrastructure changes and use of urea in-use, before compact SCR could be considered in general use. Under all of these circumstances, EPA believes that no further comparison of technologies is required under § 211(c)(2)(B) and that EPA has appropriately made the threshold determinations required under § 211(c)(2)(B) to warrant regulation of the sulfur level of diesel fuel under § 211(c)(1)(B).

(F) EPA has failed to demonstrate that the level and timing of its proposed fuel change would enable advanced exhaust emission control technologies to achieve the Tier 2 standards.

(1) Section 202(I) of the CAA requires EPA to demonstrate the feasibility of its Tier 2 emissions standards for light duty diesel vehicles by establishing a

diesel sulfur control program that will assure the availability of clean fuel to enable the use of advanced exhaust emissions control technology by the time that the low-emitting diesel vehicles are introduced. Commenter provides significant discussion on this issue and concludes that EPA has failed to satisfy its burden the CAA to demonstrate that the level and timing of its proposed diesel fuel change will render its Tier 2 standards feasible by enabling advanced exhaust emissions control technology to achieve those standards.

Letters:

Volkswagen (IV-D-272) **p. +3-7**

Response to Comment 12.2(F):

This issue is not relevant to the current rulemaking. This issue was raised in the Tier 2 rule and was dealt with in that rule. We have not reopened this issue in this rule, but are replying to provide information to the commenter.

As explained in our Response to Comments for the Tier 2 rule, EPA is not required to show the feasibility of the Tier 2 standards for diesel light duty vehicles under section 202(i). Section 202(i) requires EPA to review the appropriateness of new standards for LDVs and LDT1s, and does not distinguish between diesel-fueled and gasoline-fueled vehicles in requiring EPA to review and promulgate such standards. Nothing in the text of section 202(i) provides any justification for dividing these categories of vehicle into different subcategories of diesel-fueled and gasoline-fueled vehicles.

In the Tier 2 rulemaking, EPA also determined that it was not appropriate to promulgate separate, in particular, less stringent, standards for diesel vehicles in the LDV/LDT fleet. Diesel vehicles currently represent a tiny percentage of the LDV/LDT market. Further, diesel vehicles do not represent a critical segment of the market, as gasoline-fueled vehicles can and do exist (in greater numbers) in all segments of the market that are occupied by diesel LDV/LDTs. Thus, gasoline-fueled LDV/LDTs provide for the consumer the full panoply of vehicles in the LDV/LDT fleet. See International Harvester v. Ruckelshaus, 478 F. 2d 615, 640 (D.C. Cir. 1973) ("as long as feasible technology permits the demand for new passenger automobiles to be generally met, the basic requirements of the Act would be satisfied, even though this might occasion fewer models and a more limited choice of engine types. The driving preferences of hot rodders are not to outweigh the goal of a clean environment.").

On the other hand, allowing separate, and less stringent, standards for diesel LDV/LDTs could potentially create substantial problems for the Tier 2 program. If EPA allowed diesel LDV/LDTs to be sold at less stringent standards than gasoline LDV/LDTs, manufacturers would have an obvious incentive to build more diesel-fueled vehicles, resulting in a loss of emissions reductions. EPA therefore cannot justify allowing diesel-fueled vehicles to emit at higher rates than the gasoline-fueled vehicles in this market.

In any case, however, EPA believes that the Tier 2 standards are feasible for diesel LDVs with the diesel fuel sulfur restrictions promulgated in this rule, and considering the flexibilities in the Tier 2 standards with respect to lead-time, interim standards, and phase-in structure. Once the Tier 2 standards are fully phased in, NO_x and PM removal by the exhaust emission controls will need to be approximately 80% (assuming 1 g/mi NO_x and 0.1 g/mi PM engine-out from an LDT4 truck or MDPV - which is consistent with current certification data) for a vehicle certifying to bin 8, which is somewhat less than the removal efficiency that will be required for heavy-duty engines subjected to a test procedure with a considerably higher load factor.

Both Ford and AAM have provided data from light-duty testing to the Tier 2 docket documenting NO_x aftertreatment under lean exhaust conditions that is up to 85% efficient when used with very low sulfur diesel fuels. Similarly, light-duty data for CDPFs provided by Ford and MECA to the Tier 2 docket has demonstrated PM reductions from 80% to greater than 90% when used with such fuels.

In the period leading up to the introduction of lower sulfur diesel fuels, Tier 2 Interim Standards will be in place that are achievable through the use of currently available or near term engine and exhaust aftertreatment technologies[87]. These technologies include the use of advanced fuel systems (e.g., as electronically controlled, high-pressure common rail fuel systems) and cooled EGR to achieve low engine-out NO_x and PM levels, along with the use of conventional diesel exhaust aftertreatment such as diesel oxidation catalysts and/or near-term NO_x reduction technology such as precious-metal-based lean-deNO_x catalysts.

(G) Setting highway diesel sulfur standards based on expectations of future diesel penetration of light duty diesel vehicles is of doubtful legal validity.

(1) Currently, diesel vehicles account for only a tiny fraction of light duty vehicle and light duty truck sales. There is no guarantee that consumer will buy these engines, thus ensuring their success in the market place. The A.D. Little (AVL) study estimates that only 3.5 percent of the new car and light truck sales would be using diesel technology. Even given the unlikely EPA scenario that diesels will account for 50 percent of light duty truck sales in 2010 and beyond, HDDEs would still account for 82 percent of EPA's total highway motor vehicle PM10 emissions inventory in 2020. The petroleum industry should not be forced to invest in the capacity to produce a fuel simply in order to accommodate a segment of the vehicle market that may never materialize.

Letters:

American Petroleum Institute (IV-D-343) **p. 40**
Marathon Ashland Petroleum (IV-D-343) **p. 34-35**

Response to Comment 12.2(G):

We have not set our highway diesel fuel sulfur requirements based on expectations of further penetration of diesel engines into the light duty vehicle market. Though the reductions in sulfur promulgated today will allow such further penetration, this was not the

[87] "Cummins Sees Diesel Feasible for Early Years of Tier 2". Hart Diesel Fuel News, Sept. 20, 1999, p.2.

basis for the rule and is not a primary justification for the rule.

(H) EPA has failed to provide interested parties due process of law.

(1) The due process requirement prohibits EPA from regulating a private party without first providing notice and the bases for its proposed actions, yet EPA has failed to provide justification for many of its proposed requirements. EPA has failed to provide adequate explanation regarding the need for the PM and NO_x emission reductions or the proposed reductions in diesel sulfur content, and has failed to provide any assessment of the air quality benefits resulting from its proposal. The Docket items contain no information on the actual estimates of emissions inventories or actual air quality modeling outputs, and it is unclear whether stakeholders will have adequate time to comment on EPA's modeling efforts. Commenters note several cases where EPA should expand its analysis and provide additional information.

Letters:

American Petroleum Institute (IV-D-343) **p. 92-93**
Cummins, Inc. (IV-D-231) **p. 51-52**

Response to Comment 12.2(H)(1):

EPA fully met its requirements for notice in its proposal. The proposal documented in great detail the air quality need for this rule; in particular, we reviewed the nonattainment status anticipated for the nation without this rule, as well as the numerous other health and welfare concerns associated with diesel emissions. We also specified the tons of NO_x and PM expected to be reduced under this rule. We have updated and supplemented our information in the final rule. EPA provided five opportunities for public oral testimony and approximately 2½ months for written comments in the proposal. We entered new information received after the comment period ended into the docket as such material became available to us. Commenters had sufficient time and ability to comment on the information EPA provided to show the emissions impact of this rule as evidenced by the more than 13,000 comments received on this rule. EPA does not believe that it should wait before promulgating this rule because we have enough information at this time and have determined that these standards are appropriate for model year 2007. Acting now provides lead time and avoids the loss in air quality benefits that would occur if we delayed the rule.

Manufacturers have in the past requested that EPA provide as much leadtime as possible prior to implementation. In fact, the comments of EMA, of which Cummins is a member, requests even more lead time for this rule. Manufacturers and refiners in the Tier 2 requested that EPA promulgate its diesel sulfur rule as soon as possible to allow them to prepare for the Tier 2 rule with full knowledge of their further requirements under this rule. EPA has found that the emission control technologies required by this rule will be feasible in the time frame provided and that the standards promulgated are needed to reduce air pollution that causes or contributes to pollution which may reasonably be anticipated to endanger public health or welfare. Given the substantial emission benefits that this rule will provide and the substantial time period needed for new engines to dominate the total fleet of heavy duty engines, it is critical for these standards to go into effect as soon as possible, especially given that many metropolitan areas have relatively short deadlines for meeting the ozone NAAQS.

The final preamble, RIA and Response to Comments (in particular, the air quality sections of these documents) address the need for this rule and the pollution reductions expected from this rule.

(2) EPA has failed to provide adequate notice of its proposal for HD engines and vehicles by not finalizing the 2004 HD rule prior to the publication of this proposed rule and as a result, has failed to provide interested parties due process of law. Commenters refer to sections of the preamble (65 FR 35463) and specifically note that EPA posted the final 2004 HD rule on August 1, 2000, which gave interested parties only 14 days to review the supplemental test requirements and the effects of the emission standards. EPA has provided an insufficient opportunity to comment on the proposed standards and should extend the comment period and consider comments that are delayed with regard to the heavy-duty diesel issues as related to the supplemental test procedures. Some commenters note that this due process failure is compounded by the fact that the rulemaking record is devoid of any review and analysis by EPA of the impact of the SERTs on the proposed new emission limits, control technologies and measurement techniques. (See also Issue 7.4.3.)

Letters:

American Petroleum Institute (IV-D-343) **p. 92-93**
Cummins, Inc. (IV-D-231) **p. 21, 52-53**
DaimlerChrysler (IV-D-284) **p. 10-11**
DaimlerChrysler AG (IV-D-213) **p. 1-6**
Detroit Diesel Corporation (IV-D-276) **p. 23-26**
Engine Manufacturers Association (IV-D-251) **p. 4, 54-55**
General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 85**

Response to Comment 12.2(H)(2):

Commenters had adequate opportunity to comment on the proposed standards as they relate to the Phase 1 rulemaking signed on July 31, 2000. EPA published the proposed Phase 1 rule in October, 1999 and referred to that proposal in the NPRM for this rule. Though the final Phase 1 rule made minor modifications to what was proposed, the final regulations were very similar to the proposed regulations. EPA notified commenters as soon as possible that the final rule had been signed and posted the rule on our Internet site, as well as publishing a notice in the Federal Register announcing the final rule.

Regarding comments that the signed rule is not the final rule because it had not yet been published, the rule does become final at the time of signature. The Federal Register occasionally makes minor edits to conform with Federal Register style, but no substantive changes are made to final documents. The final rule published on October 6, 2000 is substantively identical to the document signed on July 31, 2000.

EPA also informed commenters that we would review comments on this issue if they were received promptly after the comment period ended. See e.g. Letter to E. Murphy, API, Document No. IV-C-03.

EPA addressed the cost and feasibility implications of the supplemental standards in the proposal and has updated and supplemented its analysis in this final rule.

(3) Despite frequent requests from EMA and its members, EPA never held meaningful discussions with engine manufacturers on the substance of the new diesel fuel sulfur requirements or the more stringent emission levels that were to be proposed. EPA has incorporated numerous complex provisions from the 2004 HD rule into the proposed rulemaking. EPA's actions fail to provide the regulated industry and the interested public with adequate due process. EMA notes specifically that EPA has failed to provide interested parties any meaningful opportunity to review the specifics of EPA's supplemental emission requirements, to assess them in the context of the proposed new emission standards and the emission control technologies to which they will apply, and to comment on them. In addition, EPA has not completed the necessary reviews on these requirements itself.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 5, 54-55**

Response to Comment 12.2(H)(3):

We disagree with these comments. EPA has met on numerous occasions with EMA and its members in the past year regarding heavy duty emission standards, including the standards finalized in this rule. (See Memos in Docket Section IV-E). EMA also had five opportunities to provide oral comments to EPA at the public hearings, as well as to provide written comments on the proposed rule. The proposals for this rule and the Phase 1 rule, as well as meetings with EMA and its members companies since this proposal, included specific discussions regarding the supplemental emission requirements. (See 65 FR 35467-35470.) In contrast to EMA's comments, we have closely reviewed the issue of compliance with the proposed supplemental requirements and have provided specific analysis of that issue in our final RIA See Final RIA, Chapter III.A., particularly Chapter III.A.3.b.vi. We have also been engaged in a testing program related to these standards, which has reinforced our conclusions regarding the feasibility of the standards. We have provided the public with information regarding this program as it has become available to us. See Document Nos. IV-C-08, IV-E-05, IV-E-07. See also response to comment 12.2(H)(2) above.

(4) By failing to provide details or justification for many of its proposed requirements and programs, EPA has failed to provide due process of law under the CAA. EPA cannot subject a private party to the consequences of a rule without providing notice and the bases of the proposed actions. [cites to Ass'n of Nat'l Advertisers, Inc. v. FTC, 627 F.2d 1151, 1165-66 (D.C. Cir. 1979) as an example] Commenter provides additional discussion on the requirements of the CAA in this context and also cites to Portland Cement Ass'n v. Ruckelshaus, 486 F.2d 375, 393 (DC Cir. 1973) and Global Van Lines v. ICC, 714 F.2d 1290 (5th Cir. 1983) to support their assertion that EPA cannot promulgate rules on the basis of inadequate data or on data that are known only to EPA.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 83-84**

Response to Comment 12.2(H)(4):

EPA has provided considerable discussion and underlying information justifying the regulations promulgated in this rule, both at the time of proposal and as supplemented prior to completing this rule. We have met our burden under section 307(d) of the Act.

(5) EPA's feasibility determinations are invalid since EPA relied on non-public data. In making its feasibility determination in the proposed rule, EPA relied in part on confidential data developed as a result of consent decrees entered into between the Government and certain diesel engine manufacturers. EPA has not released detailed technical information concerning the strategies used to meet the NTE requirements and other consent decree requirements that have been subsequently proposed as industry-wide regulations. Without an opportunity to review the technical data underlying EPA's reliance on the certification status of various engines families, manufacturers have not been provided with a meaningful opportunity to respond and comment on the data upon which EPA is relying. Commenters provide significant discussion on this issue and cite to case law, Pub. L. No. 105-277 (1998), and sections of the CAA to support their position on this issue.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 80-81**

Response to Comment 12.2(H)(5):

EPA has not relied on confidential data to justify this rule. The commenter cites to statements that are in the public record. Manufacturers have agreed to meet the Phase 1 standards earlier than required under the Phase 1 rules. Manufacturers have certified engines to meet NTE requirements. All information required to be provided by manufacturers for such certifications is publicly available. The commenter wishes to be provided with confidential business information regarding how particular manufacturers have met, or will meet, these standards. It is of course inappropriate for EPA to provide one competitor with information from another regarding how the competing manufacturer is meeting a standard, even if EPA had that information. EPA has, however, provided in the record, both for this rule and the Phase 1 rule, considerable data and analysis regarding how manufacturers can meet the standards. EPA has relied on data that is in the docket, not on confidential business information. The cases and statutes cited by the commenter, which concern agency reliance on non-public data, are therefore inapposite. In fact, the statutes cited generally contain provisions indicating the need to protect the confidentiality of trade secrets.

(6) One commenter noted that some manufacturers were not involved in the Consent Decree process referenced in the 2004 rulemaking, and that as a result, have not had the opportunity to participate in the discussions with EPA where the new standards and test procedures were first developed. Manufacturers who are not signatories to Consent Decrees for alleged

violations of the CAA are put at a considerable competitive disadvantage. EPA's failure to provide non-Consent Decree signatories adequate opportunity for meaningful comment would be a violation of due process.

Letters:

DaimlerChrysler AG (IV-D-213) **p. 2-5**

Response to Comment 12.2(H)(6):

Daimler Chrysler has been aware of the consent decrees for over two years and has had the opportunity on many occasions to meet with EPA, both as part of industry groups and separately, regarding the supplemental requirements. See, e.g., Docket No. A-98-32, Document Nos. II-E-02-04, 12, 15, 17, IV-E-05, 09, 13, 16. Daimler Chrysler has had full opportunity to provide its comments on these requirements and has had the same amount of time to comment on this rule as other manufacturers. We have provided them with appropriate due process.

(I) The proposed rule is arbitrary and capricious and EPA has exceeded its statutory authority with respect to certain components of the proposal.

(1) Commenter cites to CAA section 307(d)(9)(A) and asserts that EPA has contravened the applicable statutes since certain aspects of the proposed rule will not withstand judicial scrutiny. It is incumbent on EPA in its rulemaking to "articulate... a 'rational connection' between the facts found and the choice made." EPA did not meet this requirement, fully examine the relevant data or provide an adequate explanation for its actions. Commenter cites to case law to support their conclusions on this issue and notes that EPA must adequately address the concerns raised by industry and provide a rational basis for any resulting final rule.

Letters:

Engine Manufacturers Association (IV-D-251) **p. 85-86**

Response to Comment 12.2(I)(1):

EPA disagrees with the comment, which is not supported by facts. EPA has provided considerable factual and analytical support for these regulations and has explained its connection to the conclusions and decisions we are making, as discussed elsewhere in this document and the docket. For example, Chapters II, III, IV and V of the RIA provide detailed examination of the need for this rule, the feasibility of the requirements, and the economic impact of the requirements.

(2) EPA has exceeded its statutory authority in attempting to adopt "NTE" requirements and other supplemental emissions requirements and tests. EPA has failed to demonstrate the technological feasibility, cost-effectiveness or overall efficacy of those supplemental standards. (See also Issue 3.2.1.)

Letters:

Engine Manufacturers Association (IV-D-251) **p. 86**

Response to Comment 12.2(I)(2):

EPA has demonstrated the feasibility of the supplemental requirements and has taken into account the cost of such requirements in promulgating standards in this rule, as required under section 202(a)(3). EPA has included the costs of such requirements in its cost analysis and, though there are no specific requirements for cost-effectiveness in the statute, we have determined the cost-effectiveness of this rule, which is comparable to other control measures. See RIA Chapter V.

(3) EPA has exceeded its statutory authority in proposing to apply a prohibitory definition of "defeat device." (See also Issue 3.2.1.)

Letters:

Engine Manufacturers Association (IV-D-251) **p. 86**

Response to Comment 12.2(I)(3):

The commenter provides no support for this statement. EPA has not revised the definition of defeat device in this rule.

(4) Although the CAA prohibits any rule found to be "arbitrary, capricious, an abuse of discretion, ..." EPA has articulated no rational connection between this proposal and air quality, protection of public health, technological feasibility and cost. Citing court rulings which assess this standard, commenter notes that EPA relied on flawed methodology in determining potential risks of diesel exhaust and benefits of the rule. Commenter asserts that the NTE and SSS standards are arbitrary, with no rational connection between the facts and multipliers selected for the standards and that EPA significantly underestimated the costs of the proposal, and overestimated the emission reductions benefits.

Letters:

American Petroleum Institute (IV-D-343) **p. 85-86**
ExxonMobil (IV-D-228) **p. 6**

Response to Comment 12.2(I)(4):

EPA made clear in its proposal, and in this final rule, the air quality need for the pollution reductions in this rule, as well as the technological feasibility of the requirements. EPA has also shown the need for the low sulfur diesel fuel standards required in this rule. EPA's air quality analysis, discussed in detailed elsewhere, is reasonable, well documented and based on generally accepted methodology. EPA has reviewed the emissions control technologies expected to meet the requirements for vehicles and engines under this rule and found them to be feasible, as long as the low sulfur fuel required by this rule is used in the vehicles. EPA has also reviewed alternative aftertreatment technologies suggested by commenters. With regard to SCR in particular, EPA found that it would need low sulfur fuel and that there are substantial problems associated with SCR that will prevent its use by the majority of the industry in the time frame available.

(J) As a test procedure, the proposed NTE violates the statutory limitation that emissions test procedures measure conformity with the underlying standard.

(1) Commenter cites to 42 USC Sections 7525(a)(1) and 7541(b) and notes that for MY 2004 HDEs the proposed emissions standard is an average based FTP standard. The NTE establishes an absolute emission cap of 1.25 times the FTP standard. This standard in no way tests compliance with the proposed 2.5 gram FTP standard -- only the FTP test does this. The inherent inapplicability of the NTE to the FTP standard is illustrated by the fact that the FTP test cycle itself includes emissions excursions that exceed 1.25 times the standard. The mere fact that excursions above the NTE occur does not allow the conclusion that an engine will not meet the FTP standard on average over its useful life, any more than an excursion above the NTE cap during the FTP test cycle necessarily means that an engine will not meet the FTP standard. Therefore, the NTE is fundamentally inconsistent with the FTP and therefore, violates the testing provisions of the CAA.

Letters:

International Truck & Engine Corp. (IV-D-87) **p. 2-3**

Response to Comment 12.2(J):

The NTE emissions cap is a separate standard from the FTP standard, based on a different test procedure. EPA has promulgated the NTE, as well as the SSS test and associated standards, in full compliance with section 202(a), as well as sections 206 and 207. It is designed for several purposes, and is not limited to determining compliance with the FTP standards, as the commenter suggests. Section 202(a) authorizes EPA to adopt emission standards such as the NTE. As indicated elsewhere, we believe that the NTE standards for NO_x, PM, etc. promulgated in this rule are feasible.

ISSUE 13: MISCELLANEOUS

(A) EPA should ensure that local and State agencies properly use CMAQ funds for city and State road projects.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Cassara, Bob (IV-F-65)

Response to Comment 13(A):

This issue is not relevant to the current rulemaking. However, we note that the U.S. Department of Transportation developed the Congestion Mitigation and Air Quality (CMAQ) Improvement Program to fund transportation projects and programs in nonattainment and maintenance areas which reduce transportation-related emissions. According to The Congestion Mitigation and Air Quality Improvement (CMAQ) Program Guidance Document, April 1999, the Federal Transit Administration and Federal Highway Administration field offices should establish a consultation and coordination process with their respective EPA regional offices for early review of CMAQ funding proposals. The document states that review by EPA is critical to assist the determination of whether the CMAQ-proposed projects will have air quality benefits and to help assure that effective projects and programs are approved for CMAQ funding. In this way, EPA has the opportunity to work with the Department of Transportation to ensure that local and state agencies properly use CMAQ funds.

(B) EPA should also regulate emissions from the airline industry (jet fuel).

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Tseng, Joyce, et al (IV-D-3)

Response to Comment 13(B):

We are not regulating airplane emissions or the quality of jet fuel under today's rulemaking. In April of 1997, we promulgated new NO_x and CO emission standards for commercial aircraft engines. That rule adopted the voluntary NO_x and CO emissions standards of the United Nations International Civil Aviation Organization (ICAO), bringing the United States aircraft standards into alignment with the international standards. In April of 1999, we released a study entitled "Evaluation of Air Pollutant Emissions from Subsonic Commercial Jet Aircraft" which assesses the existing and potential impact of aircraft emissions on local air quality at ten selected cities. The many issues connected with any rulemaking for airplane/jet engines and fuel warrant serious attention, and we believe it would be premature today for us to attempt to raise potential resolutions to them.

(C) EPA should clarify the amount of emissions reductions achieved through these rules that a State may include in its SIP demonstration for NAAQS.

(1) EPA should consider delaying the attainment demonstration deadline to 2010 to allow states to take advantage of these significant emissions reductions.

Letters:

Koch Industries (IV-D-307) **p. 11**

Response to Comment 13(C):

EPA expects to clarify the amount of emission reductions achieved through these rules that a State may include in its SIP demonstration for the ozone NAAQS after the rule has been promulgated. Some states have already included estimates of the reductions in their ozone attainment demonstrations for 2007 (Houston, Chicago, Milwaukee). The Agency expects that others will seek to include reductions from this rule in their SIP attainment demonstrations after the rule is finalized (e.g., New York, Los Angeles). And in some cases, the Agency expects to rely on reductions from this rulemaking when it considered a proposed or final approval of a State's attainment demonstration (Beaumont-Port Arthur).

EPA disagrees that it should consider delaying the attainment demonstration deadline to 2010 to allow states to take advantage of the greater reductions in 2010 as the heavy-duty vehicle fleet is turned over with cleaner vehicles meeting today's new standards. It is the combined task of the federal government and the States to bring nonattainment areas into attainment as expeditiously as practicable. As Congress was no doubt aware, and the Agency heard repeatedly during the course of its five public hearings, every year of delayed attainment causes harm to public health and welfare. If reductions from this rulemaking are insufficient to bring areas into modeled attainment, then state and local government should considered additional measures to make up the shortfalls.

ISSUE 14: SUPPORTS OR INCORPORATES OTHER COMMENTS

Issue 14.1: Supports/Incorporates Prior Comments of Commenter

(A) Commenter provides their comments as submitted in response to the Tier 2 rulemaking as an attachment.

(1) Commenter provided a copy of their Tier 2 comments (August 2, 1999) as well as their supplemental Tier 2 comments (December 1, 1999) as attachments to their letter.

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. +A, C**

Response to Comment 14.1(A):

A copy of the RTC of comments for the Tier 2 rule has been placed in the docket for this rule. See Issue 9 for responses to comments specific to the Tier 2 rule.

The commenter attached verbatim portions of a comment previously submitted to the agency in connection with another rulemaking. The attachment included comments relating to the potential beneficial health effects of tropospheric ozone. The commenter did not specify the relationship between these previous comments (submitted in 1997 in response to EPA's proposed revisions to the National Ambient Air Quality Standards for ozone) and the current rulemaking and thus the comments do not appear to be directly relevant to this rule. In any event, we do not agree with the commenter's conclusions.

The previous comments suggest that such beneficial health effects "may significantly reduce, or even eliminate, the net health benefits of EPA's proposed ozone standards." EPA has reviewed the technical information related to the possible health benefits of tropospheric O_3 associated with its shielding of the public from potentially harmful, but naturally occurring, ultraviolet radiation from the sun. This information was previously submitted to EPA, and we have responded to this information, in conjunction with our 1997 review of the National Ambient Air Quality Standards (NAAQS) for O_3. Our technical evaluation of the information remains the same as expressed in our earlier response (Responses to Significant Comments on the 1996 Proposed Rule on the National Ambient Air Quality Standards for Ozone, U.S. EPA, July 1997, Docket Number A-95-58).

In our earlier response (p. 133), we noted that the commenter's own citations provide little confidence in the calculations made to date with respect to this issue. The EPA documents cited by the commenter include an EPA white paper (Cupitt, 1994), developed as an initial scoping analysis of the issues, in preparation for potential consideration of this issue in the Regulatory Impact Analysis (RIA) that would accompany the O_3 NAAQS regulatory package, together with internal peer reviews of that paper (Childs, 1994; Altshuller, 1994). The review of the draft estimates concluded "(1) the numbers resulting from these calculations are quite small and (2) the limitations of the accuracy and reliability of the input to the calculations produces numbers that cannot be defended, whether large or small." (Childs, 1994).

Further, we noted that the submitted documents that present quantitative estimates of such potential disbenefits, including Cupitt (1994) and one publication (Lutter et al., 1996), all base estimated disbenefits on an average change in O_3 across the year of 10 ppb. Neither these documents nor the commenter provide any support for the earlier claim that the proposed or final O_3 standards would result in a long-term spatial and seasonal average change of this magnitude; nor is there any support provided now that this rulemaking would produce a long-term spatial and seasonal average change of this magnitude. To the contrary, the final RIA for this rulemaking estimates that change in the population-weighted seasonal average 8-hour O_3 concentration likely to result from the implementation of this rule in the eastern United States is approximately 1.4 ppb (Table VII-2, Final HD Engine Diesel Fuel Regulatory Impact Analysis, December 2000), with even smaller changes likely throughout the rest of the country. Thus, apart from the substantial uncertainties inherent in the available assessments that call into question the credibility of any such estimates.[88], the use of this single assumption alone serves to significantly inflate any estimated disbenefits.

In summary, our evaluation of the available analyses that have produced estimates of health risks associated with changes in ground-level O_3 has identified major limitations in available information that resulted in the need for the analyses to incorporate broad and unsupportable assumptions. These limitations are such that we have concluded that the available technical information does not provide credible quantitative estimates of any such potential beneficial effects, and further, that any such potential beneficial effects are likely very small. This conclusion is consistent with the judgments previously expressed by internal and external reviewers of such analyses.[89] Thus, we conclude that available analyses of potential health benefits of the presence of tropospheric O_3 do not support any change to our evaluation of the adverse health effects associated with breathing O_3 in the ambient air.

Issue 14.2: Supports/Incorporates Other Commenters

(A) Supports and/or incorporates by reference testimony given by the Engine Manufacturers Association (EMA).

(1) Commenters provided no further supporting information or detailed analysis.

<u>Letters:</u>

Cummins, Inc. (IV-F-64)
Detroit Diesel Corporation (IV-F-116) **p. 198**

[88]As we noted in our earlier response, the results of recent high-dose animal toxicology studies suggest more research is needed into the direct effects of tropospheric O_3 on the skin before reaching any conclusions suggesting even very small disbenefits of reducing tropospheric O_3. Tests by Thiele et al. (1997) suggest that chronic O_3 can deplete Vitamin E in the skin, and this could make the skin more susceptible to the effects of ultraviolet-B radiation. Therefore, reducing ground level O_3 exposure might serve to reduce skin problems. Even a very small O_3 effect in this regard could completely offset or counter the small shielding effect of O_3 on ultraviolet-B radiation.

[89] A similar conclusion was also reached in an external review of such information by the Health and Ecological Effects Subcommittee of the Advisory Council on Clean Air Compliance Analysis, a part of EPA's Science Advisory Board, in conjunction with their review of "The Benefits and Costs of the Clean Air Act 1990 to 2010" (EPA, 1999b).

Response to Comment 14.2(A):

No response required. We have responded to the referenced comments elsewhere in this document.

(B) Incorporates by reference testimony given by Frontier Oil and/or Gary-Williams Energy Company in the New York public hearing.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Countrymark Cooperative (IV-F-117) **p. 74** (IV-F-191) **p. 184**

Response to Comment 14.2(B):

No response required. We have responded to the referenced comments elsewhere in this document.

(C) Supports and/or incorporates by reference testimony given by MECA.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Corning, Inc. (IV-F-77)
Johnson Matthey (IV-F- 117) **p. 94**

Response to Comment 14.2(C):

No response required. We have responded to the referenced comments elsewhere in this document.

(D) Supports and/or incorporates by reference testimony given by the NPRA.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Ergon & Lion Oil Co. (IV-F-117) **p. 183**

Response to Comment 14.2(D):

No response required. We have responded to the referenced comments elsewhere in this document.

(E) Incorporates by reference position statement of the National Council of Farmer Cooperatives.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

Countrymark Cooperative (IV-F-191) **p. 184**

Response to Comment 14.2(E):

No response required. We have responded to the referenced comments elsewhere in this document.

(F) Supports and incorporates by reference written comments as submitted by AAM and/or EMA.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

Caterpillar (IV-D-306) **p. 1**
Cummins, Inc. (IV-D-231) **p. 1**
DaimlerChrysler (IV-D-284) **p. 1**
Detroit Diesel Corporation (IV-D-276) **p. 1**
Ford Motor Company (IV-D-293) **p. 1**
Mack Trucks (IV-D-324) **p. 1**
Volkswagen (IV-D-272) **p. 1**

Response to Comment 14.2(F)(1):

No response required. We have responded to the referenced comments elsewhere in this document.

(2) Commenter provides as an attachment to their letter the supplemental comments of the AAM as submitted in response to the Tier 2 rulemaking, including Volumes I, II, and III (October 25, 1999)

Letters:

General Motors Corp. and Isuzu Motors America, Inc. (IV-D-256) **p. 2, +Att. D**

Response to Comment 14.2(F)(2):

A copy of the RTC of comments for the Tier 2 rule has been placed in the docket for this rule. See Issue 9 for responses to comments specific to the Tier 2 rule.

(G) Generally supports the positions taken by API and NPRA.

(1) Commenter provides no further supporting information or detailed analysis.

Letters:

Big West Oil, LLC (IV-D-229) **p. 1**
Chevron (IV-D-247) **p. *1**

Citgo Corporation (IV-D-314) **p. 1**
Marathon Ashland Petroleum (IV-D-261) **p. 1**
Phillips Petroleum Company (IV-D-250) **p. 7**

Response to Comment 14.2(G)(1):

No response required. We have responded to the referenced comments elsewhere in this document.

(2) Specifically references other comments that suggest flexibilities and approaches to provide universal opportunity for all refiners to meet the adopted standards on a consistent and equitable timeframe.

Letters:

Phillips Petroleum Company (IV-D-250) **p. 3**

Response to Comment 14.2(G)(2):

No response required. We have responded to the referenced comments elsewhere in this document.

(H) Supports/incorporates comments submitted by WIRA.

(1) Commenter provides no further supporting information or detailed analysis.

Letters:

Kern Oil & Refining Co. (IV-D-310) **p. 1**

Response to Comment 14.2(H):

No response required. We have responded to the referenced comments elsewhere in this document.

(I) Supports and incorporates those comments made by API and all attachments thereto.

(1) Commenter provides no further supporting information or detailed analysis.

Letters:

Equiva Services (IV-D-226) **p. 2**
ExxonMobil (IV-D-228) **p. 22**

(2) Also endorses the recommendations of the NPC study.

Letters:

LA Mid-Continent Oil and Gas Association (IV-D-319) **p. 1**

Response to Comment 14.2(I):

No response required. We have responded to the referenced comments elsewhere in this document.

(J) Supports and incorporates industry comments in the "Any Credible Evidence" (ACE) rulemaking, as applied to use of non-reference test methods to prove a violation in Section 80.29(b)(2).

(1) If the provision is finalized, it will lead to confusion in the regulated community because it is impossible for any party to assure its compliance with the rule. Furthermore, inclusion of the provision will increase industry compliance costs and may outweigh EPA's determination of the cost-effectiveness of the rule.

Letters:

Koch Industries (IV-D-307) **p. 16-17**

Response to Comment 14.2(J):

This commenter argues that the inclusion in the final diesel rule of the provision permitting the use of evidence in addition to the regulatory test method to establish compliance, will cause confusion through lack of compliance certainty. The Agency disagrees with this assertion. The Agency's Response to Comment 8.4.2(F) in this document also provides the Agency's response to this comment.

EPA disagrees with this commenter's additional argument that the rule's inclusion of this alternative evidence provision will increase industry's cost of compliance due to the alleged need for parties to conduct a multitude of tests, using a variety of methods, to assure compliance. The Agency believes, on the contrary, that the inclusion of this provision creates compliance certainty through it's establishment of the regulatory test method as the benchmark method with which to determine compliance. It is EPA's position that the compliance certainty that is created through the establishment of this benchmark status should actually hold testing costs down for industry because the evidentiary supremacy of the regulatory test method (or the approved testing alternatives) is so firmly established under this provision.

(K) Supports and/or incorporates by reference comments submitted by Cummins.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

American Public Transportation Association (IV-D-275) **p. 2**

Response to Comment 14.2(K):

No response required. We have responded to the referenced comments elsewhere in this document.

(L) Supports and/or incorporates by reference comments submitted by Detroit Diesel.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

American Public Transportation Association (IV-D-275) **p. 2**

Response to Comment 14.2(L):

No response required. We have responded to the referenced comments elsewhere in this document.

(M) Other comments presented as part of STAPPA/ALAPCO; and supports comments made by STAPPA/ALAPCO.

(1) Commenter provided no further supporting information or detailed analysis.

Letters:

CT DEP (IV-D-320) **p. 1**
Clean Air Agency (IV-D-207) **p. 1**
GA Department of Natural Resources (IV-D-268) **p. 1**
IA Department of Natural Resources (IV-D-201) **p. 1**
PA DEP (IV-D-100) **p. 3**
Regional Air Pollution Control Agency (IV-D-103) **p. 2**

Response to Comment 14.2(M):

No response required. We have responded to the referenced comments elsewhere in this document.

(N) Supports comments submitted by the Clean Air Coalition.

(1) Commenters provided no further supporting information or detailed analysis.

Letters:

AK Conservation Alliance (IV-D-349) **p. 1**

Response to Comment 14.2(N)(1):

No response required. We have responded to the referenced comments elsewhere in this document.